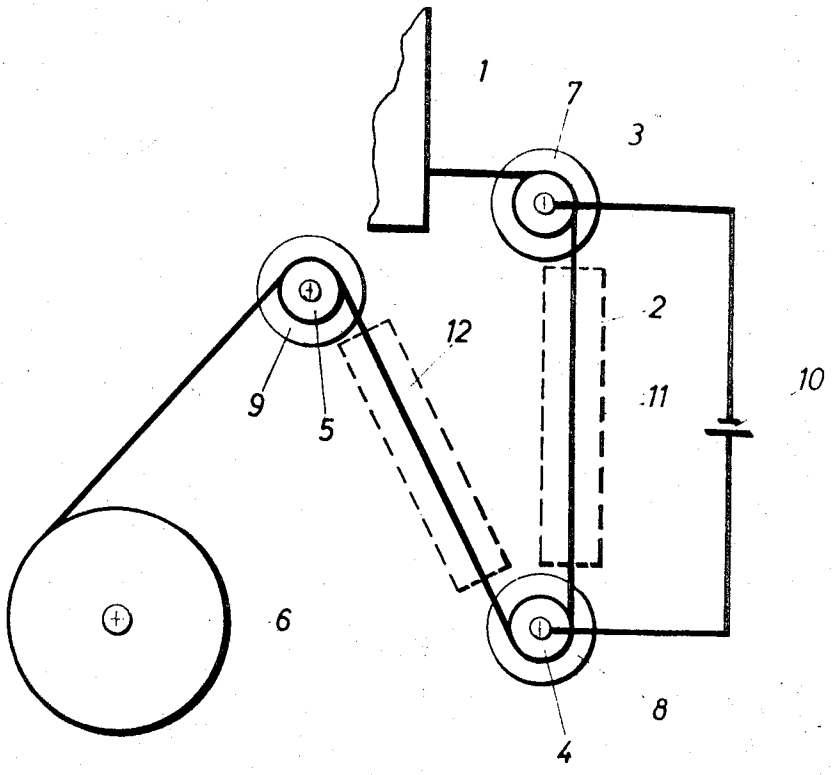
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APPARATUS FOR CONTINUOUSLY HEATING WIRE

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APPARATUS FOR CONTINUOUSLY HEATING WIRE

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ABSTRACT OF THE DISCLOSURE

Wire emerging from a wire drawing apparatus is passed through a heating zone and then a cooling zone before being rewound. A plurality of rollers driven through permanent magnetic clutches are interposed between the cooling zone and the rewinding roller to carry the moving wire so as to absorb any fluctuations in the speed of the moving wire caused by adjustments in the speed of the rewinding roller. These rollers act as buffers to prevent forces resulting from such speed fluctuations being transmitted to the wire while it is in the heating zone.

The present invention relates to the continuous heating of wires, strands, cables and the like, more particularly, to an apparatus for preventing forces caused by fluctuations in speed of the moving wire resulting from the rewinding process from being transmitted to the wire while it is being heated.

In the manufacture of wire, strands, cables of indeterminated length and the like it is frequently desired to heat such wires. This can be accomplished by passing the wire through a heating zone and then through a cooling zone after which the wire is rewound. The heating can be done electrically by passing the moving wire over an electrically conducting roller positioned at the beginning of the heating zone and driven by an adjustable permanent magnetic clutch. This arrangement has the advantage of permitting the wire to move over the current carrying roller without slipping and thus prevents the formation of burned areas on the wire. This form of apparatus has been satisfactory in operation since it can be adjusted so that the wire will almost be pushed into the heating zone instead of being pulling therein. In addition, another driven roller may be provided at the exit of the heating zone so that the forces acting upon the wire while it is in the heating zone will be balanced and thereby prevent any undesirable stretching or elongation of the wire while it is in the heating zone.

After heating, the wire is then cooled, and if necessary dried, after which the wire is wound upon a suitable spool or reel. It is known in the art that the speed of rotation of this rewinding spool must be continually changed as the wound wire accumulates on the spool. However, it is difficult to accurately regulate this adjustment in the rotational speed of the spool to prevent all stretching of the wire during this rewinding process. It has therefore been proposed to drive the rewinding spool by means of a permanent magnetic clutch to provide a resilient driving connection. This arrangement has not been completely satisfactory since variations and fluctuations in the speed of the moving wire during the rewinding were apparent in the heating zone. During heating the wire is relatively soft and readily susceptible to stretching caused by these speed fluctuations. These undesirable effects are quite serious with relatively thin wires.

It is therefore the principal object of the present invention to provide a novel and improved apparatus for

preventing undesirable stretching of moving wire while it is being heated.

It is another object of the present invention to provide a simple and inexpensive arrangement for preventing any stretching or burned areas in a wire while it is in the heated zone because of fluctuations in the speed of rewinding the wire.

The apparatus according to the present invention essentially comprises means for passing an electric current through a portion of a moving wire as it emerges from a wire drawing apparatus to define a heating zone so as to heat the wire to incandescence. The heating means may include an electrically conducting roller over which the wire passes with this roller being positioned at the beginning of the heating zone. The electrically conducting roller is driven by a permanent magnet clutch to provide a resilient driving connection. After the wire is heated it is passed through a cooling zone. After emerging from the cooling zone the wire is rewound upon a suitable roller or the like. Interposed between the heating zone and the rewinding roller there is provided roller means for carrying the moving wire and for absorbing any fluctuations in the speed of the moving wire resulting from variations in the speed at which the wire is wound on the rewinding roller so that such speed fluctuations are not transmitted to the wire in the heated zone. The roller means may comprise several rollers which are driven resiliently through permanent magnet clutches. These rollers thus operate in the manner of buffers or absorbers in that any sudden jerks to the wire delivered by the rewinding roller are absorbed by the resiliently driven roller immediately ahead of the rewinding roller.

Other objects and advantages of the present invention will be apparent upon reference to the drawing which illustrates schematically the apparatus according to the present invention.

With reference to the drawing a specific embodiment of the present invention will be described in detail. From a wire drawing apparatus **1**, such as well known in the art, a wire **2** emerges and passes over rollers **3**, **4** and **5** onto a rewinding spool **6**. The rollers **3**, **4** and **5** are resiliently driven respectively through permanent magnet clutches **7**, **8** and **9**. The clutches are known in the art and may be electrically actuated.

The rollers **3** and **4** are electrically conducting and are connected through suitable leads to a source of electrical energy **10** so that an electric current is passed through that portion of the wire between the rollers **3** and **4**. This portion of the wire defines a heating zone **11** within which the wires are heated so as to be brought to incandesence.

Between the rollers **4** and **5** the wire passes through a zone **12** in which it is cooled. If a fluid cooling medium is used then the wire is also dried within this zone.

It is apparent that within the heating zone **11** the wire is the most susceptible to tensile forces of the kind resulting from fluctuations in the speed of movement of the wire because of variations in the winding speed of spool **6**. The wire in zone **11**, being in a heated state, is relatively soft. This sensitivity to tensile forces progressively diminishes as the wire is cooled in the zone **12**.

During the rewinding of the wire upon the spool **6**, any variations or fluctuations in the rotational speed of the spool **6** will exert a stronger pulling or tensile force on the wire. A portion of this increased tensile force will be absorbed by the resilient drive which is conventionally provided to drive rewinding spool **6**. A residual portion of this increased tensile force will also be absorbed by the resiliently driven roller **5** so that in the cooling zone **12** the wire will be subjected only to those

forces which would no longer cause any permanent deformation of the wire. Any remaining portions of the abrupt tensile force will finally be absorbed by the resiliently driven roller **4** so that that portion of the wire which is in the heating zone **11** will not be subjected to any undesired tensile forces. Thus that portion of the wire within the heating zone **11** will be subjected to a substantially uniform tensile force during the winding operation. Any sudden increases in tensile forces in the wire imparted by the spool **6** will be absorbed before these forces can be transmitted to the portion of the wire within the heating zone.

The above described apparatus has been found to be particularly suitable for very thin wires in that it will prevent any undesirable stretching, deformation or burned areas in these wires which previously might be caused by changes in the rotational speed of the rewinding spool. Such thin wire may be 10–15 microns in diameter.

The resilient or elastic clutches, such as **7**, **8** and **9** are known in the art and the clutch disclosed in German Pat. 849,272 of Sept. 11, 1952 is suitable for use in this invention. The resiliency of the clutches is so selected to depend largely on the material of the wire being drawn and on the thickness or diameter of the drawn wire.

Thus it can be seen that the present invention has disclosed an apparatus which is inexpensive and simple in structure for preventing the transmission of undesirable tensile forces to that portion of a moving wire which is in a heated condition. The present invention is readily applicable for use in drawing thick wires as well as in drawing very fine wires. The apparatus effectively absorbs all abrupt increases in tensile force exerted on the wire because of variations or fluctuations in the rotational speed of the rewinding spool. By effectively absorbing such tensile forces so that they cannot be transmitted to the wire in the heated condition, the wire in the heating zone is subjected to a uniform tensile force. The resulting wire is therefore free of undesirable stretching, deformation or burned areas.

It will be understood that this invention is subject to modification in order to adapt it to different uses and conditions.

What is claimed is:

1. In an apparatus for continuously heating and cooling very thin wire, the combination of means for passing an electric current through a portion of a moving wire emerging from a wire drawing apparatus to define a heating zone to heat the wire, first and second spaced electrically conducting rollers over which the wire passes and connected to a source of electrical energy with said first and second electrically conducting rollers defining the heating zone, first and second magnetic clutches drivingly connected to said first and second electrically conducting rollers respectively to resiliently drive the same, means subsequent to said second electrically conducting roller and said heating means through which the wire passes for cooling the heated wire, a rewinding spool being resiliently driven to receive the wire after emerging from said cooling means, a third roller positioned after said cooling means and before said rewinding spool and carrying the moving wire, a third magnetic clutch drivingly connected to said third roller to drive resiliently the same, said third and second magnetic clutch driven rollers absorbing progressively fluctuations in the speed of the moving wire resulting from variations in the speed at which the wire is wound on the rewinding spool to decrease progressively the effect of fluctuations of the rewinding speed on the tension of the wire moving through the heating zone.

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