Nov. 10, 1964 E. WEISS ETAL 3,156,028

PROCESS FOR CRIMPING TEXTILE YARN

Filed June 2, 1959 4 Sheets-Sheet 1

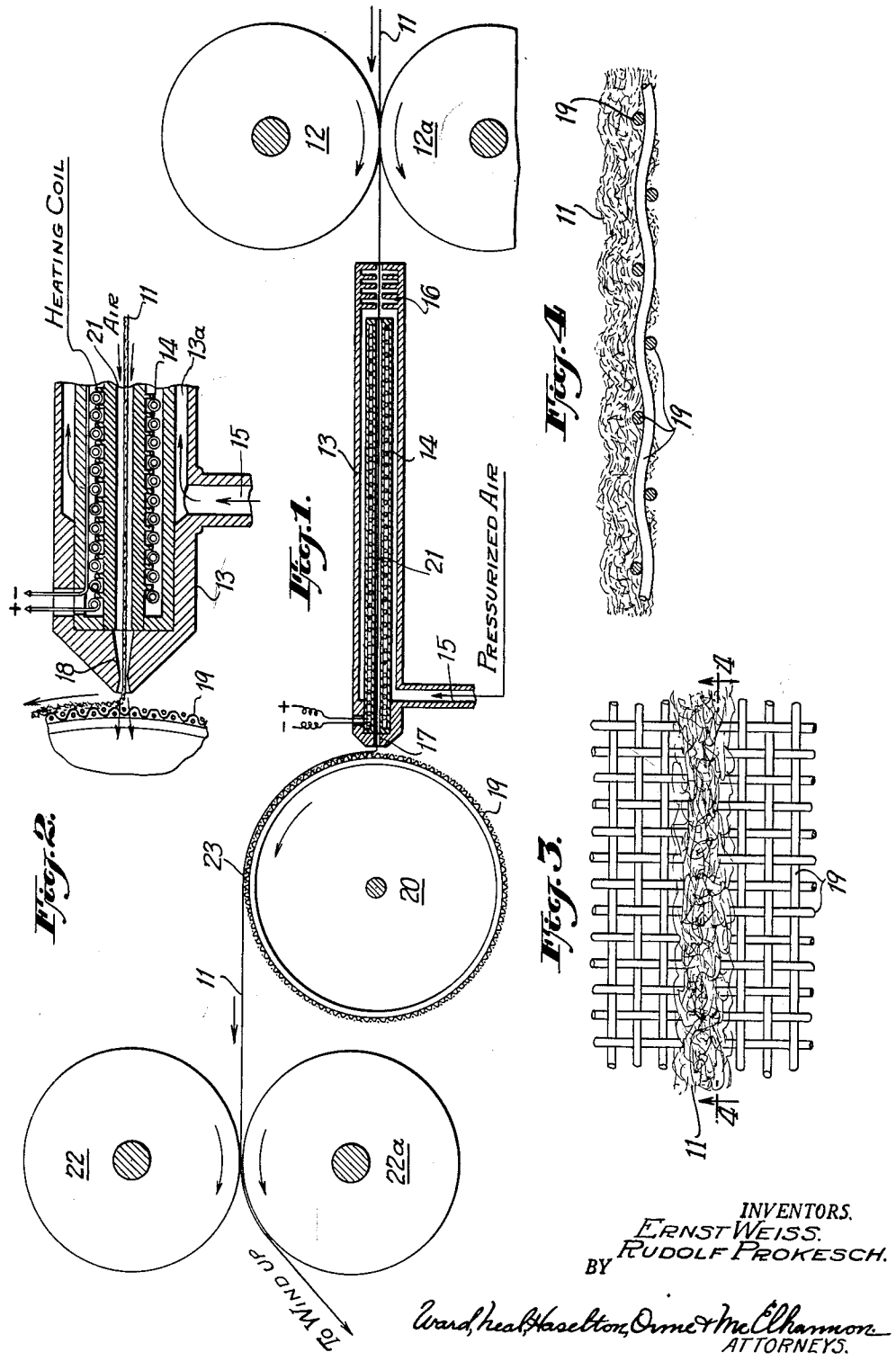


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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Fig. 13.

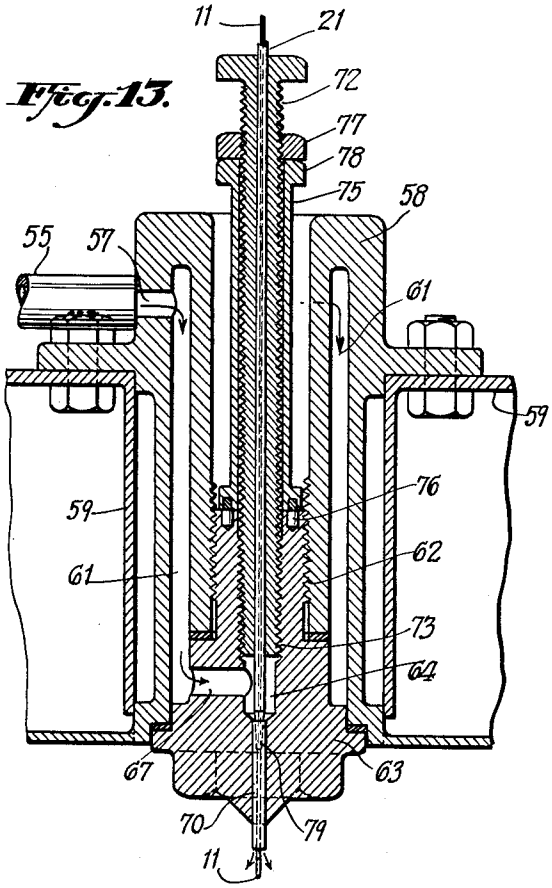


Fig. 14.

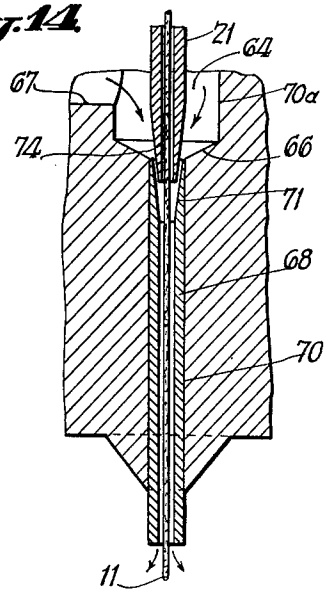
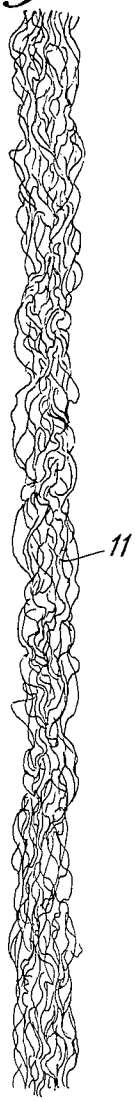


Fig. 5.



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Fig. 7.

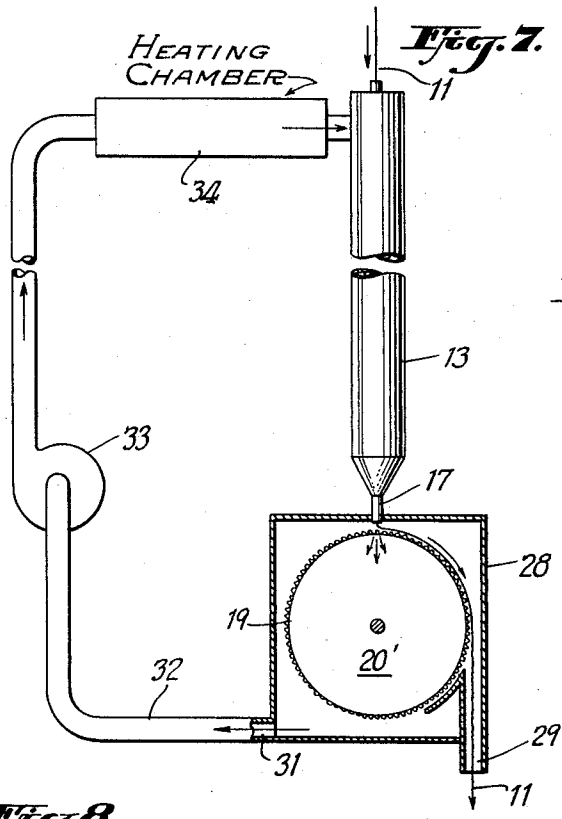


Fig. 6.

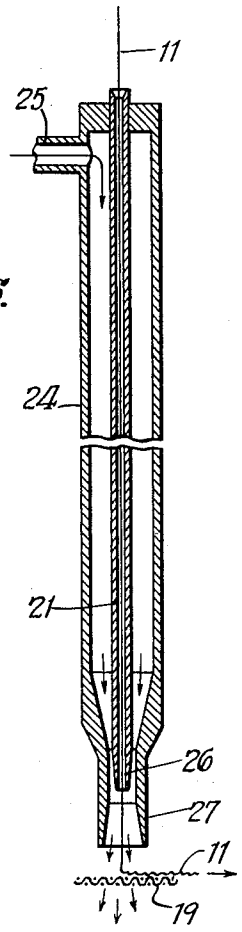
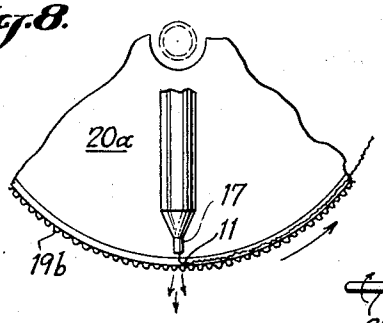


Fig. 8.



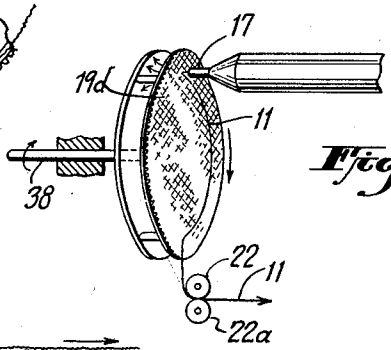
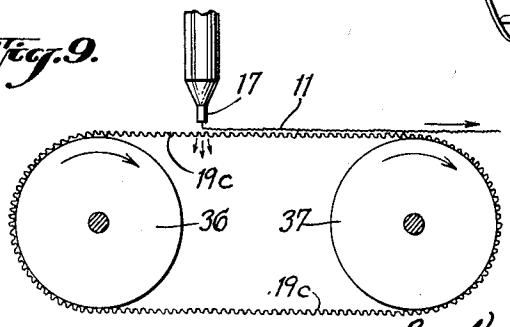


Fig. 10.

Fig. 9.



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Fig. 11.

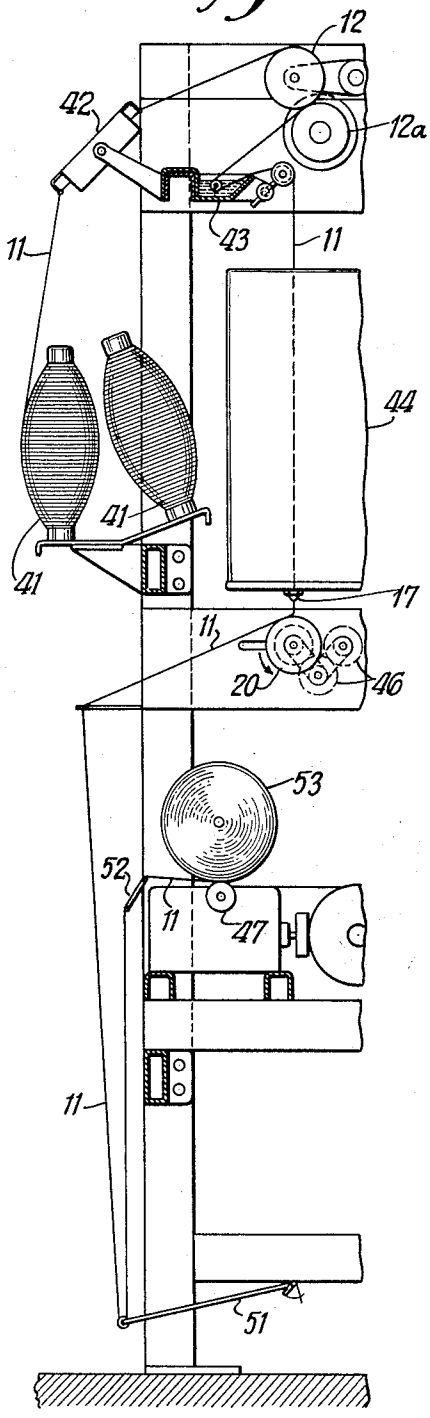
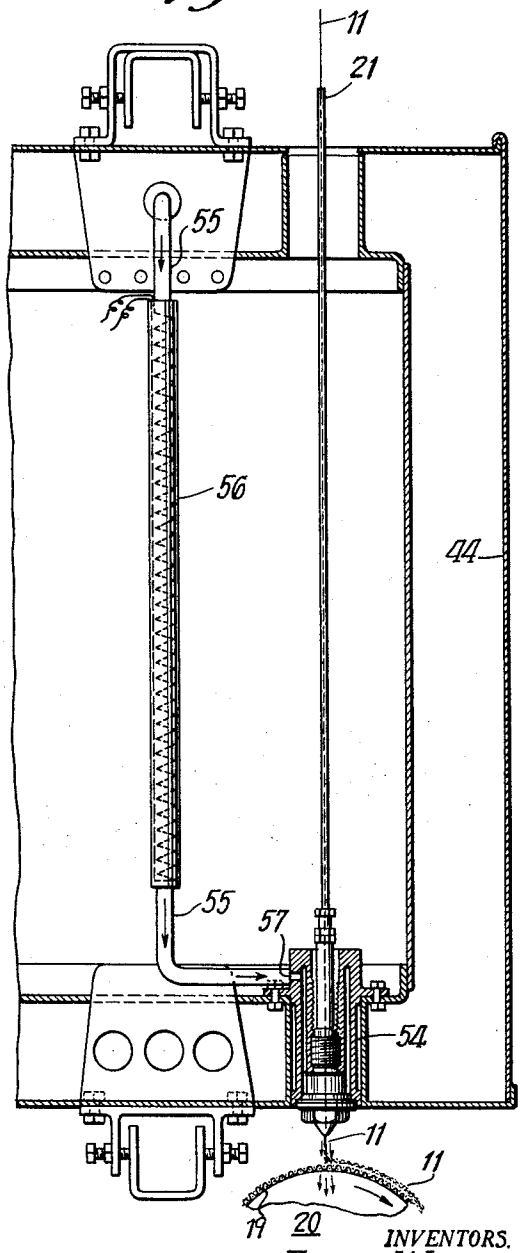


Fig. 12.



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3,156,028

PROCESS FOR CRIMPING TEXTILE YARN

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Filed June 2, 1959, Ser. No. 817,569
Claims priority, application Austria June 3, 1958
18 Claims. (Cl. 28—72)

This invention relates to a method of texturing or crimping textile yarns, and to a novel apparatus for carrying out the process.

While directed primarily to the production of crimped continuous filament synthetic yarns composed of materials such as the polyamides, for example, polyhexamethyleneadipamide and polymerizates of E-caprolactam, this invention is also applicable to polyester yarns, for example, polyethyleneglycol terephthalate as well as polyvinyl base yarns such as polyacrylonitrile. It is also applicable to the crimping or texturing of cellulose derivative yarns, for instance, cellulose acetate, and also to the crimping of natural silk. Yarns of the above materials may be composed of either continuous multifilaments or staple fibers.

The process of the present invention is particularly advantageous when compared with prior art crimping techniques because it permits crimping at comparatively much higher yarn velocities than has been possible heretofore, and yet the crimped product so produced is at least as uniform and voluminous as yarns which have been crimped by other slower and less economical processes.

In the present process a normal multifilament textile yarn, having no twist or a twist of between zero and about 300 turns per meter is continuously plastified and propelled by means of a high speed laminar stream of fluid directly against a barrier having a surface which is either so positioned as to deflect the fluid or of a character such as to permit free passage of the fluid. In either event, the fluid is substantially immediately diverted from the barrier in order to prevent the formation of turbulent streams on the surface of the barrier. The barrier against which the yarn impinges is continuously moved so that a fresh surface is always presented, and the yarn is permitted to remain temporarily thereon. The yarn is then continuously removed from the surface by a takeup device, set or cooled and wound up.

As noted above the starting multifilament yarn is a normal textile yarn which has no twist or is twisted only to the extent necessary to retain the individual filaments of the yarn in a reasonably closely packed bundle. By reason of the action of the fluid medium, particularly, at the point of impingement of the yarn against the barrier, the filaments are mechanically deformed whereby the fiber bundle is opened up. The thus deformed yarns are permitted to remain temporarily on the surface of the barrier. Substantially complete setting or hardening is effected as by natural or forced cooling before any substantial tension is applied to the crimped product.

It is important to the present process that the fluid medium which propels the yarn against the barrier be diverted as soon as possible after impingement of an adjacent incremental length of yarn in order that fluid currents not disturb the yarn on the surface of the barrier. This is preferably accomplished by the use of a screen or sieve barrier, which offers essentially no resistance to the flowing fluid. Instead of a screen another surface which is permeable to the fluid may be employed, for example, a clay filter or a hard foam substance of synthetic resin, the surface of which is characterized by a plurality of recesses or depressions. Alternatively, the impingement surface may be a fluid impermeable material,

for example, a corrugated, textured or granular surface, in which case the surface is positioned at a relatively steep angle to the axis of the traveling yarn, thereby readily permitting angular deflection of the flowing fluid. Throughout the specification and appended claims the barrier surface is described as "irregular" since the elements of the surface are not coplanar or the surface is not continuous. A sieve or screen in the shape of a drum is the preferred barrier, although the screen may present a plane surface at the point of yarn impact. The barrier screen is preferably of a size between 25 and 200 mesh. Throughout this application screen sizes are given in terms of U.S. Sieve mesh.

In the present process it is essential that the yarn be plastified prior to impingement upon the surface of the barrier, that is to say, the yarn is rendered sufficiently plastic that it will be easily deformed as the result of its impact inertia and the compressive force of the fluid stream. In most instances the yarn treated is composed of a thermoplastic material which can be rendered sufficiently plastic simply by the application of heat. For example, in a preferred embodiment of the present invention the flowing medium is compressed air at an elevated temperature which not only propels the yarn but also is in contact with the yarn for a sufficient period of time to effect plastification. However, other gases may be employed, including the vapors of a normal swelling agent for the yarn being crimped. If desired, the flowing medium may be a liquid, for example, either water at elevated temperature or a solution of a swelling agent for the particular yarn. Heated air or steam are the preferred fluids because the apparatus can be considerably simpler and the flowing fluid will present no collecting and disposal problems. It is also possible to plastify the yarn simply by passing it through a swelling liquid. In such cases compressed air at ambient temperatures may be employed as the yarn impelling fluid.

For a more complete description of the process and apparatus of the present invention reference will now be made to the drawing wherein:

FIG. 1 is a sectional view of an embodiment of the apparatus of the present invention;

FIG. 2 is an enlarged sectional view of a portion of the nozzle end of the yarn feeding and heating device of FIG. 1;

FIG. 3 is an enlarged plan view of a portion of a barrier screen with a length of yarn thereon;

FIG. 4 is a sectional elevation taken on the line 4—4 of FIG. 3;

FIG. 5 is a view of a length of multifilament yarn which has been textured in accordance with the present invention;

FIG. 6 is a sectional view of the yarn feeding tube and nozzle of another embodiment of the present invention;

FIG. 7 is a schematic representation of a portion of the apparatus of the present invention illustrating gas conveying, heating and collecting means;

FIG. 8 is a schematic view illustrating a different relationship between the nozzle and the barrier;

FIG. 9 is another schematic view illustrating the use of a continuous plane barrier;

FIG. 10 is a perspective view illustrating another plane barrier and the relationship of the nozzle thereto;

FIG. 11 is a schematic elevation of a conmplete yarn crimping apparatus in accordance with the present invention;

FIG. 12 is a sectional elevation of the fluid heating means, yarn feeding tube and nozzle of the apparatus of FIG. 11;

FIG. 13 is an enlarged detail of the lower end of the yarn feeding tube and nozzle of the apparatus of FIG. 12, and

FIG. 14 is a greatly enlarged detail of the nozzle of FIGS. 12 and 13.

Reference will now be made to FIG. 1 wherein there is illustrated one of the simplest embodiments of the present invention. A thermoplastic yarn 11 is fed axially by a pair of feeder rollers 12 and 12*a* to a yarn feeding tube 21 which is jacketed with an electrical resistance coil 14. The feeding tube and heating coil 14 are surrounded by an outer jacket 13 which is spaced from the heater to provide an annular passageway 13*a* (FIG. 2). An opening 15 is provided for introduction of air under pressure which flows along substantially the complete length of the heating element and then comes in contact with the yarn 11 just inside a labyrinth seal 16 at the feed end of the outer jacket. The air then passes axially in a laminar stream through the feeding tube 21 and propels the yarn 11 toward the nozzle end 17. The nozzle 18 (FIG. 2) is of the deLaval injector type, and is positioned in close proximity to a wire mesh screen 19, which is mounted on a rotating drum 20.

In operation, the yarn is conveyed axially through the feeding tube and nozzle at substantially the same velocity with which it is delivered by the feeder rolls 12 and 12*a* and impinges upon the moving surface of screen 19 as shown in FIG. 2. During its passage through tube 21 the yarn is heated to a plastic condition. As the plastified yarn hits the screen it is deformed i.e. crimped due to the impact on the hard wires of the screen, whereas the air stream passes through the screen. Referring to FIGS. 3 and 4, it is seen that the yarn on the screen is quite voluminous due to its crimped filaments.

The sieve 19 is constantly rotated in order to present a fresh surface to the traveling yarn, but rotation is at a substantially lower linear velocity than that of the feed rollers 12 and 12*a* since the yarn is appreciably reduced in length by reason of its deformation on the screen. While it is difficult to prescribe a definitive ratio of the linear velocity of the feed rollers to the velocity of the screen it is reasonable to say that the screen is moved at a velocity between about 25 and 75% of that of the input or feed rollers.

A pair of takeup rollers 22 and 22*a* are so positioned with respect to the screen 19 as to enable a temporary retention of the yarn on the impact surface. In the apparatus of FIG. 1 the deformed yarn remains on the screen from the point of impact to a point 23 on the drum 20.

In order to wind up the resulting crimped yarn with some degree of tension, the takeup rollers 22 and 22*a* are so operated as to remove the yarn from the screen at a linear speed slightly greater than the speed at which the screen is moving. By reason of the fact that the yarn is now textured takeup speed must be substantially less than the rate at which the yarn impinges upon the screen. For example, the takeup device operates at a linear speed between about 50 and 90% of the speed of the feed rollers. In a typical example, the ratio of linear speeds of the feed rollers, moving screen and takeup rollers is about 100:55:70.

Another yarn feeding member is illustrated in FIG. 6 wherein the feeding tube 21 is provided with a spaced jacket 24 which is adapted as at 25 for introduction of a hot fluid medium, for example air under pressure. The lower end of tube 21 and jacket 24 are shaped as at 26 and 27 respectively, to provide a modified injector nozzle which is positioned adjacent the barrier, for example, screen 19. In this embodiment the air or other flowing medium is exteriorly heated, and after passage of substantial quantities of hot gas the feeding tube 21 becomes hot and acts as a radiant heater for the yarn. However, the direct contact with the hot gas at the nozzle is generally sufficient to plastify the yarn.

Since considerable energy is expended in heating the gas and propelling the same through the yarn feeding member, it is desirable to conserve as much heat as possible in the gas, which of course requires collection and reuse of the gas after it has passed through the screen or been diverted in some other manner from the barrier. This may be accomplished as shown in FIG. 7 by providing an enclosure 28 about drum 20'. The enclosure is adapted as at 29 and 31 to provide exits for the crimped yarn and gas, respectively. Gas is withdrawn from enclosure 28 through conduit 32 by a compressor 33 after which it is delivered to a heating chamber 34 and then introduced to the yarn feeding member, the nozzle end 17 of which projects into enclosure 28.

While the barrier screen is preferably in the shape of a drum and the yarn is preferably directed at the outer surface of said drum as shown in FIGS. 1 and 7, the yarn may be impinged upon the inner side of a drum-shaped screen 19*b*, as shown in FIG. 8. In this embodiment the entire yarn feeding member is positioned inside of the screen drum 20*a*.

The yarn may also be impinged upon a plane irregular surface, for example, a continuous length or belt of screen material 19*c* (FIG. 9) moving about a pair of rollers 36, 37.

In still another embodiment of the present invention the yarn may be impinged upon a circular plane irregular impact surface such as screen 19*d* in FIG. 10, which is suitably mounted on a rotating shaft 38. In this embodiment the time of residence of the yarn 11 on the screen may be controlled not only by the speed of rotation of the screen but also by adjusting the radial distance between the center of the screen and the point of impingement.

The apparatus of FIGS. 11–14 is a typical machine in accordance with the present invention for crimping a single yarn. Referring to FIG. 11, it is seen that the apparatus is vertically arranged with the yarn 11 being drawn from one of the pirns 41. Two such pirns are shown, and the one on the right is a spare pirn. The yarn 11 is drawn from the pirn by feed rollers 12, 12*a* in which pair roll 12 is a driven pressure roll, through a yarn brake mechanism illustrated generally at 42, and thence by suitable guide rollers through a trough or other liquid container 43 where the yarn is moistened. The yarn then passes into the feeding tube, not shown, where it is contacted with heated air, for example, and discharged through nozzle end 17 in the usual manner. The feeding tube, heater and nozzle are enclosed by a cover member indicated generally at 44. The yarn impinges upon screen drum 20 which is rotated by means of a drive indicated at 46. It is then removed from the screen under slight tension exerted by a driven takeup roller 47. Intermediate the drum and the takeup roller, the crimped yarn passes in contact with a pivotal guide 51 which equalizes tension in the yarn and thence in contact with a further guide system 52. The yarn is finally wound under slight tension onto a spool or bobbin 53.

For details of those elements enclosed by member 44 reference will now be had to FIG. 12. The yarn feeding tube 21 is provided at its lower exit end with a yarn heating and nozzle member indicated generally at 54. Air under pressure from a source not shown, is conveyed through pipe 55, to opening 57 in member 54. The air is heated by a ceramic insulated electric heating element 56 which surrounds the pipe.

As seen in FIG. 13 member 54 consists of an upper hollow block 58 which is rigidly secured to the machine frame 59. Block 58 is so constructed as to provide an annular manifold 61 intermediate its inner and outer concentric walls, and its outer wall is bored as at 57 to provide access from pressurize air line 55 to the manifold. The inner wall of block 58 is threaded as at 62 to receive a nozzle block 63 which is axially bored and counterbored as shown and the counterbore is threaded as at 73. The lower end 70*a* of the counterbore is tapered as at 65 (FIG. 14) into bore 70. The nozzle block 63 is also bored as at 67 to permit access from the manifold 61 to the lower end 70*a* of the counterbore.

Referring to FIG. 14, a tube **68** is positioned in the bore **70** by a forced or friction fit, and the upper end of the tube **68** is bored or otherwise machined to produce a taper **71**, which tapered portion serves as an element of the injection nozzle. The wall of the lower end of feeding tube **21** is tapered as shown at **74** and serves as another element of the injector. The tapered portions of tubes **21** and **68** which come in contact with the air stream are highly polished.

An elongated hollow bolt **72** is secured by a friction fit about tube **21** and is threaded into nozzle block **63**. It will be seen that the lower end of bolt **72** is spaced from the tapered end of tube **21**, and also that the lower end of counterbore **70***a* is not threaded. When the bolt **72** is in position in the block its lower end serves as the upper wall of an axial chamber **64** which communicates with bore **67**.

A spacing sleeve **75**, having a flanged head **78**, is positioned about hollow bolt **72** and is free to move axially relative thereto. The lower end of sleeve **75** is provided with lock points indicated generally at **76** which engage suitable recesses in the upper surface of the nozzle block **63**. A lock nut **77** is positioned on the bolt **72** just above the head **78** of the spacer sleeve. When the lock nut is tightened all parts are rigidly held in the position shown. The nozzle is adjusted as indicated by the dotted lines **79** in FIG. 13 by backing off the lock nut and screwing down or backing off the hollow bolt, thus inserting or withdrawing the tapered end of tube **21**, after which the lock nut is reset.

In operation of the apparatus of FIGS. 12–14 heated air enters the manifold **61** and passes into chamber **64** where it heats tube **21** and the other elements of the heating and nozzle member **54**, and passes thence through the nozzle and into tube **68**. By reason of the zone of low pressure in and adjacent the tapered end of tube **21** the yarn travels along with the air through tube **68** and onto the screen or other barrier. The yarn is easily plastified in passing through member **54** and by its direct contact with the heated air. The air passes through chamber **64** and tube **68** in a laminar stream and any substantial formation of turbulant air stream is prevented.

The process of the present invention is further illustrated by the following non-limiting examples.

Example 1

A 210 denier, 34 filament nylon yarn having a twist of 80 turns per meter was uniformly moistened with water and fed to the apparatus of FIG. 1 at a speed of 93.5 meters per minute, and propelled through the nozzle by a stream of air at 3 atmospheres absolute pressure and 270° C. The yarn in plastic condition as a result of its passages through the heating element and contact with the heated air was directed against a drum-shaped rotating 70 mesh wire screen and removed from the screen at a speed of 69 meters per minute after which it was conveyed to a winding apparatus. The resulting crimped yarn was voluminous and had a crimp contraction of 19%.

Example 2

The nylon yarn of Example 1 was uniformly impregnated with a 1% aqueous solution of phenol and then impinged at a speed of 100 meters per minute with the aid of air at 3.5 atmospheres absolute pressure and 200° C. against a rotating 100 mesh wire screen. The yarn was removed from the screen at a speed of 70 meters per minute and wound on a bobbin. The crimped voluminous yarn obtained had a crimp contraction of 9.5%.

Example 3

A 140 denier, 68 filament nylon yarn having a twist of 20 turns per meter was propelled by air at 3 atmospheres absolute pressure and 265° C. at a speed of 95 meters per minute against a continuously rotating 100 mesh wire screen as shown in FIG. 9. The yarn was

removed from the screen at a speed of 70 meters per minute and wound on a bobbin. Two such yarns were plied together with 100 turns per meter in the S direction and the finished crimped voluminous yarn had a crimp contraction of 9.5%.

Example 4

A slightly twisted 90 denier, 30 filament yarn of a polymerizate of E-caprolactam was introduced into an injector nozzle as illustrated in FIG. 6 and propelled at a speed of 100 meters per minute with the aid of saturated steam at 3 atmospheres absolute pressure. The plastified yarn was impinged upon a rotating 80 mesh wire screen drum after which it was removed from the drum at a speed of 85 meters per minute and wound up. The crimped voluminous yarn so produced had a crimp contraction of 12.6%.

Example 5

A 100 denier, 48 filament polyethyleneglycol terephthalate yarn having 30 turns per meter was uniformly impregnated with a 2% aqueous solution of phenol and processed as set forth in Example 2. The crimped voluminous yarn so produced had a crimp contraction of 4.7%.

Example 6

A 100 denier, 36 filament polyacrylonitrile yarn was passed through an injector nozzle at a yarn speed of 64 meters per minute. Compressed air at 280° C. plastified and propelled the yarn against a round rotating 140 mesh wire screen as illustrated in FIG. 10. The yarn was removed from the rotating screen at a speed of 58 meters per minute, cooled in air and subsequently wound onto a bobbin. The crimped voluminous yarn so produced had a satisfactory crimp contraction.

Example 7

A slightly twisted 200 denier, 33 filament cellulose acetate yarn made by spinning secondary acetate, was impregnated with a liquid mixture consisting of one part by volume of acetone alcohol and 99 parts by volume of water. It was then fed through an injector nozzle in accordance with the present invention at a speed of 65 meters per minute. In the nozzle it was plastified with compressed air at 265° C., and impinged directly upon a rotating porous clay cylinder which easily let the air pass through it. The resulting deformed yarn was removed from the clay cylinder at a speed of about 59 meters per minute. The crimped, voluminous yarn was cooled in air and wound up. It had a satisfactory crimp contraction.

Example 8

A slightly twisted thread of 88 denier degummed natural silk was uniformly moistened with water and then passed through an injector nozzle at a speed of 64 meters per minute. Compressed air at 360° C. was introduced to the nozzle and propelled the yarn against a rotating 170 mesh wire screen drum. The yarn was subsequently removed from the drum at a speed of 52 meters per minute, cooled and wound on a bobbin. The crimped yarn so produced was voluminous and had a crimp contraction which was entirely satisfactory.

Crimp contraction is defined as the contraction of the yarn which results when the crimp is completely developed by wetting. This characteristic is determined and measured as follows:

An eight yard length of textured yarn is removed from each of five bobbins or cones and each length is wound onto a circular reeling device having a circumference of one yard, under sufficient tension to cause the yarn to lie flat, e.g. about 0.1 g./denier. The yarn is then removed from the reeling device in a skein which is eighteen inches long and consists of sixteen lengths of yarn. Each of the five skeins so formed is treated for 10 minutes in distilled water at 60–70° C. in a tensionless condition. It is then removed from the water and dried without tension.

Each skein is then completely wet out by immersion for 30 seconds in water at 60° C. containing either 2 g./liter "Santomerse" No. 1 Flake (Monsanto Chemical Co.) or the same quantity of "Perminal" (Imperial Chemical Industries, Ltd.). The skein is then hung on a hook in the wet state and loaded with 0.2 g./denier (e.g. 100/2 denier yarn with 640 g.). Care is taken to be sure that the skein hangs flat.

After loading for one minute the length (a) of the wet stretched skein is determined. Then the weight is removed and the skein is dried at 50–60° C. while hanging free without load. After cooling for one hour the skein is loaded with 0.002 g./denier and after one minute the length (b) is again determined. From these measurements, crimp contraction is determined as follows:

$$\text{Percent crimp contraction} = 100 - (100\Sigma b/\Sigma a)$$

where

$$\Sigma a = a_1 + a_2 + a_3 + a_4 + a_5$$

and

$$\Sigma b = b_1 + b_2 + b_3 + b_4 + b_5$$

What is claimed is:

1. A process for crimping a textile yarn, which comprises inducing a yarn to travel axially by means of a fluid stream, plastifying the yarn, impinging the fluid stream and the plastified yarn against a hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, retaining the yarn temporarily on said irregular surface, diverting the fluid therefrom, and subsequently removing the yarn from said surface.

2. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially by means of a fluid stream, plastifying the yarn, impinging the fluid stream and the plastified yarn against a hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, retaining a length of the yarn temporarily on said irregular surface, diverting the fluid therefrom, and subsequently removing the yarn from said surface.

3. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially by means of a gas stream, heating the yarn to plastify the same, impinging the gas and the plastified yarn against a hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, retaining the yarn temporarily on said irregular surface, diverting the flowing fluid therefrom, and subsequently removing the yarn from said surface.

4. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially and plastifying the same by means of a stream of hot gas, impinging the hot gas and the plastified yarn against a hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, retaining the yarn temporarily on said irregular surface, diverting the flowing fluid therefrom, and subsequently removing the yarn from said surface at a rate between about 50 and 90% of the rate of yarn impingement.

5. A process for crimping a textile yarn, which comprises inducing a yarn to travel axially by means of a fluid stream, plastifying the yarn, impinging the flowing fluid stream and the plastified yarn against a fluid permeable hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, permitting the fluid to pass through said surface, retaining the yarn temporarily thereon and subsequently removing the yarn from said surface.

6. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially and plastifying the same by means of a hot gas stream impinging the hot gas and the plastified yarn against a gas permeable hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, permitting the gas to pass through said surface, retaining the yarn temporarily thereon and subsequently removing the yarn from said surface.

7. A process as set forth in claim 6 wherein the gas stream is hot air.

8. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially by means of a stream of air while heating the yarn sufficiently to plastify the same, impinging the air and the plastified yarn against a wire screen while moving the screen at the point of yarn impingement thereagainst in a direction substantially normal to the axis of the traveling yarn, allowing the air to pass through the screen, retaining the yarn temporarily on said screen and subsequently removing the yarn from said screen at a rate between about 50 and 90% of the rate of yarn impingement.

9. A process as defined in claim 1 wherein treatment of the yarn with the fluid takes place in the presence of an organic softening agent for the yarn.

10. A process as defined in claim 9 wherein the softening agent is a liquid which plasticizes the yarn.

11. A process as defined in claim 1 wherein said yarn is composed of polyhexamethyleneadipamide.

12. A process as defined in claim 1 wherein said yarn is composed of a polymerizate of ε-caprolactam.

13. A process as defined in claim 1 wherein said yarn is composed of polyethyleneglycol terephthalate.

14. A process as defined in claim 1 wherein said yarn is composed of polyacrylonitrile.

15. A process as defined in claim 1 wherein said yarn is composed of cellulose acetate.

16. A process as defined in claim 1 wherein said yarn is composed of natural silk.

17. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially by means of a stream of steam, heating the yarn to plastify the same, impinging the steam and the plastified yarn against a hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, retaining the yarn temporarily on said irregular surface, diverting the flowing fluid therefrom, and subsequently removing the yarn from said surface.

18. A process for crimping a thermoplastic textile yarn, which comprises inducing a yarn to travel axially by means of a fluid stream, heating the yarn to plastify the same, impinging the fluid stream and the plastified yarn against a hard irregular surface while moving the irregular surface at the point of yarn impingement thereagainst in a direction transverse of the axis of the traveling yarn, retaining the yarn temporarily on said irregular surface, diverting the flowing fluid therefrom, setting the yarn by cooling before any substantial tension is applied to the crimped yarn, and winding up the yarn under tension.

References Cited in the file of this patent

UNITED STATES PATENTS

2,244,281	Alibert	June 3, 1941
2,313,630	Dockertz	Mar. 9, 1943
2,395,136	Millhiser	Feb. 19, 1946
2,435,891	Lodge	Feb. 10, 1948
2,508,462	Marshall	May 23, 1950
2,751,661	Shattuck	June 26, 1956
2,807,862	Griset	Oct. 1, 1957
2,859,506	Slayter	Nov. 11, 1958
2,874,446	Sellers	Feb. 24, 1959