United States Patent [19]

Raschle

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[45] **June 12, 1973**

[54] **YARN HEATING APPARATUS**

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[73] Assignee: **Heberlein & Co. AG.,** Wattwil, Switzerland

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[21] Appl. No.: **147,855**

[30] **Foreign Application Priority Data**

Jan. 6, 1971 Switzerland 102/71

[52] **U.S. Cl.** ..... **34/154,** 34/152, 57/34 HS

[51] **Int. Cl.** **F26b 13/00**

[58] **Field of Search** ..... 28/62; 34/41, 152, 34/154; 57/34 HS

[56] **References Cited**

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2,823,292	2/1958	Kunzle	34/152 X
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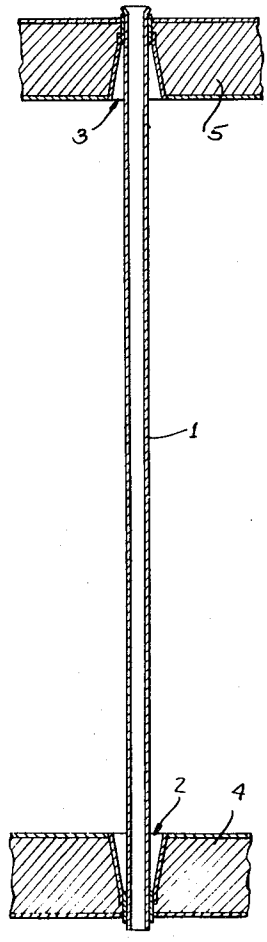
Primary Examiner—Carroll B. Dority, Jr.

Attorney—John Thomas Cella

[57] **ABSTRACT**

Apparatus for continuous heating of linearly advancing textile yarns by means of a tube sealed at its ends in an enclosure containing a heated fluid medium, the tube having certain physical characteristics to provide a substantially constant wall temperature.

8 Claims, 6 Drawing Figures



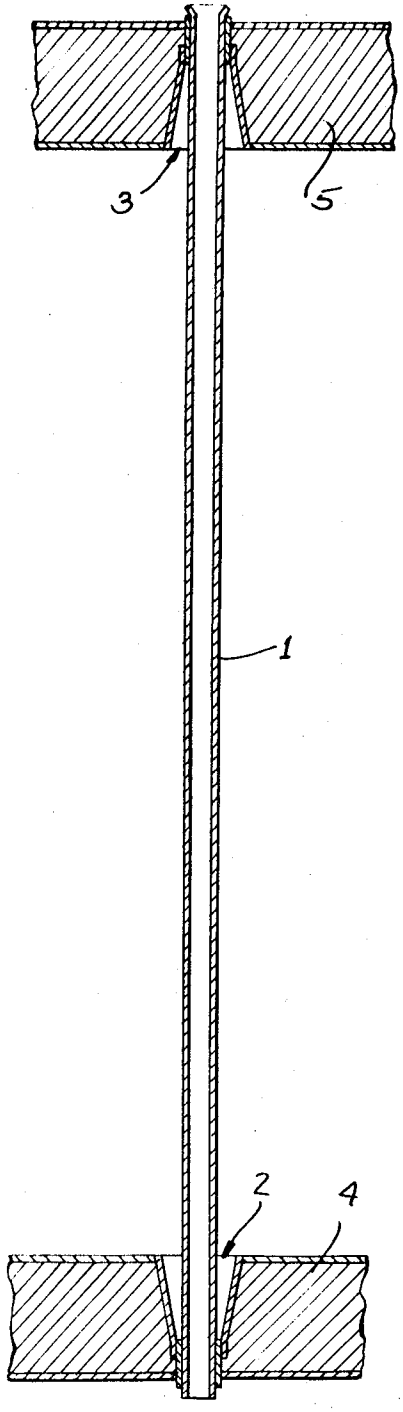


Fig. 1.

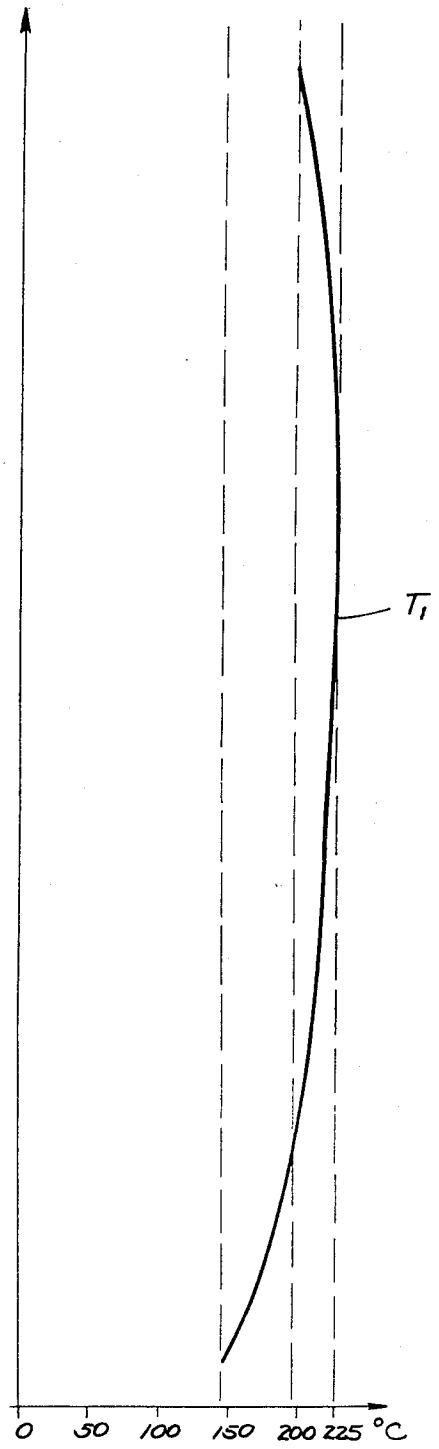


Fig. 2.

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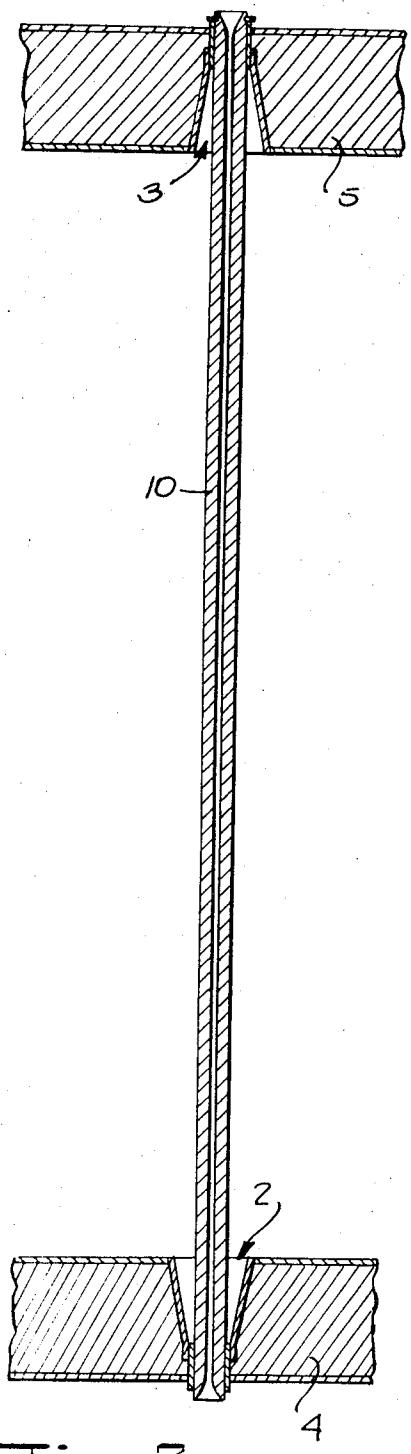

Fig. 2.

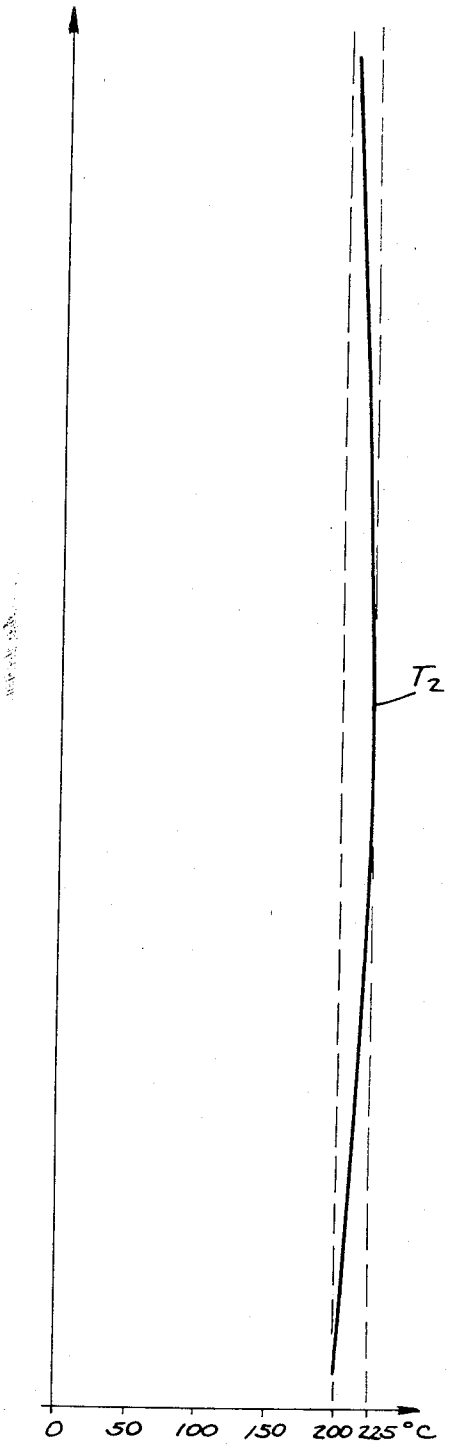

Fig. 4.

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FIG. 5

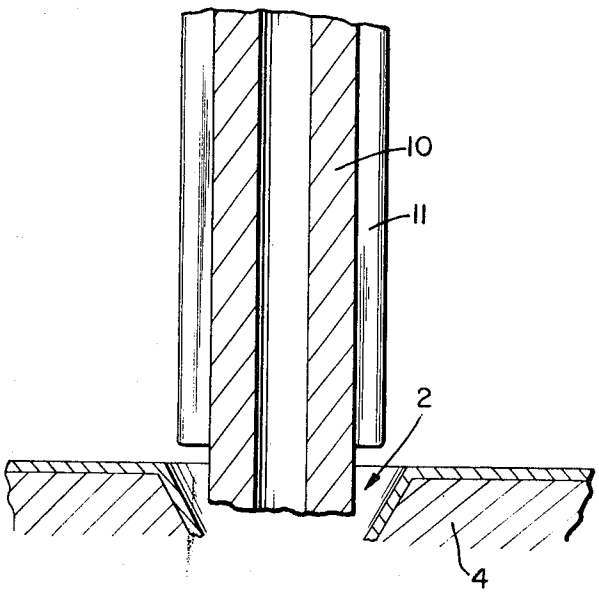
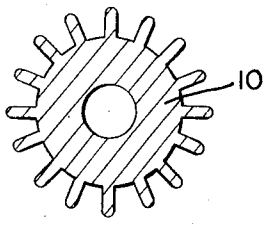


FIG. 6



YARN HEATING APPARATUS

This invention relates to apparatus of heating continuously advancing lengths for yarn consisting at least partially of thermoplastic material. More particularly, the invention relates to a tubular heater constructed to afford a very nearly uniform temperature throughout its length.

For uniformly and homogenously heating textile filaments and yarns of usual titers, apparatuses with tube-shaped members are known in which the heat radiated from the heated walls of the tubes is transferred to the yarns. Such heating tubes are used particularly in false-twisting machines for texturing synthetic thermoplastic textile yarns for heat-setting the false-twist. A known apparatus of this type consists of an enclosure containing a heated gaseous medium and in which a number of steel tubes through which the yarns pass in axial direction are arranged in axial parallelism, the tubes being heated by the gaseous medium. Since the length of the these tubes is limited by the space available within the treatment machine, i.e., as a rule not more than 1 m, it is essential to supply to the yarn as much radiated heat as possible over the entire length of the tube, i.e., in the optimal case, the walls of the tube should be at the same temperature over their entire length. With steel tubes used in the know apparatus, having a usual wall thickness and interior diameter, this optimal condition is not reached, but rather, as a rule, a considerable temperature decrease exists at the extremities of the tube, particularly at the lower extremity, it being usual to mount the tubes axially vertically. Additional heating apparatus embodying similar disadvantages is shown in U.S. Pat. No. 3,085,390.

It is the purpose of the present invention to avoid this disadvantage and to produce a heating tube having a wall temperature as constant as possible over its entire length.

The object of the invention, therefore, consists in an apparatus for heating continuously moving textile yarns consisting at least partially of synthetic thermoplastic material by means of heating tubes arranged in an enclosure containing a heated fluid medium, the yarns passing in axial direction through the tubes. The apparatus of the invention is characterized in that the walls of the tubes consist of a material of a heat conductivity of at least 70 kcal / *d* T °C, where d = distance in meters, T = time in hours and °C = temperature in celsius degrees, that the interior diameter of the tubes is not over 4 mm and that the wall thickness is at least 2.5 mm. In a preferred embodiment, the walls of the tubes may consist of aluminum, the interior diameter of the tubes may be 2.5 – 3.5 mm, and the thickness of the tube walls between 3 and 5 mm. Furthermore, the outer faces of the tube walls may be formed with ribs in order to improve heat transfer from the fluid medium to the tube wall.

There has thus been outlined rather broadly the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception upon which this disclosure is based for the designing of other structures for

carrying out the several purposes of the invention. It is important, therefore, that the claims be regarded as including such equivalent construction as do not depart from the spirit and scope of the invention.

A specific embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawings, forming a part of the specification wherein:

FIG. 1 is an elevational sectional view of a known heating tube;

FIG. 2 is a view similar to that of FIG. 1, but illustrating a heating tube according to the present invention;

FIGS. 3 and 4 are graphic representations of the temperature conditions in the heating tubes of FIGS. 1 and 2, respectively; and

FIGS. 5 and 6 are sectional views illustrating the tube with longitudinal ribs.

In FIG. 1, a steel tube 1 (conductivity = 43 kcal / d T °C) of a wall thickness of 1 mm and an interior diameter of 10 mm is shown. The steel tube 1 is situated in a closed enclosure of squared shape and is sealed in aligned openings 2, 3 of the bottom 4 and of the cover 5, respectively, of the enclosure, the bottom and cover being partially shown. The enclosure contains air heated approximately to 230°C, which transfers its heat to the steel tube 1.

In FIG. 3, the temperature curve T_1 of the interior face of the tube 1 is graphically shown extending over the whole of its length. The temperature curve T_1 has a maximum of 225°C somewhat above the middle of the tube and diminishes rather sharply towards the tube ends, i.e., to approximately 150°C towards the bottom of the enclosure, and to approximately 200°C towards the cover of the enclosure. This particular temperature curve is caused by the accumulation of hot air in the upper part of the enclosure, and by a certain chimney effect in the relatively wide steel tube. In this tube, an optimal heat transfer is obtained only over a part of the tube length so that, at higher yarn speeds, under certain circumstances, an insufficient heating effect on the yarn is obtained. It will also be appreciated that with such apparatus, the speed of the advancing yarn is often limited.

In FIG. 2, instead of a usual steel tube, a heating tube 10 of the present invention is shown. This tube is also arranged in openings 2, 3 of the bottom 4 and of the cover 5, respectively, of an enclosure containing air of approximately 230°C. The tube 10 consists of aluminum (heat conductivity 175 kcal / d T °C) and has wall thickness of 4.5 mm and an interior diameter of 3 mm. In FIG. 4, the temperature curve T_2 on the inner wall of the tube 10 is graphically shown over its whole length. It will be seen that the temperature curve T_2 is flatter than the one of FIG. 3, and the temperature is reduced to approximately 200°C at both tube ends. In the tube 10 of the present invention, because of better heat conductivity of the aluminum used for the tubes, and because of the larger wall thickness of the tubes and the smaller inner diameter of the same, the marked temperature decrease existing in known tubes is avoided at the lower end of the same so that an optimal heat transfer to the yarn to be treated is possible over substantially the whole length of the tube. FIGS. 5 and 6 illustrate a series of longitudinal ribs 11 formed integral with the tube in order to facilitate heat transfer from the fluid medium to the tube wall. The tube of the present invention permits higher yarn speeds without

the risk of insufficient heating of the yarns. As tube material, besides aluminum, also other metals with a heat conductivity of at least 70 kcal / d T °C may be used, such as copper with a conductivity of 320 kcal / d T °C or brass which, depending on the type of alloy, includes conductivities of between 70 and 100 kcal / d T °C.

From the foregoing description, it will be seen that the present invention overcomes the difficulties noted in respect of presently known heating tubes, and permits more uniform heating and generally faster advance of the yarn, and thus greater overall production speeds.

What is claimed is:

1. Apparatus for heating continuously advancing textile yarns consisting at least partially of synthetic thermoplastic material by means of a tube sealed at its ends in an enclosure containing a heated fluid medium, through which tube the yarn passes in axial direction, characterized in that the tube walls consist of a material with a conductivity of at least 70 kcal / c T °C, that the interior diameter of the tube is not more than 4 mm and the tube wall thickness is at least 2.5 mm.

2. Apparatus according to claim **1**, characterized in that the tube walls are made of aluminum.

3. Apparatus according to claim **1**, characterized in that the tube walls are made of copper.

4. Apparatus according to claim **1**, characterized in that the tube walls are made of brass.

5. Apparatus according to claim **1**, characterized in that the interior tube diameter is 2.5 – 3.5 mm and the wall thickness is 3 – 5 mm.

6. Apparatus according to claim **1**, characterized in that the outer faces of the tube is are provided with ribs.

7. A heating tube of the class described comprising an elongate body having walls consisting of a material with a conductivity of at least 70 kcal / d T °C, a wall thickness of at least 2.5 mm, and an interior diameter of not more than 4 mm.

8. A tube according to claim **7**, characterized in that its outer surface is formed with ribs.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,738,017 Dated June 12, 1973

Inventor(s) JOSEF RASCHLE

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 3, change "apparatus of" to -- apparatus for --; line 27, change "know" to -- known --.
Column 3, line 20, change "70 kcal / c T°C" to -- 70 kcal / d T°C --.
Column 4, line 12, delete "are".

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

FORM PO-1050 (10-69)

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