FIN WINDING MACHINES
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ABSTRACT OF THE DISCLOSURE

For crowding fins on a spirally finned tube moving longitudinally from a finning machine, closely together at spaced apart collets forming cam surfaces attached thereto. A cam follower closes a switch each time it rides up a cam surface, to energize a solenoid which opens a valve to admit compressed air into a cylinder having a piston rod. The finning machine has two clutches; one of which, when engaged, causes the tube to move longitudinally at its normal speed, and the other of which, when engaged, causes the tube to move longitudinally at a speed slower than normal. When compressed air is admitted into the cylinder, its piston rod disengages the one clutch and engages the other clutch, causing the tube to move slower longitudinally through the finning machine so that its fins are crowded close together.

This invention relates to machines for winding extended surface fins spirally on heat exchange tubes.

Certain duties require that a spirally finned tube should have spaced apart along the length of the tube, collars for contact with tube supporting or air baffling structure. Previously, this has required several short lengths of fin spaced apart by such collars. This has been accomplished by sliding a prewound, short length of fin on a tube, soldering or otherwise securing the fin to the tube, sliding a collar on the tube against the adjacent end of the fin, soldering or otherwise securing the collar to the tube, sliding another prewound, short length of fin on the tube, soldering or otherwise securing this fin to the tube, sliding another collar on the tube against the adjacent end of the fin, soldering or otherwise securing this collar to the tube, and so on. Such a process has been slow and costly.

This invention eliminates the necessity for such collars by spirally winding a fin on a tube, and by winding the turns of the fin very closely together where the collars have been required. A conventional fin winding machine is used, and means is provided for decreasing the rate of advance of the tube on which the fin is wound for causing the turns of the fin to be wound very closely together in the locations along the length of the tube where the collars have been required, and for increasing the rate of advance of the tube to normal for providing normal fin spacing between such locations. This is all done automatically without stopping the finning machine during the finning of a single length of tube, and greatly reduces the time required for and the cost of producing such a tube.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a side view of the left end portion of one embodiment of this invention;

FIG. 1A is a side view of the right end portion of the one embodiment of this invention, and

FIG. 2 is an enlarged, fragmentary view, partially in section, of the fin forming rolls, and of a portion of a finned tube.

A conventional finning machine has a tube advancing and rotating head 10 similar to the head 27 of the R. M. Stikeleather Patent No. 2,799,389, the specification of which is included by reference herein. Such a head has means for varying the speed of rotation of a tube independently of the rate of advance of the tube.

An electric motor 11 drives through pulleys 12 and 13 and a belt 14, a gear box 15. The gear box 15 drives through a shaft 16, a pulley 17 and a belt 18, a pulley 19 on a shaft 20. The lower end of the shaft 20 is formed as a beveled roll 21 which cooperates with a tapered roll 22 to squeeze the peripheral portion of a ribbon to cause it to curl about and adhere as a fin 23 to a tube 24, as disclosed in said patent. The roll 22 is on a shaft 25 on which there is a gear 26 meshed with a gear 27 on the shaft 20, and is driven by the shaft 20 through the gears 26 and 27.

The gear box 15 drives through a pulley 30 and a belt 31, a pulley 32. The pulley 32 corresponds to the pulley 37 of the head 27 of said patent, and drives the mechanism within the head 10 which advances the tube 24 through the head 10 and past the rolls 21 and 22. A pulley 34 is attached to the pulley 32, and drives through a belt 35, a pulley 36 on one end of the shaft 37. A pulley 40 is on the other end of the shaft 37, and drives through a belt 41, a pulley 42. The pulley 42 is slidable along a shaft 43 of the head 10, which shaft 43 corresponds to the shaft 57 of the head 27 of said patent. The shaft 43 drives the tube advancing mechanism within the head 10. A clutch disc 44 is attached to the shaft 43.

A pulley 46 attached to the pulley 32, drives through a belt 47, a pulley 48 on one end of a shaft 49. A pulley 50 on the other end of the shaft 49, drives through a belt 51, a pulley 52 slidable along the shaft 43. The clutch disc 44 is between the pulleys 42 and 52. Since the pulley 50 which drives the pulley 52 is much smaller than the pulley 40 which drives the pulley 52, the pulley 42 rotates much slower than does the pulley 52.

A sleeve 54 around the shaft 43 to the left of the pulley 42, is pivoted to the upper end of lever 55 which is pivoted at 56 to extension 57 of the casing of the head 10. The lower end of the lever 55 is attached to a sleeve 58 which is secured by nuts 59 on a threaded piston rod 60 of an air cylinder 61. A sleeve 64 around the shaft 43 is pivoted to the upper end of lever 65 which is pivoted at 66 to the extension 57. The lower end of the lever 65 is pivoted to a sleeve 69 which is secured by nuts 68 on the threaded piston rod 60. The air cylinder 61 is connected by tubes 70 and 71 to a two-way valve 72 which is connected by a tube 73 to a conventional source of compressed air which is not shown. The valve 72 has an air release tube 74. The valve 72 is adjusted by a solenoid 75 to admit compressed air through the tube 70 into the cylinder 61 for causing the piston rod 60 to move to the right, or to admit the air through the tube 71 into the cylinder 61 for causing the piston rod 60 to move to the left. The solenoid 75 is connected by wires 76 and 77 in series with a conventional switch 78 to electric supply lines 1, and 12.

A collet 80 has its right end within the left, outer end of a tube 24 to be finned, and has a slot 81 into which extends a screw 82 which is adjustable to spread the slot 81 to tighten the connection of the collet to the tube. An index rod 84 has its right end threaded into the left end of the collet 80, with nuts 85 locking this connection. The rod 84, while as illustrated, rotating with the collet 80 and the tube 24 while the latter is being finned, could be rotatably attached to the collet so that it would not turn with the latter.
The rod 84 has equally spaced apart, cam collars 86 attached thereto, each collar having a central, cylindrical cam surface 87 with sloping surfaces 88 on opposite sides thereof. A cam follower 89 pivoted at 90 to a support 91, while it is in contact with a cam surface 87, closes the switch 78 to energize the solenoid 75. The switch 78 opens when the cam follower 89 is off a cam surface 87, and deenergizes the solenoid 75.

Operation

In operation, the head 10 rotates and advances the tube 24, and the fin 23 is wound on the tube 24 by the action of the rolls 21 and 22 as is disclosed in detail in the said patent. As the tube 24 is advanced, it moves to the right, carrying with it the rod 84 with its cam collars 86. When the cam follower 89 is on a cam surface 87, the switch 78 is closed, the solenoid 75 is energized and adjusts the valve 72 to admit compressed air into the cylinder 61 to cause the piston rod 60 to move the upper ends of the levers 55 and 65 to the right, moving the pulley 42 against the clutch disc 44, and moving the pulley 52 away from the clutch disc 44. The low speed pulley 42 drives through the clutch disc 44, the shaft 43 of the head 10, causing the tube 24 to be advanced at a much slower than normal rate. This causes the turns of the fin to be wound very closely together in spaced apart groups 92.

When the cam follower 89 rides off a cam surface 87, the switch 78 is opened, the solenoid 75 is deenergized, and the valve 72 is adjusted to admit compressed air into the cylinder 61 to cause the piston rod 60 to move the upper ends of the levers 55 and 65 to the left, moving the pulley 42 away from contact with the clutch disc 44, and moving the normal speed pulley 52 against the clutch disc 44. The pulley 52 drives through the clutch disc 44, the shaft 43 of the head 10 at its normal speed for causing the tube 24 to be advanced at its normal speed so as to provide normal fin spacing between the groups 92.

The fin groups 92 can be used to receive tube supports or air baffles. Since they are provided automatically at high speed on a tube that can have any desired practical length, their cost is relatively low.

What is claimed is:

1. In combination with a finning machine having a head for rotating and longitudinally advancing a tube to be finned, said head having a first shaft connected to its tube advancing mechanism, and having a second shaft connected to its tube rotating mechanism, said machine having rolls for deforming an edge portion of a ribbon to be wound as a fin on said tube, and said means for rotating said first shaft, including a first means normally connected to said first shaft for rotating said first shaft at a normal speed, and including a second means for rotating said first shaft at a slower than normal speed, and means controlled by said control member for disconnecting said first means from said first shaft and connecting said second means from said first shaft and connecting said first means to said first shaft when said control member is between said surfaces.

2. In combination with a finning machine having a head for rotating and longitudinally advancing a tube to be finned, said head having a first shaft connected to its tube advancing mechanism, and having a second shaft connected to its tube rotating mechanism, said machine having rolls for deforming an edge portion of a ribbon to be wound as a fin on said tube, and having means for rotating said first and second shafts and said rolls, an index rod connected to the outer end of said tube so as to be moved longitudinally with said tube, said rod having aligned, spaced apart cam surfaces, a cam follower which said surfaces contact in succession when said rod is moved longitudinally with said tube, said means for rotating said first shaft including a first means for rotating said first shaft at a normal speed, said first means being normally connected to said first shaft, said means for rotating said first shaft including a second means for connection to said first shaft for rotating said first shaft at a slower than normal speed, and means controlled by said cam follower for disconnecting said first means from said first shaft and connecting said second means to said first shaft when said follower is on one of said surfaces, and for disconnecting said second means from said first shaft and connecting said first means to said first shaft when said follower is between said surfaces.

3. In combination with a finning machine having a head for rotating and longitudinally advancing a tube to be finned, said head having a first shaft connected to its tube advancing mechanism, and having a second shaft connected to its tube rotating mechanism, said machine having rolls for deforming an edge portion of a ribbon to be wound as a fin on said tube, and having means for rotating said first and second shafts and said rolls, an index rod connected to the outer end of said tube so as to be moved longitudinally with said tube, said rod having aligned, spaced apart cam surfaces, a cam follower which said surfaces contact in succession when said rod is moved longitudinally with said tube, a switch adjusted to one position when said follower is on one of said surfaces, and adjusted to a second position when said follower is between said surfaces, said means for rotating said first shaft including a first means normally connected to said first shaft for rotating said first shaft at a normal speed, and including a second means for connection to said first shaft for rotating said first shaft at a slower than normal speed, and means for connecting said first means to said first shaft, and means including said switch for energizing said solenoid, said solenoid acting to disconnect said first means from said first shaft and to connect said second means to said first shaft when said switch is in one said position, and acting to disconnect said second means from said first shaft and to connect said first means to said first shaft when said switch is in said second position.

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