Aug. 14, 1956 W. GOODHUE 2,758,357

APPARATUS FOR TREATING CONTINUOUS STRIP MATERIAL

Filed Oct. 15, 1953

Fig. 1.

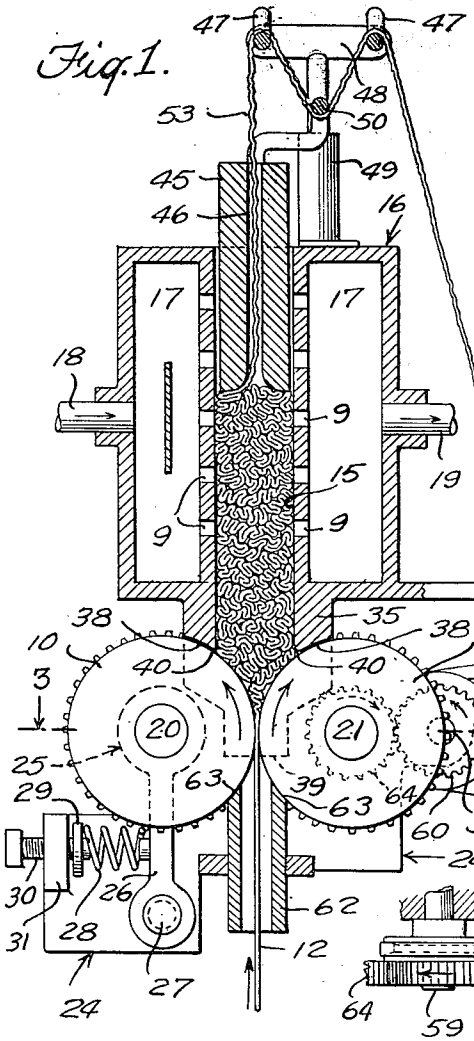
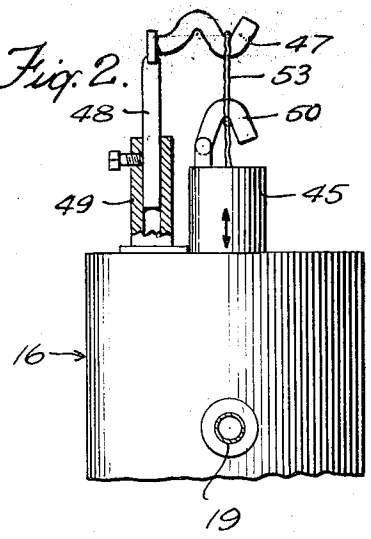


Fig. 2.



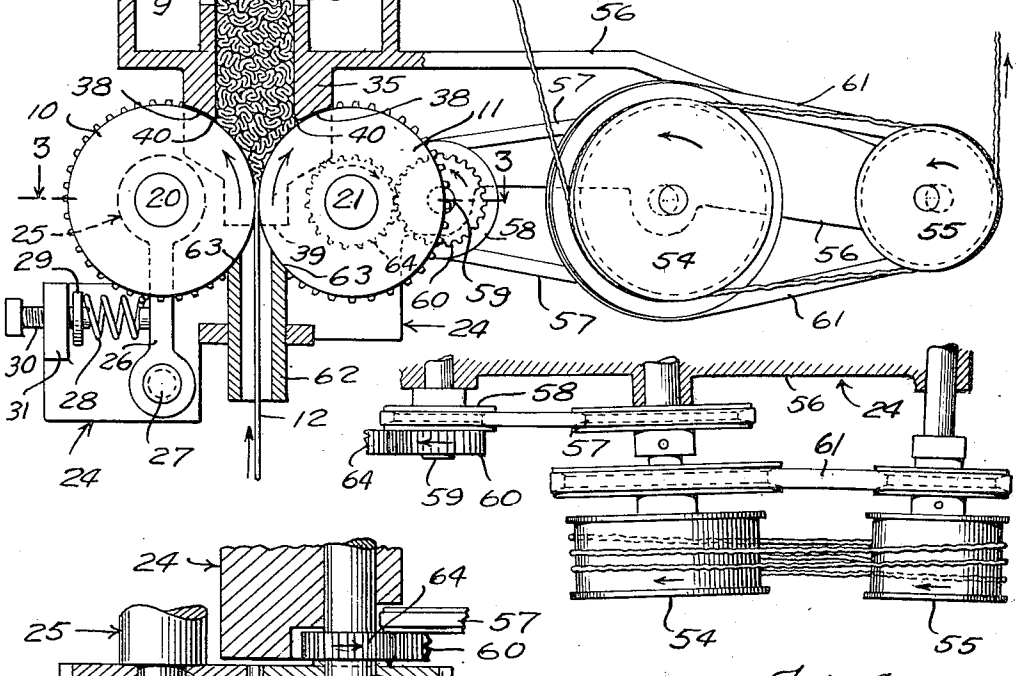


Fig. 4

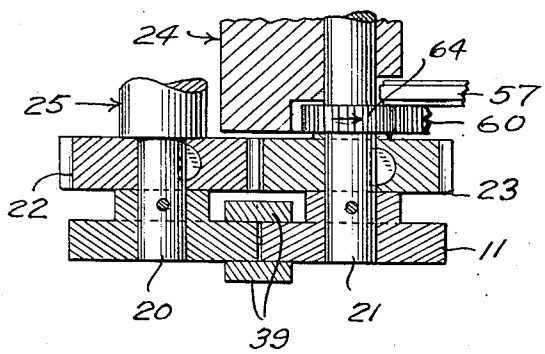


Fig. 3

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APPARATUS FOR TREATING CONTINUOUS STRIP MATERIAL

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8 Claims. (Cl. 28—1)

This invention relates to an apparatus for treating continuous strip material such as yarn or a web and more particularly to a device for controlling the rate of withdrawal of such material from a chamber.

An object is to provide, in an apparatus of the above type, novel and improved means for controlling the rate of withdrawal of the material so as to maintain a constant quantity of such material in the chamber.

Another object is to provide an apparatus for the above purpose having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully described.

In accordance with this invention the material, which may constitute filament tow, filament yarn, spun yarn, or a web, is fed into a chamber containing a mass of such material for treatment therein. The treated material is withdrawn from the chamber by a pair of delivery rolls operating at a fixed speed ratio to the average rate of feed into the chamber. The delivery rolls deliver the filament to a subsequent processing step such as a winder operating at constant speed or at constant tension.

The rate of withdrawal of the material is controlled by varying the tension of the material supplied to the delivery rolls. The resilience of the material is such that the material stretches or contracts slightly in response to such variations in tension and thus modifies the rate of withdrawal from the chamber by the constant speed delivery rolls. This variation is controlled in accordance with the level of the material in the chamber so as to maintain such level substantially constant.

The nature of the invention will be better understood by referring to the following description, taken in connection with the accompanying drawing forming a part thereof, in which a specific embodiment has been set forth for purposes of illustration.

In the drawing:

Fig. 1 is a vertical section through a crimping apparatus embodying the invention;

Fig. 2 is a partial side elevation showing the arrangement of the tensioning device;

Fig. 3 is a transverse section taken on the line 3—3 of Fig. 1; and

Fig. 4 is a detail showing the arrangement of the delivery rolls.

Referring to the drawing more in detail the invention is shown for purposes of illustration as comprising a pair of feed rolls 10 and 11 which are adapted to feed continuous filament tow or yarn 12 into an elongated chamber 15 formed in a housing 16. The housing 16 is provided with a hollow jacket 17 communicating with pipes 18 and 19 for the circulation of heating fluid. The housing 16 may have passages 9 for the injection of a heating fluid or setting fluid such as steam into the chamber 15. The housing 16 may be electrically heated as by Calrods if desired.

Feed rolls 10 and 11 are shown as mounted on shafts 20 and 21 respectively and driven by meshing gears 22 and 23 respectively. The shaft 21 is mounted in a fixed bearing carried by a frame 24 which also carries the housing 16. The shaft 20 is journaled in a bearing 25 carried by an arm 26 which is pivoted at 27 to the frame 24 and is spring-pressed by spring 28 seated against a disc 29 held on an adjusting screw 30 threaded into a fixed ear 31 attached to the frame 24. The spring 28 is adapted to hold the roll 10 in pressure engagement with the filament passing between the rolls 10 and 11 and the teeth on the gears 22 and 23 are sufficiently deep to remain in mesh when the roll 10 is retracted in response to the passage of the filament. The roll 10 may be loaded hydraulically or weighted for gravity loading to replace the spring loading if desired.

The chamber 15 may be circular in cross section or of any other desired cross section and may be tapered. The housing 16 carries at its lower end a saddle 35 having a bore which forms a continuation of the chamber 15.

The saddle 35 is provided with a pair of curved surfaces 38 conforming generally to the peripheries of the feed rolls 10 and 11 and with a pair of side members 39 which extend on opposite sides of the rolls 10 and 11 so as to form a confined crimping chamber. The curved surfaces 38 of the saddle 35 terminate at edges 40 which are rounded so as to avoid corners or sharp edges which might damage the filaments.

The crimped material within the chamber 15 is held compacted by a plunger 45 which fits loosely therein and rests upon the packed material in the chamber.

The plunger 45 fits within the chamber 15 and has a central passage 46 for the crimped tow or yarn 53. The passage 46 is of a size to form a friction device for eliminating slubs or snarls.

The crimped tow or yarn feeds through the passage 46 to a tension device or drag comprising a pair of hooks 47 carried by bracket 48 adjustably mounted in an arm 49 carried by the housing 16, and a movable hook 50 attached to the plunger 45 and extending upwardly in the plane between the hooks 47. The yarn passes through both hooks 47 and under the intermediate hook 50 in such a manner that the friction drag depends upon the vertical displacement of the intermediate hook 50 with respect to the fixed hooks 47. That is, as the hook 50 descends to deflect the yarn as it passes over the hooks 47 an increase in tension is applied to the yarn. Hence as the plunger 45 is lowered due to a decrease in quantity of material in the chamber 15 the drag on the yarn, and the tension produced therein is increased, and as the plunger rises due to an increase in the quantity of material in the chamber 15 the hook 50 no longer deflects the yarn between the hooks 47 and the tension produced therein is eliminated.

The sensivitity of the friction device is a function of the number of wraps around the hooks 47 and the friction coefficient of the hook 50 itself.

A particular type of variable drag device has been shown for purposes of illustration only. Other devices, the drag of which can be varied as a function of the quantity of material in the chamber 15 or as a function of the movement of the plunger 45, may be used, if desired. The hooks 47 and 50 can be replaced by loops or bars or rollers.

The yarn passes from the tension device to delivery rolls 54 and 55 which are shown as mounted on a bracket 56 and connected to be driven by belt 57 from a pulley 58 on a shaft 59 carrying a gear 60 driven by the gear 64 mounted on the shaft 21 so that the rolls 54 and 55 rotate at a speed which has a predetermined ratio to the speed of the feed rolls 10 and 11. The delivery rolls 54 and 55 are shown as of different sizes and connected by a belt 61 to rotate at the same average peripheral speeds. The rolls 54 and 55 are mounted to

rotate about non-parallel axes to facilitate the feed of the yarn which is wound around the two rolls a number of times so as to obtain the necessary grip. The delivery rolls may deliver the yarn to a constant speed or a constant tension winder or to any subsequent treating stage.

For guiding the yarn 12 to the feed rolls 10 and 11 a guide tube 62 is provided having at its upper end curved surfaces 63 which conform to the surface of the feed rolls 10 and 11 and which serve to guide and center the filament 12 with respect to the feed rolls.

In operation the yarn to be crimped is fed through the tube 62 to the feed rolls 10 and 11 which force the yarn into the crimping chamber 15. As the yarn is fed into the crimping chamber 15 between the feed rolls 10 and 11 it is folded over and crimped as set forth in Rainard Patent No. 2,575,837 dated November 20 1951. The crimped yarn or filament is held compacted and crimped in the crimping chamber under setting conditions of time, temperature and moisture until the crimp has been set. The temperature is controlled by the heat supplied to the housing 16. The heat supply may be electrical or a fluid such as steam. If moisture is required for setting the passages 9 may be used to pass steam into the interior of the chamber.

The filament with the set crimp is removed by the delivery rolls 54 and 55 which are timed with respect to the feed rolls to operate at about the speed required to maintain the chamber 15 filled to a constant level. If however the crimped filament 53 is withdrawn at too fast a rate, the plunger 45 moves downwardly thereby lowering the hook 50 and increasing the tension on the filament. This causes the effective length of the filament to be increased slightly between the hooks 47 and the delivery roll 54, and thus reduces the rate at which it is withdrawn from the chamber by the delivery rolls. The feed rolls 10 and 11 however continue to operate at the same speed and feed material into the chamber which again elevates the plunger 45. This raises the hook 50 of the friction device and reduces the tension on the filament. A balance is thus reached at which a substantially constant amount of material is maintained within the crimping chamber.

The crimp frequency and amplitude is controlled as a function of the back pressure and the mechanical characteristics of the filament (bending movement, crushing resistance and the like). Spring loading may be used to supplement the weight of the plunger 45, if desired.

Obviously the crimping chamber may be reversed with respect to the feed rolls so that the filament is fed downwardly instead of upwardly to the crimping chamber in which case spring loading will be used for the plunger 45.

The crimped filament remains in the crimping chamber under setting conditions a sufficient length of time for the internal stresses produced by the crimping to be relieved, so that the tendency of the crimp to open up after the material is removed from the chamber is reduced. The material immediately cools and becomes permanently set upon withdrawal from the crimping chamber or the crimping chamber may be so designed that the material cools to a temperature below that at which there is any tendency for plastic flow while still packed in the chamber. Since the stresses have been relieved by maintaining the material in heated condition in the crimping chamber the crimp becomes permanently set. Suitable moisture and pH conditions may be established in the crimping chamber, depending upon the type of material being crimped. The provision of a controlled rate of discharge as well as a controlled rate of feed establishes a uniform operation. The nature of the crimp, the temperature, the time within the crimping chamber, and the rate of feed can be regulated with great accuracy.

The invention has been shown as applied to a stuffer crimper for purposes of illustration. It is obviously useful for controlling the rate of delivery of any yarn, filament or web from a chamber so as to maintain uniform conditions within the chamber.

The invention may be applied to various uses and changes and modifications may be made therein as will be apparent to a persons skilled in the art.

What is claimed is:

1. An apparatus of the class described comprising a chamber, means feeding yarn or the like into said chamber, a delivery roll withdrawing the yarn from said chamber, and means controlling the rate of withdrawal of said yarn by said delivery roll comprising a variable tension device between said chamber and said delivery roll adapted to exert a variable drag on the yarn fed to said delivery roll, and means responsive to variations in the quantity of yarn in said chamber to adjust said device to vary the drag exerted thereby on said yarn.

2. An apparatus of the class described comprising a chamber, means feeding yarn or the like into said chamber, a delivery roll withdrawing the yarn from said chamber, and means controlling the rate of withdrawal of said yarn by said delivery roll comprising a variable tension device between said chamber and said delivery roll adapted to exert a variable drag on the yarn fed to said delivery roll, a member in said chamber movable in accordance with the quantity of yarn therein, to adjust said device to vary the drag exerted thereby on said yarn.

3. An apparatus for treating yarn or the like, comprising a member having walls forming a chamber, means to feed said yarn into said chamber, delivery rolls operating at fixed speed ratio with respect to the feed means, withdrawing yarn from said chamber, a member engaging the material in said chamber and adapted to advance and retract according to the quantity of material in said chamber, a variable tension device between said chamber and said delivery rolls actuated by said last member to control the drag on the material fed to said delivery rolls, whereby the rate of withdrawal of said yarn by said delivery rolls is varied to maintain a predetermined quantity of material in said chamber.

4. An apparatus for treating yarn or the like, comprising a member having walls forming a chamber, means feeding said yarn into said chamber, a plunger loosely mounted in said chamber to rest upon the material therein and to be advanced or retracted as the quantity of material in said chamber varies, delivery rolls operating at fixed speed ratio with respect to the feed means for withdrawing the yarn from said chamber, a variable tension device between said chamber and said delivery rolls actuated by said plunger to control the drag on the material fed to said delivery rolls, whereby the rate of withdrawal of the yarn from said chamber by said delivery rolls is varied to maintain said plunger at a predetermined level in said chamber.

5. An apparatus for crimping filament tow or yarn, comprising a member having walls forming a crimping chamber, a pair of feed rolls positioned to feed said filament continuously into one end of said chamber, delivery rolls operating at constant speed withdrawing crimped filament from the opposite end of said chamber, a second member engaging the material in said chamber at said last end and adapted to advance and retract according to the quantity of material in said chamber, a variable tension device controlling the tension of the filament supplied to said delivery rolls, said device being responsive to the movement of said second member to vary the tension produced thereby on said yarn so as to vary the rate of withdrawal of the yarn by said delivery rolls.

6. An apparatus for crimping filament tow or yarn, comprising a member having walls forming a crimping chamber, a pair of feed rolls at one end of said member positioned to feed material into one end of said chamber, a plunger loosely mounted in the other end of said chamber to rest upon the material therein and to be advanced or retracted as the quantity of material in said chamber

varies, delivery rolls operating at constant speed for withdrawing the crimped material from said other end of said chamber, a variable tension device controlling the tension of the filament supplied to said delivery rolls, said device being responsive to the movement of said plunger to vary the tension produced thereby on said yarn so as to vary the rate of withdrawal of the yarn by said delivery rolls.

7. An apparatus for crimping filament tow or yarn, comprising a member having walls forming a crimping chamber, a pair of feed rolls positioned to feed said filament continuously into one end of said chamber, delivery rolls operating at constant speed withdrawing crimped filament from the opposite end of said chamber, a second member engaging the material in said chamber at said last end and adapted to advance and retract according to the quantity of material in said chamber, a variable tension device controlling the tension of the filament supplied to said delivery rolls, said device being responsive to the movement of said second member to vary the tension produced thereby on said yarn so as to vary the rate of withdrawal of the filament by said delivery rolls, said variable tension device comprising a series of hooks over which said yarn passes, one of said hooks being movable with said second member to vary the relative displacement of the hooks and the friction drag exerted thereby.

8. Apparatus as set forth in claim 7 in which said chamber is mounted above said feed rolls for the feed of said yarn upwardly therethrough and said second member rests by gravity upon the material in said chamber.

References Cited in the file of this patent

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