April 1, 1969 R. K. STANLEY 3,435,497

STRAND TREATMENT

Filed Sept. 25, 1967 Sheet 1 of 2

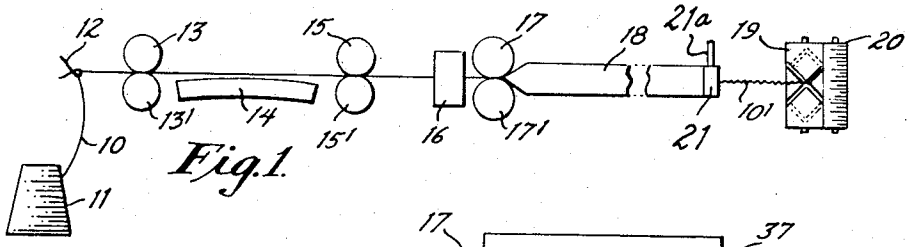


Fig. 1.

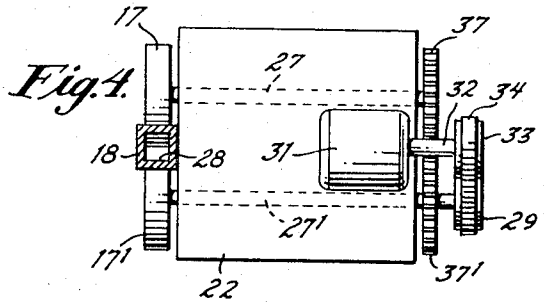


Fig. 4.

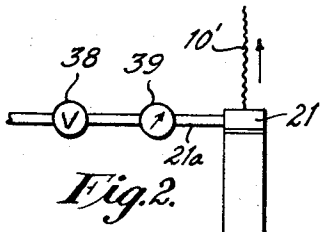
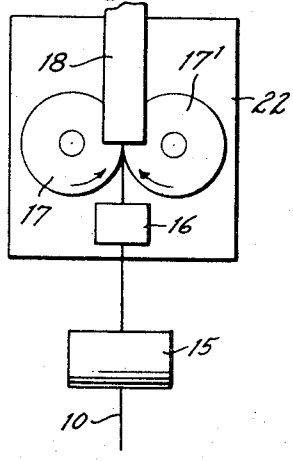


Fig. 2.



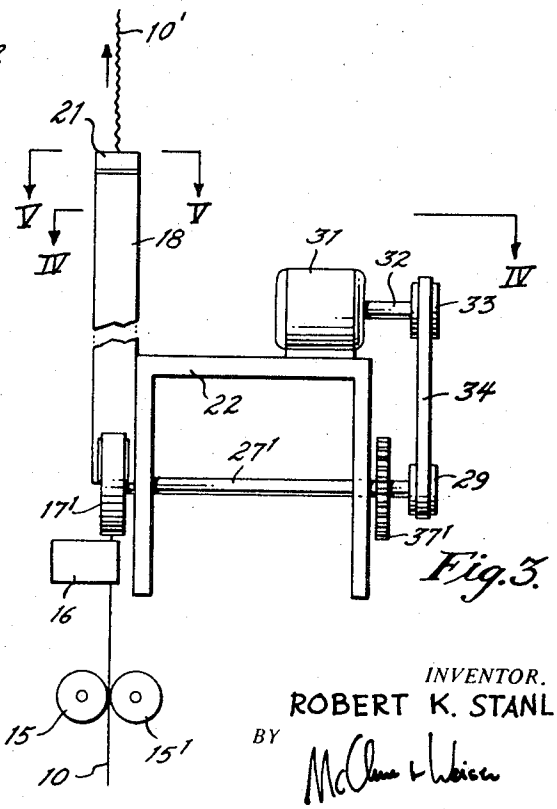
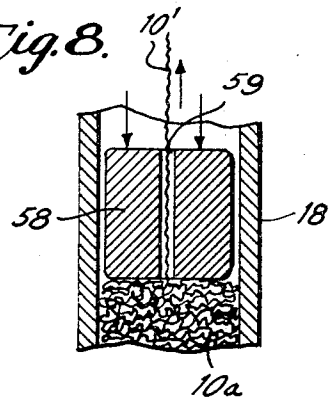


Fig. 3.

Fig. 8.



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STRAND TREATMENT

Filed Sept. 25, 1967 Sheet 2 of 2

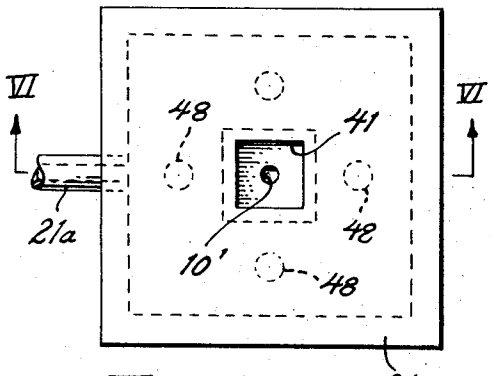

Fig. 5.

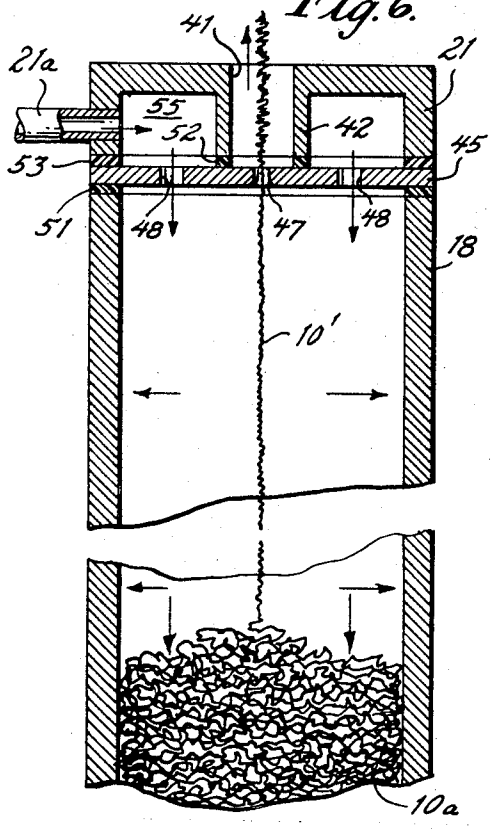

Fig. 6.

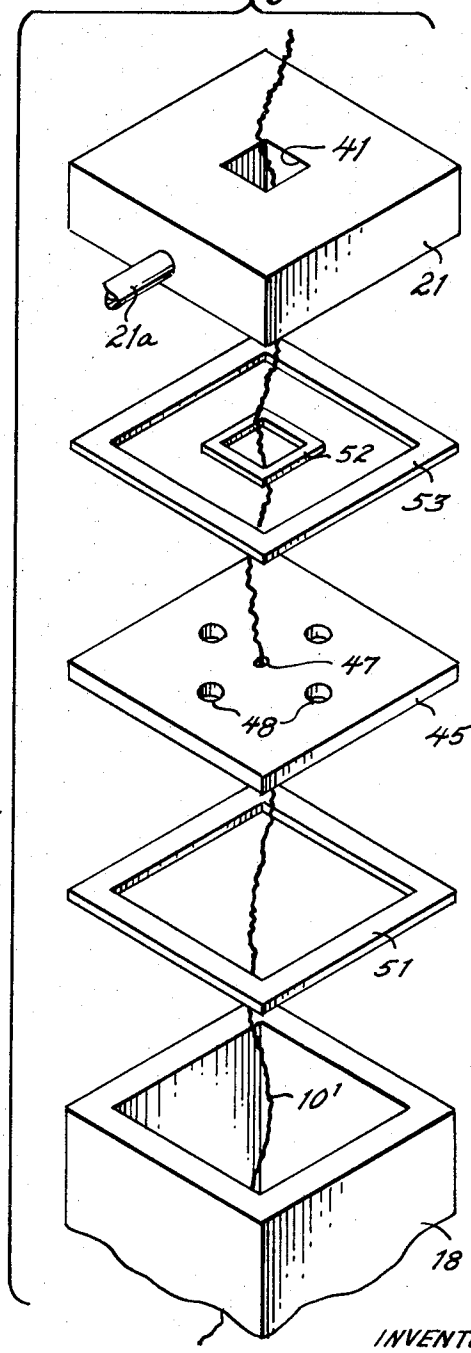

Fig. 7.

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STRAND TREATMENT

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Int. Cl. D04h 17/00; D05c 15/00; D02g 3/00
U.S. Cl. 28—72 11 Claims

ABSTRACT OF THE DISCLOSURE

A process of stuffer crimping textile strands is disclosed wherein back pressure is applied to an accumulation of strand by fluid contact therewith, as by injecting gas under pressure in the portion of a stuffing chamber downstream from the strand accumulation. Optionally a solid weight may be added, resting on the strand accumulation.

This invention relates to treatment of textile strands, particularly by compressive crimping thereof as in a stuffer crimper.

It is conventional to crimp a textile strand compressively by feeding it by and between a pair of nip rolls into the entrance of a temporarily confining region, the exit of which is closed wholly or partially by suitable means so that the strand accumulates therein under pressure and forces the entering strand to buckle into a three-dimensional sawtooth or zigzag configuration. The construction is such that the crimped strand accumulation eventually moves, or moves by, the closure means so as to escape from the confinement, whereupon it may be wound up. It is also known to dispense with such closure means, as in my U.S. Pat. 3,279,025 and in my patent application Ser. No. 567,245 filed July 22, 1966, the specification of which is incorporated herein by reference, and to rely upon lateral friction and possibly the weight of the strand accumulation to provide crimping back pressure.

A primary object of the present invention is novel application of back pressure in a stuffer crimper.

Another object is enhanced uniformity of back pressure in a stuffer crimping process.

A further object is advantageous control of the degree of crimp imparted to a strand by stuffer crimping.

Other objects of the present invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

FIG. 1 is a schematic representation of the processing of textile strand according to the present invention;

FIG. 2 is a front elevation of component stuffer crimping apparatus;

FIG. 3 is a side elevation of the apparatus of FIG. 2; and

FIG. 4 is a sectional plan, taken at IV—IV on FIG. 3;

FIG. 5 is a fragmentary plan view, on an enlarged scale, taken at V—V on FIG. 3;

FIG. 6 is a front sectional elevation, taken at VI—VI on FIG. 5;

FIG. 7 is an exploded perspective view of the apparatus of FIGS. 5 and 6; and

FIG. 8 is a front sectional elevation, on an intermediate scale, of a modification in the apparatus of the preceding views.

In general, the objects of the present invention are accomplished in treatment of a textile strand to crimp it, wherein the strand is stuffed into the entrance of a laterally confining region in which it accumulates temporarily and is crimped and from which it is subsequently withdrawn through an exit thereof, by applying fluid pressure to the strand accumulation to compress it before the crimped strand exits from the confining region.

FIG. 1 shows, schematically, strand **10** unwinding from conical package **11** to pass through guide **12** and successive pairs of nip rolls **13**, **13'** and **15**, **15'**, with heater **14** for the strand intervening between the pairs of rolls. Pair of nip rolls **17**, **17'** for feeding the strand into stuffing chamber **18**, part of whose length is omitted from the view to conserve space, follow after strand-traversing means **16**. Cap **21** at the exit end of the chamber has tube **21***a* joining one side thereof. Crimped strand **10'** is withdrawn from the exit of the chamber and is wound onto cylindrical package **20** by grooved traversing drive roll **19**.

FIGS. 2, 3, and 4 show stuffer-crimping components and associated elements (FIGS. 2 and 3 only) of the same apparatus in front and side elevation and plan, respectively. FIG. 4 is partly in section, and the strand shown in FIGS. 2 and 3 is omitted from FIG. 4 for clarity.

Stuffing chamber **18** is supported on the front leg of inverted U-frame **22**. Shafts **27**, **27'** for respective feed rolls **17**, **17'** are journaled in the front and rear walls of the frame and have intermeshing gears **37**, **37'** thereon behind the rear leg of the frame. Shaft **27'** also has driven pulley **29** thereon. Motor **31** on the horizontal upper surface of the frame has shaft **32** on which is drive pulley **33**. Belt **34** interconnects drive pulley **33** and driven pulley **29** to transmit rotational force to the gears, shafts, and feed rolls themselves. The direction of rotation is such as to feed or stuff the strand by and between the counter-rotating feed rolls into the chamber entrance. Strand-traversing means **16** through which the strand passes immediately ahead or upstream of the feed rolls moves the strand back and forth along the roll nip for optimum distribution of strand in the entrance portion of the chamber. Tube **21***a*, which joins cap **21** at the exit end of the chamber, has valve **38** and pressure gage **39** therein, the view being broken off as the tube extends to a source (not shown) of fluid under pressure, which may be provided from the atmosphere or otherwise.

FIGS. 5, 6, and 7 show the downstream or exit end portion of stuffing chamber **18** in plan, front sectional elevation, and in exploded perspective, respectively, including cap **21**. The cap has central opening **41** coaxial with the stuffing chamber for the crimped yarn to be withdrawn through and has underlying collar **42** spaced from the surrounding wall of the cap. Between the cap and the end of the stuffing chamber is spacer **45**, which has small axial bore **47** to accommodate the strand and also has openings **48** spaced about the bore. Gasket **51** seals the spacer to the end of the stuffing chamber. Similar gasket **53** seals the spacer to the surrounding wall of the cap, while smaller gasket **52** seals the spacer to collar **42** of the cap. Annular space **55** defined between the cap and the spacer communicates with the exterior through adjoining tube **21***a*, which passes through the cap wall, and with the interior of the stuffing chamber through openings **48**.

As indicated by arrows in FIG. 6, fluid injected into space **55** from tube **21***a* passes through openings **48** into the interior of stuffing chamber **18**, whose lower portion contains accumulation **10***a* of crimped strand. The force

of the fluid is applied, as also indicated by arrows, to the strand accumulation as well as the chamber wall. Such force supplements the wall friction exerted against the strand accumulation and the strand weight (in the illustrated chamber orientation) to compress the strand into its distorted or crimped configuration. Crimped strand **10'** withdrawn from compressed strand accumulation **10***a* passes through small bore **47** in the spacer and out of the pressurized interior of the chamber. Of course, some fluid leaks out along with the strand, but it is a small quantity. Such leaking fluid also serves to expand the crimped strand as the fluid expands to the atmospheric pressure outside, thereby increasing the apparent bulk of the strand and tending to dephase adjacent bends or crimps as is desirable and also tending to remove any slubs or the like.

Whereas the crimp level, such as frequency and extent, can be controlled by setting the rate at which the crimped strand is withdrawn or wound up, as disclosed in the aforementioned patent application, relative to a fixed infeed rate, a feature of the present invention is controlling the crimp level by appropriate adjustment of the applied fluid pressure. Increasing the fluid pressure increases the frequency or extent (or both) of crimp while decreasing it decreases the crimp level, permitting a fine adjustment therein without necessity for changing windup speed. Valve **38** facilitates such pressure adjustment.

The fluid pressure and flow rates to be used are in large part determined by the characteristics of the strand being crimped and the particular physical dimensions of the apparatus used, as well as the degree of effect desired. When crimping nylon strands of about 1100 denier and about 70 filaments, a pressure on the order of several pounds per square inch above atmospheric will produce a readily detectable change in crimp level. At that fluid pressure, some change in crimp may be detected as the pressure is changed only one p.s.i. or so. The most convenient fluid to use is air, which may be applied at whatever temperature is desired, preferably heated, although if obtained directly from the surrounding atmosphere it may be left at room temperature to aid gradual cooling in the chamber or even be cooled when it is desired to cool the strand more quickly. Its moisture content may be adjusted as desired, and may comprise steam, preferably superheated so as to avoid condensation in the chamber. Additives, such as oils, moisteners, or finishes may be included in vapor or droplet form, as desired.

When the stuffing chamber is operated upright with the entrance below the exit, the back pressure applied to the strand accumulation may be supplemented by insertion of a solid weight in the stuffing chamber, as illustrated in FIG. 8. In that view of a lower portion of the chamber, weight **58** having axial bore **59** therethrough fits slidably inside the chamber and rests on strand accumulation **10***a*. As indicated by the arrows the weight presses downward, under gravitational force as well as the applied fluid force, and aids in compression of the strand being crimped. Such a weight may be useful with particularly large or stiff strands and will permit a shortening of the stuffing chamber while still permitting unsynchronized constant-speed windup.

While some modifications of the present invention have been suggested above, additional modifications may be made, as by adding, combining, or subdividing parts or steps, or by substituting equivalents, while retaining at least some of the benefits and advantages of the invention, which itself is defined in the following claims.

What is claimed is:

1. In treatment of a textile strand to crimp it wherein the strand is stuffed into the entrance of a laterally confining region in which it accumulates temporarily and is crimped without filling the region to the exit end thereof and from which the crimped strand is subsequently withdrawn lengthwise through the exit end, the improvement

comprising injecting fluid into the unfilled portion of the confining region and thereby applying fluid pressure to the strand accumulation to compress it before the crimped strand exits from the confining region.

2. Strand treatment according to claim **1**, wherein the fluid pressure is applied by injection of gas into the confining region.

3. In treatment of a textile strand to crimp it wherein the strand is stuffed into the entrance of a laterally confining region in which it accumulates temporarily and is crimped and from which it is subsequently withdrawn through an exit thereof, the improvement comprising applying fluid pressure to the strand accumulation to compress it before the crimped strand exits from the confining region, wherein the fluid pressure is applied by injection of gas into the unfilled portion of the confining region alongside but spaced from the exit for the strand.

4. Strand treatment according to claim **2**, wherein the gas comprises steam.

5. Process of controlling the crimp imparted to a textile strand by stuffer crimping, comprising stuffing the strand into a laterally confining region at a first rate to accumulate temporarily under compression and then be withdrawn from the compressed accumulation thereof, applying fluid pressure to the compressed strand accumulating to the confining region from a location between the leading edge of the strand accumulation and the exit, and withdrawing crimped strand lengthwise from the leading edge thereof at a location spaced from the exit and from the confining region and the fluid pressure therein at a second rate less than the first rate.

6. Process according to claim **5**, wherein the crimp in the strand is varied by varying the applied fluid pressure while maintaining the input and output rates of the strand essentially constant.

7. Process according to claim **5**, including the step of supplementing the fluid pressure by applying a back pressure to the strand accumulation in a direction opposite to its passage direction by means of solid strand-impeding means.

8. Process according to claim **7**, wherein the solid strand-impeding means comprises a weight.

9. Process of controlling the crimp imparted to a textile strand by stuffer crimping, comprising stuffing the strand into a laterally confining region at a first rate to accumulate temporarily under compression and then be withdrawn from the compressed accumulation thereof, applying fluid pressure to the compressed strand accumulating in the confining region from a location between the strand accumulation and the exit, and withdrawing crimped strand from the accumulation thereof and from the confining region and the fluid pressure therein at a second rate less than the first rate, wherein the crimp in the strand is varied by varying the temperature of the applied fluid.

10. Process of controlling the crimp imparted to a textile strand by stuffer crimping, comprising stuffing the strand into a laterally confining region at a first rate to accumulate temporarily under compression and then be withdrawn from the compressed accumulation thereof, applying fluid pressure to the compressed strand accumulating in the confining region from a location between the strand accumulation and the exit, and withdrawing crimped strand from the accumulation thereof and from the confining region and the fluid pressure therein at a second rate less than the first rate, wherein the crimp in the strand is varied by varying the moisture content of the applied fluid.

11. Process of controlling the crimp imparted to a textile strand by stuffer crimping, comprising stuffing the strand into a laterally confining region at a first rate to accumulate temporarily under compression and then be withdrawn from the compressed accumulation thereof, applying fluid pressure to the compressed strand accumulating in the confining region from a location between the

strand accumulation and the exit, and withdrawing crimped strand from the accumulation thereof and from the confining region and the fluid pressure therein at a second rate less than the first rate, wherein the applied fluid comprises steam.

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U.S. Cl. X.R.

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