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HEATING SYSTEM FOR YARNS AND THREADS

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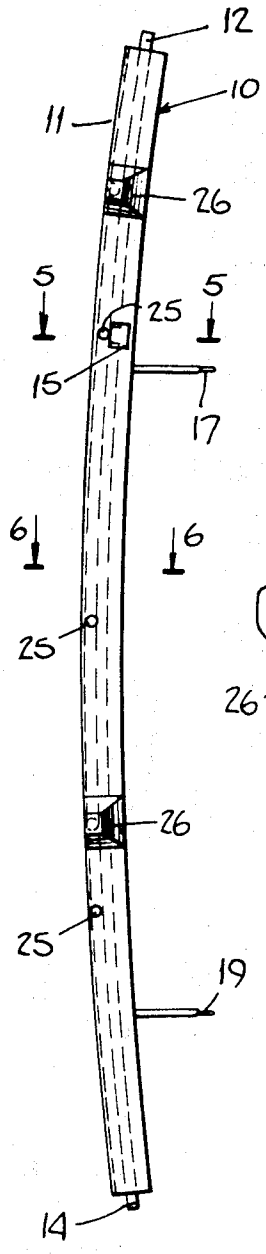


Fig. 1.

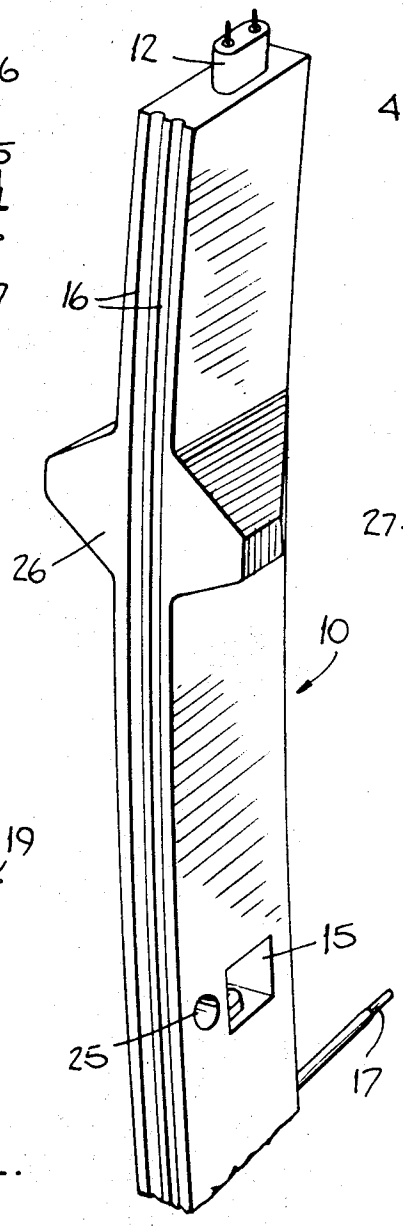


Fig. 2.

Fig. 3.

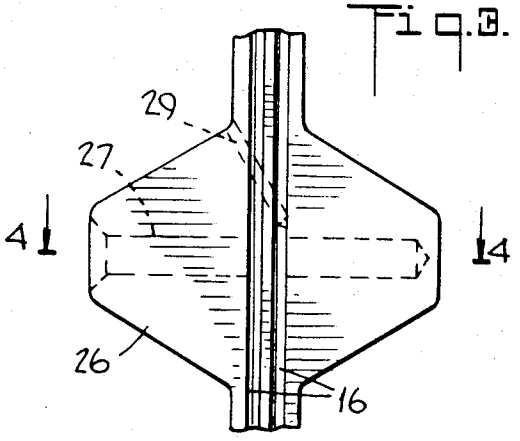


Fig. 4.

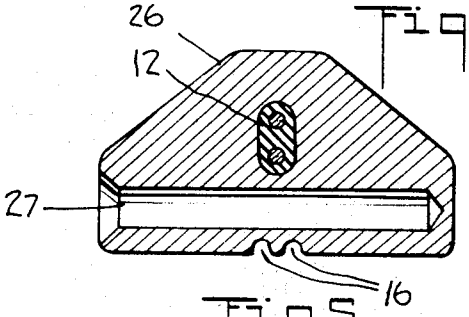


Fig. 5.

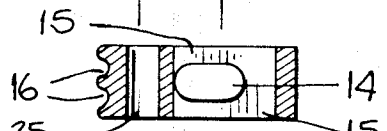
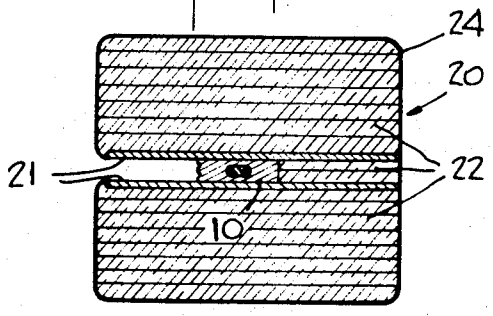


Fig. 6.

Fig. 7.



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HEATING SYSTEM FOR YARNS AND THREADS

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U.S. Cl. 28—62 6 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for heat treatment of continuously advancing thread-like structures by means of electrical resistance heated contact means.

This invention relates to an apparatus for heating continuously advancing yarns, threads and the like, and more particularly to electrical resistance heating apparatus adapted to heat the advancing material in sequential steps with a minimum of heat loss.

Apparatus are known for the heat treatment of continuously advancing textile yarns, threads, ply-yarns and the like, hereinafter yarns, according to which the yarn is temporarily brought into a plastic state by heating. By such a plastification, which is followed by resolidification by cooling, mechanical deformations which have been imparted to the yarns, such as twist or spiral deformations or the like, can be permanently fixed.

It is also known to employ electrical resistance heat treatment devices in which the yarn is passed in axial direction through a metal tube enveloped by a heating coil, whereby heating is effected by means of convection; and metal contact surfaces have also been used to heat yarns advancing along in contact with same, see U.S. Pat. No. 3,041,814.

Those skilled in the art are also aware of the use of contact plates such as metal plates or rails in which separate contact surfaces are heated to different temperatures for preheating and main heating.

Various disadvantages have been associated with the foregoing expedients. For example, in the last mentioned arrangement heating of the advancing yarns is interrupted so that the desired uniform effect cannot be obtained.

Accordingly, the present invention is intended to obviate the difficulties and disadvantages of known yarn heating apparatus of the class described, and to contribute apparatus wherein the close temperature control of the yarns necessary to production of a uniform product of high quality is achieved, while permitting the yarns to be advanced at the high speeds employed in modern yarn processing machinery.

Thus, the present inventive concept is directed to an apparatus for heat treatment of continuously axially advancing yarns comprising an elongated contact body, heating means cooperatively associated with the contact body to maintain different zones of that body at predetermined temperatures, respectively, and thermal resistance means interposed between the zones.

It is preferred that the heating means be of the electrical resistance type, and that it be embedded within the contact body which latter may be cast around the heating means in order to achieve good heat transfer therebetween.

According to one aspect of the invention, the heating means comprise at least two heating elements so arranged within the contact body that each has a terminal end adjacent that of the other so that the respective temperature zones are also adjacent one another.

Notwithstanding the proximity of the heating zones, it is desired to have a relatively abrupt transition from one temperature to another; and for this purpose the thermal resistance is positioned at the adjacent ends of the heating means. This thermal resistance may take the form of a hollow extending through the contact body, preferably at right angles to the direction of movement of the yarns; or it may be a core of low thermal conductivity positioned within the body or extending through it; or the thermal resistance may constitute a reduction in the cross-sectional area of the heat conductive contact body; or it may constitute a greater spacing between the ends of the heating means.

The contact body may be enlarged laterally at selected locations along its length, preferably at least one such enlargement occurring in each temperature zone, these enlargements being bored for reception of temperature control devices such as thermocouples or the like.

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 may readily be utilized as a basis 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 constructions as do not depart from the spirit and scope of the invention.

Specific embodiments of the invention have been chosen for purposes of illustration and description, and are shown in the accompanying drawings forming a part of the specification wherein:

FIG. 1 is a side elevational view of apparatus according to the present invention;

FIG. 2 is a perspective view of a position of the contact body;

FIG. 3 is a front elevational view of a position of the contact body;

FIG. 4 is a cross-sectional view taken along the lines **4**—**4** of FIG. 3;

FIG. 5 is a cross-sectional view taken along the lines **5**—**5** of FIG. 1;

FIG. 6 is a cross-sectional view taken along the lines **6**—**6** of FIG. 1; and

FIG. 7 is a cross-sectional view illustrating the present apparatus in an appropriate environment.

Referring to the drawings in detail, and particularly to FIG. 1 thereof, there is shown a contact body **10** formed with a convex contact surface **11**. Heating elements **12** and **14**, in the form of heating bars heatable by heating coils (not shown), are embedded in the body **10** and terminate adjacent one another at a location at which a thermal resistance **15**, about which more will later be said, is positioned.

As shown in FIGS. 2 to 7, the contact surface **11** is formed with two grooves **16**, although any convenient number may be used, so that one or more yarns may be treated. These grooves may be coated with a suitable material such as Teflon to prevent the deposit thereon of compositions which may have been applied to the yarns, see U.S. patent application Ser. No. 607,434; or the grooves may be hard chromed to facilitate cleaning.

The yarn proceeds in a downward direction, as viewed, and generally the element **12** will be set at a higher temperature than the element **14** so that the preheating effect will approximate a thermal shock to the yarn while the heater **14** will serve to effect the main heat treatment of the yarn.

In order to maintain a definite temperature gradient between the preheat and main heat zones, and to reduce the flow of heat between these zones, the thermal resistance **15** is positioned therebetween. In the illustrated embodiment, and as shown in FIGS. 1 and 5, the thermal resistance may comprise a hollow configuration of rectangular cross-section extending through the contact body at a right angle to the direction of yarn movement. This construction maintains the heat conducting cross-section of the contact body as small as possible consistent with necessary strength, and prevents interruption of heat flowing to the yarns. Several such hollows may of course be used, or a cast-in core of low thermal conductivity such as foamed glass asbestos or ceramic material may be used, the contact body may be necked down in cross-section, or one of the elements **12** or **14** may be shortened.

Again, supporting pins **17** and **19** consisting preferably of a material of a low heat conductivity coefficient such as V4A grade steel are cast into the contact body to serve as mounts for that body in respect of an enclosure **20** to be discussed later. The pin **17** may be connected to the contact body adjacent the thermal resistance **15** to assist in heat dissipation; and the pin **19** is connected to the body near its opposite end.

As shown in FIG. 7, the enclosure **20** may comprise a series of layers **21** of insulating material such as asbestos and mineral fiber mats **22** which overextend the contact face of the body **10** and are themselves enclosed in a thin metal casing **24**; and the entire assembly is held together by a series of bolts (not shown) which pass through holes **25** (FIG. 1). One of these bolt holes may be located adjacent the thermal resistance **15** further to reduce the heat conducting cross-section of the contact body between the heating elements.

Actually, it is preferred that the pin **19** be connected to the enclosure **20** or to the contact body by a spring (not shown) to allow for expansion and contraction of the contact body.

At suitable locations in each of the heating zones, the contact body is formed with lateral protrusions **26** which are contoured as truncated pyramids decreasing in cross-section in a direction outwardly of the body **10**. Each such protrusion is bored as at **27** and **29** (FIGS. 3 and 4) for reception of temperature sensing and control devices (not shown).

From the foregoing description it will be seen that the present invention contributes a contact body for heat treating yarns which body is of unitary construction and provides uniform controlled heating through two heating zones with a controlled temperature gradient therebetween. A relatively short contact body made according to the present invention can treat yarns advancing at the high speeds achieved in modern yarn twisting or other treating machines.

The apparatus of the present invention will now be understood and its advantages will be appreciated by those persons skilled in the art.

What is claimed and desired to be secured by Letters Patent is:

1. Apparatus for heat treatment of continuously axially advancing yarns comprising, an elongated slightly convex heat conductive contact body having a continuous yarn contact surface, separate heating means encased within said contact body to maintain different zones of said yarn contact surface, each at predetermined temperatures, respectively, and thermal resistance means in said contact body adjacent the ends of said heating means.

2. Apparatus according to claim **1**, wherein said heating means are at least two electrical heating elements and said thermal resistance means comprises means forming at least one hollow in said contact body.

3. Apparatus according to claim **2**, wherein said thermal resistance extends through said contact body at right angles to the direction of advance of said yarns.

4. Apparatus according to claim **1**, wherein said heating means are at least two heating elements encased within said contact body and said thermal resistance comprises a core of low thermal conductivity positioned in said contact body at the adjacent ends of said heating means.

5. Apparatus according to claim **1**, wherein said thermal resistance means comprises a reduction of cross-sectional area of the heat conductive contact body.

6. Apparatus according to claim **1**, wherein said thermal resistance means comprises a reduction of the length of at least one of the heating means.

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U.S. Cl. X.R.

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