

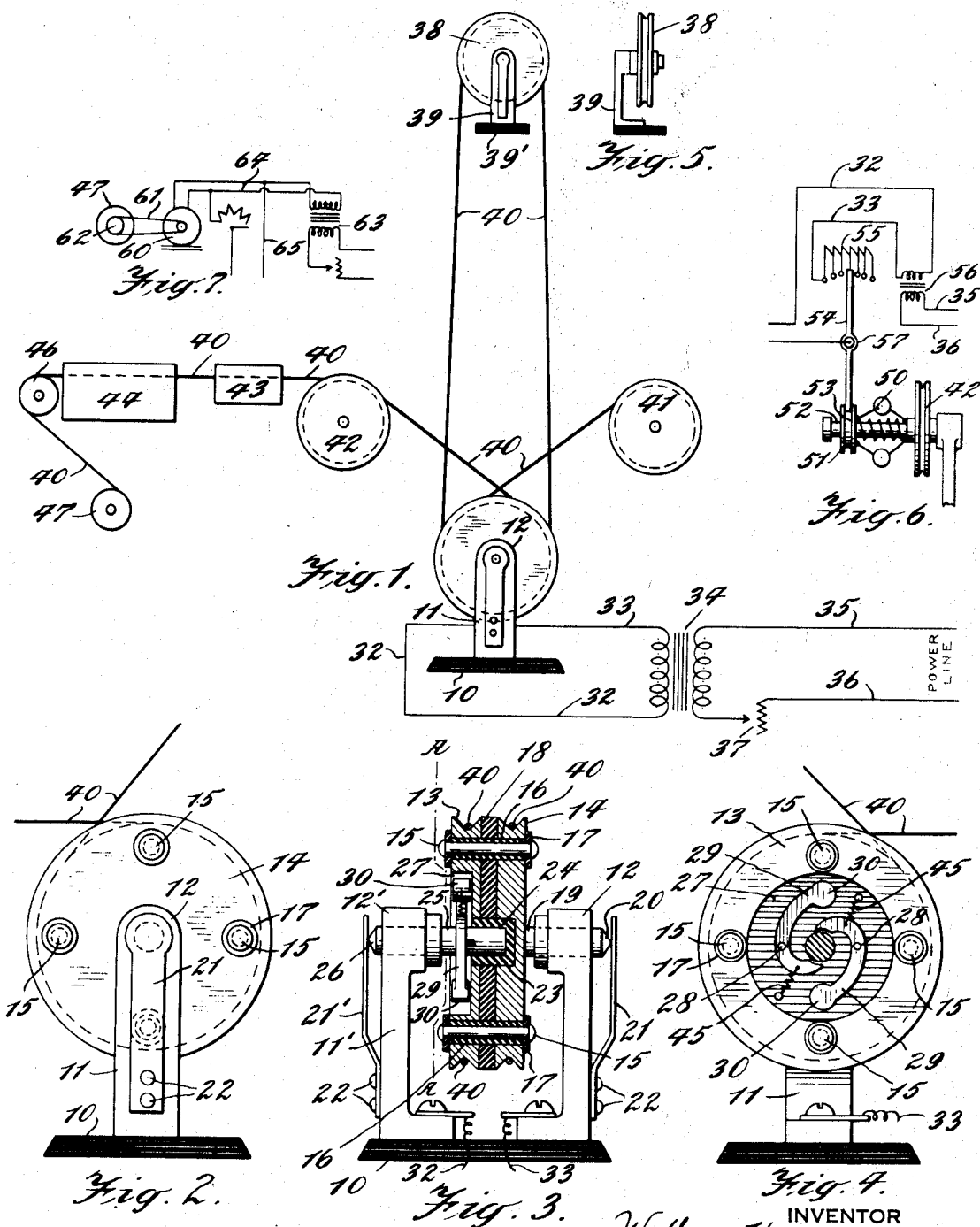
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APPARATUS FOR HEATING WIRE

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APPARATUS FOR HEATING WIRE

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11 Claims. (Cl. 219—11)

This invention relates to an apparatus or device for annealing or oxidizing a moving wire during its travel through the device. It is a division of my application, Serial No. 505,704, filed December 31st, 1930. The invention is especially adaptable for the purpose of annealing wire which is to be insulated. The device may be installed in a wire insulating machine, or in other machines where it is desired to anneal the wire at a high rate of speed or at the same rate of speed as that at which the wire moves through the machine to which the device is attached. The invention is very suitable for use where it is desirable to clean or prepare the surface of bare wire before it is coated with insulation. The wire may be only annealed, or, by increasing the temperature the wire may be oxidized, if desired.

In the usual method now employed for annealing wire, the wire after being wound upon spools is placed in an oven and brought to the required heat for annealing, depending upon the size of the wire, etc. In this method, any soap or grease compound used in drawing the wire to size, which is wound up with the wire on the spools and annealed in the oven, is deposited upon the surface of the wire. When this soap or compound is covered with insulating material it will cause spots in the insulation. The same sort of trouble may occur when the wire is passed through a heated pipe or oven, or brought into contact with a flame or other direct heating means, either in a suitable chamber or exposed to the air.

Prior annealing methods are slow, require much handling, labor and expense and another great disadvantage in such methods and in the devices for carrying out such methods is that the heated wire will stretch or elongate under any strain while it is hot. This is especially true of the smaller sizes of wire, and this elongation of the heated portion of the wire makes it hard to feed through an automatic winding machine for winding the wire into a coil, etc. In some cases, the diameter of the wire will be reduced by the stretch, thus rendering it unfit for many electrical purposes, due to increased resistance caused by the reduced diameter of the wire.

With my invention it has been found that a speed of 400 to 600 feet per minute for #40 gauge wire and 200 to 300 feet per minute for #30 gauge wire can be employed without any noticeable stretch or elongation. With the degree of the annealing heat under perfect control, speeds higher than this can be easily reached without objectionable or appreciable elongation of the wire.

One of the objects of my invention is to provide apparatus for annealing or oxidizing a wire in a continuous manner during the travel of the wire through the apparatus.

Another object of this invention is to provide means whereby, during the heating of the wire, no elongation or stretch of that portion of the wire which is being heated or any other portion of the wire takes place during such heat treatment.

Still another object is to provide apparatus whereby the wire is rendered free from oil and foreign matter preparatory to its being coated or enameled, when coating or enameling of the wire is desired.

A further object is to provide automatic means so that when heat is to be applied through an electric current to successive portions of the wire, the electric current is turned on and off by the travel of the wire in such a manner that should the wire become stationary, the current and therefore the heat will be reduced to prevent melting or overheating of that portion of the wire that is at that instant in position to be heated and the current is turned on when the travel of the wire attains a predetermined rate of speed. Also provision is made whereby variations in the speed of travel of the wire will not cause appreciable variations in the degree of annealing.

While I show and describe herein an illustrative embodiment of a suitable apparatus for carrying out my invention, it is understood that modifications may be employed, such, for example, as a duplication of parts and change in material and that the device may be enclosed or exposed to the air, and that suitable changes may be made to suit it to different sizes of wire or to wire of different material or metals, also that by suitable housing the device can be operated so that the annealing takes place in the presence of inert gases, steam, etc. to prevent tarnish forming on the surface of the wire due to the annealing operation.

My invention comprises certain construction and combination of parts illustrated, for example, in the accompanying drawing in which Fig. 1 is a side view of the device showing it installed near a wire insulating machine; Fig. 2 is an enlarged side elevation of a portion of the device. Fig. 3 is a front elevation of the same, shown partly in section; Fig. 4 is a sectional view, taken on the line A—A of Fig. 3; Fig. 5 is a side elevation of the wheel for suspending the wire during the heating; Fig. 6 shows how the electric current that is supplied to the device may be varied with-

in certain limits, and in proportion to speed changes in the rate or travel of the wire; Fig. 7 shows a modification by which automatic control of the current can be secured.

5 The device as here illustrated comprises a base 10 of insulating material, and to which are secured the two uprights 11 and 11' which are formed at their upper ends with aligned bearings 12 and 12' or a single support may be used if desired.

10 A rotor comprising two sheaves or wheels 13 and 14 formed of a good electrical conductor such as brass, are secured together side by side by means of bolts or rivets 15 which are insulated therefrom by the insulating bushings 16 and the washers 17, while the sheaves 13 and 14 are separated by a disk 18 of insulating material, in such a manner that a sheave 13 is electrically insulated from the sheave 14.

20 The sheave 14 is formed with a stud shaft 19 projecting from its outer face and adapted to rotate freely in the bearing 12. The outer end of this stud shaft 19 is pointed as shown at 20 and contacts with a flat spring 21, which is secured to the upright 11 by the screw 22. If a central upright is employed, as mentioned above, the two sheaves may be mounted one on each side thereof, and the spring 21 may be hinged to a suitable base so that by removing the spring from contact with the end of the shaft the wire may be readily placed on or taken from the wheel.

This sheave 14 is also formed on its inner face with a bore 23 extending partway therethrough in line with the stud shaft 19. Within this bore 23 is mounted a cup-shaped bushing 24, and within this bushing 24 is secured one end of a shaft 25, the other end of which is freely rotatably mounted in the bearing 12' of the upright 11'. The shaft 25 is pointed at the end as shown at 26 and is in contact with a flat spring 21'. The shafts 19 and 25 thus rotate in the bearings 12 and 12' and contact with the springs 21 and 21'.

40 The sheave 13 is recessed as at 27. Within the recess 27 are pivoted on pivots 28 two contact arms 29 which are formed with weighted ends 30 which, when the sheave 13 is rotated, will by centrifugal force move outwardly and bring the arms 29 into contact with the shaft 25 thus establishing an electrical connection between the sheave 13 and the shaft 25. This connection is broken by the springs 45 when the wheel 13 stops its rotation or reaches a sufficiently low speed to enable the springs 45 to overcome the centrifugal force.

55 The uprights 11 and 11' are connected by lead wires 32 and 33, respectively, to an electrical transformer 34 or other source of current which in turn is connected to a power line 35 and 36, the amount of current from which is governed by a rheostat 37 connected in said power line. Each of the sheaves 13 and 14 thus constitute a terminal of the electric circuit.

60 Above the device and at some suitable distance (which may be varied to suit conditions) is mounted a single sheave or wheel 38 which is freely rotatable in a bracket 39 which is mounted on a base 39' of insulating material, so that the wheel 38 is insulated from all other parts of the machine. This sheave may be made of heat resisting or heat insulating material, such as moulded mica or asbestos material with a proper center bearing.

70 The wire 40 to be annealed is carried from a supply spool 41 to the sheave 14, around which it is given approximately one turn, and is then

carried up and around the sheave 38, then down to the sheave 13, around it and to the idler wheel 42, to the applier 43 for coating material, the oven 44 and thence to the wheel 46 and take-up spool 47.

5 It is understood that the sheave 38 may be located at a predetermined or adjustable distance from the sheaves 13 and 14 depending upon the size of the wire to be treated, the length of time required for each treatment and the degree of 10 heat applied. In the application of electrical heat as herein shown, the electrical current may be of any desired voltage being controlled by a rheostat and automatic means applied to the device. In this particular it may be here stated 15 that while I have shown an automatic switch built into the wheel, that this may be located in connection with any of the moving parts or other pulleys or wheels and may be of any suitable construction to open and close an electrical circuit 20 by the change of speed of travel of the wire.

In the automatic control illustrated in Fig. 6 of the drawing, I have shown a governor applied to the sheave 42 comprising a ball governor 50 similar to that type used in phonographs, etc. so 25 arranged that speed variations, such as would occur during starting and stopping, will vary the current and thus insure an even annealing, this being accomplished by a sliding collar 51 mounted on the shaft 52 to which is pivotally secured one 30 end of the ball arms 50. The collar 51 is formed with a groove 53 within which is placed one end of a pivoted arm 54, the other end of which forms the arm for the rheostat 55 which is connected in the power line from the transformer 56, the 35 wires 32 and 33 being carried to the wheels 13 and 14.

It has been found in practice that sufficient current to cause a proper annealing heat to be generated in the wire when traveling is too great if 40 the speed of travel is reduced and will tend to fuse the wire. Also if the speed of the wire is increased the flow of current must be increased to anneal properly and it is highly desirable that the annealing temperature be kept at the proper 45 amount at all times.

By having a rheostat or controlling arm 54 operated by the sliding collar 51, the pivot point of the arm being at 57, the arm can be made to move over a suitable row of contacts of the rheostat 55 and vary the current applied to the transformer 56, thus any variation in speed of the wire 40 traveling over the wheel 42 will vary the current for annealing.

Where no speed variations are encountered in 55 operation, a simple arrangement, as shown in Fig. 7, may be employed. The motor 60 draws the wire 40 and winds it on the spool 47 by the belt 61 and pulley 62. I have shown the primary of the transformer 63 and leads 64 to the motor 62 connected in parallel to the power line 65 so that as the motor is started the drop in voltage across the terminals will drop across the transformer and as the motor comes up to speed the current will increase also in proportion. The secondary 65 of transformer 63 is used for annealing and I have found this entirely satisfactory provided a commutator starting type of motor is employed.

The simple centrifugal switch shown in Figs. 3 and 4 will suffice if a small amount of unannealed 70 wire is not objectionable at the start and stop of the operation.

In the operation of the device, it will be seen that part of the wire 40 which travels up from the sheave 14 to the sheave 38 and back to the 75

sheave 13 is always in the electrical circuit between the sheaves 13, 14 and acting as a resistance to the current is heated and annealed during its travel from the sheave 13 to the sheave 14, but that part of the wire 40 leading from the supply spool 41 to the sheave 14 and from the sheave 13 to the idler 42 is cold and as the two sheaves 13 and 14 are secured together they move in synchronism. Therefore, as the wire 40 is pulled from the sheave 13, the sheave 14 simultaneously turns the same amount. No elongation strain is exerted on the hot portion of the wire 40 between the sheaves 13 and 14, this part of the wire traveling freely. It is important that just sufficient tension be employed to keep the wire 40 in good electrical contact with sheaves 13 and 14, there being an expansion and contraction on heating and cooling the wire, so the wire should be slightly free to accommodate this action on the sheaves.

These portions of the wire which are in contact with the sheaves 13 and 14 act as contacts for leading the current to that portion of the wire which is looped up from the sheaves 13 and 14 to the sheave 38. Due to the heat conductivity of the sheaves 13 and 14, the wire which is in contact therewith is not heated and the sheave with which the heated wire comes into contact aids in cooling the wire. That portion of the wire which is being heated by the electric current may, if desired, be passed through a chamber and heated by any other suitable means.

Also the distance between the device and the pulley 38 may be varied as desired to govern the length of wire being heated and also the device may be so arranged that the sheaves 13 and 14 may be mounted on a central bearing and the springs 21 hinged so that the wire may be placed thereon from the side and not have to be threaded between the uprights 11 and 11'. It is also understood that direct current could be used instead of alternating, with suitable changes.

I claim:

1. In an apparatus of the class described, means for exerting tension upon a wire, means for forming a portion of said wire into U-shape and heating said U-shaped portion while moving said wire longitudinally, means for transmitting said tension from one part of said wire to another part by by-passing it around said portion being heated, and means for varying the length of the portion being heated.

2. In an apparatus of the class described, means for moving a wire longitudinally and forming portions thereof into U-shape and heating said portions in succession, means controlled by the speed of movement of said wire to vary the amount of heat applied thereto, and means for relieving tension on the portions of said wire as they are being heated.

3. In an apparatus of the class described, means for moving a wire longitudinally and forming portions thereof into U-shape and heating said portions in succession, means controlled by the speed of movement of said wire to vary the amount of heat applied thereto, means for

relieving tension on the portions of said wire as they are being heated, and means for cooling said wire at the end of said heated portions.

4. In an apparatus of the class described, means for moving a wire longitudinally and forming portions thereof into U-shape and heating said portions in succession, means controlled by the speed of movement of said wire to vary the amount of heat applied thereto, means for relieving tension on the portions of said wire as they are being heated, and means for cutting off the heat when the speed of movement of said wire becomes less than a predetermined amount.

5. In a device for heating wire, means for subjecting said wire to an electric current for heating a portion of it while it is being moved, means to prevent strain from being placed upon that portion of the wire which is being heated, and means controlled by said wire for breaking the electric current when the wire moves at a speed below a predetermined amount.

6. In a device for heating wire, means whereby continuous movement is imparted to the wire, electrical means for heating a portion of the moving wire, means to prevent elongation strain from being imparted to that portion of the wire which is being heated, and means controlled by said wire for closing the electrical current of said heating means when the movement of the wire has reached a predetermined rate of speed.

7. In a device for heating a wire, a pair of coaxial rotating elements insulated from each other and connected to a source of electricity, and means to cause said wire to contact with said elements at separated points along said wire.

8. In a device for heating a wire, a pair of coaxial sheaves rotating at the same peripheral speed and insulated from each other, a source of electricity connected to said sheaves, said wire passing around said sheaves in succession.

9. In a device for heating a wire, a pair of sheaves rigidly connected together and rotating side by side at the same peripheral speed and insulated from each other, a source of electricity connected to said sheaves, said wire passing around said sheaves in succession and a rotatable element over which said wire passes between said sheaves.

10. In a device for heating a wire, a pair of rotating elements insulated from each other and connected to a source of electricity, means to cause said wire to contact with said elements at separated points along said wire, and centrifugal means carried by one of said rotating elements to close the connection to said source of electricity when this element is rotated.

11. In a device for heating wire, means for subjecting said wire to an electric current for heating a portion of it while it is being moved, means to prevent strain from being placed upon that portion of the wire which is being heated, and an element carried by said first-named means and operated by centrifugal force to complete said electric current connection.

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