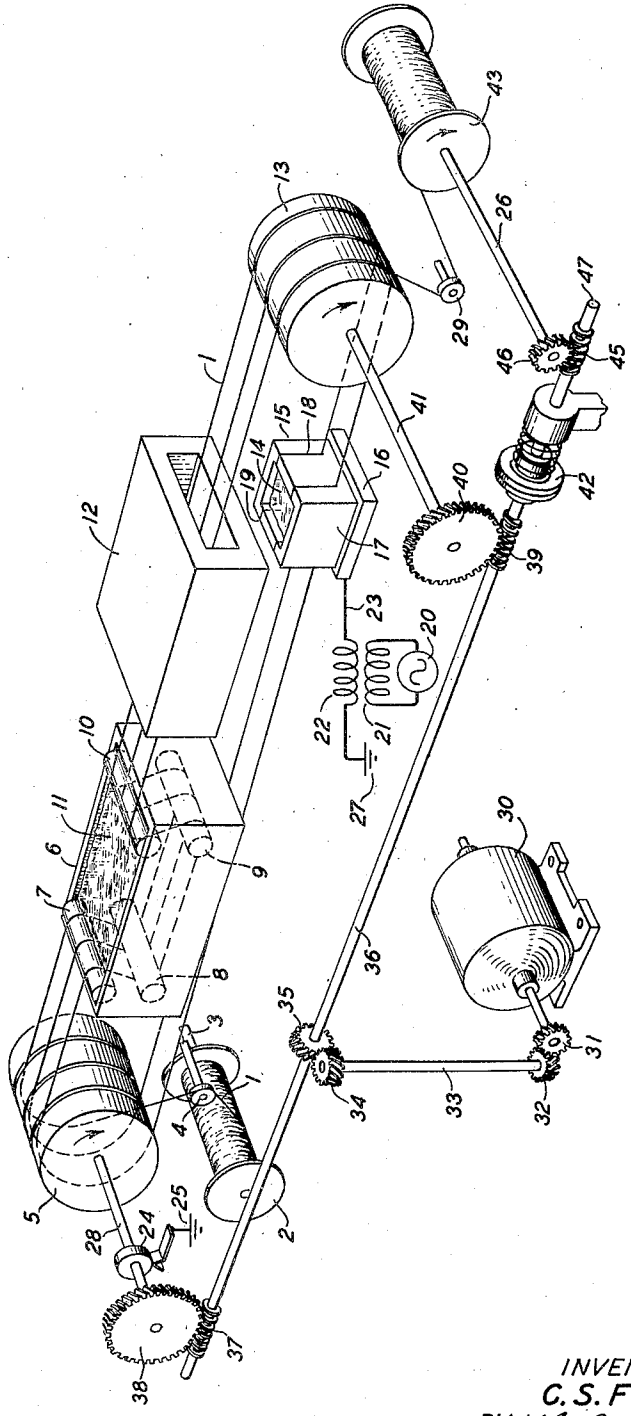
July 5, 1938. C. S. FULLER 2,122,463

METHOD OF ENAMELING WIRE

Filed March 27, 1936



INVENTOR
C. S. FULLER
BY H. G. Bamfield
ATTORNEY

Patented July 5, 1938 2,122,463

UNITED STATES PATENT OFFICE

2,122,463

METHOD OF ENAMELING WIRE

Calvin S. Fuller, Summit, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application March 27, 1936, Serial No. 71,149

5 Claims. (Cl. 91—70)

This invention relates to electrical conductors and more particularly to a method of coating conductors with insulation such as enamel insulation.

In the process of coating electrical conductors with insulation, and especially in the case of coating wires with an enamel or the like, it is the practice in some instances to pass the wire through a bath of suitable coating material one or more times with a drying or baking operation after each coating. However, it has been discovered that oftentimes the resulting insulating coating contains numerous weak points and imperfections which are due to the initial condition of the wire being coated instead of improper methods of applying the insulation. An examination of such wire discloses considerable variability in its surface, there being ridges, slivers and other such flaws present. These irregular projections make it extremely difficult to coat with an even thickness of insulation. The resulting insulated wire on account of these imperfections often has weak points at which the slivers etc., almost project through the insulation, or uninsulated points at which the slivers actually extend through the coating. While for some uses such defects in insulation may be negligible, in others such as in the manufacture of relay coils, cables and the like wherein turns of wire are tightly positioned together, these defects materially reduce the efficiency and life of the apparatus.

An object, therefore, of the present invention is an insulated wire having substantially no defects in the insulated coating.

Another object of the invention is a method of improving the surface condition of the wire prior to coating with a final insulating layer.

A further object of the invention is a combined process of continuously improving the surface condition of the wire and coating the wire.

Still another object of the invention is a process of removing defects in the surface of the wire after it has been coated with one or more layers of insulation.

In accordance with the present invention, these and other objects are attained by coating a wire by any suitable process with an insulating coating such as an enamel coating and then passing the coated wire through a current carrying liquid such as mercury or an electrolyte. A potential is applied between the wire and the liquid electrode. As each defect in the insulation passes through the liquid electrode the projecting slivers and the like are subjected to a sufficient current to cause arcing. The heating effect of the current and the chemical effect of the arc destroy the particle or defect causing the low resistance. The wire is then recoated in any suitable manner and, if necessary, redrawn through the liquid electrode. The final coating will cover up any craters formed by the electric current and will result in an improved and evenly coated wire.

This invention will be more clearly understood from the accompanying detailed description and the drawing which shows in schematic form apparatus for producing improved insulated wire.

As shown in the drawing, the wire 1 to be coated is wound upon spool 2 which is positioned on shaft 3. The wire 1 passes over guide pulley 4 around driving drum 5 to the tank 6 containing the insulating material 11 where it passes around guide rollers 7 and 8, and 9 and 10, and receives a coating of the insulating compound. The coated wire 1 then passes through a suitable drying or baking oven 12. Preferably the enameled wire is baked in the oven 12 until dry. In many cases the wire will be coated imperfectly and slivers and other projections will extend through the coating. On emerging from the baking oven 12, the coated wire passes around driving drum 13 and through the current carrying liquid 14 which is held in a suitable receptacle 15. While this receptacle may be of any suitable construction, it has been found satisfactory to form the bottom 16 of metal and the sides 17 of soft rubber. The current carrying liquid may be an electrolyte or mercury. The wire enters and leaves this receptacle 15 through slits 18 and 19 in the rubber walls and does not come in contact with the metal base 16. The elastic rubber walls grip the wire tightly and prevent any of the current carrying liquid 14 from leaving the container through the slits.

A potential is applied to the coated wire and to the conducting fluid and when a projection on the wire extends through the insulation and contacts with the conducting liquid current flows through this projection and over the wire. As shown in the drawing, a potential is applied to the conducting liquid from generator 20 through the windings 21 and 22 of the transformer over conductor 23 to the base 16 which is in contact with liquid 14. One side of the transformer winding 22 is grounded at 27. The wire 1 is grounded at 25 through drum 5, shaft 28 and contact 24. This permits a current to flow from transformer 20 through the conducting liquid

14 over the slivers which project through the initial insulating coating and over the wire to ground 24. Since the slivers are small, they will be destroyed by the heating effect of the current and also by the arcing formed at that point. The wire will now have a very small crater in the coating in place of the sliver and this is filled up by a subsequent coating of enamel. The wire is carried around drum 5 a second time and again passes through the tank containing the insulating material where it receives a second coating and through baking oven 12, around drum 13 and to the current carrying liquid 14 where any remaining slivers or other such defects are removed electrically. The wire again passes around drum 5 and is given a final coating of insulation and the coating is baked on in oven 12. On leaving oven 12, the wire is conducted over drum 13 to guide pulley 29 and is wound upon spool 43 which is turned by shaft 26. It is, of course, obvious that the apparatus may be enlarged so that the wire may be passed through the liquid electrodes and coating bath as many times as is desirable, and that it can be constructed so that more than one wire can be enameled at a time.

As shown in the drawing, the drums 5 and 13 are driven at the same rate by motor 30 through gears 31 and 32, shaft 33, gears 34 and 35, shaft 36, gears 37 and 38 and shaft 28; and gears 39 and 40 and shaft 41. The take-up spool 43 is also driven by motor 30 through the train of gearing mentioned above and shaft 36 which carries friction clutch 42. When shaft 41 is turned, it turns gears 45 and 46 which rotate spool 43 through shaft 26. As an increased number of turns of wire is taken up on spool 43 slippage of friction clutch 42 will increase thereby compensating for the increase in effective diameter of the spool 43 and preventing undue tension on the coated wire.

What is claimed is:

1. The method of improving the continuity of insulation on wire which comprises coating the wire with insulation, passing the coated wire through a liquid electrode, applying a potential between the wire and electrode sufficient to reduce any metallic projections of the wire through the coating and subsequently recoating the wire.

2. The method of improving the continuity of insulation on wire which comprises coating the wire with insulation, baking said coating in an oven, passing the coated wire through a liquid electrode, applying a potential between the wire and electrode sufficient to reduce any projections of the wire through the coating, and subsequently coating and baking the coated wire a second time.

3. The method of improving the continuity of insulation on wire which comprises coating the wire with insulation, baking said coating in an oven, subjecting the coated wire while it is passing through mercury to a sufficient potential to remove substantially any projections of the wire through the insulation, and filling in any voids in the insulating coating by recoating the wire.

4. The method of improving the continuity of insulation on wire which comprises coating the wire with enamel, baking said coating in an oven until dry, subjecting the enameled wire while it is passing through mercury to a sufficient potential to remove substantially any portions of the wire extending through the insulation, and filling in any voids in the enamel coating by recoating the wire.

5. The method of manufacturing insulated wire comprising coating the wire with insulation, immersing the coated wire in a bath of mercury, impressing a sufficient potential across the wire and the bath to reduce substantially metallic projections of the wire protruding through said coating, applying a second coating of insulation to the wire, immersing the wire with the second coating of insulation thereon in a bath of mercury, impressing a sufficient potential across the wire and the bath to reduce metallic projections protruding through the coating and applying a third coating of insulation to the wire.

CALVIN S. FULLER.