This invention relates to coating of filamentary material, particularly wire heaters such as are utilized in indirectly heated cathodes and tube heaters.

These heaters are usually made by castophoretically coating a long length of wire, stripping off a short length of coating at equal spaced intervals along the length of the wire and cutting the wire substantially midway of the stripped sections. The wire is then formed by a winding machine into a coiled heater with substantially parallel strands and sharp bends between the strands, the two ends of the coil extending in the same direction and slightly beyond the coil proper. As a result of the bending operation, it frequently occurs that the coating at the bends will flake off leaving bare heater wire, thus promoting shorts between heater sections or between the heater and the cathode sleeve within which the heater is placed. Therefore, heater wires, particularly those intended for use in premium or raggedized tubes, are subjected to a further dipping or castophoretic process to coat the wire at the bends of the wire. In such subsequent treatment, it had been difficult, previous to the instant invention, to prevent the bare ends of the heater wire from becoming coated, thereby necessitating the still further operation of cleaning the coating off these ends. By another mode of coating heater wires, folded wires are immersed in a coating bath and the wire coated, but the coating near the ends of the wire is haphazard with no uniformity of size of bare wire remaining for attachment to lead-in conductors of a tube. With this immersion wires may be re-coated throughout except for desired lengths at the ends of the wire.

It is, therefore, an object of the invention to provide a process for coating filaments and particularly folded wires while providing for uniform lengths of uncoated wire ends. It is a further object of this invention to provide a process for re-coating a wire while leaving the ends clear of any coating contamination.

These and other objects will be apparent after reading the following specification and claims in conjunction with the accompanying drawing in which:

Fig. 1 is a view of a spread out coated wire which is to be again coated so as to insulate undesired bare portions.

Fig. 2 is a view of a pair of thin metal foil sheets between which the bare ends of coils are clamped and a recoating tank, said sheets being unwrapped from supply rolls.

Fig. 3 is an enlarged cross-section through the foil and wire ends taken on the line 3–3 of Fig. 2.

Fig. 4 is an enlarged fragmental view of a wire to be coated held between a pair of foil strips.

Fig. 5 is a section on the line 5–5 of Fig. 4.

Fig. 6 is a sectional view through the coating tank showing the immersion of the wire and protective foil in the tank.

Fig. 7 discloses a modification wherein the foil is of angle formation to enable a shallow tank to be utilized.

Fig. 8 shows a modified form of foil strip adapted to embrace the wire end, and

Fig. 9 illustrates how the modified foil may be applied to the wire ends.

Referring to the drawings in greater detail, at 20, Fig. 1, there is illustrated a folded, coated, heater wire with bare ends 22 and insulting coating 24. This wire, after it has been folded, oftentimes may have portions of the coating flaked off, most frequently at the bights of the wire, for example, as indicated at 26 and 28 in Fig. 1. For the purpose of making the latter reliable for use, it is necessary to reinsulate these bare portions. To do this it had been customary in the past to either apply insulating coating compositions by brushing the same on the wire or to pass the damaged heater through a cataphoretic bath. In either event the ends of the wire which should have been left bare became coated more or less and had to be cleaned again.

To secure uniformity of product, that is, wires which are properly insulated and which have clean bare ends, the following novel means and method have been evolved.

Two strips of pliable easily deformable metal foil 30 and 32 are fed in parallel spaced track from rolls of the material. These strips are of indefinite length, paper thickness and of a width equal to about one and one-half times the desired length of bare end of a wire. In a practical embodiment, the strips are of aluminum foil, one inch wide and .001" thick. As these foil strips are fed from the rolls, filaments 20 are positioned between the strips with the bare ends 22 of the wire extending about 1/8 way across and between the registering strips and the coated portion 24 just extending to the adjacent edges of the strips, for example, by sliding the wires across the width of a table 25. The strips are then pressed together by passage through a pair or pairs of horizontal feeding rolls 40 and 42, coated if desired, with a resilient coating. The rolls also press the foil strips about the bare wires to provide good electrical contact between the strips and the wire and also to exclude the bare wire from direct contact with the cataphoretic bath through which the wires are to be subsequently passed. Because of the pliable character of the metal foil and the adhesion of the strips to each other, the wire ends remain embedded in the foil without possibility of coating fluid entering between the foils and wire ends. One or more pairs of these feeding and press rolls 40, 42 may be provided along the length of run of the strips. After the strips and wire have passed over a coating tank 44, the strips are turned into a vertical plane. This may be accomplished by employing pairs of resilient faced rollers 46, 48 which twist the strips from a horizontal into a vertical plane, the rollers 48 being mounted on parallel vertical axes. The rollers 48 are spaced from the lower edges of the strips where the wires are embedded to prevent the rollers being brought into contact with the coating liquid 49 within the tank. Strip edge engaging guide rollers 50, mounted on horizontal axes, are employed to depress the strips 30 and 32 so that lower edges, as seen more clearly in Fig. 6, and all exposed portions of the wires held by the foils, will be submerged in the bath in the tank.

The strips or foils not only protect the wires against a deposit forming on the wire ends, but also, where cataphoretic coating is employed, they form the medium for conducting the electric current to the wires during the coating process.

After passing through the bath, the foils pass beyond the feed rollers. The foils may then be stripped off the wires in any suitable manner, as by peeling.

In a modification of the above disclosed method, see Fig. 7, the strips 30 and 32 may be bent to form right angular web portions 52, 54 so that the filaments may
travel through the bath in a position parallel to the surface of the bath, thereby permitting the use of a shallow tank.

In a variant of the process disclosed, the two separate strips of foil are replaced by a single wide strip 56, see Fig. 8, bent into V formation, the bare ends 22 of the wires being inserted between the arms of the V prior to squeezing the bent portions of the strip about the wire ends.

Where cathode-rectic coating is employed, current from a D.-C. source 62 grounded at one end may be fed to a strip, as 32, by means of a brush 64 and the tank may be grounded as at 66.

Having thus described the invention, what is claimed is:

1. In the process of electrophoretically coating filaments with an insulating composition, the steps of laying the ends of the filaments between two registering strips of electroconductive foil, pressing the foil strips about the filament ends so as to snugly engage the same and immersing the filaments and a portion of the strips in a bath containing said insulating composition and applying an electric potential to said strips and to said bath.

2. In a process of electrophoretically coating filaments with an insulating composition, the steps of laying the ends of said filaments on a moving electroconductive foil strip, covering the so laid filament ends with a second electroconductive foil strip registering with the first foil strip, pressing said strips together to securely clamp the filament ends between the strips, passing the filaments and portion of the strips immediately embracing the filaments ends through a coating bath containing said insulating composition and applying an electrical potential to said strips and to the bath.

3. In the process of electrophoretically coating filaments with an insulating composition, the steps of laying the ends of said filaments on a moving electroconductive foil strip, covering the so laid filament ends with a second electroconductive foil strip registering with the first foil strip, pressing said strips together to securely clamp the filament ends between the strips, bending said strips longitudinally to form an angled foil strip with a vertical web and a horizontal web confining the filament ends, passing the filaments and portion of the strips immediately embracing the filament ends through a coating bath containing said insulating composition, and applying an electric potential to said strips and to the bath.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,076,741</td>
<td>Peck</td>
<td>Apr. 13, 1937</td>
</tr>
<tr>
<td>2,330,346</td>
<td>Snyder</td>
<td>Nov. 21, 1940</td>
</tr>
<tr>
<td>2,697,236</td>
<td>McCain et al.</td>
<td>Dec. 21, 1954</td>
</tr>
<tr>
<td>2,019,994</td>
<td>Rodes</td>
<td>Nov. 5, 1955</td>
</tr>
</tbody>
</table>