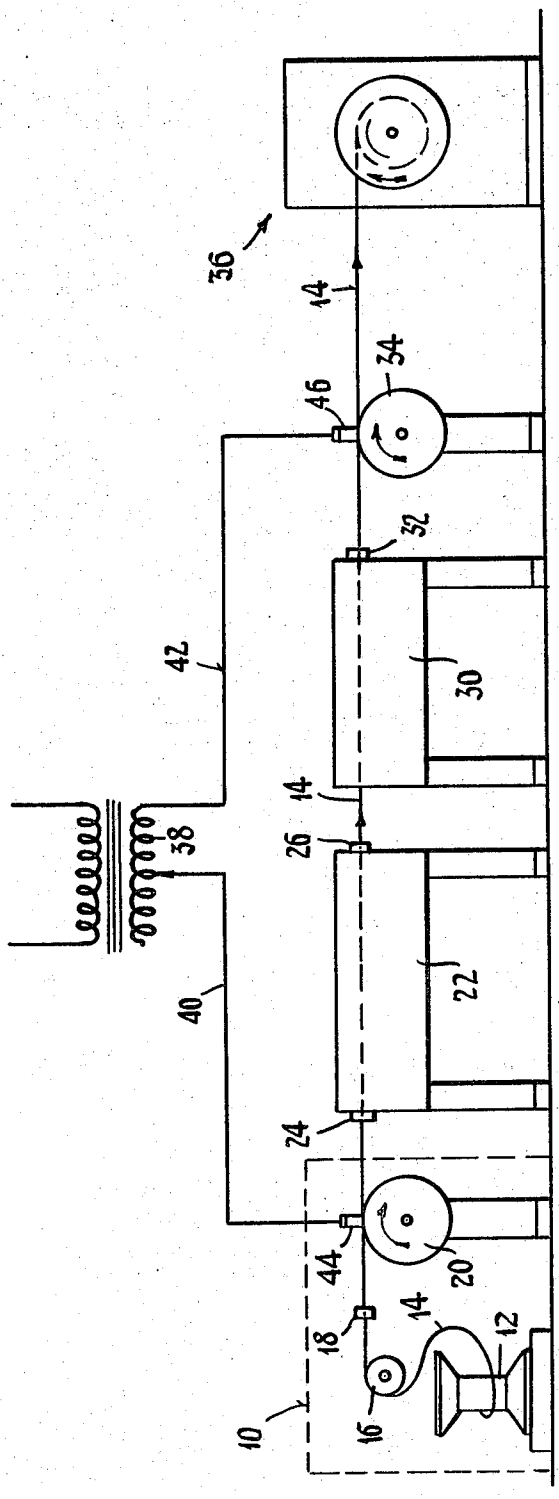
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PROCESS FOR TREATING WIRE

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# PROCESS FOR TREATING WIRE

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## ABSTRACT OF THE DISCLOSURE

A method of continuously processing wire containing a high percentage of copper, which involves pulling the wire through a reducing die and around a powered capstan to reduce its diameter and raise its temperature. The wire is then immediately, without cooling or bending or otherwise physically altering it, pulled through a molten tin bath to coat and simultaneously anneal the wire. Added heat may be imparted to the wire without contamination by means of an electric current passed through the wire via the pulling capstans as the wire passes through the tin bath.

This invention relates to wire treatment, and more particularly to wire drawing, coating and annealing.

An object of the invention is to provide a novel and improved method of and apparatus for continuously drawing, coating and annealing wire of the type containing a high percentage of copper, such as copper wire and brass wire, by which increased production is obtained with lower costs.

Another object of the invention is to provide an improved method and apparatus as above set forth, which produces a high quality in the finished product.

A further object of the invention is to provide an improved method and apparatus as characterized, which are especially simple, eliminating steps and equipment heretofore necessary in performing the operations of drawing, tinning and annealing.

Features of the invention reside in the provision of an apparatus as above outlined, which is efficient and effective, easily used and put into practice, and which requires a minimum of upkeep and maintenance.

Other features and advantages will hereinafter appear.

The single figure of the drawing is a diagrammatic-schematic representation of the improved and simplified wire treatment apparatus as provided by the invention, and which utilizes the improved method or process.

As shown, the broken-outline box **10** indicates a conventional wire drawing machine having a pay-off means **12** from which there is brought a wire strand **14**. The wire **14** is of copper, or has a high copper content, such as brass wire or other similar alloys. The wire **14** is brought around a capstan **16** and then through a reducing die **18**, by which the diameter is made smaller. The wire **14** is then brought around a payout capstan **20**, from which latter it is pulled in leaving the machine.

In accordance with the present invention, the wire **14** is not at this point stored or cleaned or provided with flux, or subjected to any similar operations. Instead, from the capstan **20** the wire **14** is brought directly and while in motion into a tin pot **22**, being led into the molten tin from side areas thereof, as through inlet and exit dies **24**, **26** respectively having their openings located below the level or top surface of the tin during the operation of the equipment. The dies **24**, **26** have bores which are only slightly larger than the wire **14** in diameter, whereby no reduction in the size of the wire is effected but instead an entry and exit is provided which does not permit leakage of the molten tin at these points.

I have found that it is possible to successfully coat a copper or copper containing wire with tin or tin alloys



without precleaning the wire **14** or fluxing it, by means of the above procedure and process, and also that a satisfactory annealing of the wire may be accomplished by virtue of the heat to which it is subjected in the tin bath or pot **22**. In part I attribute the success of this process to the heating effect of the drawing die **18**, which reduces the wire diameter. Such working of the wire causes heat in the wire, presumably due to molecular friction as well as the friction between the die surfaces and the exterior or peripheral surfaces of the wire. The heat imparted to the wire **14** during working in the die **18** is not largely lost by passing the wire over the pulling capstan **20**, for the reason that the capstan temperature increases above the ambient, and for the further reason that heat transmission from the wire to the capstan is low due to the small areas of contact between these elements. Thus, the wire **14** in leaving the capstan **20** has an appreciably raised temperature, which in conjunction with the high temperature of the tin bath, results in a satisfactory coating of tin on the wire as well as an annealing of the wire.

After leaving the tin bath **22**, the wire **14** passes into a water cooling tank or bath **30** and thereafter passes out of the water cooling bath through an airwiper **32** which removes the moisture and effects a drying of the wire. The wire **14** then passes around another pulling or powered capstan **34**, which is the means by which the wire is pulled through the dies **24**, **26**, the tin bath **22**, the water cooling bath **30** and the airwiper **32**, and pulled around and from the capstan **20**. From the capstan **34** the wire **14** which is now coated with tin and annealed, passes to a spooling machine **36** where it is placed on spools for shipment and use.

To supply additional heat to the travelling wire **14** as it passes through the tin bath **22** an electric heating current is provided. Such current may come from a transformer secondary **38** having leads **40**, **42** connected by means of suitable brushes **44**, **46** to the capstans **20**, **34**. The voltage and current may be regulated as required, depending on the size of the wire, the resistance of the contacts established between the wire and the capstans **20**, **34** and other conditions involved with the coating and annealing.

It will now be understood from the foregoing that I have provided a novel and improved, greatly simplified method and apparatus for continuously drawing, coating and annealing copper wire and wire containing a high percentage of copper. Between the wire drawing machine **10** and the tin bath **22** no intermediate steps nor equipment are required, such as cleaning baths, storage facilities if the wire is to be first spooled, fluxing baths and the like. Instead, the wire in leaving the wire drawing machine **10** passes into the tinning bath **22** from a side thereof whereby it is not contaminated by dirt, sludge, oxides and the like normally existing at the top surface of the bath.

The side entry of the wire into the bath **22** is also considered to contribute to the success of my simplified drawing, coating and annealing process, as at present understood. However, essentially the improved process comprises pulling the wire through a die to reduce its diameter and raise its temperature, and immediately thereafter and at a closely adjacent point pulling the wire through a molten tin bath to coat the wire with tin and simultaneously to anneal the wire. Such process eliminates intermediate steps and equipment, and enables treatment in the manner explained at a very high rate of speed whereby increased productivity is obtained with the use of fewer pieces of equipment.

The process is such that the wire in being brought directly into the tin bath is also perfectly clean and free of surface oxide and surface dirt, not only because of the high speed but also since it does not pass through the top

surface of the tin bath. The equipment is seen to eliminate bending of the wire during the tinning, annealing and water cooling. This reduces the likelihood of the wire breaking while being bent or flexed at higher annealing temperatures, where tensile strengths are considerably reduced. It also enables higher tinning and annealing speeds to be had. With the present process there is not required the cleaning of wire with acid or other means, which normally is practiced if the wire in leaving the drawing machine is stored on spools and coated at a later time.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. The process of continuously treating wire containing a high percentage of copper, which includes the steps of pulling the wire through a die and around a powered capstan to reduce its diameter and raise its temperature, and immediately thereafter without bending it or reducing its temperature or physically changing the wire and at a closely adjacent point pulling the wire through a molten tin bath to coat the wire with tin and simultaneously to anneal the wire.

2. The process of claim 1, wherein the wire is pulled into the tin bath through a side thereof.

3. The process of claim 2, wherein the wire is pulled out of the tin bath through a side thereof.



4. The process of claim 3, and including the further steps of pulling the wire leaving the tin bath immediately through a water cooling bath and thereafter spooling the wire.

5. The process of claim 4, and including the further step of passing a heating electric current through that portion of the wire which is travelling through the tin bath and water cooling bath.

6. The process of claim 1, and including the further step of adding heat to the wire without adding contaminants thereto prior to entry of the wire into the tin bath.

7. The process of claim 6, wherein the adding of heat to the wire and the pulling of the wire around the powered capstan are done simultaneously and at the same point.

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