Fig. 3

Fig. 4

Elements:

10, 11, 12, 13, 14, 15

5, 4, 6
ROLLING WIRE FROM ALUMINIUM AND ITS ALLOYS

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Generally, in rolling of wire a certain minimum strength is specified for the wire rolled. Such minimum strength depends upon the diameter of the finished wire, that is the drawn wire. In case of a thin final wire usually no difficulties are involved in obtaining a rolled wire having satisfactory strength. However, if the final wire has a larger diameter, that is, if the reduction by drawing of the rolled wire is less, great difficulties have hitherto been encountered in producing a rolled wire of sufficient strength. It is possible by starting from a very heavy rolled wire to secure sufficient reduction by drawing, even for wire having relatively large final diameter, to obtain the required strength. This, however, requires the mill to be adjusted when changing to the wire diameter desired, and furthermore the usual wire drawing machines are not adapted for drawing such heavy rolled wire and the consumption of power in the wire drawing machine will be considerably greater than if it were possible to start from a lighter rolled wire.

One way of previously obtaining high strength in the rolled wire was to allow the coils to run out leaving them to cool, which was normally the case in manual rolling. This method has been adopted with a particular attempt to obtain high strength in the rolled wire, but the result has been a consequence of the nature of the manual rolling. With completely automated rolling of wire, however, the shifting of the wire between the sets of rolls is effected automatically and the coils formed never get sufficient time to cool to an extent having appreciable effect on the wire. Furthermore, the rate of speed of the rolls is greater, which also contributes to increasing the temperature of the wire during the rolling operation, which in turn will make the material rolled softer, with resultant decreased strength.

However, applicants have found out that it is possible to obtain a desired cold treatment of the rolled wire and therewith an increased strength, if the wire during its passage between the sets of rolls is led through a cooling liquid. It is essential for carrying the invention into practice that the cooling be efficient. Thus, in practice it is not possible to obtain the desired result without using a flow of cooling liquid.

According to the preferred embodiment of the invention, cooling liquid is caused to flow through pipes, through which the wire is passed, and thereby preferably under a high pressure, for example, between 1 and 10 atmospheres positive pressure.

In doing so it is desirable to subject the wire to cooling as closely as possible to the stage at which the wire is ready-rolled, in order to obtain the desired cooling treatment in a rolling operation carried out subsequent to the cooling operation. An example of such a suitable stage constitutes a cooling of the wire between the second and third sets of rolls from ready-rolled wire, although cooling also may take place between one or more of the other sets of rolls. Any cooling liquid any suitable liquid may be used, for example, water or oil-emulsified water. Applicants have found it particularly desirable to use the same cooling liquid as is used for cooling in the sets of rolls, which contributes to simplification of the drainage system.

Another important feature in carrying the invention into practice is control of the rate of cooling. In many cases it is desirable that the hardness of the wire does not exceed a certain maximum limit. By making use of the cooling apparatus embodying the invention such a relatively accurate control of the rate of cooling is rendered possible. A particularly suitable way for the control of the rate of the cooling process is to vary it in accordance with the consumption of power in sets of rolls following the cooling operation for obtaining the desired strength in the ready rolled wire.

In view thereof the invention comprises an arrangement of rolling mills for rolling wire, particularly from aluminium and its alloys, wherein the wire is allowed to pass through a guide tube containing cooling medium in order at high rolling velocities to obtain a desired cooling treatment of rolled wire, characterized in that a number of entirely open guide tubes arranged in alignment with each other and with the rolling groove, said guide tubes being of such a small diameter that the wire passing therethrough will be surrounded by an approximately spaced-formed jacket of cooling medium, the tubes being connected to a pump arrangement for cooling medium having such capacity that a high pressure, for example, 1—10 atmospheres of positive pressure, may be maintained in the tubes with a corresponding rapidity of flow of the medium induced thereby.

In the following, an example embodying the invention will be described in detail with reference to the accompanying diagrammatic drawing.

In the drawing:
Fig. 1 is a view of a wire rolling mill between two sets of rolls having arrangements for cooling the wire in accordance with the principles of the invention;
Fig. 2 is a plan view of the arrangement shown in Fig. 1; and
Figs. 3 and 4 are cross sections of the arrangement in Fig. 2 along the lines III—III and IV—IV, respectively, which show more in detail the action of the apparatus.

In the drawing reference numeral 1 designates a pair of rolls, for example, the third from the end, and 2 the next succeeding set of rolls. The hot work coming from the set of rolls 1, the approximate path of which is designated by 3, is introduced into a guide tube 4. Connected to the pipe for the supply of cooling liquid, if, for example, water (see particularly Fig. 4) near the inlet end of the guide tube are supply pipes 5, 6. The supply pipes 5 and 6 are suitably fixed to the guide tube in such a way that the cooling liquid is introduced in the guide tube in a tangential direction and at an oblique angle to the length direction of the guide tube, a helical movement being imparted to the cooling liquid in the tube 4. In the drawing the liquid has been shown as carried concurrently through the guide tube in relation to the movement of the work, but it is also possible to force the cooling liquid in countercurrent direction.

However, in order to obtain a satisfactory cooling action with the apparatus embodying the invention it is required to have a very thin water jacket around the hot work passing through the tube 4 and to provide for a great difference between the velocities of the hot work and the cooling medium, since otherwise the rapid cooling necessary would not be obtained. Obviously, a certain cooling effect would also be obtained by having a thick water jacket, but in such case a pump of considerable capacity would be necessary in order to provide for rapid flow and to insure that the cooling medium always is in contact with all points of the hot work during the course of the cooling, due to the fact that the tubes 4 are fully open.

The provision of sealing members would both complicate the construction and use of the apparatus.
Thus in accordance with the invention the tubes are made of such small diameter in relation to that of the work that there is obtained only a small clearance space between the tube-wall and the hot work. This in turn requires an accurate guiding of the hot work into the tubes 4, for which reason the latter in accordance with Figs. 1 and 2 are flared at their inlet ends so that the leading end of the work will easily enter the tubes 4.

It is preferred to attach the guide tube 4 in such a way that it may be easily forced out of its working position, if the wire should get jammed. This may occur, for example, in the way shown more in detail in Fig. 3. Placed inside the box 7 which is arranged for the collection of cooling liquid and supported from brackets 8 and 9 fixed in relation to the sets of rolls and furthermore provided with an outlet 10 are two frames for the guide tube 4. Fixed to each one of the frames are retainers 12 provided with spring loaded balls 13, which engage a fitting 14. Thus the tube 4 is arranged between two such fittings 14. The spring force may be varied by means of the set screws 15. The supply pipes 5, 6 in the ends thereof connected to the tube 4 are connected, for example, by means of hoses, to supply conduits. If the wire should get jammed in the tube 4 during the rolling operation, the pipe would get forced, together with both of its fittings 14, out of its position of engagement in relation to the balls 13, and breaking the hose couplings to the supply pipes 5, 6. No damage of the apparatus then results from this arrangement.

If desired, as is shown in the drawing, a plurality of guide tubes 4 with a cooling device may be arranged in series and in the embodiment shown four such tubes are shown.

Obviously, the invention is not restricted to the embodiment shown, but different modifications and alterations are possible within the scope of the claims.

Having now described the invention what we claim as new and desire to secure by Letters Patent is:

1. A rolling mill comprising two spaced roll stands through which wire is successively rolled, and means for cooling the wire between said stands comprising guide tube means through which the wire is passed, said guide tube means having an internal diameter providing relatively small clearance space between the tube means and the wire passing therethrough, and means for forcing a liquid coolant through said clearance space at a substantially superatmospheric pressure and a relatively high velocity with respect to the velocity of the wire through said guide tube means resulting from the relatively high pressure of the coolant, said means for forcing the liquid coolant through the guide tube means comprising means for supplying liquid coolant tangentially to the clearance space between the guide tube means and the wire passing there-through, whereby to create a helical flow of coolant around the wire passing through the guide tube means.

2. Apparatus as defined in claim 1 in which said guide tube means is divided into a plurality of aligned and relatively short guide tubes to which coolant is individually delivered and from which coolant is individually discharged.

3. Apparatus as defined in claim 2 in which means is provided to releasably secure the individual guide tubes in normal position and to permit displacement of said guide tubes from their normal position in the event of jamming of the wire within the tubes.

4. Apparatus as defined in claim 3 in which the guide tubes are secured by means of spring-loaded balls engaging recesses and anchoring means for the tubes and releasable upon jamming of the tubes to permit said anchoring means to be released and moved longitudinally with the tube.

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