W. E. GIBBS.

APPARATUS FOR ANNEALING WIRE.

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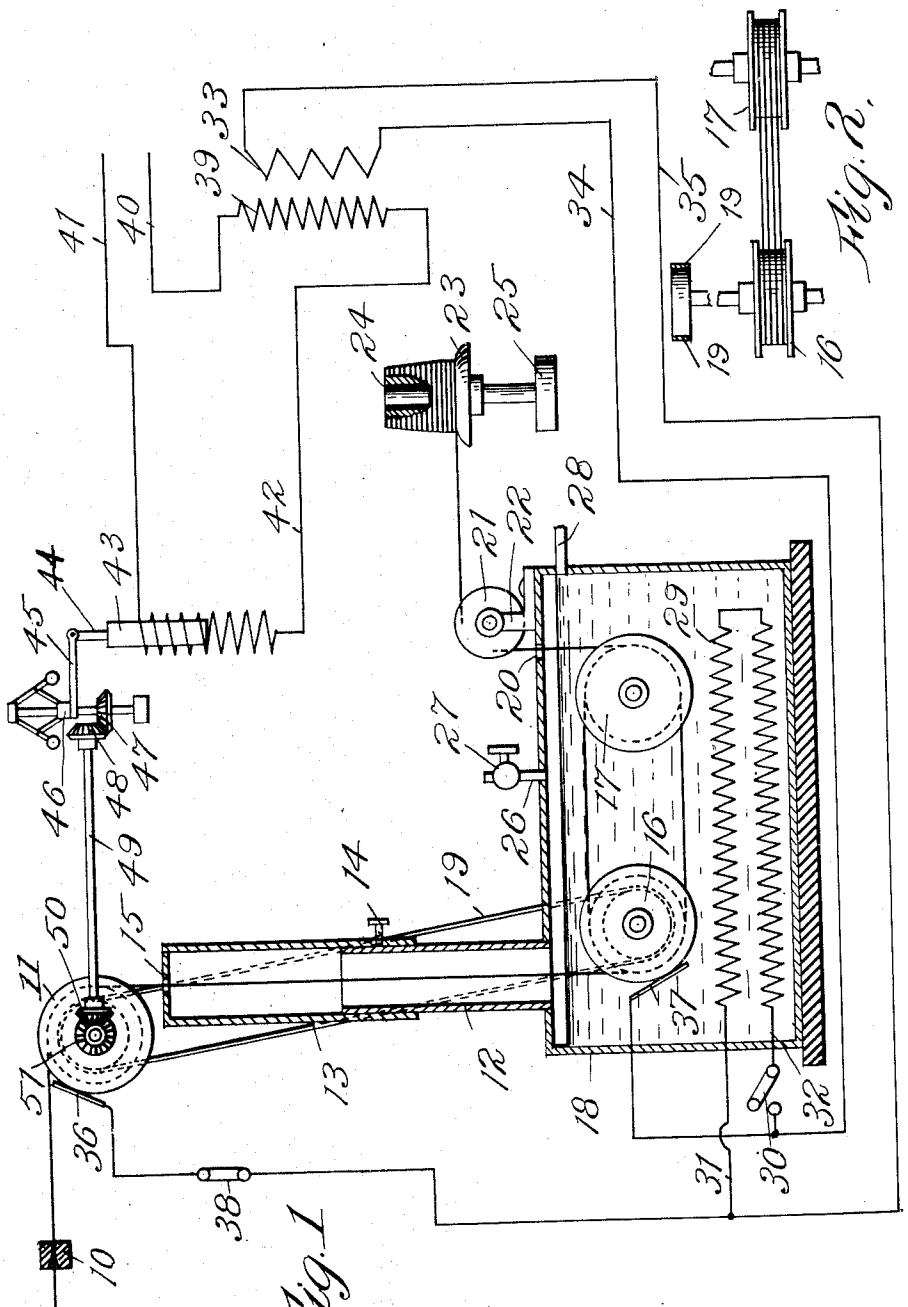

Fig. 1

Fig. 2.

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APPARATUS FOR ANNEALING WIRE.

1,043,089. Specification of Letters Patent. Patented Nov. 5, 1912.

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To all whom it may concern:

Be it known that I, WILLIAM E. GIBBS, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Annealing Wire, of which the following is a full and clear specification.

My invention relates in general to annealing wire, and more particularly to annealing by the electrical current.

It has already been proposed to employ the electric current for producing the heat necessary for annealing the wire, but so far as I am aware, the principle has not been successfully applied in commercial practice. The passage of the electric current through the wire to be annealed offers the advantage of direct and local heating in the wire itself thus affecting the annealing with great rapidity. But in order to effect the annealing rapidly the wire must be fed at considerable speed through the apparatus, and the pressure of the electric current must bear a certain relation to this speed. Thus if the current passing through a given portion of the wire moving at a particular speed is only sufficient to produce the best annealing temperature therein just before the wire moves out of circuit a higher speed and the same current would fail to produce the best annealing temperature, whereas a lower speed with the same current would produce an excessive temperature.

One of the objects of my invention is to maintain the voltage in the proper relation to the speed of the wire. By such regulation the combining of the annealing with the wire drawing process becomes commercially practicable and in the preferred form of my invention the annealing is carried on at the same time with the drawing of the wire.

While the wire is at the annealing temperature it is important to protect it from oxidation by the air which must be excluded from the wire, and not admitted thereto until the temperature of the wire has fallen below the point at which it discolors in contact with the atmosphere. Water offers a convenient means for effecting the cooling, but the wire should leave the water in a dry condition. In accordance with my invention, the protection against oxidation during annealing, the cooling after annealing, and the drying after cooling by water, are all obtained in a simple manner by keeping the cooling water at the boiling point so as to supply a steam bath for the protection of the wire during annealing and to cool the wire below the oxidizing point, but leave it at a sufficiently high temperature to emerge in substantially a dry state.

Other features of the invention will appear in the description and illustration of an embodiment of my invention in connection with a wire drawing apparatus. Such an embodiment is shown in the accompanying drawings in which—

Figure 1 is an elevation with parts in section, of so much of a drawing and annealing apparatus as is necessary to illustrate my invention, and Fig. 2 is a plan view showing the arrangement of rollers for carrying the annealed wire through the cooling water.

Assuming the application of the invention to annealing copper wire, which will serve to illustrate the principles involved, it will be understood that the drawing will be effected in one or a series draw plates in any well known or desired manner. As the drawing *per se* is not claimed as a novel step, I have shown a single draw plate 10 which may be assumed to be the final draw plate. The wire is drawn through draw plate 10 by a suitable drawing drum 11. Passing from the drawing drum 11 the wire descends through a steam bath within a telescopic tube formed of stationary member 12 and sliding cap 13 which may be set in any desired position on stationary tube 12 by means of set screw 14 or other suitable device. The sliding cap 13 has a perforation 15 at the top to permit the passage of the wire. After passing through the steam bath the wire is carried one or more times around a pair of drums 16 and 17 underneath the surface of cooling water contained in a tank 18 suitably insulated from the rest of the machine, from which the stationary tube 12 rises. The drum 16 is driven at the same speed as the drawing drum 11 as indicated by belt connection 19, while the drum 17 may be idle. Drums 16 and 17 are journaled in suitable bearings in the walls of the tank 18. From the drum 17 the wire passes through the perforation 20 in the top of water tank 18 and over an idler 21 sup-

ported in bracket 22 upon the top of the tank 18 and is taken up upon a cooling drum or "block" 23 in known manner. "Block" 23 preferably has an insulating bushing 24 and may be driven by belt connection 25. Water may be supplied to the tank 18 through supply pipe 26 provided with a regulating valve 27 and may be kept at the proper level in the tank by an overflow 28.

In order to supply heat to the water in the tank 18 so as to produce the steam for the steam bath and so that the wire will issue from the cooling bath in a dry state, a heating coil 29 is provided. The heating coil 29 will in many cases be used only when starting up the operation to produce the initial boiling temperature, after which the quenching of the annealed wire which passes into the water at the annealing temperature will be sufficient to maintain the boiling temperature. This will depend upon the size and speed of the wire which is being annealed, and upon the amount of radiation which takes place from the tank 18. A switch 30 is preferably provided in the heating coil circuit 31, 32, so that the supply of current to the heating coil 29 may be interrupted when the heat produced by the quenching of the wire is in itself sufficient to maintain the necessary temperature in the water bath.

The current for producing the annealing temperature in the wire may be either alternating or direct, but that herein shown is in the form of alternating current produced in the secondary 33 of a transformer and is led to the wire by circuit 34, 35 and brushes 36 and 37, the former brush bearing upon the wire upon the drawing drum 11 and the latter brush bearing upon the wire upon the drum 16. As herein shown the heating coil current 31, 32 may be supplied from the same circuit under proper conditions. A switch 38 is provided in the circuit leading to the wire to be annealed so that the circuit may be open or closed at will. Inasmuch as the temperature attained by the portion of wire to be annealed between the brushes 36 and 37 will depend upon the speed at which the wire is traveling, I prefer to automatically control the voltage, and hence the current strength, by the speed of the wire. For this purpose primary 39 has its supply circuit 40, 41 provided with a regulating device of suitable character as represented conventionally by the variable inductive resistance coil 42, in which the position of the plunger core 43 may be regulated by connecting link 44 and arm 45 projecting from collar 46 of a centrifugal governor driven by the drawing drum 11. Suitable connection for this purpose may be made through miter gears 47, 48, shaft 49 and miter gears 50, 51, the latter being secured upon the shaft of the drawing drum 11. This control device is so arranged that with an increase in speed the core 43 is withdrawn a corresponding amount from the variable inductance coil 42 whereby the inductance is reduced and the voltage in the primary raised. Any rise in voltage in the primary produces a corresponding rise in the secondary and hence the desired change in voltage between the brushes 36 and 37. Fore wire No. 22 B. & S. gage the length of wire through which the annealing current passes may be about three feet, and the current at 10 volts may be about 150 amperes when the wire is coming from the draw plate at its usual speed, and by proper regulation may be varied to suit any particular wire or speed.

Oxidation of the wire while at the annealing temperature can be entirely avoided by suitably adjusting the cap 13 upon the fixed tube 12 of the steam bath. When it is desired to permit a certain amount of oxidation this can be accomplished by sliding cap 13 farther down upon the tube 12 so that the wire is exposed during the heating. The color produced by the oxidation will vary with the amount of oxidation and may thus be controlled by adjusting the cap 13 upon the tube 12.

I claim—

1. In apparatus of the character described, the combination with means for heating the wire to the annealing temperature; of an adjustable steam tube surrounding a predetermined portion of the heated wire, and a water tank adapted to contain water for quenching the wire and adapted to supply steam to said adjustable steam bath.

2. In apparatus of the character described, the combination with means for heating the wire to the annealing temperature; of a telescopic steam tube comprising a stationary tubular member and a slidable cap surrounding a predetermined portion of the heated wire, and means for supplying steam to said steam bath.

3. In apparatus of the character described, the combination with means for heating the wire to the annealing temperature; of a steam bath surrounding the heated portion of the wire, a water tank for quenching the wire, said water tank having its only steam vent through said steam bath, and auxiliary means disposed in the water tank for heating the water therein.

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