This invention relates to coating, and more particularly to borating material such as copper-clad nickel-iron wire, commonly called "dumet.”

The principal object of my invention, generally considered, is to eliminate imperfections such as black oxide streaks in borated “dumet.”

Another object of my invention is to produce wire, especially “dumet,” for use in connection with electric lamps, which has a perfect or unbroken coating of material, such as borax, on the surface thereof, whereby said wire is more readily wet by molten glass and protected from oxidation until used.

A further object of my invention is an apparatus for producing borated dumet, in which the borax coating is free from breaks and the wire free from black oxide streaks, by first passing through a furnace where the solvent is evaporated and the borax fused in place on said wire, and then on through an air-cooled device where the wire is cooled in gradually increasing air currents, so that when it reaches the actuating can, it has cooled sufficiently so that the borax coating remains therein unimpaired.

A still further object of my invention is the production of coated wire in which the coating is kept in perfect condition by avoiding contact with anything until it is entirely set, and then eliminating sharp bends by employing a driving capstan of relatively large diameter.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

In the drawing:

Figure 1 is a side elevational view, partially in vertical section, of apparatus embodying my invention.

Figure 2 is an enlarged plan view of a novel air cooler shown in Figure 1, in the direction of the arrows II—II.

Figure 3 is an enlarged transverse sectional view of said cooler on the line III—III of Figure 1, in the direction of the arrows.

In accordance with the former practice of coating wire such as copper clad nickel-iron wire, commonly called “dumet,” for use as leads in incandescent electric lamps, with borax, where the applied heat is high, the wire holds too much of the heat from the time it leaves the furnace until it reaches the winding spool. All pulleys, guides, brackets and the spooling head are, therefore, hot from the transmitted heat during the borating operation, making it necessary to remove the spooled wire with cloth pads. The borax coating on the wire is, therefore, still in a plastic condition and abrades at each point of contact, or chips off in turning on the many small pulleys, formerly employed. Said former method is, therefore, defective, in that the heat and oxidation of the wire are uncontrollable, because the softened borax is scraped off, or otherwise removed, allowing the formation of black oxide streaks on the finished product.

In accordance with my invention, I have remedied these former defects by the employment of an arrangement such as shown in the drawing.

Referring to the drawing, there is shown a borax bath 14, desirable comprising a metal receptacle 12, heated as by means of a gas flame 13, so that the borax solution 14, held therein, is kept at a desired elevated temperature such, for example, as 55° C.

The wire 15, in the process of being borated in accordance with my invention, is drawn as by means of a capstan drive 16 from a spool or other supply 17 thereof, over a pulley 18 mounted in any desired manner as on a standard 19, to direct the wire through furnace 21, which burns off any grease and conditions the surface of the wire for the application of the coating, into the borax bath 14 under spool 22, revolving therein. A water storage tank 23 may be provided to keep the bath 14 at the desired level, as by a proper setting of the supply valve 24.

After emerging from the bath 14, the wire 15 passes through the furnace 25 where it is heated to a sufficiently high temperature to not only evaporate the water or other solvent from the coating material 4, but fuse the solid substance or borax into a well distributed film on said wire. When the wire 15 emerges from the furnace 25 it is white hot. In order to shorten the cooling time, I pass said wire directly to an air-cooler device 26, shown in detail in Figures 2 and 3. This device desirably comprises a compressed air manifold 27, consisting of a copper tube, which may be ½” in diameter and 8” long, with small holes arranged therein, as shown in detail in Figure 2. These holes are desirably so disposed that the amount of air blown on the wire gradually increases from a minimum at the receiving end of the cooler to a maximum at the discharge end, as by, preferably, first increasing the size of the air discharge holes 28, then arranging them in multiple, while increasing in size, as indicated at 29, and finally spacing the multiple holes closer together longitudinally of the cooler, as indicated at 31, whereby the cooling speed is accelerated. The multiple holes, 29 and 31, de-
slightly flare outwardly and are directed on the wire 18, as illustrated in Figure 3.

The cooler 26 is desirably provided with upwardly converging sides 32 which may be formed of a sheet of material embracing the lower portion of the copper tube 27 and providing an upwardly opening trough 33, through which the wire 18 passes.

The air cooler 20 may be held on a standard 34, provided with a rod 35 on which a bracket or supporting portion 36 of the air cooler is adjustably mounted, as by means of set screw 37.

The wire 18 is cooled, even after emerging from the cooler 20, preferably by jets of cool air ejected, from small nozzles 38, at the wire where it engages the pulley 39, which serves merely as a vibration dampener and which is barely touched by the wire, thereby cooling both wire and pulley at this point and preventing the possibility of any material abraded of the borax coating by said contact.

The pulley 39 is desirably adjustably mounted on standard 41 by having its carrying frame 42 held at the desired elevation by means of set screw 43.

By virtue of cooling the wire by streams of compressed air, which decrease in temperature as they ascend, while, at the same time, making the cooling small at first and gradually accelerated by increasing the amount of air directed thereon, I avoid blowing any hot borax off the wire and, at the same time, quickly cool and set the coating thereon. The amount of air used can be raised or lowered according to the size of the wire, and the wire oxidation, or color, which appears, in accordance with my method, before reaching any point of contact, stopped at the desired point.

In the former system, the wire pulleys change from very hot to warm, with corresponding color changes in the wire. For example; when the pulleys are very hot the desired color is farther away from the furnace, and when cooler it is closer to the furnace and cannot be controlled.

The capstan 16 replaces all small pulleys formerly used between the borating tank 4 and the spool 44 on which the borated wire is finally wound, with the exception of the vibration pulley 39 which does not involve bending the wire to any appreciable extent.

After passing around the drive capstan 18, the wire which, at the time of engagement with said capstan, is cooled to the necessary extent to avoid coating damage, passes on to the spool 44 on which it is finally wound. Means, such as distributing pulley 45, may be provided for automatically causing the wire to wind back and forth across the receiving spool 44, said apparatus being driven in any desired manner, as by means of the belt 46 from a motor, not shown through the gearing 47, 48 and 49. The drive capstan may be energized from the same motor, as by means of belt or sprocket chain 51 passing over idler pulleys 52 and 53.

From the foregoing disclosure, it will be seen that I have devised an apparatus for coating wire, and particularly coating "dumet" with borax for use in connection with the manufacture of lamps, whereby the former defect of black oxide streaks is eliminated, and wire having an unbroken and perfect coating of borax on its surface, is produced.

This procedure, and such apparatus has been used in actual production resulting in the manufacture of a large quantity of uniformly borated "dumet" wire, with no shrinkage due to poor coating or black oxide streak.

Although 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 appended claims, and that I am not limited to the use of gas as the heating medium. It will also be understood that the same result cannot be accomplished by natural cooling, because too long a length of wire in the process of cooling would be required than would be possible without support, and any supporting spools would injure the wire coating before it was set.

I claim:
1. Apparatus for coating wire, comprising a borax bath, a furnace, and a cooler comprising a compressed air manifold having air jet holes so spaced that the cooling air increases in volume from the entering end to the discharge end of said cooler, and means for drawing wire successively through said bath, furnace and cooler, whereby it is coated, said coating being fused thereon, and the coated wire cooled at an accelerated rate, so that it may then be spooled without injury to the coating.
2. A cooler for coated wire comprising a compressed air manifold, a sheet of metal embracing said manifold and providing upstanding sides forming a trough for receiving wire, said manifold having apertures in its upper portion spaced at gradually decreasing distances in order to provide a gradually increasing amount of cooling air for said wire as it passes from receiving to discharge end.
3. A cooler for coated wire comprising a compressed air manifold, means associated with said manifold for providing a wire-receiving trough thereabove, the upper surface of said manifold having air jet holes so disposed that the amount of air blown on the wire gradually increases from a relatively small amount at the receiving end to a relatively large amount at the discharge end of the cooler.

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