

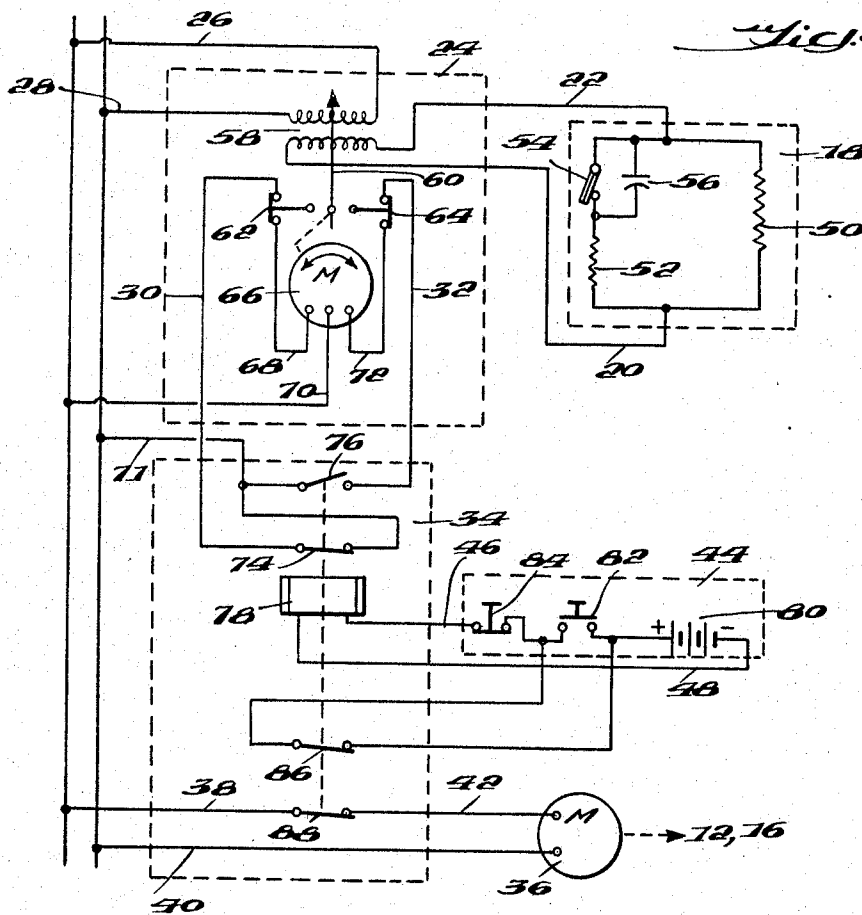
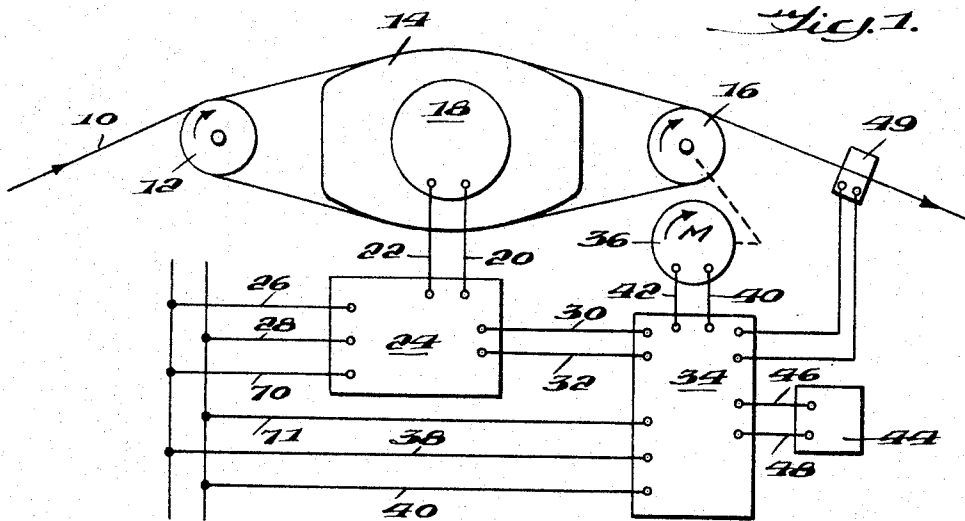
May 14, 1968

J. P. SMOOTS, JR

3,382,555

YARN HEATER

Filed Oct. 27, 1965



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3,382,555

YARN HEATER

John Pfeiffer Smoots, Jr., Signal Mountain, Tenn., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Oct. 27, 1965, Ser. No. 505,325

5 Claims. (Cl. 28—62)

ABSTRACT OF THE DISCLOSURE

Temperature controls for the "hot shoe" in a yarn-drawing machine. A dual wound electrical heater, located in the shoe, has a pair of resistance elements connected in parallel and supplied from an autotransformer arranged to reduced power when yarn advance stops and to increase power when yarn advance resumes. In either mode of control, a thermostatic switch connected to one of the elements maintains shoe temperature at a preset level.

This invention relates generally to the production of yarn and, more particularly, to the heat treatment of synthetic thermoplastic yarns.

In situations where yarn is advanced over the surface of a heated body, close regulation of body temperature is necessary in order to insure uniform treatment of successive yarn lengths. Furthermore, temperature must be held constant when there is a sudden decrease in heat requirements responsive to an interruption of yarn motion. Available apparatus either includes complicated and costly electrical components which frequently require considerable maintenance or it fails to provide for sudden and large variations in the demand for heat.

The object of this invention is to provide for the automatic adjustment of heat supplied to a yarn contact surface with apparatus which is not only reliable but also inexpensive and easy to maintain.

The above objective has been achieved in a yarn-handling apparatus which includes a pair of rotatably mounted rolls, a power drive connected to one of the rolls, a shoe having a contact surface over which yarn advances between the rolls and a heater installation in the shoe. The heater installation has two electrical elements which are connected to a variable power source. One of the heating elements has a thermostatic switch and a capacitor series connected therewith in a parallel connection. Between the power drive and source, there is a control coupling for varying the source to an adjusted low level when the drive is disabled and returning it to an adjusted high level when the drive is restored.

Other objectives and advantages will be apparent from the following specification wherein reference is made to the accompanying drawing in which:

FIGURE 1 is a diagrammatic view of the yarn-handling apparatus into which the heater installation of the present invention has been incorporated; and

FIG. 2 is a schematic wiring diagram of the control and temperature regulation features.

Referring first to FIG. 1, a continuous yarn line 10, supplied from a source (not shown) is advanced one or more times over driven roll 12, thence in contact with the surface of a shoe 14, around drive roll 16, back across shoe 14 to roll 12 and is finally withdrawn to a further processing stage or windup (not shown). A heating installation 18 is placed in a cavity within shoe 14. Power for installation 18 is furnished over leads 20, 22 from a variable source 24 which is line connected over leads 26, 28. Control signals for varying source 24 are received over leads 30, 32 from a relay coupling 34. Relay coupling 34 also controls the application of line power to drive motor

36 over leads 38, 40, 42. Motor 36 is mechanically linked to roll 16. A start and stop device 44 controls the operation of relay coupling 34 over leads 46, 48. Optionally, a yarn break detector 49 may also be connected to relay coupling 34.

Turning now to FIG. 2, installation 18 includes a first resistance element 50 connected in parallel with a second resistance element 52. Element 52 is series connected with a parallel connection which includes a the thermostatic switch 54 and a capacitor 56. Power for these heaters is fed over leads 20, 22 from the secondary winding of variable transformer 58 which has a line connected (26, 28) primary winding and a movable arm 60. At adjustable positions on either side of arm 60 and in its path of motion are located two normally closed limit switches 62, 64. Arm 60 is mechanically linked to a reversible electric motor 66. The direction of rotation for motor 66 is determined by which pair of lines 68, 70, or 70, 72 is energized. Line 68 is connected through switch 62 and over line 30 to one side of a relay switch 74 in coupling 34. The other side of switch 74 is connected both to one side of a relay switch 76 and to the line over a lead 71. The third lead 72 to motor 66 is connected through limit switch 64 and over lead 32 to the second side of switch 76. Switch 76 is open and switch 74 is closed when relay coil 78 is energized. Power to energize coil 78 is obtained from power supply 80 over lines 46, 48. As shown, device 44 has a start switch 82 and a stop switch 84. Another relay switch 86 in coupling 34 is connected in parallel with start switch 82. A fourth relay switch 88, normally closed, completes the circuit to drive motor 36 over leads 38, 40, 42. As shown schematically at 49 in FIG. 1, an optional switch opened by yarn breakdown can be connected to relay coupling 34. If provided, it is connected in series with stop switch 84. Other conventional controls such as for overload protection may be included in relay coupling 34.

The illustrated apparatus has two modes of operation, depending on whether or not yarn is being transported across the hot shoe 14. These two modes of operation require widely different heat inputs from installation 18. For example, to maintain the hot shoe at constant temperature in an actual situation where nylon yarn was advanced in ten wraps around rolls 12, 16, resistance elements 50, 52 required 170 watts of power whereas only 59 watts were required when drive motor 36 was stopped.

When motor 36 is started by depressing starter switch 82, relay coil 78 is energized, thereby closing switches 74, 86, 88 and opening switch 76. This starts reversible motor 66 and moves arm 60 toward switch 62. When arm 60 contacts switch 62, it opens the circuit supplying power to motor 66. In the ensuing mode of operation, a high level of power is furnished from power transformer 58 to the two heaters 50, 52, which level depends on the adjusted location of limit switch 62 in the path of arm 60. Thermostatic switch 54 functions to maintain shoe temperature at a constant preset level. Capacitor 56 is provided to eliminate chatter of switch 54 and reduce any effects of machine vibration on its operation.

When motor 36 is stopped, for example, by depressing stop button 84, switches 74, 86, 88 open and switch 76 closes. Through closed switches 76, 64, power is now supplied to motor 66 to operate it in the reverse direction, thus moving arm 60 in the direction toward limit switch 64. This direction of movement continues until switch 64 opens, de-energizing motor 66. Transformer 58 is now adjusted to a lower output level determined by the adjusted location of switch 64. Heaters 50, 52 are now operated at a lower input level and thermostatic switch 54 is able to control temperature of hot shoe 14 even though a much lower rate of heat dissipation is experienced. If used

the optional yarn break detector switch 49 automatically performs the same function as stop switch 84.

Thus, a simple, inexpensive and reliable apparatus has been provided for controlling the temperature, in this case, of a hot shoe for treating yarn, which apparatus avoids sudden rises in temperature when yarn motion is interrupted. This not only eliminates unnecessary loss of power but also, in the case of thermoplastic yarns, prevents melting of yarn on the shoe.

Instead of the illustrated parallel connection of heater elements 50, 52, an independent power supply for element 52 and switch 54 could be provided. Numerous adaptations and modifications of a similar nature will occur to those skilled in the art without departure from the spirit of this invention, which accordingly is intended to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a yarn-handling apparatus including a pair of spaced rolls and a shoe having a contact surface over which yarn is advanced between said rolls, a heater installation in said shoe, said installation comprising: two electrical heating elements, a variable power source connected to one of said elements and a series connected thermostatic switch through which the other elements is energized, said power source having means for its variation to a low level when the advance of yarn is interrupted.

2. The apparatus of claim 1 wherein is provided a capacitor connected in parallel with said thermostatic switch.

3. A yarn-handling apparatus including a pair of spaced rolls, a shoe having a contact surface over which yarn is advanced between said rolls, a heater installation in said shoe and a variable power source for said installation, the latter comprising two electrical heating elements con-

nected in parallel to said source, one of said elements having a thermostatic switch and a capacitor series connected therewith in a parallel connection, said power source having means for its variation to a low level when the advance of the yarn is interrupted.

4. A yarn-handling apparatus comprising: a pair of rotatably mounted rolls; drive means connected to at least one of said rolls; a shoe having a contact surface over which yarn advances between said rolls; two electrical heating elements in said shoe, said elements being connected in parallel, one element having a thermostatic switch series connected therewith; a variable power source for said elements; and a control coupling between said drive means and said source for varying the latter between a low level when the drive means is disabled and a high level when the drive means is restored.

5. The apparatus of claim 4 wherein said variable power source comprises a transformer including a movable arm, a reversing motor and a drive connection between the motor and arm.

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ROBERT R. MACKEY, *Acting Primary Examiner.*

I. C. WADDEY, *Assistant Examiner.*