July 11, 1950 J. H. PFAU 2,514,557

CRIMPING APPARATUS

Filed Aug. 7, 1948 2 Sheets-Sheet 1

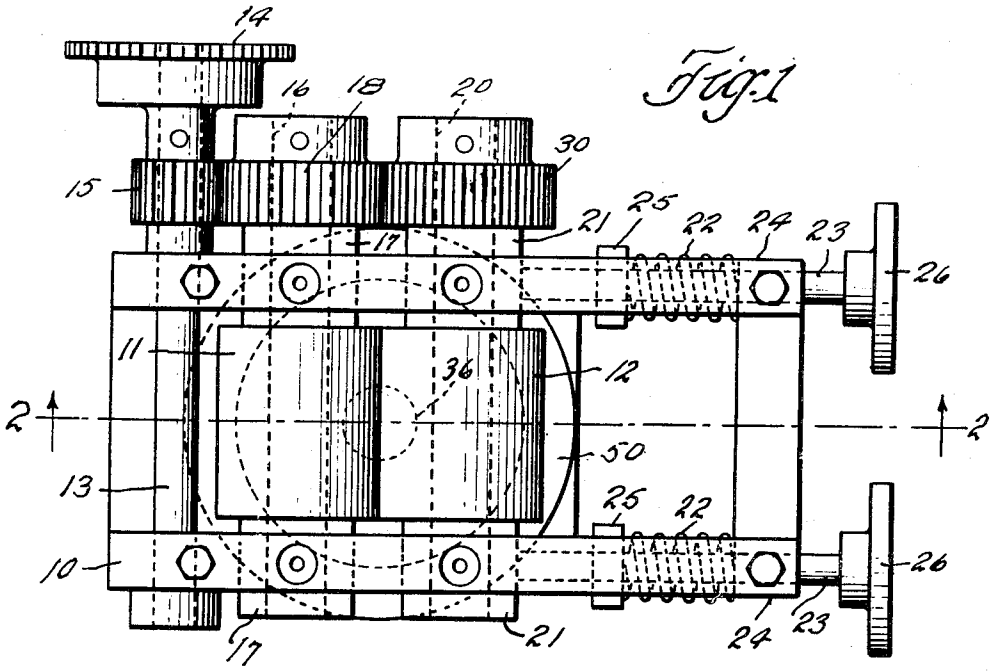


Fig. 1

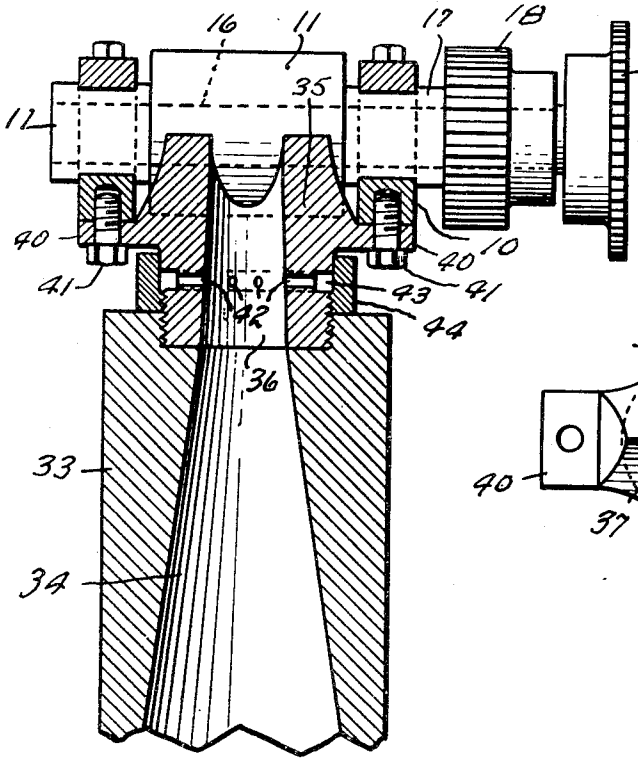


Fig. 4

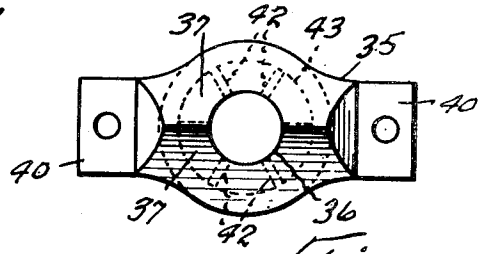


Fig. 5

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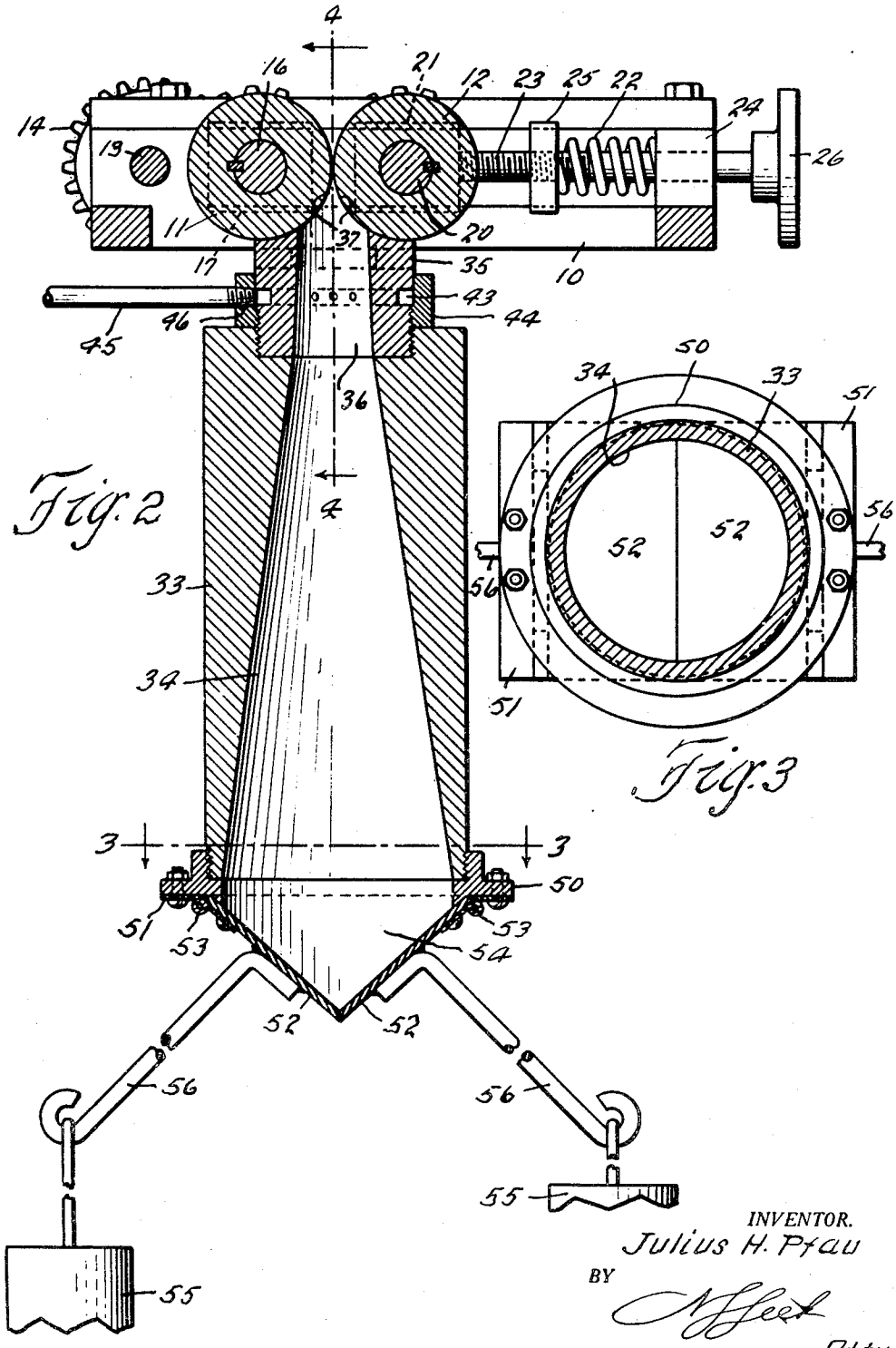


Fig. 2

Fig. 3

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UNITED STATES PATENT OFFICE

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CRIMPING APPARATUS

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13 Claims. (Cl. 19—66)

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This invention relates to an apparatus for improving the characteristics of fibers, and more particularly to an apparatus for imparting a controlled crimp to wool and other naturally resilient fibers having similar characteristics.

An object of the invention is to provide a novel and improved apparatus for producing a fiber characterized by a predominant, sharp, angular bend or crimp with the portions between bends substantially straight.

Another object is to provide a novel and improved apparatus for imparting an artificial crimp to wool fibers.

Another object is to provide a crimping apparatus of the above type which is adapted for use in conjunction with the usual processes for converting stock wool into yarn.

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

It is known that certain wools, such as South American, New Zealand, Iceland, Leicester, and others are naturally less highly crimped than wools from other localities and breeds and are less useful for many purposes, such as for use as fabric pile. Also the lower grade portions of fleece from blooded sheep are generally less highly crimped than the finer fibers. The lack of crimp of such wools affects their compressibility, resilience, crispness of fabrics made from such wools, covering power and the processing, such as carding and spinning, and may determine the limiting fineness of the yarns spun from these wools. The addition of crimp to such wools and to wools higher than carpet grade, but lower than fine clothing grade, would increase their usefulness.

The present invention provides an apparatus for adding crimp to such wools and may also be used to improve the characteristics of the highly crimped natural wools. The product obtained is uniform and predictable as to characteristics.

In accordance with one embodiment of this invention, the crimp is produced mechanically by feeding the pretreated fibers between feed rolls into a crimping chamber which is maintained full of fibers under a predetermined back pressure. As the fibers are forced into the crimping chamber, they are laid in a zig-zag form and are pressed to form sharp angular bends or crimps with intervening straight portions, the length of which depends upon several factors, such as the characteristics of the fibers and the pressure to which the fibers are subjected in the crimping chamber.

The crimp is set by treatment in a setting

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chamber with steam under controlled conditions of time, temperature, moisture and pH in the range below which the natural resilience of the fibers resists deformation and above which degradation occurs, the relationship being such that the fibers are brought to the plastic condition necessary for the formation of a permanent crimp.

In the present apparatus the crimping and setting chambers are continuous and are preferably formed with slightly flaring walls in the direction of feed so as to reduce the friction of the fibers against the walls. The walls may also be plated and polished to reduce the friction further. The setting chamber is of a size to hold the fibers for a predetermined setting time in their passage therethrough.

Passages are also provided for the admission of a setting agent such as steam or a chemical setting agent into the chambers in a position to act on the fibers during their passage therethrough and while held under the necessary crimping pressure.

The novel features which are characteristic of this invention will be better understood by referring to the following description, taken in connection with the accompanying drawings in which a specific form of crimping apparatus has been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a top plan view of an apparatus embodying the present invention;

Fig. 2 is a vertical section taken along the line 2—2 of Fig. 1;

Fig. 3 is a horizontal section taken along the line 3—3 of Fig. 2;

Fig. 4 is a transverse vertical section taken along the line 4—4 of Fig. 2; and

Fig. 5 is a detail view of the saddle.

Referring to the drawings more in detail, the crimper is shown as comprising a frame 10 carrying a pair of feed rolls 11 and 12 and drive shaft 13. The shaft 13 is journalled in the frame 10 and carries a sprocket 14 which is driven by a suitable power source, not shown, and a pinion 15. The feed roll 11 is keyed to a shaft 16 journalled in bearing blocks 17 fixed to the frame 10 and carrying a gear 18 meshing with the pinion 15. The feed roll 12 is keyed to a shaft 20 journalled in bearing blocks 21 which are slidable in the frame 10. The roll 12 is held in pressure engagement with the material fed between the rolls by springs 22 seated around threaded rods 23 which bear against the bearing blocks 21. The rods 23 extend through a bracket 24 attached to the frame 10 and carry nuts 25 and adjusting

knobs 26. The nuts 25 are held against rotation by the frame 10. The springs 22 are seated between the nuts 25 and the bracket 24 and their tension may be adjusted by means of the knobs 26.

The shaft 20 carries a gear 30 meshing with the gear 18. The gears 18 and 30 have teeth of sufficient depth to remain in mesh throughout the normal range of sliding movement of the shaft 20 during the operation of the crimper.

Positioned below the rolls 11 and 12 is a vertical tube 33 having a conical bore 34, forming a setting chamber. The tube 33 is attached to a saddle 35 having a tapered central bore 36 forming a crimping chamber and having a curved upper surface 37 conforming to the bight of the rolls 11 and 12 and machined to have a slight running clearance from the surface of the rolls. The saddle 35 is formed with ears 40 which are attached to the frame 10 by bolts 41 and with a plurality of radial passages 42 for the injection of a setting agent into the crimping chamber. The radial passages 42 communicate with an annular passage 43 in the saddle 35 which is closed by a collar 44 to form an inlet manifold. The fluid is supplied to the annular passage 43 by a pipe 45 registering with a port 46 in said collar.

At its lower end the tube 33 carries a flanged extension 50 to which a pair of brackets 51 are attached. A pair of doors 52 are hinged to the brackets 51 by hinges 53 and are held closed against the tapered end 54 of the extension 50 by weights 55 attached to arms 56 secured to the doors. The doors 52 are symmetrically arranged with respect to the center line of the chambers so as to discharge the fibers along the center line causing them to be packed uniformly across the chamber from the feed rolls to the discharge door.

In the operation of the crimper, the rolls 11 and 12 are driven by any suitable source of power and the fibers to be crimped are fed thereto, preferably in the form of a rope or a web. The fibers are held in the crimping and setting chambers by the doors until they have been packed sufficiently to force the doors slightly open against the force of the weights 55. The back pressure of the packed fibers causes the fibers being forced against the packed fibers by the feed rolls to be folded over in zigzag crimps, the spacing of which depends upon the nature of the fibers and the back pressure. The co-axial alignment of the feed rolls and the discharge doors causes all of the fibers to feed uniformly along the chamber in a predetermined length of time.

A setting agent, such as steam, is introduced through the pipe 45 and passages 42 into the mass of packed fibers. Of course the area of injection may be varied, but should be sufficiently spaced below the top of the saddle 35 so that the mass of fibers forms a seal. The pressure of the steam and the tapered setting chamber help to overcome or reduce the friction of the fibers against the walls and facilitate their passage through the setting chamber. The walls of the crimping and setting chambers may be polished or plated by a metal such as chromium to reduce further the friction of the fibers and ensure a uniform passage through the chambers.

The raw wool is first opened, scoured, for example with soap and soda ash in several stages, then washed and dried in the usual manner to form stock wool. The scouring and washing may be carried out under conditions to leave the stock wool with the desired pH for crimping. This pretreated stock wool is fed directly at a uniform rate to the feed rolls 11 and 12 of the crimper through a suitable hopper or may be fed to a web-forming device such as a card and fed as a web or condensed into a rope which is fed to the feed rolls 11 and 12 as a sliver or slubbing. If a more uniform feed is required, the stock wool may be picked and carded and condensed to a rope for the above purpose after one or more stages of carding. A uniformity in density of feed stock is preferred to prevent jamming or slipping at the feed rolls or undue lateral movement of the feed rolls.

In either case, the fibers are stuffed by the feed rolls 11 and 12 into the crimping chamber and through the setting chamber and are forced out of the bottom of the setting chamber against the pressure exerted by the discharge doors 52.

The back pressure at the entrance of the crimping chamber controls the size of the crimp, a higher pressure causing a finer crimp (more crimps per inch) and vice versa.

For equilibrium conditions of moisture content and pH, the setting time varies inversely with the temperature. For temperatures below 212° F., hot water may be injected into the crimping and setting chambers and may contain added chemicals to aid in producing a permanent set. For example such setting agents as thioglycolic acid and its salts, such as calcium or sodium thioglycolate, formaldehyde, a sulfoxylate formaldehyde, such as zinc or sodium, and the like, may be used.

For higher temperatures, steam under pressure may be used. The quality of steam should be selected to cause the fibers to reach the desired temperature and moisture content. Due to the packing of the mass of fibers, they are relatively impermeable to steam and steam pressure suited to produce the desired high temperatures may be used.

The crimped fibers emerge from the crimper in the form of a very condensed tow or rope, which is easily opened and separated. It may then be dried, carded, formed into a roving and spun in the usual manner.

The fiber thus crimped is characterized by sharp angular bends or crimps which may or may not be uniformly spaced, but are separated by relatively straight lengths of fiber. It may be spun into yarn and skein dyed or may be picked and stock dyed in the usual manner.

It is evident that changes and modifications may be made in the apparatus without departing from the scope of the invention.

What is claimed is:

1. An apparatus for crimping fibers, comprising a member having a bore forming a chamber, a pair of feed rolls at one end of said member and a movable closure at the other end of said member forming end closures for said chamber, means driving said rolls to feed said fibers therebetween into said chamber, means causing said movable closure to resist the discharge of the fibers so as to hold the fibers in said chamber under a predetermined pressure, and injector means disposed to inject a fluid into an intermediate part of said chamber into contact with said fibers.

2. An apparatus for crimping fibers, comprising a member having a bore forming a chamber, a pair of feed rolls at one end of said member and a movable closure at the other end of said member forming end closures for said chamber, means driving said rolls to feed said fibers therebetween into said chamber, means causing said movable closure to resist the discharge of the fibers so as to hold the fibers in said chamber

under a predetermined pressure, said member having a plurality of injector passages spaced therearound and communicating with said chamber below said rolls for the injection of a fluid.

3. An apparatus for crimping fibers, comprising a member having a bore forming a chamber, a pair of feed rolls at one end of said member and a movable closure at the other end of said member forming end closures for said chamber, means driving said rolls to feed said fibers therebetween into said chamber, means causing said movable closure to resist the discharge of the fibers so as to hold the fibers in said chamber under a predetermined pressure, said member having a plurality of injector passages spaced therearound and communicating with said chamber below said rolls for the injection of a fluid, and having an annular passage communicating with said first passages to supply said fluid thereto.

4. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a setting member having a bore forming a setting chamber communicating with the other end of said crimping chamber and forming a continuation thereof, a movable closure at the exit end of said setting chamber having means to resist the discharge of the fibers therefrom, one of said members having a fluid supply duct communicating with the chamber therein for the supply of treating fluid to the fibers in said chamber.

5. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a setting member having a bore forming a setting chamber communicating with the other end of said crimping chamber and forming a continuation thereof, a movable closure at the exit end of said setting chamber having means to resist the discharge of the fibers therefrom, said first member having a fluid supply duct communicating with said crimping chamber to supply treating fluid to the fibers therein.

6. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a setting member having a bore forming a setting chamber communicating with the other end of said crimping chamber and forming a continuation thereof, a movable closure at the exit end of said setting chamber having means to resist the discharge of the fibers therefrom, said first member having a steam supply duct communicating with said crimping chamber at a point sufficiently below said feed rolls to cause the fibers above said duct to form a packing to prevent escape of steam.

7. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said

member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a setting member having a bore forming a setting chamber communicating with the other end of said crimping chamber, and forming a continuation thereof, a movable closure at the exit end of said setting chamber having means to resist the discharge of the fibers therefrom, said first member having a plurality of radial passages spaced therearound and communicating with said crimping chamber for the supply of treating fluid to the fibers therein and having an annular passage communicating with said radial passages for the supply of said fluid to said radial passages.

8. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a setting member having a bore forming a setting chamber communicating with the other end of said crimping chamber and forming a continuation thereof, a movable closure at the exit end of said setting chamber having means to resist the discharge of the fibers therefrom, one of said members having a fluid supply duct communicating with the chamber therein for the supply of treating fluid to the fibers in said chambers, said members being so shaped that the chambers therein increase in cross section from said rolls to said exit end whereby passage of the fibers therethrough is facilitated.

9. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a setting member having a bore forming a setting chamber communicating with the other end of said crimping chamber and forming a continuation thereof, a movable closure at the exit end of said setting chamber having means to resist the discharge of the fibers therefrom, one of said members having a fluid supply duct communicating with the chamber therein for the supply of treating fluid to the fibers in said chamber, the surfaces of said members forming said chambers being polished to reduce the friction of the fibers in their passage therethrough.

10. An apparatus for crimping fibers, comprising a pair of horizontal feed rolls, a vertical member disposed beneath said rolls and having a bore forming a chamber closed at one end by said rolls, means driving said rolls to feed said fibers therebetween into said chamber, a pair of doors carried by said member closing the lower end of said chamber, said doors being symmetrically arranged and hinged at their outer edges to opposite sides of said member, means yieldably holding said doors in closed position to resist the discharge of the fibers so as to hold the fibers in said chamber under a predetermined pressure.

11. An apparatus for crimping fibers, comprising a pair of horizontal feed rolls, a vertical member disposed beneath said rolls and having a bore forming a chamber closed at one end by said

rolls, means driving said rolls to feed said fibers therebetween into said chamber, a pair of doors carried by said member closing the lower end of said chamber, said doors being symmetrically arranged and hinged at their outer edges to opposite sides of said member, weights positioned to hold said doors in closed position to resist the discharge of the fibers so as to hold the fibers in said chamber under a predetermined pressure.

12. An apparatus for crimping fibers, comprising a pair of horizontal feed rolls, a vertical member disposed beneath said rolls and having a bore forming a chamber closed at one end by said rolls, means driving said rolls to feed said fibers therebetween into said chamber, a pair of doors carried by said member closing the lower end of said chamber, said doors being symmetrically arranged and hinged at their outer edges to opposite sides of said member, means yieldably holding said doors in closed position to resist the discharge of the fibers so as to hold the fibers in said chamber under a predetermined pressure, said member having injector passages disposed to inject a treating fluid into an intermediate part of said chamber into contact with said fibers.

13. An apparatus for crimping fibers, comprising a pair of feed rolls, means driving said rolls to feed said fibers therebetween, a member having a bore forming a crimping chamber, said member having a curved surface at one end shaped to conform to the bight of said rolls, said feed rolls being disposed to form a closure of said chamber at one end, a second member having a bore forming a setting chamber communicating with the other end of said crimping chamber and forming a continuation thereof, a pair of doors hinged at opposite sides of said second member at the discharge end of said setting chamber and, in closed position, being oppositely inclined to form a central wedge shaped passage, and means yieldably holding said doors in closed position, but allowing said doors to open in response to a predetermined internal pressure exerted by the packed fibers in said setting chamber.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,991,563	McAdams	Feb. 19, 1935
2,187,567	Esselmann	Jan. 16, 1940
2,300,791	Lodge	Nov. 3, 1942
2,311,174	Hitt	Feb. 16, 1943
2,419,320	Lohrke	Apr. 22, 1947