Dec. 5, 1967 R. S. BYERS ETAL 3,355,784

HEATER FOR TEXTILE MACHINERY

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FIG. 1.

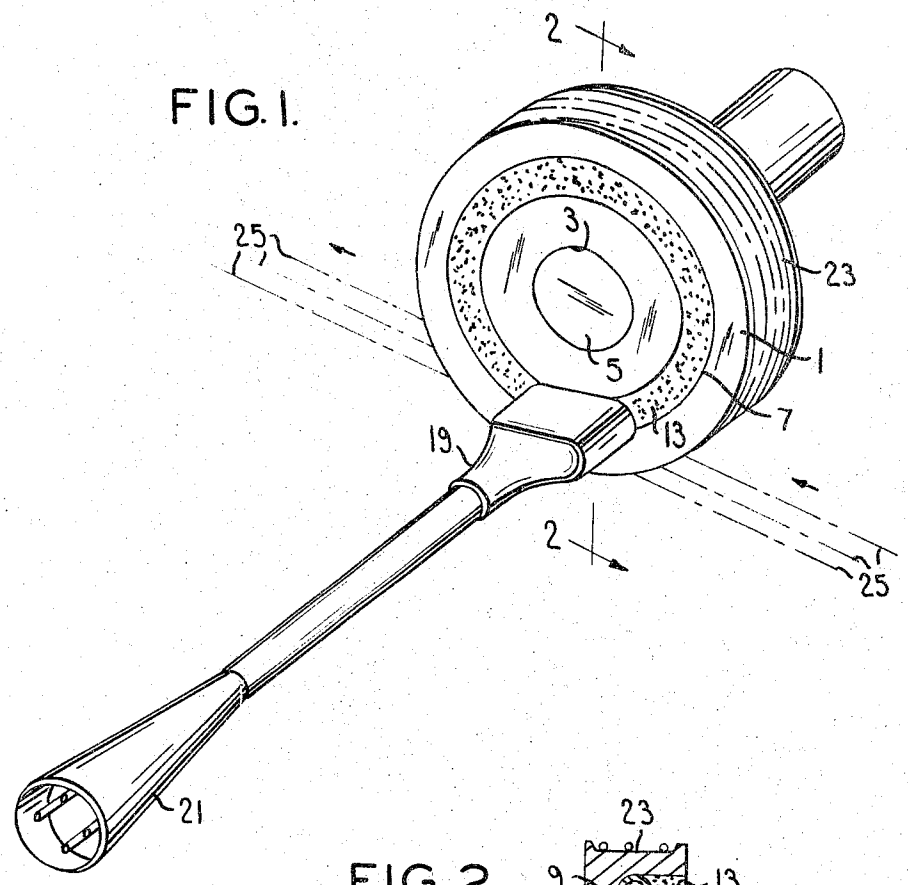
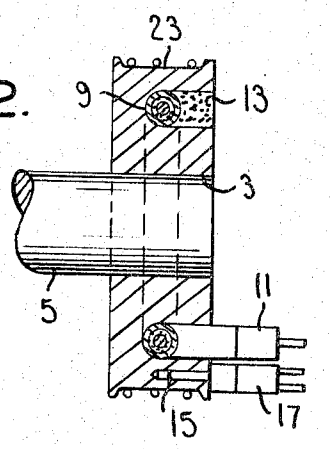


FIG. 2.



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FIG. 3.

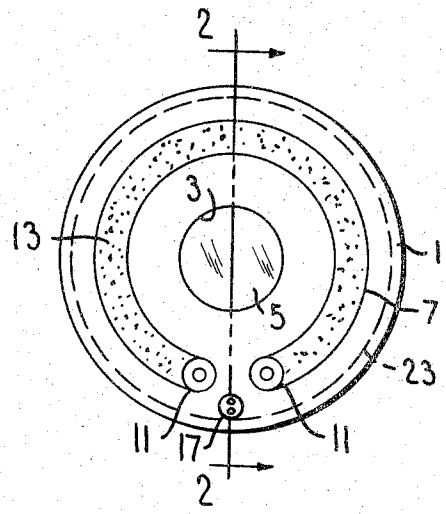


FIG. 4.

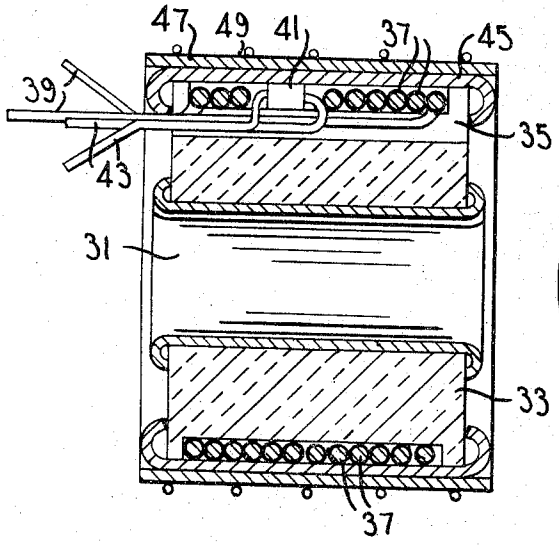
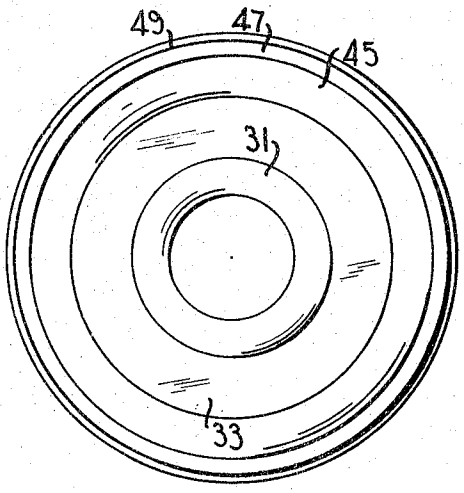


FIG. 5.



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United States Patent Office 3,355,784 Patented Dec. 5, 1967

3,355,784

HEATER FOR TEXTILE MACHINERY

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Filed Jan. 5, 1966, Ser. No. 518,840
2 Claims. (Cl. 28—62)

ABSTRACT OF THE DISCLOSURE

A recessed fixed spool is provided for retaining an electrical-resistance heater and a thermistor for controlling heater current and spool temperature. At least the peripheral portion of the spool is composed of the material selected from the group consisting of graphite, tungsten and molybdenum upon which silicon carbide is vapor deposited. The vapor-deposited silicon carbide coating has a crystalline structure which has a hardness approximately that of sapphire. Its thickness is on the order of 1/64 of an inch or more and provides an ideal surface roughness in the range from 60 to 100 microinches (root mean square). This provides an extremely long-wearing surface which achieves an ideal coefficient of friction for moving strands of yarn which are looped about the exterior surface to be heated in progress through textile machinery.

Among the several objects of the invention may be noted the provision of a heater of low thermal mass for use as a yarn-warming heater for high-speed textile processing machinery, such heaters requiring fast warm-up and recovery times; and the provision of a heater of this class which has a long-wearing surface and an ideal coefficient of friction between itself and synthetic yarn which is produced or processed by the textile processing machinery. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the apparatus hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

FIG. 1 is a perspective view illustrating one form of the invention;

FIG. 2 is a longitudinal section viewed on line 2—2 of FIGS. 1 and 3, illustrating a heater spool, connector parts being removed;

FIG. 3 is a right-hand side elevation of FIG. 2, connector parts being removed;

FIG. 4 is a longitudinal section showing another form of the heater; and

FIG. 5 is a right-hand side elevation of FIG. 4.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

The purpose of the heater of the present invention is to heat synthetic yarn made by high-speed textile processing machinery. Such machinery may extrude single or multiple filaments in continuous lengths, each of relatively small individual diameter, or may only alter the characteristics of single or multiple filament material previously produced on other machinery. The yarn after it is formed is sent to other process machines, some known as draw twisters or draw winders, to further alter the characteristics. In these processes, it requires heating and tensioning. An important requirement of successful heating and tensioning means is that it shall have a fast warm-up and recovery time and a long-wearing surface of a proper coefficient of friction between itself and a synthetic yarn.

Referring now more particularly to FIGS. 1–3, there is shown at numeral 1 a spool having a central opening 3 for fixed mounting upon a supporting pin 5 or the like. This spool is annularly grooved on one side in horseshoe form as shown at 7 for the reception of a horseshoe-shaped electrical-resistance heater element 9 from which extend terminals 11. This is of the insulated, metal-sheathed type, one type of which is sold under the trade name Chromalox. Conventional potting compound 13 holds the heater element 9 in place in the groove, the terminals 11 extending out through the compound 13 from one side of the spool 1. Extending into the spool from the same side is a recess 15 in which is located a conventional thermistor or thermocouple for detecting temperature changes and converting them into electrical signals useful through conventional circuitry for controlling current in and the temperature of the heater 9. By this means the temperature of the spool is controlled.

At numeral 19 is shown an electrical plug carrying suitable wiring connected between the heater and thermistor terminals 11 and 17 to a connecting cord plug 21.

The material of which the spool 1 is composed is graphite, tungsten or molybdenum, or the like with graphite preferred. These are materials to which a coating of silicon carbide may be and is adhered by chemical vapor deposition in known manner. The crystalline coating of silicon carbide thus adhered by vapor deposition on the cylindrical surface 23 of spool 1 is a nonporous hermetic coat of very great hardness, approximating that of sapphire. This provides an extremely long-wearing surface and one which achieves an ideal coefficient of friction. Its hermetic sealing feature is particularly useful on the preferred graphite for spool 1. The graphite is preferred because of its ability to withstand high temperatures without oxidizing. The vapor deposition is in the form of a film of controlled thickness which may be in the order of 1/64 of an inch or thicker and produces a surface roughness, for example, in the range of from 60 to 100 microinches (root mean square). It will be understood that surface roughness, at least to some extent, determines the coefficient of friction. In FIG. 1 are illustrated strands of synthetic yarn, numbered 25, which approach the surface 23 of spool 1 in the direction shown at the right, each looping about it once, after which each is taken off to proceed to the left toward a twister (not shown).

Referring now more particularly to FIGS. 4 and 5, there is shown an alternative form of the invention. In this form there is provided a central metal bushing 31 around which is formed a spool 33 of asbestos insulating composition. This spool is slotted as shown at 35. Wrapped about it is an insulated heater wire 37, the leads 39 of which extend out through the slot 35. In the slot and among the windings 37 is located a temperature-sensing thermistor 41, the leads 43 of which also extend out from the slot 35. Surrounding the spool 33, wire 37 and thermistor 41, is a metal sheath 45. Outside of the sheath 45 is a replaceable sleeve 47 of graphite, tungsten or molybdenum. The outside surface 49 of this sleeve is provided with chemically vapor deposited silicon carbide such as above described in connection with the first form of the invention. It will be understood that the bushing 31 is mounted upon a suitable supporting pin as by means of a medium press fit. This form of the invention is even more compact than that of FIGS. 1–3. Because the sleeve 47 has a medium press fit on the sheath 45, it may readily be removed and replaced, as required.

It will be appreciated that while the spool assembly constituting the invention is shown as being circular, it may have other shapes such as elliptical, if desired. Thus the term spool is intended to comprehend both circular and other spool shapes.

Advantages of both forms of the invention are:

(1) The spool assembly, with the heater and thermistor buried therein near its peripheral frictional surface, is of low thermal mass and therefore has a fast warm-up and recovery time in response to the flow of current through the heater as controlled by the thermistor.

(2) The vapor-deposited silicon carbide coating located directly on the outside of the heater transmits heat rapidly and permits of high-speed slip of the yarn 25 around the surface without damage to the yarn, the coefficient of friction being ideal for proper back tension on the yarn passing from the spool (acting as a brake) in the drawing process.

(3) The exterior surface of the heater, being of hardness approximating that of sapphire, provides an extremely long-wearing surface.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above apparatus without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A yarn heater comprising a spool having an exterior peripheral surface and a first horseshoe-shaped recess extending therein from one end, said recess lying adjacent said peripheral surface, a horseshoe-shaped heater in said recess, a potting compound retaining the heater in the recess, said heater having terminals extending axially from the recess, a second recess in the spool adjacent said exterior surface, a thermistor in said second recess having terminals extending axially from the spool, said exterior peripheral surface of said spool being composed of a material selected from the group consisting of graphite, tungsten and molybdenum, and a film of vapor-deposited coating of silicon carbide on said peripheral surface.

2. A yarn heater comprising a central metallic bushing, a cylindrical metal sheath spacedly surrounding said bushing, a spool of an insulating composition located in the space between said bushing and said sheath, a wound wire heater wrapped around said spool between it and said sheath, and a thermistor located on the periphery of said spool adjacent said sheath, said heater and thermistor having leads extending from the spool beneath said bushing and said sheath, a sleeve removably pressed on the exterior of said cylindrical sheath, said sleeve being composed of a material selected from the group consisting of graphite, tungsten and molybdenum, and a vapor-deposited film of silicon carbide located on the outside of said removable sleeve.

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