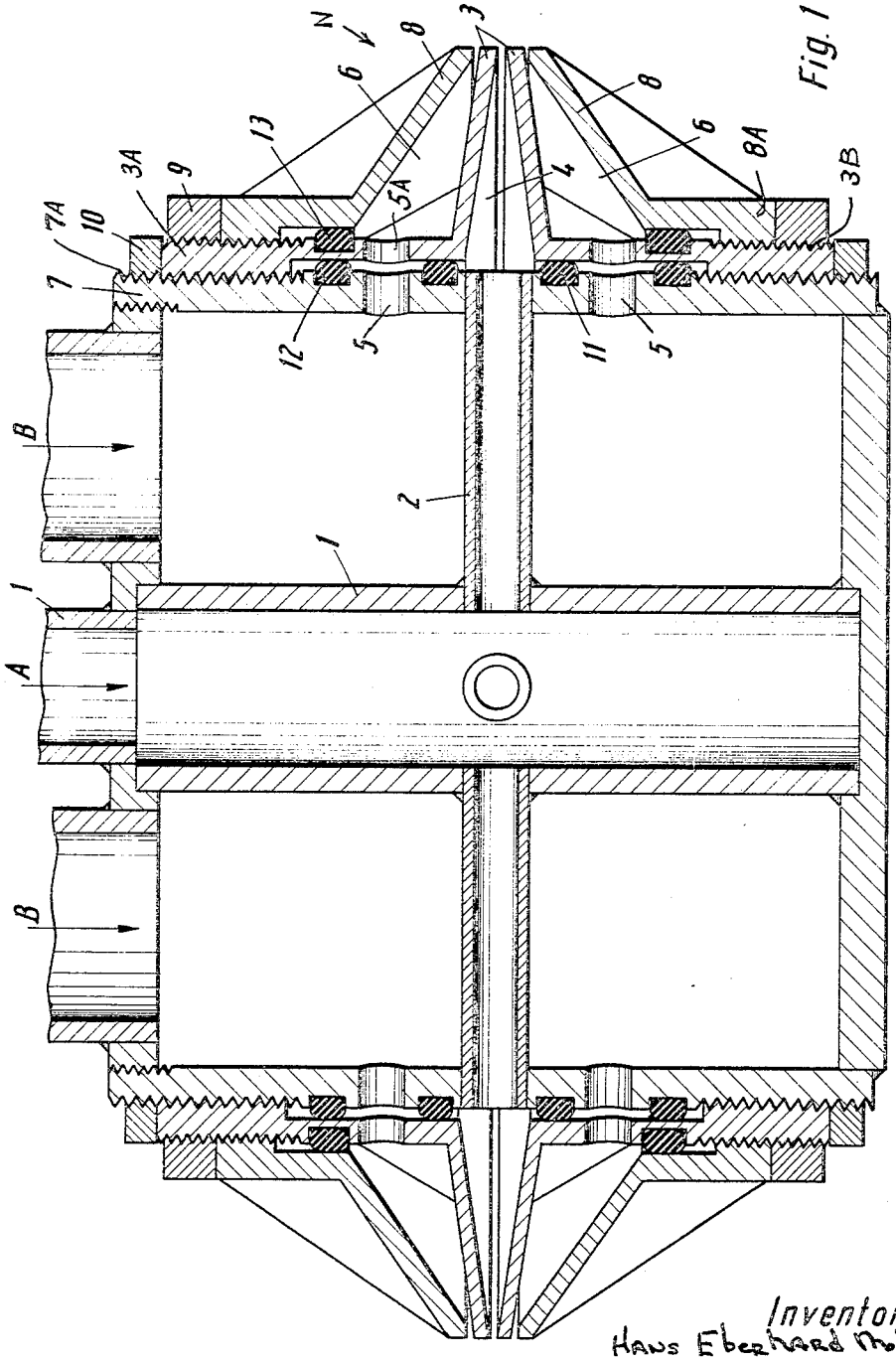
Dec. 16, 1969 H. E. MOBIUS 3,484,048

APPARATUS FOR COOLING AN ANNULAR COIL CONSTITUTED BY A PLURALITY OF CONVOLUTIONS OF HOT WIRE

Filed March 25, 1968 3 Sheets-Sheet 1

Fig. 1



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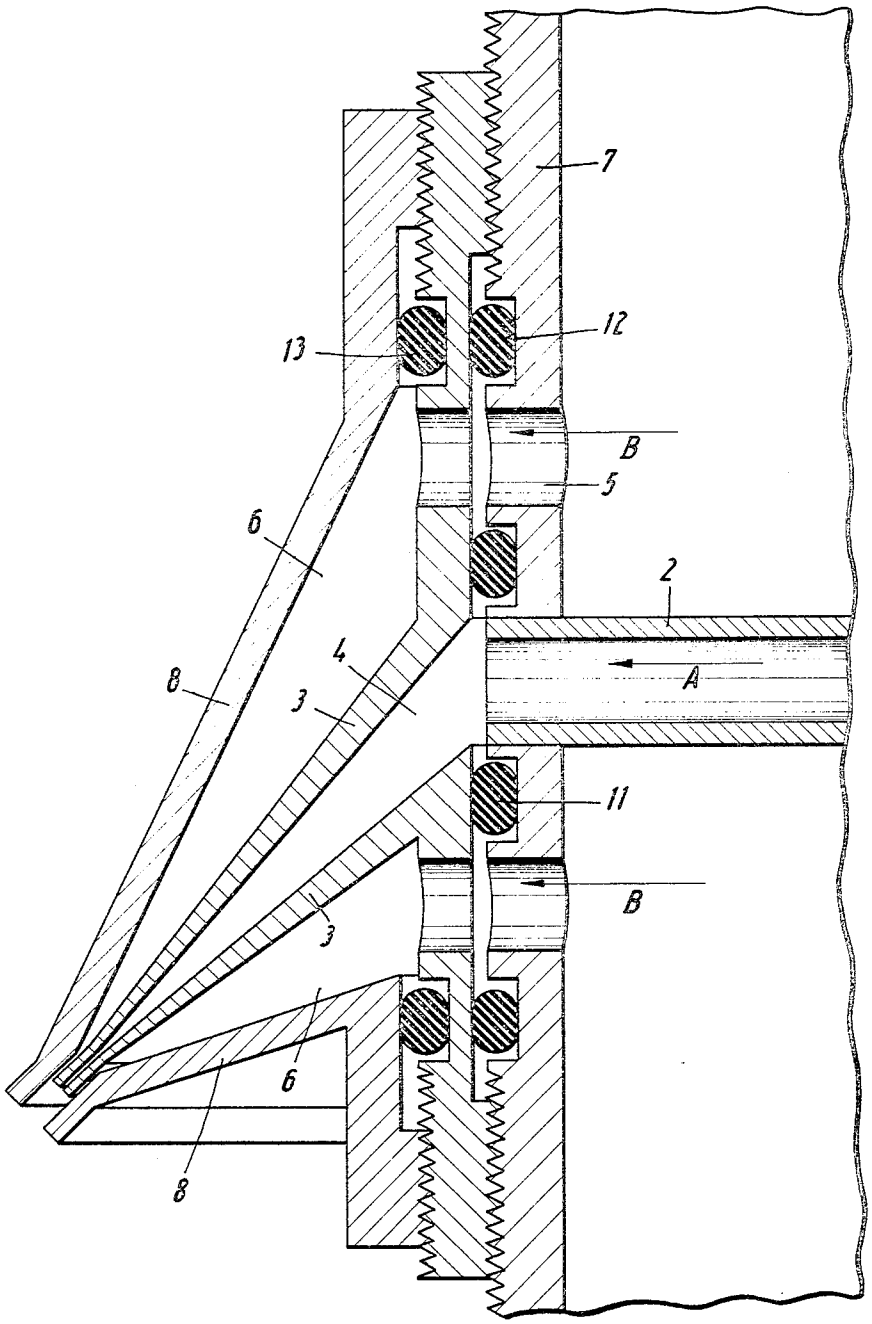


Fig. 2

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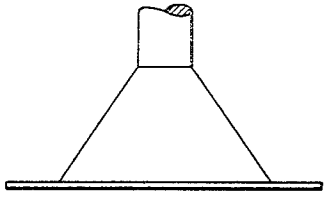
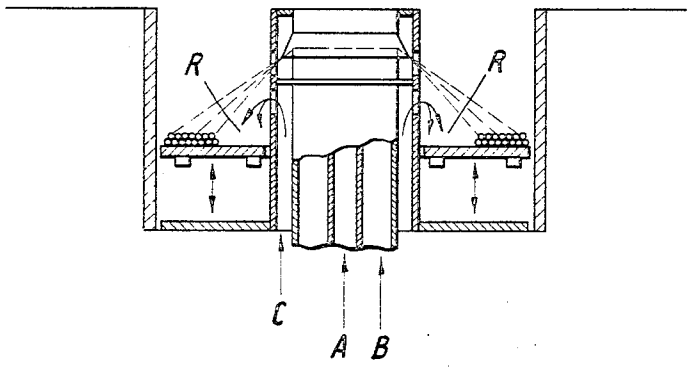


Fig. 3



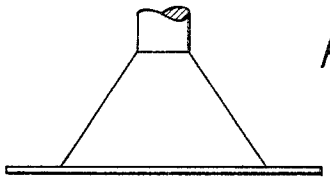
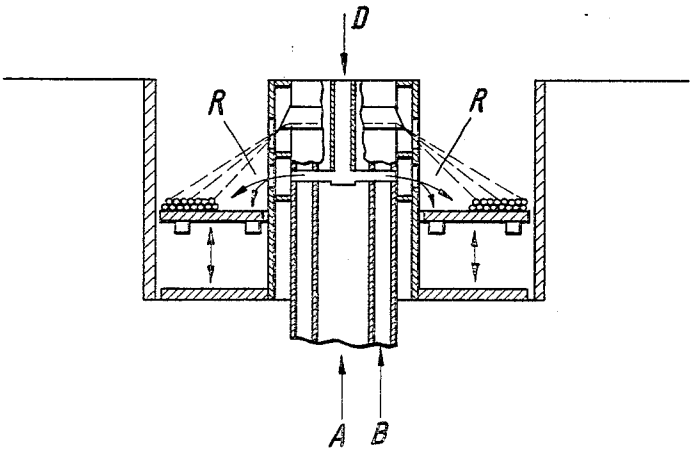


Fig. 4



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3,484,048

APPARATUS FOR COOLING AN ANNULAR COIL CONSTITUTED BY A PLURALITY OF CONVOLUTIONS OF HOT WIRE

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R 45,659
Int. Cl. B05b 7/06
U.S. Cl. 239—424 5 Claims

ABSTRACT OF THE DISCLOSURE

A double walled tubular assemblage for insertion into the middle of the coil provided with a plurality of axially located annular nozzle structures, with each nozzle structure including components providing annular chambers for air and liquid with such components including means providing outlet openings for the air and liquid and with such outlet openings being adjustable to enable the openings for air and liquid to be regulated precisely and independently of each other without the necessity of arresting the connections to the source of supply for the air and liquid.

The present invention is directed to apparatus for cooling an annular coil constituted by a plurality of convolutions of hot wire and more particularly to an assemblage operably related to the annular coil for controlling the cooling for assuring that all convolutions are uniformly cooled.

More specifically, the present invention relates to a double walled tubular structure adapted to be inserted into the middle of the annular coil and being so constructed and arranged that a liquid such as water is atomized with the assistance of a fluid such as compressed air. The double walled tubular structure is particularly efficacious for utilization in system for cooling wire in connection with continuous wire rod mills.

Heretofore, it has been proposed to cool closed wire coils or wire during the reeling thereof with finely atomized water and the cooling medium is supplied as evenly as possible and the droplet diameter should be less than 50 microns.

In accordance with an older principle, a double tube structure provided with numerous nozzles for carrying a cooling medium or compressed air has served for the atomization of the water during the cooling process of the wire. The nozzles which have been used and which have been known for an extended period of time include a central aperture or hole from which the water issues together with an annular aperture or gap for the compressed air. However, such an arrangement has not been entirely satisfactory in that the number of nozzles which can be located on the circumference and as a consequence the uniformity of the supply of the cooling medium is limited. Furthermore, in many situations, the amount of the cooling medium issued per unit of time is not sufficient even in structures in which the nozzles on the double tubed structure have been closely arranged.

In connection with situations in which a relatively large amount of a cooling medium must be furnished, such as for example for heavy wire coils, it has been proposed to employ a ring nozzle (slotted nozzle) by means of which it is possible to issue the cooling medium uniformly and with large amounts thereof at the same time. In this connection, attention is directed to Patent No. 3,339,373 dated Sept. 5, 1967.

The present invention is directed to an assemblage which will overcome the objectionable characteristics of

the prior art and which includes a double walled tubular means provided with ejector nozzle means which, among other advantageous results, allows the cooling medium to be issued in a uniform fashion together with large amounts thereof as well as providing means whereby the gaps or openings for the liquid (water) and fluid (air) can be precisely adjusted independently of each other wthout the necessity of arresting the flow of the liquid and fluid from the sources of supply.

More specifically, the ejector nozzle structure includes means constituting inner lips, providing an opening through which the liquid may be directed and outer lips cooperable therewith for providing means through which fluid may be directed.

Further objects and advantages of the present invention will become more readily apparent to persons skilled in the art from the following detailed description and annexed drawings and in which drawings:

FIGURE 1 is a fragmentary vertical sectional view of a double walled tubular structure embodying the present invention,

FIGURE 2 is a view generally similar to FIGURE 1 of a modification of the assemblage illustrated in FIGURE 1,

FIGURE 3 is an exploded view partly in elevation and partly in section of a further embodiment of the invention, and

FIGURE 4 is a view generally along the lines of FIGURE 3 illustrating still a further embodiment of the invention.

Referring now to FIGURE 1, there is illustrated an embodiment of the invention in which a double walled tubular structure provided with ejector nozzle means is adapted to be juxtaposed relative to an annular coil defined by a plurality of convolutions of hot wire for controlling the cooling thereof in order to insure that all of the convolutions are uniformly cooled. More specifically, there is provided a central or inner tube **1** and a concentric outer tube **7** to the outer circumference or periphery of which are fitted nozzle units N. A liquid (water) is adapted to enter the tube **1** and fluid (air) is adapted to enter the space defined between the tube **1** and the tube **7**.

Each nozzle unit N comprises a lip portion **3** and an outwardly directed portion **3A** with such portions constituting a central annular chamber **4** which is in communication with the interior of the tube **1** via radial tubes **2**. The portions **3A** are provided with an internal screw thread which coacts with an external screw thread **7A** of the outer tube **7**. Annular packings **11** and **12** are located between the portions **3A** and the circumference of the tube **7** for the customary sealing purposes.

The nozzle unit N further includes lip portions **8** spaced outwardly of the lip portions **3** and outwardly directed portions **8A** of somewhat less diameter than the diameter of the portions **3A**. The portions **8A** are provided with an internal screw thread which coacts with an external screw thread **3B** of the portions **3A**. An annular packing **13** is located between the portions **3A** and **8A** for the usual purposes.

The relationship of the lip portions **3** and **8** is such as to provide an annular chamber **6** therebetween and this chamber is in communication with the space constituted between the tubes **1** and **7** via bores **5** and **5A** in the tube **7** and portions **3A** respectively.

Due to the screw threaded connection between the portion **3A** and the tube **7** and the portion **8A** and the portion **3A**, it will be appreciated that the lip portion **8** can be displaced relative to the lip portion **3**. Hence, the present nozzle structure permits a rapid and accurate adjustment of the three openings or gaps, namely the liquid carrying gap, the fluid gap between the lip portions

8 and 3 and the openings 5 and 5A. As a consequence, the desired droplet size can be adjusted in a simple and easy fashion or the nozzle can be adapted to the particular requirements involved.

The lip portions 3A and 8A can be secured in the desired adjusted position by manipulation of lock nuts 10 and 10A respectively.

It is believed that the operation of each nozzle unit N is readily apparent from the foregoing description since it is clear that the liquid entering tube 1 will leave the chamber 4 via its outlet and the fluid will leave the chamber 6 via its outlet which encompasses the outlet of the chamber 4.

According to a further embodiment of the invention, the liquid and fluid does not necessarily have to issue from the unit at right angles to the axis of the tubes 1 and 7 and in this connection attention is drawn to FIGURE 2. It should be mentioned that this particular embodiment is especially suitable for the cooling of the wire during reeling with the end face of the enlarging ring receiving the atomized liquid.

In the situation where the medium does not issue at right angles to the axis of nozzle unit, the jet forms, for example, together with the bottom plate of the reel, a conical cavity which leads to a deformation of the issuing jet. To stabilize the direction of the jet, a variant of the invention provides for the introduction of air into the cavity thus formed. Depending upon the geometric conditions, it may suffice if a free communication is provided between the outside atmosphere and the cavity formed. If necessary, air can be furnished into such cavity with a slight positive pressure.

FIGURES 3 and 4 illustrate two forms of assemblage for the stabilization of the jet of the nozzle in connection with an Edenborn reel.

The stabilization of the jet (FIG. 4) is accomplished either by the hollow shaft of the reel or by an air transmitting shaft in the nozzle head which terminates below the annular nozzle and allows the conveyance of air into the cavity form (FIG. 3). Manifestly, similar arrangements may be utilized in connection with a Garret reel.

It will be appreciated that in the drawings, only one liquid (water) gap or opening is illustrated but needless to say the tube 7 may be provided with a plurality of nozzle units such as for example, when a very large capacity of cooling medium is required. If a plurality of nozzles are employed, all of the nozzles are advantageously directed with the center of the jet on the center of the object to receive the cooling medium. Hence, the jet centers of the individual nozzles enclose with the axis of the tubes 1 and 7 a different angle.

The type of nozzle unit described herein is also applicable when for example, a reeled wire core is to be cooled from the exterior thereof. The essential structural features remain the same in such situations and the inwardly directed nozzles are furnished with liquid and fluid from a triple tubular arrangement closed on the end face which constitutes two encircling chambers. The outer of the two chambers contains the liquid and the inner the fluid. The liquid passes by way of a plurality of radial

tubes from the outer chamber to the annular chambers constituted by the lip portions. The fluid enters the two annular chambers through apertures.

I claim:

1. Apparatus for cooling a coil of wire comprising a tubular means adapted to be disposed in operative relationship to the coil, a plurality of annular nozzle means on the periphery of the tubular means, separate means within the tubular means for supplying liquid and air respectively, each nozzle means including inner lip portions providing an inner chamber for the liquid and an outlet opening for the liquid, means providing communication between the inner chamber and the liquid supplying means, outer lip portions coacting with the inner lip portions providing an outer chamber for the air and an outlet opening for the air surrounding the outlet opening for the liquid, means providing communication between the outer chamber and the air supplying means, means for adjusting the inner lip portions relative to the tubular means and further means for adjusting the outer lip portions relative to the inner lip portions for varying the outlet opening for liquid, the outlet opening for air and the means providing communication between the outer chamber and the air supplying means.

2. The apparatus for cooling a coil of wire as claimed in claim 1 in which the adjusting means includes an internal screw thread on the inner lip portions cooperable with an external screw thread on the tubular means and the further means an internal screw thread on the outer lip portions cooperable with an external screw thread on the inner lip portions.

3. The apparatus for cooling a coil of wire as claimed in claim 1 in which said tubular means includes concentric inner and outer tubes, radial tubes leading from the inner tube to the chamber for the liquid with the inner tube and radial tubes constituting the means providing communication between the inner chamber and the liquid supplying means, said outer tube having bores therein communicating with the chamber for the air and the annular space between the inner and outer tubes and the bores constituting the means providing communication between the outer chamber and the air supplying means.

4. The apparatus as claimed in claim 3 in which the axis of the chamber for the liquid and the concentric tubes define an acute angle.

5. The apparatus for cooling a coil of wire as claimed in claim 4 in which the space enclosing the jet of atomized liquid and a lower limit is connected to a source of air.

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EVERETT W. KIRBY, Primary Examiner

U.S. Cl. X.R.

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