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ELECTRIC THREAD HEATER

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ELECTRIC THREAD HEATER

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2 Claims. (Cl. 219—20)

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This invention relates to apparatus for heating travelling threads, yarns, filaments and the like hereinafter referred to generally as "threads."

In the manufacture of artificial threads it is sometimes desired to subject a travelling thread to a treatment involving heating the thread under tension. Examples of such treatments are drying processes and the stretching and shrinking of threads of thermoplastic cellulose derivatives as described and claimed in the patent to Harry M. Avern and Joel Straw, No. 2,584,779, dated February 5, 1952, according to which a process for the production of high tenacity threads of thermoplastic cellulose derivatives suitable for weaving comprises the steps of heating preformed threads of the thermoplastic cellulose derivative to a temperature sufficient to render them plastic, stretching the threads at least 50 per cent while they are in the heated plastic state, and subsequently permitting the threads to shrink at least 8 per cent while they are in a heated plastic state. When carrying out such stretching and shrinking treatments, the tension of the heated thread is dependent to a large extent on its temperature and slight variations in temperature usually cause marked variations in tension. For example, when stretching heated thermoplastic threads at a temperature of, say, 230° centigrade as described in the above-mentioned specification, the tension is usually of the order of 5 grams and a variation of 1° centigrade will usually cause a corresponding variation in tension of about 1 gram. Since increase in tension tends to cause dulling or even breakage of the thread, and an increase in temperature will cause a decrease in tension, and in the extreme case, will cause melting of the threads, it is highly desirable to maintain a substantially uniform tension in the thread during the heating operation.

It is the object of this invention to ensure a substantially uniform tension in the thread during the heating operation.

According to the present invention, apparatus for heating a travelling thread comprises an electrically-heated chamber through which the thread passes and a thread guide directing the passage of the thread through the chamber, wherein the thread guide is spring mounted and the movement of the guide due to variation in load on it arising from the tension in the thread is used to control the heat in the heating chamber so that changes in tension arising in the thread make compensating changes of temperature in the heating chamber. The spring-

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mounting of the thread guide is preferably of the cantilever type. The thread may be passed over the controlling guide before entering or after leaving the heating chamber.

In a preferred form of the invention the chamber is heated by a heater in an alternating current circuit which includes a saturable reactor the impedance of which determines the current to and the temperature of the chamber, the saturating coil of the reactor being arranged in a direct current circuit so that the value of the direct current is controlled by the movements of the guide which thereby determine the impedance of the reactor. The direct current to the saturating coil may be obtained from a direct current supply or may be obtained by rectifying an alternating current.

The direct current circuit preferably includes, in addition to the saturating coil, a fixed resistance so arranged that the movements of the guide cause the fixed resistance to be cut out of the direct current circuit and thus effect a corresponding adjustment of the impedance of the saturable reactor. This fixed resistance is preferably formed by two approximately equal resistances and means provided for cutting out substantially one-half of the fixed resistance in the direct current circuit when no thread is running over the guide. This arrangement enables the heater to be brought approximately to the treatment temperature before starting operations. With half the resistance in the direct current circuit and no thread running, the heater will reach a temperature which is approximately mid-way between the upper and lower temperature limits set with the whole of the resistance respectively out of and in the direct current circuit.

One example of apparatus constructed in accordance with the present invention is illustrated in the accompanying diagrammatic drawings in which—

Figure 1 is a front view, partly in section, of the apparatus for heating the yarn and showing the electrical circuits for heating the chamber and for controlling the current in the heating circuit,

Figure 2 is a plan of one end of the guide and guide pulley of the apparatus shown in Figure 1, and

Figure 3 shows a modified circuit for controlling the current in the heating circuit.

Referring to the drawings, thread 1 is passed continuously through a vertical heating chamber 2 and over a guide pulley 3 carried by a horizontal cantilever spring 4 held at its fixed end

by blocks 5. The chamber 2 is heated by a heater 6 in an alternating current circuit supplied by a mains supply 7. The alternating current circuit includes a saturable reactor 8 the impedance of which determines the current to and the temperature of the heater 6.

The saturating coil 9 of the reactor 8 is arranged in a direct current circuit which includes a low-voltage source of direct current 10, a variable resistance 11 for general control of the heating system, and a fixed resistance 12. The resistance 12 as shown is made up of two approximately equal resistances 13, 14 joined in series in order to facilitate starting up as described below.

The cantilever spring 4 is connected to one end of the fixed resistance 12 and it carries two contact discs 15, 16 which are respectively arranged slightly below and slightly above two fixed contacts 17, 18. The contact 17 is connected between the resistances 13 and 14 and the contact 18 is connected to the other end of the resistance 14.

In operation, the alternating current circuit is adjusted by means of the variable resistance 11 in the direct current circuit to give the desired temperature and tension in the thread 1; slight increase in tension in the thread 1 passing through the chamber 2 causes the cantilever spring 4 to be pulled down so that the disc 16 touches the contact 18 and sets up a cycle as follows: The fixed resistance 12 is cut out of the direct current circuit, the current in the saturating coil 9 is increased, the impedance of the reactor 8 is lowered, the current in the heating circuit is increased, the temperature of the heater 6 is increased, the temperature of the thread 1 is increased and the tension in the thread 1 is lowered. The lowering of the tension allows the spring 4 to rise, thus breaking the contact between disc 16 and contact 18 and putting the fixed resistance 12 back into the direct current circuit. During a continuous run the spring 4 repeatedly makes and breaks this contact to give substantially uniform tension but as the direct current is low and as the direct current circuit is not completely broken there is no appreciable sparking across the spring 4 to the contact 18.

The provision of the two approximately equal resistances 13 and 14 to form the fixed resistance 12 enables the heater to heat up quickly to approximately the desired temperature before starting operations. Thus, when no thread is running, the upper disc 15 of the spring 4 will touch the upper contact 17 and so put the resistance 14 in the direct current circuit. The heater 6 will then reach a temperature which is approximately that obtaining during normal running, that is to say, half way between the lower temperature limit set with the fixed resistance 12 in the direct current circuit and the upper temperature limit set with the resistance 12 out of the direct current circuit.

The resistance 14 preferably consists of or comprises a signal lamp 19 which gives a visible indication whether the apparatus is functioning correctly or not.

During continuous running there is a tendency for metal to be transferred between the disc 16 and the contact 18. This transfer of metal may

be substantially avoided either by periodically reversing the polarity of the low voltage source 10 or by using an alternating current circuit to the disc 16, the contact 18 and the resistances 11 and 12 and rectifying the current across the coil 9. This alternative is illustrated in Figure 3 in which an alternating current supply 20 is rectified across the coil 9 by a bridge rectifier 21, the circuit being otherwise the same as that shown in Figure 1.

What I claim is:

1. Apparatus for heating a travelling thread under substantially uniform tension comprising in combination a heating chamber, a cantilever beam, a thread guide on the free end of said cantilever beam, said guide being adapted to direct the passage of thread through said heating chamber, an alternating current heating circuit and a direct current control circuit, said heating circuit comprising a heating element in said chamber and a saturable reactor the alternating current winding of said reactor being in series with said element, and said control circuit comprising the saturating coil of said saturable reactor, a fixed resistance and a shunt in parallel with said fixed resistance comprising a fixed contact and a movable contact said fixed and movable contacts being in series with said saturating coil, the movable contact being mounted on said cantilever beam whereby a change in tension of thread moving through said heating chamber to said guide causes said beam to move, altering the relationship between said contacts, thus determining the presence of said fixed resistance in said control circuit and consequently varying the impedance of said saturable reactor, thereby varying the current through said heating element and the temperature of the heating chamber, whereby the original variation in tension of the thread is compensated for.

2. Apparatus as claimed in claim 1 wherein the fixed resistance comprises two resistances of approximately equal size joined in series, a second fixed contact connected between said two resistances and a second movable contact mounted on the cantilever beam and normally in contact with said second fixed contact when the thread guide is not carrying thread, said second fixed contact and said second movable contact when in contact establishing a shunt in the control circuit around one of said two equal resistances, whereby when the thread guide is not carrying thread approximately one-half of the fixed resistance is shunted out of the control circuit and the temperature of the heating chamber can be kept at a level suitable for easy resumption of operation.

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