July 9, 1963 L. W. RAINARD ETAL 3,096,558

CRIMPING APPARATUS

Filed Sept. 23, 1959

3 Sheets-Sheet 1

Fig. 1.

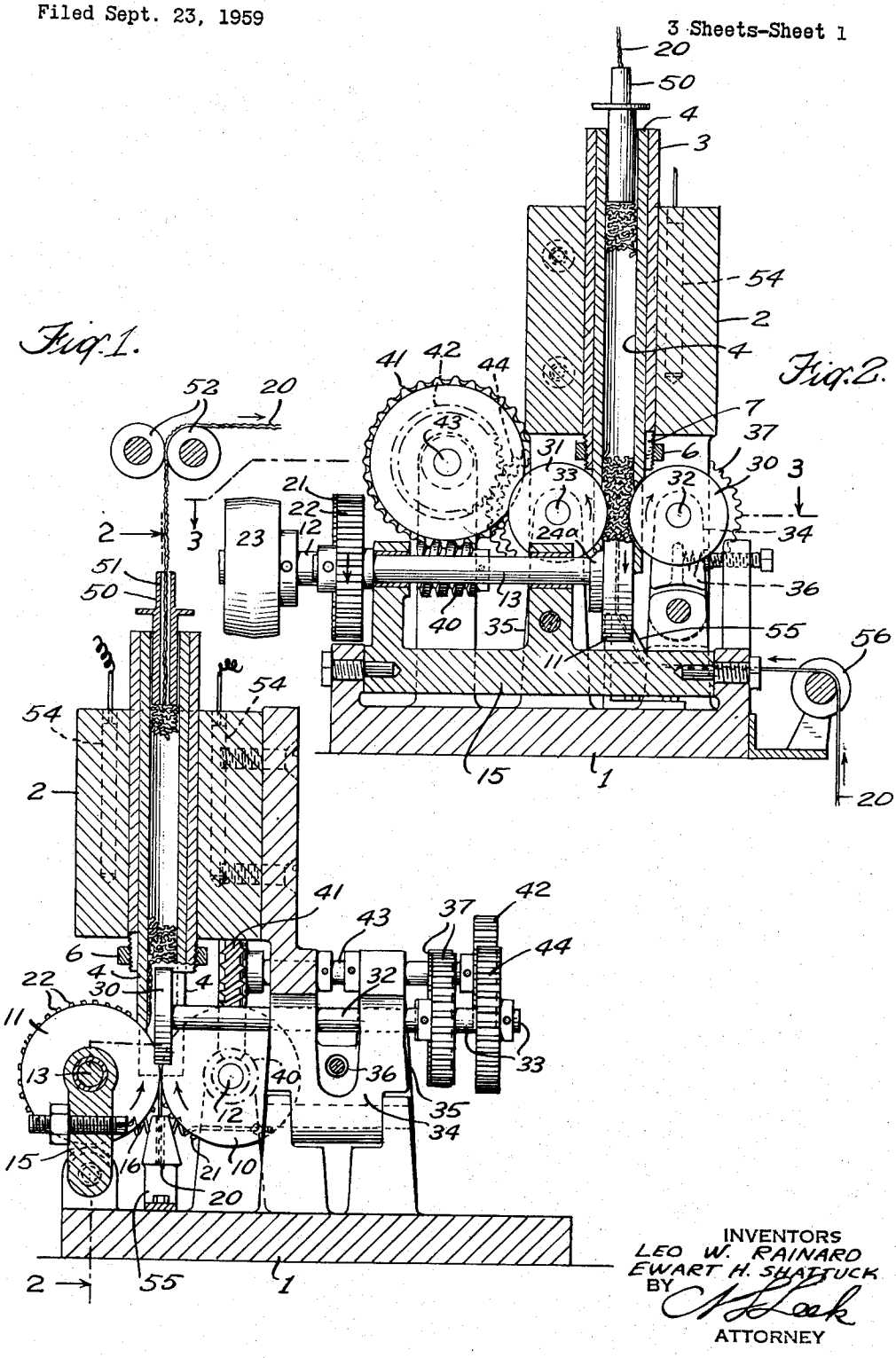

Fig. 2.

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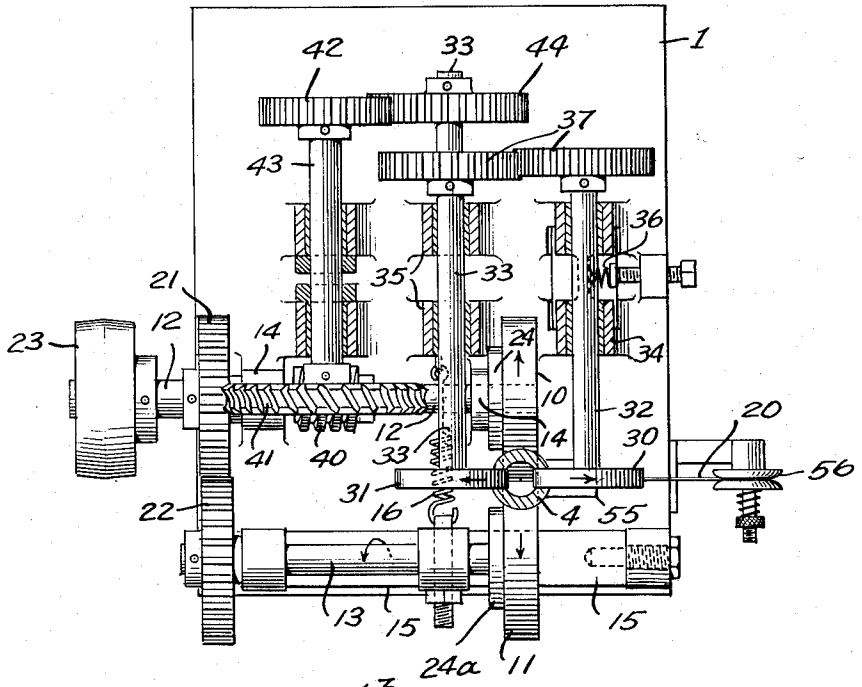
Fig. 3.



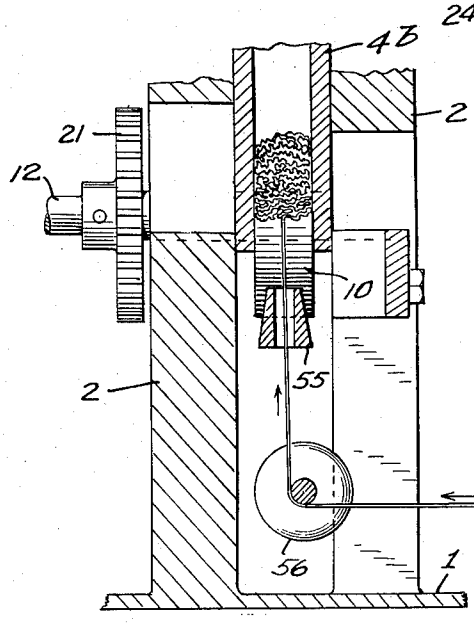


Fig. 8.

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Fig. 5.

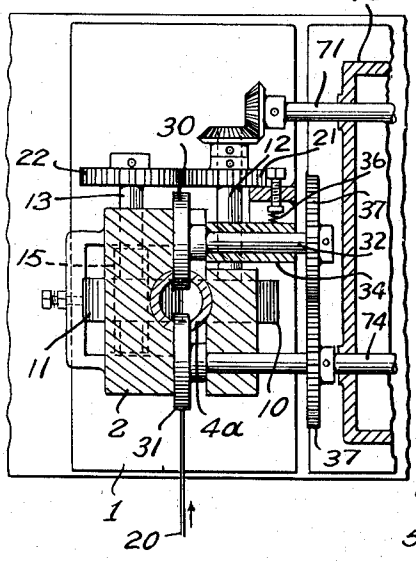
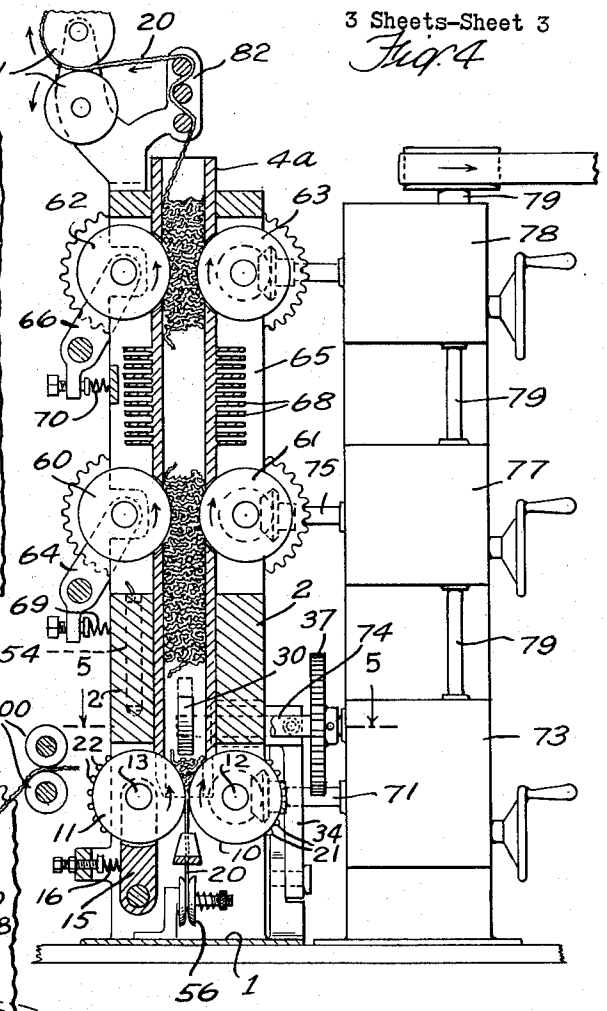


Fig. 4



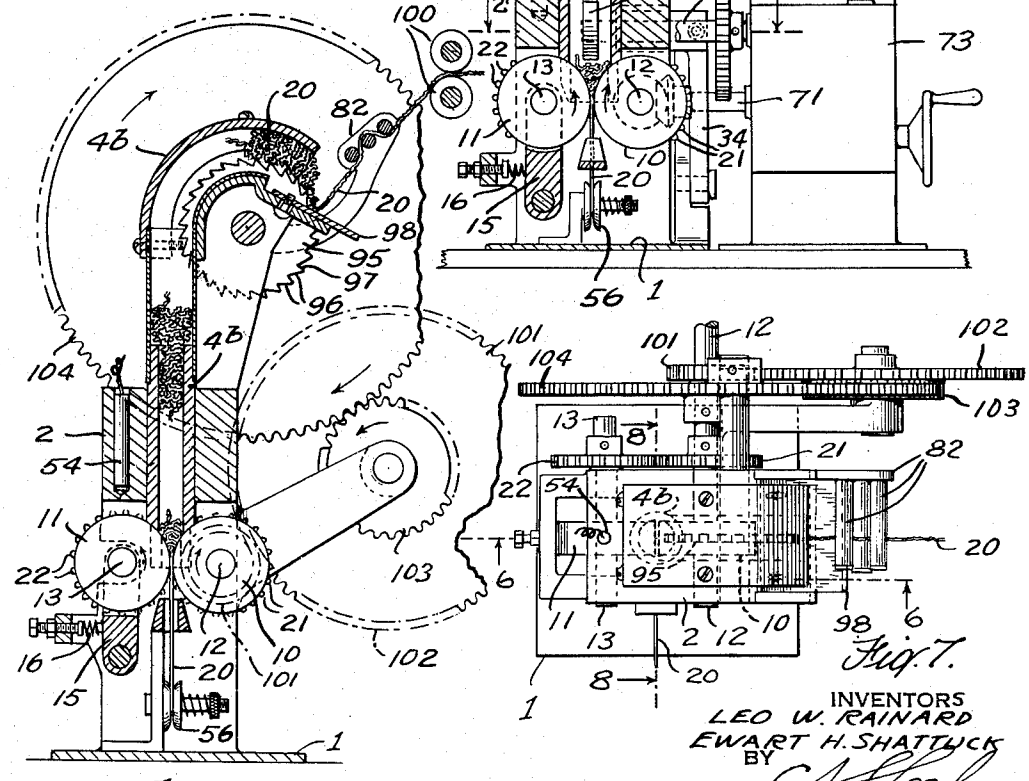


Fig. 6

Fig. 7.

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United States Patent Office

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3,096,558

CRIMPING APPARATUS

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3 Claims. (Cl. 28—1)

This invention relates to apparatus for crimping fibers, filaments, tow or yarn and more particularly to apparatus of the stuffer crimper type wherein the material to be crimped is fed into a closed chamber against the pressure of a mass of crimped material held compacted therein.

An object is to provide a novel and improved apparatus of the above type.

Another object is to provide in a stuffer crimper, new and improved means for controlling the pressure on the packed mass of material.

Another object is to provide means for subjecting the packed mass in the chamber to different controlled pressures in various parts of the chamber.

Another object is to improve the crimp uniformity in the treated material.

Another object is to provide a stuffer crimper in which the pressure in the crimping area can be controlled independently of the length of the chamber or of the pressure in the setting area.

Another object is to provide an apparatus of the above type wherein the crimped mass of material in the chamber is subjected to varying, controlled pressures as the setting progresses.

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

In accordance with this invention the fibers in the form of filaments or tow in continuous or staple form, or yarn spun from such fibers or composed of twisted or untwisted bundles of continuous filaments or tow, hereinafter referred to generally as fibers, are crimped by being fed between feed rolls into a confined crimping chamber against the pressure of a mass of fibers held compacted therein whereby the fibers are folded over into a zig-zag crimp as they enter the chamber from the bite of the feed rolls, as described more in detail in Shattuck Patent No. 2,760,252.

The fibers are compacted in a confined crimping zone at the bite of the feed rolls by a control member in the form of one or a pair of wheels mounted to rotate about axes, which extend normal to the axes of the feed rolls and extend peripherally into the crimping chamber adjacent the bite of the feed rolls to form a constriction in the chamber for retarding to a controlled extent the passage of the mass of packed fibers, and thereby maintaining a controlled crimping pressure. The wheels may be driven at a fixed rate to the drive of the feed rolls which may be adjustable for control purposes, or a controlled pressure may be obtained by driving the wheels at a constant speed and driving the feed rolls through a constant torque clutch as set forth in copending application Serial No. 665,618, filed June 13, 1957, Patent No. 2,960,730.

As a further embodiment the control may be effected by one or a pair of threaded pins extending into the crimping chamber to provide a predetermined constriction adjacent the bite of the feed rolls.

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In addition the pressures on the mass of fibers in heating and cooling zones may be controlled by additional pairs of wheels disposed at the exit ends of the respective zones and driven at controlled rates which may be adjusted individually.

In some cases a suitable control wheel may be disposed at the exit end of the chamber for controlling the discharge of the crimped mass of fibers and the withdrawal and winding of the crimped filaments, tow or yarn therefrom.

The details of the invention will be apparent from the following description taken in connection with the accompanying drawings in which certain specific examples have been set forth for purposes of illustration.

In the drawings:

FIG. 1 is a vertical section of a crimping apparatus embodying the invention;

FIG. 2 is a vertical section taken on the line 2—2 of FIG. 1;

FIG. 3 is a horizontal section taken on the line 3—3 of FIG. 2;

FIG. 4 is a vertical section, similar to FIG. 1, illustrating a further embodiment of the invention;

FIG. 5 is a horizontal section taken on the line 5—5 of FIG. 4;

FIG. 6 is a vertical section taken on the line 6—6 of FIG. 7 illustrating a still further embodiment of the invention;

FIG. 7 is a top plan view of the apparatus of FIG. 6; and

FIG. 8 is a vertical section taken on the line 8—8 of FIG. 7 with parts broken away.

In the embodiments of FIGS. 1 to 3 the crimper is shown as comprising a base 1 carrying a block 2 having a bore in which a sleeve 3 is seated. A tube 4 forming the crimping chamber is mounted in the sleeve 3 and is clamped thereto by a nut 6 on the split lower end 7 of the sleeve 3. A pair of feed rolls 10 and 11 are mounted on shafts 12 and 13 respectively which are journalled in brackets 14 and 15 carried by the base 1. The bracket 15 is shown as mounted for pivotal movement and is spring-loaded by a spring 16 to hold the feed rolls 10 and 11 in gripping contact with a tow or yarn 20 to be fed thereby into the end of the tube 4. The lower end of the tube 4 is saddle-shaped to receive the rolls 10 and 11 and to form, with the bite of said rolls, a confined crimping chamber.

The shafts 12 and 13 are connected by intermeshing gears 21 and 22, and the shaft 12 is driven by a driving pulley 23 from a source of power not shown. The rolls 10 and 11 may be connected to the shafts 12 and 13 through constant torque clutches 24 and 24a which may be of the mechanical or magnetic type, as set forth in copending application Serial No. 665,618.

A pair of control wheels 30, 31 are mounted on shafts 32, 33, respectively journalled in brackets 34, 35 on the base 1. The bracket 34 may be pivotally mounted and spring-pressed by spring 36 to permit the wheel 30 to be retracted for the passage of a mass of material within the tube 4.

The shafts 32, 33 are connected by intermeshing gears 37 for operation in unison and the shaft 32 may be driven from the feed roll shaft 12 by a gear train comprising a

worm 40 on the shaft 12, a worm wheel 41, and pinion 42 on an idler shaft 43, and a gear 44 on the shaft 33.

The wheels 30, 31 may have a smooth or serrated or toothed surface and serve to restrict the feed of the mass of crimped material in the tube 4 so as to control the feed pressure of the material in the crimping zone between the wheels 30, 31 and the bite of the feed rolls 10, 11.

A plug 50 rests upon the mass of filaments in the discharge end of the tube 4 and is of a weight selected to maintain the mass between the wheels 30, 31 and the plug 50, under a suitable pressure for setting the crimp. The crimped material is withdrawn through a hole 51 in the plug 50 by a pair of delivery rolls 52 which may be driven at a predetermined rate which bears a predetermined relationship to the rate of the wheels 30, 31 or of the feed rolls 10, 11.

The portion of the tube 4 within the block 2 may be heated by heating rods 54 or the like and the fibers may be guided to the feed rolls 10, 11 by a guide 55 and tensioning gate 56.

In the operation of this embodiment the fibers in the crimping chamber or zone are maintained under a selected crimping pressure which may be higher or lower than the pressure in the setting chamber or zone. The pressure in the crimping zone is determined by the relative rates of drive of the feed rolls 10, 11 and the control wheels 30 and 31 while the pressure in the setting zone is determined by the rate of the control wheels 30, 31, the rate of the delivery rolls 52 and the weight of the plug 50.

It may be preferable to drive the shaft 12 at a rate to supply fibers into the crimping zone in excess of the rate of feed of the mass of crimped fibers in the wheels 30, 31 and to adjust the constant torque clutches 24 and 24*a* so that the feed rolls maintain a constant pressure within the crimping zone which is independent of the rate of feed of the wheels 30, 31.

Of course the drive of the delivery rolls may be controlled by the movement of the plug 50 so as to maintain the mass of crimped material in the tube 4 at a substantially constant level at the exit end.

In the embodiment of FIGS. 4 and 5 a plurality of control wheels are provided to control independently the pressures in the crimping, heating and cooling zones.

In this form the base 1, block 2, feed rolls 10, 11 are similar to the corresponding elements of FIGS. 1 to 3 and have been given the same reference numerals.

The tube 4*a* of FIGS. 4 and 5 extends above the block 2 and two pairs of control wheels 60, 61, 62, 63 are mounted to rotate about axes parallel to the feed rolls 10 and 11 and are disposed to pass through slots in the tube 4*a* at spaced points above the block 2. The wheels 60, 61 are shown as mounted on brackets 64, 65, respectively, carried by the base 1 and engage the mass of fibers within the tube 4*a* at the exit end of the heating zone. The wheels 62, 63 are mounted on the brackets 66 and 65 and engage the crimped material near the discharge end of the tube 4*a*. Cooling fins 68 may be disposed on the tube 4*a* between the wheels 60, 61 and the wheels 62 and 63. The brackets 64 and 66 may be pivoted and adjustably spring-pressed by springs 69 and 70 respectively, to allow for passage of irregular masses of crimped fibers therebetween.

The feed rolls 10, 11 are connected to be driven by a shaft 71 from an adjustable drive such as a Reeves drive indicated by box 73. The control wheels 30, 31 are connected by a shaft 74 to be similarly driven from the drive box 73. Control wheels 60, 61 are driven by shaft 75 from a variable speed drive indicated by box 77 and control wheels 62, 63 are similarly driven from a gear box 78. The boxes 73, 77 and 78 are driven by a common drive shaft 79.

The crimped tow or yarn 20 is withdrawn from the top of the tube 4*a* by delivery rolls 81 through a gate 82.

In operation the action within the crimping zone is similar to that described above. The pressure on the mass of crimped fibers in the tube 4*a* within the heating zone is controlled by the rate of drive of the control wheels 60, 61 and the pressure on the mass of crimped fibers within the cooling zone is controlled by the rate of drive of the control wheels 62, 63. Since these controls are independent the pressures within the three zones may be adjusted as desired. For example, a predetermined relatively high pressure may be maintained in the crimping zone to effect the desired crimp characteristics. A substantially lower pressure may be maintained in the heating zone so that the mass of fibers is relaxed or opened somewhat to facilitate the uniform heating of the fibers to the temperature required for setting. Then the pressure may be increased in the cooling zone to a value intermediate the first two mentioned pressures so as to hold the crimp fully formed while the fibers cool to a temperature at which the crimp is permanently set.

In the discharge zone above the level of the control wheels 62, 63, there is no appreciable pressure on the fibers within the tube 4*a*. Hence the tow or yarn can be extracted from the mass by the delivery rolls with a minimum of tension on the material. The crimp is thus retained in the fibers without subjecting them to mechanical distortions.

Alternatively, it may be desirable to exert the highest pressure on the fibers in the crimping zone, then subject the fibers to progressively lower pressures in the heating and cooling zones. This or other combinations can readily be effected by suitable adjustment of the drives for the various sets of wheels.

In the embodiments of FIGS. 6 to 8, the block 2 and feed rolls 10 and 11 are similar to that above described.

The feed rolls are mounted to feed the yarn for crimping into the end of a tube 4*b*.

A control wheel 95 is disposed at the exit end of the tube 4*b* and the tube is bent around the periphery of the wheel 95 to provide an increased area of contact between the wheel and the mass of fibers in the tube.

The wheel 95 is shown as provided with ratchet-shaped teeth 96 having radial sides 97 facing the oncoming fibers within the tube. Stripper plate 98 is positioned to strip and support the fibers which have been discharged onto the periphery of the wheel 95. The crimped fibers are withdrawn through a tension gate 82 by a pair of delivery rolls 100.

The construction of this embodiment is similar to that above described.

The wheel 95 is driven from the shaft 12 of the feed roll 10 by a gear train 101–104. The ratio may be selected so that the back pressure on the fibers in the tube 4*b* can be controlled as desired. The fibers are withdrawn by the delivery rolls with a minimum of tension.

It is to be understood that the control wheels in the various embodiments may be smooth-surfaced or roughened, or toothed, as desired, and the relative speeds are adjustable for obtaining the desired pressure effect on the fibers.

The crimping tube 4, 4*a* and 4*b* has been shown as circular in section. It may, however, be rectangular or elongated in the direction of the axes of the feed rolls, in which case the control wheels 60 to 63 of FIGS. 4 and 5, or the control wheel 95 of FIGS. 6 to 8, may rotate about axes parallel to the axes of the feed rolls 10 and 11 and may have an axial length corresponding to the width of the tube so as to ensure the uniform feed of the mass of crimped fibers in the tube.

What is claimed is:

1. A stuffer crimper comprising an elongated chamber, feed rolls disposed to feed fibers into one end of said chamber to be folded over and crimped due to the pressure of the mass of previously crimped fibers in said chamber, said feed rolls being adapted to exert pressure for advancing the mass of crimped fibers along said

chamber to a discharge point, and a plurality of driven control wheels projecting peripherally into said chamber and disposed at spaced points along said chamber, said control wheels being connected for independent adjustment as to relative rates of drive.

2. A stuffer crimper as set forth in claim 1 in which said wheels are disposed at the ends of crimping, heating and cooling zones respectively.

3. A stuffer crimper as set forth in claim 1 wherein a spring-loaded control wheel is positioned adjacent the bite of the feed rolls.

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