

PATENT SPECIFICATION

(11) 1 285 970

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DRAWINGS ATTACHED

- (21) Application No. 2427/72 (22) Filed 18 Nov. 1969
- (62) Divided out of No. 1 285 969
- (31) Convention Application No. 777 820 (32) Filed 21 Nov. 1968
- (31) Convention Application No. 834 792 (32) Filed 19 June 1969 in
- (33) United States of America (US)
- (45) Complete Specification published 16 Aug. 1972
- (51) International Classification D02G 1/12
- (52) Index at acceptance D1F 40A1 40AY 53 6



(54) IMPROVEMENTS IN OR RELATING TO THE CRIMPING OF YARN

(71) We, JOSEPH BANCROFT & SONS Co., a Corporation organized and existing under the laws of the State of Delaware, United States of America, of Wilmington, Delaware, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to stuffer crimpers of the type wherein a yarn is fed between feed rolls into one end of a crimping chamber to form a core of crimped yarn which is advanced along the chamber by the pressure exerted by the incoming yarn.

A stuffer crimper of the invention is suitable for crimping yarn of large size, such as carpet size yarn.

In stuffer crimpers, it is desirable to be able to accommodate several different types of yarn in a single apparatus and therefore it is necessary to be able to control the crimping pressure and the parameters of treating fluid. However, for best effect the treating fluid should be able to contact intimately the whole of the core in the crimper. Hitherto treating has been effected by injecting fluid into the core in the crimping chamber and the crimping pressure has been controlled by positive withdrawal of yarn from the chamber in response to the level of the core in the crimping chamber.

According to the present invention there is provided stuffer crimping apparatus comprising a crimping chamber; feed rolls disposed to feed yarn for crimping into the inlet of said crimping chamber for crimping said yarn against the core of previously crimped yarn; a heating chamber registering with the outlet of said crimping chamber, and variable yarn core clothing means at the outlet of said crimping chamber for contacting said core of crimped yarn and restricting the flow of said core therethrough to control the back pressure in said crimping chamber; said heating chamber including a housing with a cage of spaced parallel rods having their inner surfaces

spaced from the inner walls of said housing for confining and guiding a core of crimped yarn through said heating chamber, said inner surfaces forming a continuation of the walls of said crimping chamber and extending throughout the length of said heating chamber.

Controlling the crimping pressure using the choke means downstream of the crimping chamber and then controlling treatment parameters in the heating chamber downstream of the choke means enables crimping pressure and treatment parameters to be controlled independently, a hitherto unprecedented step since previously the crimping pressure inhibited the degree of permeation of the treating medium through the core of crimped yarn in the crimping chamber.

In order that the invention may be more readily understood, the following description is given, merely by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is an end elevation with portions broken away of a stuffer crimper embodying the invention;

FIGURE 2 is a partial front elevation of the crimping apparatus on a large scale than Figure 1;

FIGURE 3 is an enlarged elevation, partly in section, taken along the line 3—3 of Figure 2;

FIGURE 4 is a transverse section taken along the line 4—4 of Figure 1;

FIGURE 5 is a transverse section taken on the line 5—5 of Figure 1;

FIGURE 6 is a perspective view of the low friction chamber of the embodiment of the preceding Figures;

FIGURE 7 is a front elevation of the discharge end of the embodiment of the preceding Figures;

FIGURE 8 is a transverse section taken along the line 8—8 of Figure 7;

FIGURE 9 is a partial elevation similar to Figure 2 illustrating a yarn core choking device of the apparatus of Figures 11 and 12;

FIGURE 10 is a section taken along the line 10—10 of Figure 9;

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FIGURE 11 is a front elevation of a crimping apparatus with parts broken away illustrating a further embodiment of the invention;

FIGURE 12 is a transverse section taken along the line 12—12 of Figure 11;

FIGURE 13 is a side elevation, with parts in section, illustrating a modified form of crimping chamber; and

FIGURE 14 is a section taken on the line 14—14 of Figure 13.

Referring to Figures 1—8 in detail, there is shown a stuffer crimper having a split, rectangular crimping chamber 10 mounted in a support bracket 11 and shaped at its lower end to form a nosepiece conforming to the bite of a pair of feed rolls 12 and 13. The feed roll 12 is carried on a shaft 14 journaled in the bracket 11. The roll 13 is carried on a shaft 15 journaled in a bracket 16 which is pivoted to the bracket 11 and is biased into feeding engagement with the roll 12 by a rod 17 and a weight 18 interconnected through a pivoted bell crank lever 19. The shafts 14 and 15 are interconnected for driving at the same speed by spur gears 20 and 21. The shaft 14 is driven from a suitable source of power as by a belt and a belt pulley 23.

Yarn 25 is fed to the bite of the feed rolls 12 and 13 through a traverse guide 26 sliding on rods 27 and having an arm 28 carrying a cam follower 29 riding in a closed helical groove 30 in a traverse roll 31.

The traverse guide 26 is offset from the bite of the feed rolls 12 and 13 so as to cause the yarn to lie on the surface of the feed roll 13 for a substantial distance as it is advanced to the bite. The grip of the feed roll on the yarn which is fed around a predetermined portion of its surface, for example, at least around an arc of 45°, serves to improve the feed and to relieve the strain which would otherwise be produced at the bite and which tends to cause breakage of the yarn, particularly when the yarn is rapidly traversed. The roll 31 is mounted on a shaft 32 and is driven from the shaft 14 through a set of reducing gears 36. The arrangement is such that the yarn is traversed along the bite of the feed rolls 12 and 13 as it is fed into the crimping chamber so as to provide a more uniform distribution of the yarn in the chamber.

A heating chamber comprising a block 40 is mounted on the bracket 11 above the crimping chamber 10. The block 40 carries heating rods 41 for maintaining the wall thereof at the desired temperature. A set of vertical rods 42 disposed in a rectangle and secured in upper, centre, and lower rectangular collars 43, 44 and 45 have curved inner surfaces disposed in alignment with the inner surface of the crimping chamber 10 to form a continuation thereof. The collars 43, 44 and 45 fit within the walls of the block 40 and hold the rods 42 spaced therefrom. The lower collar 45 is centered with the chamber 10 by pin 47 car-

ried by the collar 45 and entering a slot 48 in the wall of the chamber 10.

The arrangement is such that the core 50 of crimped yarn in the chamber 10 passes upwardly along the rods 42 and is supported thereby as it advances through the heating chamber.

A pair of yarn core choking members in the form of plates 51 of flexible metal are mounted on shafts 52 which are journaled in upstanding ears 53 on the walls of the chamber 10 with their axes parallel to the axes of the feed rolls 12 and 13. The plates 51 extend upwardly into the cage formed by the rods 42 in the heating zone and are biased toward the sides of the core 50 by a cord 55 carrying a weight 58. The cord 55 is fixed to a pulley 56 carried by one of the shafts 52. The cord 55 passes around a guide roller 59 and is attached to weight 58. Spur gears 57 cause the shafts 52 to turn at the same speed and maintain the two plates 51 symmetrically inclined with respect to the longitudinal axis of the core 50.

The plates 51 compact the core which passes therebetween and impede the advance of the core so as to produce a back pressure at the bite of the feed rolls 12 and 13 which can be controlled by the weight 58.

A cooling cage 60 is formed by a set of rods 61 which are held in an upper collar 62 (Figure 7) and a lower collar 63 (Figure 1). The rods 61 register with the rods 42 and form a continuation thereof. The collar 43 carries positioning pins 64 entering holes in the collar 63 for holding the cooling cage in registration with the cage formed by the rods 42 in the heating chamber. The rods 61 and the collars 62 and 63 are similar in shape to the rods 42 and the collars 43 to 45.

A second yarn core choking device positioned in the cooling cage 60, comprises sets of fingers 66 carried on pins 67 journaled in a support bracket and biased towards the core 50 by weights 68 attached to the ends of rods 70 which are fixed to the pins 67.

The fingers 66 maintain the core under a predetermined pressure in the core portion downstream of the yarn choking plates 51. This pressure is controlled by suitable selection of the weight 68.

The position and the pressure of the two yarn choking devices are selected in accordance with the requirements of the particular yarn being processed. The back pressure produced by the first choking device affects the crimp leg length (crimping amplitude) and the pressure exerted by the second choking device affects the density of the core in the setting chamber which, in turn, affects the crimp angle which is set into the yarn. The location of the first choking device near the bite of the feed rolls in the crimping chamber makes it unnecessary to maintain a relatively high pressure on the core by the second choking

device which would tend to cause the core of yarn to snake or otherwise distort and become jammed against or between the rods in the chamber thereby creating a non-uniform advancing of the core through the setting chamber and in some cases an actual stoppage completely of the advance thereof. In many instances, the second choking device may be omitted depending upon the desired characteristics of the crimp. The spacing of the outer surfaces of the rods 42 from the walls of the heating chamber permits circulation of heated air within the chamber and provides a more uniform heating for the core as it passes there-through. A sensing device for the end of the core 50 comprises a collar 75 disposed to slide around the outer surfaces of the rods 61 and carrying a pair of inner rollers 76 which are in parallel spaced position and are disposed on opposite sides of the end rods 61 for guiding the collar as it rises and falls with the core. The rollers 76 rest on the top surface of the core and the crimped yarn 77 is extracted therebetween by delivery rolls or by a winder not shown. A pivoted bracket 78 includes arms 79 pivoted to the two sides of the collar 75 on opposite sides of the cage. The pivoted bracket 78 carries an arm 80 engaging a pin 81 extending from a sprocket 82 on a shaft 83 carrying a chain 84. The chain 84 engages a sprocket 85 carried on a shaft 86 of a potentiometer 87 which is adapted to vary the speed of a motor driving the feed rolls or a winder or other take up device in a sense to vary the rate of feed or extraction of the crimped yarn so as to maintain the end of the core at a substantially constant level.

Referring to the embodiment of Figures 9 to 112, the feed rolls, nosepiece, and heating and cooling cages are similar to those above described and have been given the same reference characters with the suffix "a". The heater housing is split and comprises a front part 90 and a rear part 91 which are hinged together and may be opened to provide access to the heating cage for cleaning. The collars 43a, 44a and 45a fit within the bore of the housing and are secured therein by the housing walls when the parts are closed.

In this embodiment, means is provided for the admission of steam into the heating chamber in the space around the core of crimped yarn in the heating cage. For this purpose, a horizontal bore 92 is formed in each of the parts 90 and 91 to receive steam from an external source and to supply the same to horizontal slits 93 which extend through the walls of the housing parts at a point above the lower collar 45a. The steam, thus, envelops the core in the heating cage and permeates the crimped yarn. The lower collar 45a closes the space between the walls and the core to prevent condensate from dripping onto the feed rolls. Any such condensate is absorbed by the core and passes upwardly therewith.

In order to minimize such condensation, heating rods 94 may be disposed in bores in the housing walls below and adjacent the inlet slits 93. Vertical grooves 95 are milled in the end walls of the housing, extending upwardly past the centre collar 44a and the upper collar 43a so as to allow the steam to contact the core in the space between the upper and lower collars and to escape into the atmosphere past the upper collar 43a.

The housing walls are heated by suitable means such as strip heaters 96 which may be temperature controlled by any suitable means. The parts 90 and 91 of the housing are formed with rib 97 and groove 98 which mesh for sealing the heating chamber against escape of steam.

Steam is supplied from an external source at, for example, pressure of 0.7 to 17.5 kilograms per square centimetre and at temperatures of from 116°C. to 210°C. depending upon the pressure. The chamber is maintained by the strip heaters at a temperature which is usually somewhat above the steam temperature, for example, at a temperature of from 121°C to 236°C. The required chamber temperature will depend upon the nature of the yarn and the rate at which the core passes through the chamber. The temperature must, of course, be below that at which degradation occurs. When the steam enters the heating chamber its pressure is reduced to substantially atmospheric pressure, owing to the fact that the chamber is vented to the atmosphere. Hence, the steam becomes super heated or dry steam as it contacts the core. Should any condensation occur owing to contact with the relatively cool core the condensate is re-vaporized by the heat supplied by the rods 94 and also due to the high temperature maintained in the chamber by the strip heaters 96.

The yarn is thus subjected to an atmosphere of steam in the heating chamber which is adapted to provide optimum setting conditions. As the yarn reaches the cooling zone the steam is immediately dissipated leaving the yarn in a dry state which is suitable for winding onto a package.

In this embodiment, the first yarn core choking device is shown as comprising a pair of choking elements 100 (Figures 9 and 10) journaled in the walls of the crimping chamber 10a. These choking elements 100 are formed with straight surfaces 101 which are offset from their centres and extend upwardly from such centres with top edges 102 which are adapted to be displaced inwardly toward the centre of the chamber as the choking elements are turned. In their retracted state, the straight surfaces 101 are disposed in recesses in the walls of the chamber 10a and are substantially coplanar therewith. The choking elements 100 are geared together by spur gears 103 and are biased towards the centre of the chamber by a cord 104 and a weight 105.

The embodiment of Figures 9 and 10 has the advantage that the choking is effected at a point in the crimping chamber near the bite of the feed rolls whereas the yarn choking step in the embodiment of Figures 1 to 8 is effected within the zone of the heating chamber. Such a first choking device may be substituted in the embodiments of Figures 1 to 8, if desired. The arrangement selected will depend upon the characteristics of the yarn and the dimensions of the various parts. In any event, the comparatively small area of contact between the sides of the core with the rods forming the heating and cooling cages produces a minimum of friction on the core, and the back pressure can be controlled by the arrangement of the two choking devices and by the pressures exerted thereby on the sides of the core as it advances. The sensing member shown conforms to the average position of the top surface of the core and also forms a guide for the yarn which is extracted therefrom.

Referring to the form of Figures 13 and 14 the crimping apparatus is shown as comprising an outer housing 110 supported by suitable means, not shown, having a central bore terminating in a bottom lip 111. A heater ring 112 is seated in said bore against the bottom flange 111 and is formed with a series of peripherally spaced holes adapted to receive heating elements not shown for heating the crimping chamber.

The crimping chamber 113 is composed of a split cylindrical element seated within the heater member 112 and having a bottom member 114 terminating in a central nosepiece 115 which is adapted to receive yarn for crimping from a pair of feed rolls 116 as in the embodiments of Figures 1 to 12.

A plurality of ribs 120, shown in the form of T bars are spaced around the periphery of the chamber 113 with their crossheads 121 disposed in slots in the inner surface of the chamber wall. These ribs 120 may be secured to the bottom wall 114 by suitable means, for example soldering, and extend upwardly above the top of the chamber 113, to form a cooling zone 122. The ribs are secured at their top ends to a ring 123 for rigidity.

Vertical grooves 124 are shown as formed in the outer surface of the chamber 113 opposite the ribs 120 to provide air pockets for controlling the heat transfer from the heater ring to the chamber walls and thence to the ribs.

The inner edges 125 of the ribs 120 form a support for the core of crimped yarn as it advances along the crimping and heating chamber and along the cooling cage above such chamber where the crimp is set in the yarn. Since the ribs 120 contact the core of yarn only at spaced points the friction which opposes the advance of the core is reduced to a minimum.

A switch 127 may be mounted on a bracket

123a and actuated by feeler wire 128 which extends between the bars 120 to rest upon the top of the core in the cooling zone. The switch 127 is connected to control the feed motor or the winder motor for maintaining the core at a constant level as described above in connection with Figures 1 to 12. While only so much of the apparatus is shown in Figures 13 and 14 as is necessary for an understanding of the operation of this embodiment, it is to be understood that the remainder of the apparatus in this embodiment is similar to that described above.

The apparatus illustrated in the accompanying drawings and described above is also described and claimed in our co-pending Patent Application No. 56504/69 (Serial No. 1285969).

WHAT WE CLAIM IS:—

1. Stuffer crimping apparatus comprising a crimping chamber; feed rolls disposed to feed yarn for crimping into the inlet of said crimping chamber for crimping said yarn against the core of previously crimped yarn; a heating chamber registering with the outlet of said crimping chamber; and variable yarn core choking means at the outlet of said crimping chamber for contacting said core of crimped yarn and restricting the flow of said core there-through to control the back pressure in said crimping chamber; said heating chamber including a housing with a cage of spaced parallel rods having their inner surfaces spaced from the inner walls of said housing for confining and guiding a core of crimped yarn through said heating chamber; said inner surfaces forming a continuation of the walls of said crimping chamber and extending throughout the length of said heating chamber.

2. Apparatus according to claim 1, wherein said variable yarn core choking means comprises a pair of yieldable yarn core choking members in opposed relationship biased toward each other.

3. Apparatus according to claim 2, wherein a portion of each of said choking members extends from said crimping chamber into the inlet of said heating chamber.

4. Apparatus according to claim 3, wherein said choking members have surfaces adapted to register with the inner walls of said crimping chamber when in a retracted position.

5. Apparatus according to claim 4, wherein said choking members form a part of the walls of said crimping chamber when fully retracted.

6. Apparatus according to any one of claims 2 to 5, wherein said choking members are mounted on shafts connected to turn oppositely through similar angles, and wherein biasing means is provided for urging said shafts in rotation.

7. Apparatus according to any one of the preceding claims, wherein said cage includes a plurality of collars encircling said rods and

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Vertical grooves 124 are shown as formed in the outer surface of the chamber 113 opposite the ribs 120 to provide air pockets for controlling the heat transfer from the heater ring to the chamber walls and thence to the ribs.

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2. Apparatus according to claim 1, wherein said variable yarn core choking means comprises a pair of yieldable yarn core choking members in opposed relationship biased toward each other.

3. Apparatus according to claim 2, wherein a portion of each of said choking members extends from said crimping chamber into the inlet of said heating chamber.

4. Apparatus according to claim 3, wherein said choking members have surfaces adapted to register with the inner walls of said crimping chamber when in a retracted position.

5. Apparatus according to claim 4, wherein said choking members form a part of the walls of said crimping chamber when fully retracted.

6. Apparatus according to any one of claims 2 to 5, wherein said choking members are mounted on shafts connected to turn oppositely through similar angles, and wherein biasing means is provided for urging said shafts in rotation.

7. Apparatus according to any one of the preceding claims, wherein said cage includes a plurality of collars encircling said rods and



spacing the outer surfaces of said rods from the inner walls of said housing.

5 8. Apparatus according to claim 7, wherein said collars include spaced grooves for receiving said outer surfaces of said rods.

10 9. Apparatus according to any one of the preceding claims, wherein said rods are in the form of members having radially inwardly extending ribs with their inner edges disposed to contact and confine the core of crimped yarn located within said heating chamber.

10. Apparatus according to claim 9, wherein said ribs are formed with peripheral heads

disposed in contact with the inner walls of said chamber and secured thereto.

15 11. Apparatus according to any one of the preceding claims and including second yarn core choking means disposed beyond the exit of said heating chamber for controlling the back pressure present in said heating chamber. 20

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1972.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.