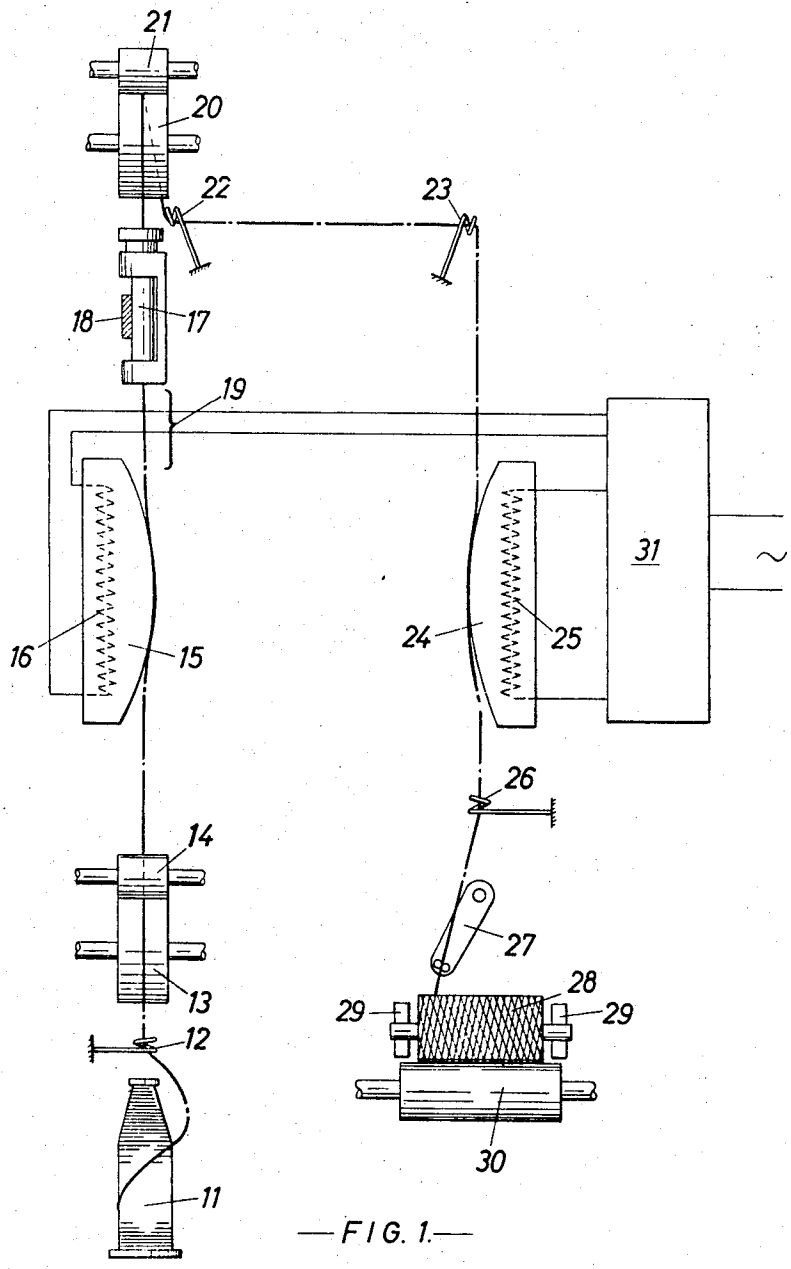
Oct. 14, 1969 E. P. R. SCRAGG 3,472,011

TREATMENT OF ARTIFICIAL YARNS AND THREADS

Original Filed Oct. 2, 1963 3 Sheets-Sheet 1



— FIG. 1.—

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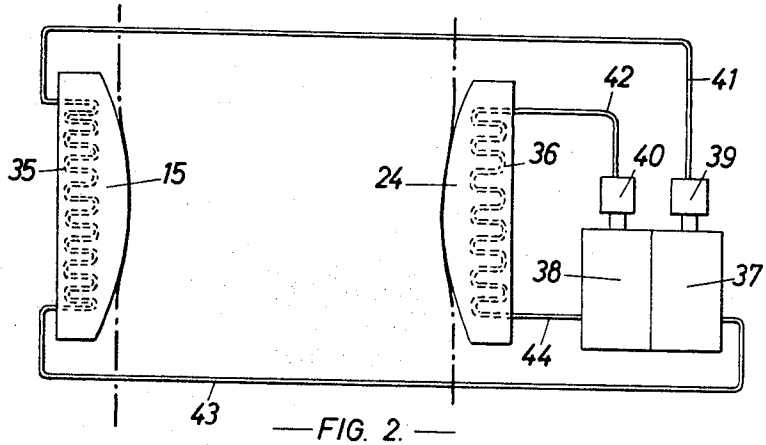
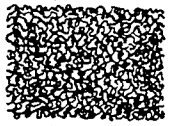
TREATMENT OF ARTIFICIAL YARNS AND THREADS

Original Filed Oct. 2, 1963 3 Sheets-Sheet 2

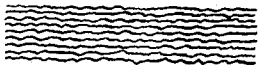


—FIG. 2.—

—FIG. 3.—



—FIG. 4.—



—FIG. 5.—

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TREATMENT OF ARTIFICIAL YARNS AND THREADS

Original Filed Oct. 2, 1963 3 Sheets-Sheet 3

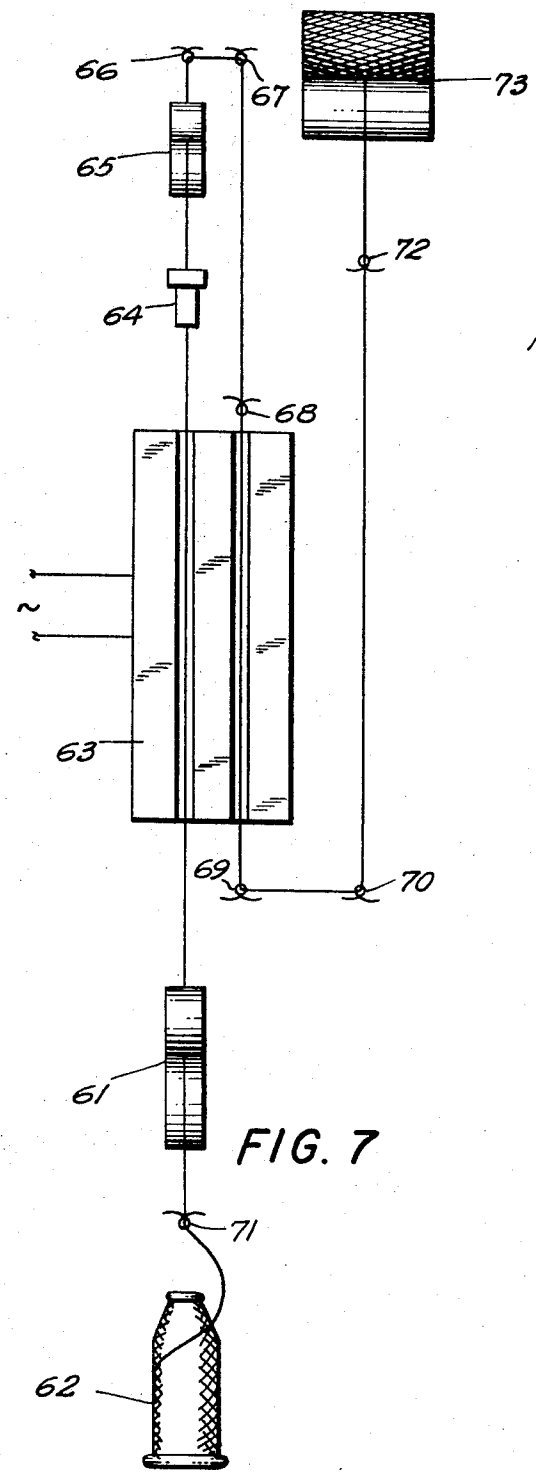
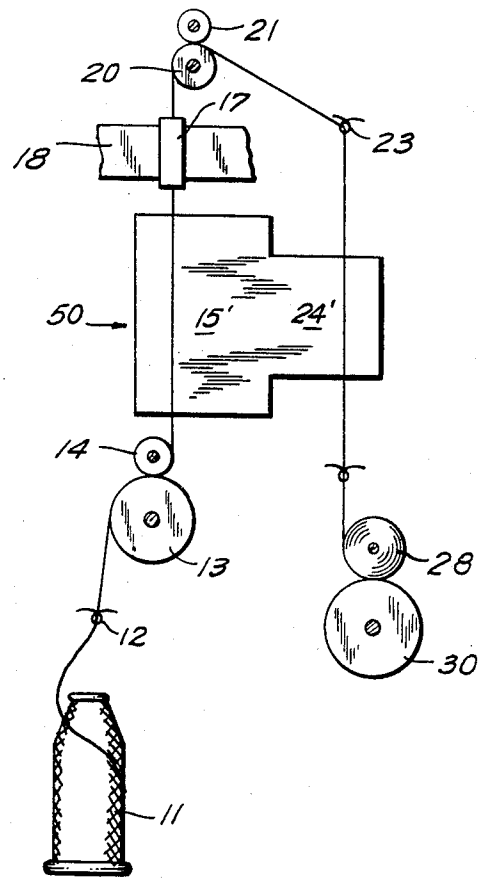


FIG. 7

FIG. 6



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3,472,011

Patented Oct. 14, 1969

3,472,011

TREATMENT OF ARTIFICIAL YARNS AND THREADS

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Continuation of application Ser. No. 317,396, Oct. 2, 1963, which is a continuation-in-part of application Ser. No. 747,162, July 8, 1958. This application May 23, 1966, Ser. No. 552,342

Claims priority, application Great Britain, July 11, 1957, 21,962/57

Int. Cl. D01h *13/26;* D02g *3/02*

U.S. Cl. 57—34

29 Claims

ABSTRACT OF THE DISCLOSURE

A process and an apparatus for continuous treatment of thermoplastic yarn. The apparatus comprises heating means, a false twisting device arranged after the heating means, feed means for feeding yarn through the heating means and the false twisting device. Reheating means is provided for continuously reheating the yarn. Advancing means is provided for continuously advancing the yarn to the reheating means at a predetermined speed. Withdrawal means continuously withdraws the yarn from the reheating means at a speed smaller than the predetermined speed at which the yarn is advanced to the reheating means so that the yarn, upon reaching the reheating means, is enabled to contract to an extent solely determined by the difference between the speeds at which it is advanced to and withdrawn from the reheating means.

This application is a continuation of application Ser. No. 317,396, filed on Oct. 2, 1963, now abandoned, which application in turn is a continuation-in-part application of application Ser. No. 747,162, filed on July 8, 1958, now abandoned.

The present invention concerns the treatment of thermoplastic synthetic yarns and threads and has for its object to provide improvements in the bulking thereof whereby a greater degree of fullness and feel and appearance of wool is obtained than is now produced by known methods of treatment.

It is known to treat thermoplastic synthetic yarns and threads by twisting, heat setting and untwisting (commonly known as crimping) to produce a bulked yarn or thread. Some of the bulked yarns or threads now produced are quite suitable for many purposes, but for other purposes the bulking is not sufficiently stable, or the yarn is excessively elastic, and this invention aims at providing this stability and, if necessary, reducing the elasticity. The invention can be carried out on a machine such as an uptwister, suitably modified, so that the complete operation of crimping and stabilizing can be carried out in a continuous operation, but the stabilizing can also be done separately on yarn or thread previously crimped and packaged.

In its broadest aspect the invention consists in relaxing a crimped and normally bulked thermoplastic synthetic yarn or thread and subjecting it to heat treatment while relaxed, so that the heat treatment fixes the relaxation and the yarn or thread is stabilized and can in this state be wound into a package in a soft but workable state or condition.

In one embodiment of the invention there is mounted at the base of a machine of the kind known as an uptwister a package of the yarn or thread to be treated. Above the package are nip rollers, one at least of which is driven and the thread is carried around the top nip roller and is fed upwardly and passed through, or in close proximity to a heating device, above which is a spinner whose rotation puts twist into the thread between it and the nip rollers below. From this spinner the thread is passed to a top set of nip rollers, the rotation of the spinner now removing the twist it formerly inserted; thence is carried round a friction wheel, taken downward and subjected to a further heat treatment in the same or a different heating device, and reversed again by carrying it around an idle roller below, from which it is taken up again and carried around a further wheel from which it is passed upward and packaged.

The second wheel referred to, which, it will be appreciated, draws the thread downwards after it has left the first wheel also draws it up again, and may apply less tension to the thread than was applied during the first upward passage where the false twist was put in. This is effected by running the second wheel at a surface speed less than that of the first. Consequently the thread as it is subjected to the second heat treatment is in a relaxed state, and is stabilized in this state or condition by the second heat treatment.

It is convenient to conduct the double operation of crimping and subsequent stabilizing on one machine in one operation, but crimped yarn can be stabilized in the same way in a separate operation.

It is to be understood that the second heat treatment need not be at the same temperature as the first, nor need it be of the same duration, nor need the same heater be used for both heat treatments when the continuous operation method is used. In addition the degree of relaxation may be varied as may be required by varying the speed of the last yarn-pulling device.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic layout of a suitable apparatus arrangement in which electric heating is used, for carrying the invention into effect;

FIG. 2 is a fragmentary schematic layout showing an alternative arrangement in which oil heating is used;

FIG. 3 is a side view of a piece of yarn composed of multifilament before being acted upon by apparatus in accordance with the invention;

FIG. 4 is a side view of a similar portion of yarn in a relaxed condition after being crimped;

FIG. 5 is a side view of a corresponding length of yarn after some of the crimp has been relaxed;

FIG. 6 is a schematic illustration of another embodiment; and

FIG. 7 is a schematic illustration of yet another embodiment.

Referring to FIG. 1 it will be seen that at the base of a machine or apparatus to carry out the invention there is mounted a package **11** of the yarn to be treated. This package is preferably coned and the yarn is ballooned off it to pass through a guide **12** and then over a driven nip roller **13** onto which the yarn is pressed by the top free roller **14**. The thread is carried around the top roller and fed upwardly through or over an electrically heated plate **15** having a channel or groove formed in it, the plate being heated to a degree sufficient to soften the yarn by an inset electrical element **16**. The surface of the plate **15** is preferably made slightly convex so that yarn tension holds the yarn in contact with the plate throughout substantially the whole of its passage over it. The plate assembly preferably contains suitable heat lagging both around the element **16** and over the front of the plate and yarn so as to reduce radiation and convection losses.

Above the heater the yarn passes through a false twist head or spindle **17** driven by a belt **18** at a high rate of speed. These false twist heads are well known, and such a head comprises means for frictionally engaging the yarn so as to impart to it at the point of engagement a twist

which runs in opposite directions on each side of the head. Below the head, the twist runs back through the region **19**, in which the yarn passes freely through an air space and is therein cooled, to the yarn passing over the surface of the plate **15** where the yarn is partially softened. As a result, a high rate of twist is set in the yarn in the heated zone and is fixed therein by cooling in the air space. The twisted yarn, after passing through the twister head **17**, encounters the reverse twist applied by the said head to the yarn, with the result that the yarn, if tension is released, takes up a bulky shortened configuration of the type shown in FIG. 4. The yarn, however, is not allowed to shorten at this point since it is drawn upwards by the driving roller **20**, being held in contact therewith by means of the top nip rollers **21**. It has been found preferable to cause the takeup speed of the yarn by roller **20** to be very slightly less than the feed speed of the yarn by the roller **13**, a figure of 2% being suitable.

The yarn after leaving the rollers **20**, **21** could of course be wound on a package and used as original fully crimped yarn. It has been found that a considerable market exists for yarn which, if allowed to shorten takes up a configuration such as that shown in the FIG. 5, i.e., in which the diameter and contraction are both less than that of the yarn shown in FIG. 4. The yarn is therefore passed through the two guides **22**, **23** and then downwards through a further heated plate **24** which receives its heat from an electrical element **25**. This heater device is similar in general construction to that constituted by the plate **15** and the element **16**, but it is advisable for its temperature to be rather less, say 30° C. less than that of the temperature of the plate **15**, although this second temperature is determined not only by the amount of crimp which it is desired to relax, but also by the nature of the material being treated. Finally after leaving the heater **24** the yarn passes through a second cooling air space, through another guide **26** and thence via a distributing finger **27** to a package **28**. The said package is held against the surface of a driven roller **30** by means of guide **29** so that the peripheral or uptake speed of the package is substantially constant. The said speed determines the amount of crimp which is removed or relaxed from the yarn during its passage across the heated plate **24**, and is preferably of the order of 20% less than the peripheral speed of the rollers **20**, **21**.

Since for the best results both as regards crimp setting, crimp relaxing and dye absorption during subsequent finishing processes it is essential that all yarn temperatures should be as constant as possible, the temperatures of the plates **15** and **25** are conveniently regulated by deriving their electrical supplies from a controller **31**. The said supplies may be regulated in accordance with the temperature of a reference region such as an oven which temperature is predetermined by means of a suitable preset regulator, or alternatively the said regulation may be effected by means such as thermocouples located in the said plate assemblies, and acting upon regulator servomechanism in the controller **31**, in a manner known per se. Alternatively both plates may be heated to the same temperature, the second plate being shorter than the first. Finally, the plates may be combined in a single assembly. Thus, referring to FIG. 6, it will be seen that the arrangement is substantially identical with that of FIG. 1 except that a heating unit **50** is provided combining the heating units **15** and **24** into a single unit. The portions **15'** and **24'** of the heating unit **50** are engaged by the yarn and are heated to the same temperature, but of course the portion **24'** is shorter than the portion **15'**, as indicated. It will also be noted that the guide **22** of FIG. 1 is unnecessary since the single guide **23** suffices to direct the yarn from the rollers **20**, **21** back to the unit **50**. Otherwise the arrangement of FIG. 6 is identical with that of FIG. 1.

In the embodiment which is illustrated in FIG. 7, the forwarding rollers **61** feed the yarn from the supply package **62** through the guide **71**, and then the yarn is heated by engaging a channel in a curved heating plate **63**. The yarn then passes through the false twist until **64** to the forwarding rollers **65** from which the yarn is guided by the guides **67**, **68**, and **69** back across the heating plate **63** in another channel thereof. From the guide **69** the yarn moves through the guides **70** and **72** to the takeup package arrangement **73**. Although the plate **63** is uniformly heated, the guides **68** and **69** are positioned to provide a length of contact of the yarn passing through the second channel which is different from the length of contact with the yarn passing upwardly through the first channel from the forwarding roller **61**. Thus, it is possible by properly positioning the guides **68** and **69** to provide for the yarn moving downwardly in the right channel of the plate **63** of FIG. 7 a length of contact less than that of the yarn moving upwardly through the left channel of FIG. 7.

In one particular method according to the invention the yarn was nylon and the heater temperature was 220° C. The overfeed between the rollers **61** and **65** of FIG. 7 was 2%, which is to say rollers **61** have a peripheral speed 2% greater than the peripheral speed of the rollers **65**. The twist inserted into the yarn was at the rate of 80 turns per inch, while the forwarding speed of the yarn from the bobbin **62** was 70 feet per minute. The length of contact of the yarn in the left heater channel of FIG. 7 was 15 inches. The overfeed from the rollers **65** to the takeup package **73** of FIG. 7 was 13–25%, and the length of contact of the yarn in the right heater channel of FIG. 7 was 12 inches.

Referring to FIG. 2 the arrangement of apparatus is generally similar to that of FIG. 1 except that heating is effected by oil instead of electrical. In this arrangement the plate **15** has an oil heating element **35** and the plate **24** has an oil heating element **36**. Heated oil from thermostatically controlled reservoirs **37** and **38** is displaced by pumps **39** and **40**, through pipes **41** and **42** respectively to the elements **35** and **36** respectively, being returned to the reservoirs by pipes **43** and **44**.

Where an installation comprises a number of separate units, if electrically heated all the heating elements of the plates **15** or of the plates **24** may be connected in parallel, while series connection is prepared in oil heated arrangement.

Although the process of the present invention has been described as being continuously effected on a single machine, it should be understood that the process may be varied by winding the yarn on a suitable receptacle after crimping, and thereafter passing the yarn through a second machine to relax the said crimp partially, and the invention should be understood as including such a method of manufacture.

Finally, the plates may be heated by circulating a suitable heated fluid such as oil through them, the oil temperature being automatically regulated during its passage through the circulating mechanism.

It should of course be understood that a machine to carry our process into effect may comprise a plurality of plates, the temperature of all the said plates being controlled from a single common control mechanism.

What is claimed as new and desired to be secured by Letters Patent is:

1. A continuous process for producing a partially relaxed crimped thermoplastic synthetic yarn, comprising the steps of heating the yarn after it leaves a package, to an extent sufficient to soften the yarn; imparting a high degree of twist to the yarn while hot and soft; fixing the twist in the yarn by cooling the latter; untwisting the yarn in an untwisting zone to thereby produce a semifinished crimped yarn capable of undergoing a predetermined maximum amount of contraction and tending to contract to such maximum amount; withdrawing said semifinished crimped yarn from said untwisting zone and advancing it into a reheating zone at a predetermined speed; withdrawing the yarn from said reheating zone at a speed

smaller than said predetermined speed at which said semifinished crimped yarn is advanced into said reheating zone without any tensioning of said yarn between said advancing of said semifinished crimped yarn into said reheating zone and withdrawing of said yarn from said reheating zone, so as to permit said semifinished crimped yarn to partially contract upon entering said reheating zone to a predetermined degree substantially smaller than said predetermined maximum amount and solely determined by the difference in the speeds at which it is advanced into and withdrawn from said reheating zone and to pass through said reheating zone in its thus partially contracted state; reheating in said reheating zone said semifinished crimped yarn in its partially contracted state to an extent only sufficient to partly relax the crimp of said semifinished crimped yarn while the latter is in said partially contracted state thereof and sufficient to fix the relaxation of said partially relaxed crimped yarn but without affecting the extent of partial contraction of said semifinished partially relaxed crimped yarn; and cooling said yarn so as to stabilize it in its partially contracted state with its crimp partly relaxed to obtain a finished only partially contracted yarn whose crimp is partly relaxed.

2. A process as defined in claim 1, wherein the step of heating said yarn includes passing the latter in contact with a heated surface.

3. A process as defined in claim 1, wherein the step of heating the yarn includes passing the latter continuously over a heated surface.

4. A process as defined in claim 3, wherein the yarn is heated in said reheating zone to a temperature which is less than the temperature in the first-mentioned heating step.

5. A process as defined in claim 1, and further comprising the step of maintaining the yarn under tension during the first-mentioned cooling of said yarn, so as to substantially prevent contraction of the same.

6. A process as defined in claim 1, wherein the step of fixing the twist in said yarn by cooling the latter comprises forwarding the yarn into a cooling zone at a given speed, and withdrawing the yarn from said cooling zone at a speed lower than said given speed.

7. A process as defined in claim 6, wherein the speed of withdrawing said yarn from the cooling zone is substantially 2% lower than said given speed.

8. A process as defined in claim 1, wherein said yarn is heated in said reheating zone to a temperature which is lower than the temperature to which it is heated in the first-mentioned heating step.

9. A process as defined in claim 8, wherein the temperature to which said yarn is reheated in said reheating zone is substantially 30 degrees centigrade below the temperature to which said yarn is heated in the first-mentioned heating step.

10. A process as defined in claim 1, and further comprising the step of winding up said yarn upon cooling and stabilization in partially relaxed crimped state.

11. A process as defined in claim 1, wherein the speed at which said yarn is withdrawn from said reheating zone is a constant speed.

12. A process as defined in claim 1, wherein the speed at which the yarn is withdrawn from said reheating zone is substantially 20% smaller than the speed at which the yarn is advanced into the reheating zone.

13. A process as defined in claim 1, wherein the yarn is nylon, wherein the step of cooling the yarn comprises withdrawing the yarn from a cooling zone at a speed which is 2% smaller than the speed at which the yarn is advanced into the cooling zone; wherein the step of heating and reheating the yarn include passing the yarn through zones of identical temperature with the yarn being subjected to the temperature of the reheating zone for a lesser period of time than in the heating zone; and wherein the step of withdrawing the yarn from said reheating zone comprises withdrawing at a speed which is from thirteen to twenty-five percent below the speed at which the yarn is advanced into said reheating zone.

14. A process as defined in claim 13, wherein the temperature of said heating and reheating zones is 220 degrees centigrade.

15. An apparatus for continuous treatment of plain thermoplastic yarn, comprising heating means; a false twisting device arranged after said heating means; feeding means for continuously feeding yarn through said heating means and said false twisting device to thereby produce a semifinished crimped yarn capable of undergoing a predetermined maximum amount of contraction and tending to contract to such maximum amount; reheating means for continuously reheating semifinished crimped yarns to an extent sufficient to partly relax the crimp of said semifinished yarn; combined withdrawing and advancing means for continuously withdrawing said yarn from the region downstream of said false-twisting device and advancing it to said reheating means at a predetermined speed; and withdrawal means for continuously withdrawing the yarn from said reheating means at a speed smaller than said predetermined speed at which the yarn is advanced to said reheating means without provision of any tensioning means for tensioning of said yarn between said combined withdrawing and advancing means and said withdrawal means, so as to permit said semifinished crimped yarn upon reaching said reheating means to partly contract to a predetermined degree substantially smaller than said predetermined maximum amount and solely determined by the difference between the speeds at which it is advanced to and withdrawn from said reheating means, the latter reheating the thus partially contracted crimped semifinished yarn to an extent sufficient to partly relax the crimp of said partially contracted crimped yarn while the latter is in its partially contracted state and sufficient to fix the relaxation of said partially relaxed crimped yarn but without affecting said predetermined degree of relaxation.

16. An apparatus as defined in claim 15, and further comprising a cooling zone provided subsequent to said false twisting device for cooling said yarn and for fixing therein the twist applied by said false twisting device, said combined withdrawing and advancing means continuously advancing said yarn through said cooling zone and to said reheating means.

17. An apparatus as defined in claim 16, wherein said cooling zone is an air space.

18. An apparatus as defined in claim 16, wherein said predetermined speed at which said combined withdrawing and advancing means advances said yarn through said cooling zone is so selected as to maintain said yarn tensioned.

19. An apparatus as defined in claim 15, wherein said yarn feeding means feeds said yarn at a predetermined rate; and wherein said advancing means includes yarn forwardly means receiving yarn from said yarn feeding means and forwarding said yarn at said predetermined speed which is different from said predetermined rate.

20. An apparatus as defined in claim 15, wherein said reheating means reheats said yarn to a temperature which is less than the temperature to which said yarn is heated by said heating means.

21. An apparatus as defined in claim 15, and further comprising yarn feeding means adapted to feed said yarn from a supply at a predetermined rate and wherein said advancing means includes yarn forwarding means receiving yarn from said feeding means and forwarding it at said predetermined speed which is different from said predetermined rate.

22. An apparatus as defined in claim 21, wherein said reheating means heats said yarn to a temperature which is less than the temperature to which said yarn is heated by said heating means.

23. An apparatus as defined in claim 15, wherein both said heating and said reheating means are electrically heated and thermally lagged curved plates.

24. An apparatus as defined in claim 23, and further comprising means for providing an unrestricted path of movement for said yarn past said reheating means to said withdrawal means; and means for controlling the electrical inputs of said heating means and said reheating means.

25. An apparatus as defined in claim 15, wherein both said heating means and said reheating means are oil-heated curved plates.

26. An apparatus as defined in claim 15, wherein said heating means and said reheating means are combined into a single unit.

27. An apparatus as defined in claim 26, wherein said single unit includes a single heating plate having a pair of yarn-receiving channels; and further comprising guide means guiding the yarn through one of said channels while positioning the yarn so as to have in said one channel a length of contact with said plate which is different from the length of contact of the yarn in the other channel.

28. An apparatus as defined in claim 26, wherein said single unit comprises a single heating plate having a relatively long portion forming said yarn heating means and a shorter portion forming said reheating means.

29. An apparatus as defined in claim 15, wherein said reheating means reheats said yarn to a temperature which is substantially 30 degrees centigrade below the temperature of said heating means.

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JOHN PETRAKES, Primary Examiner

U.S. Cl. X.R.

57—157

Dedication

3,472,011.—*Ernest Philip Rushton Scragg,* Sutton Grange, Macclesfield, England. TREATMENT OF ARTIFICIAL YARNS AND THREADS. Patent dated Oct. 14, 1969. Dedication filed June 25, 1982, by the assignee, *Lex Tex Ltd., Inc.*

Hereby dedicates said patent to the Public.

[*Official Gazette June 19, 1984.*]

Dedication

3,472,011.—*Ernest Philip Rushton Scragg,* Sutton Grange, Macclesfield, England. TREATMENT OF ARTIFICIAL YARNS AND THREADS. Patent dated Oct. 14, 1969. Dedication filed June 25, 1982, by the assignee, *Lex Tex Ltd., Inc.*

Hereby dedicates said patent to the Public.

[*Official Gazette June 19, 1984.*]

REEXAMINATION CERTIFICATE (729th)

United States Patent [19]

Scragg

[11] **B1 3,472,011**

[45] Certificate Issued **Jul. 21, 1987**

[54] **TREATMENT OF ARTIFICIAL YARNS AND THREADS**

[75] Inventor: **Ernest P. R. Scragg**, Sutton Grange, England

[73] Assignee: **Lex Tex Ltd.**, Fort Lauderdale, Fla.

Reexamination Request:
No. 90/000,069, Sep. 9, 1981

Reexamination Certificate for:

Patent No.:	**3,472,011**
Issued:	**Oct. 14, 1969**
Appl. No.:	**552,342**
Filed:	**May 23, 1966**

Disclaimer of Claim(s) 1-29 filed Jun. 25, 1982 (1043 O.G. 123)

Related U.S. Application Data

[63] Continuation of Ser. No. 317,396, Oct. 2, 1963, abandoned, which is a continuation-in-part of Ser. No. 747,162, Jul. 8, 1958, abandoned.

[30] **Foreign Application Priority Data**

Jul. 11, 1957 [GB] United Kingdom 21962/57

[51] **Int. Cl.**[4] **D02G 1/02**; D01H 13/28

[52] **U.S. Cl.** **57/290**; 219/388

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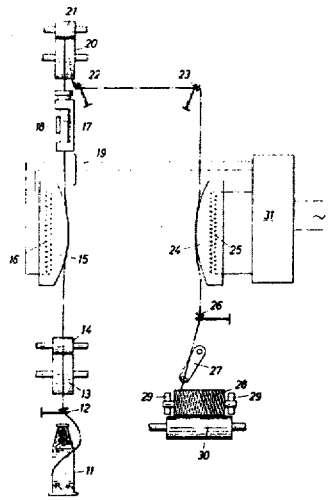
Primary Examiner—John Petrakes

[57] **ABSTRACT**

A process and an apparatus for continuous treatment of thermoplastic yarn. The apparatus comprises heating means, a flase twisting device arranged after the heating means, feed means for feeding yarn through the heating means and the false twisting device. Reheating means is provided for continuously reheating the yarn. Advancing means is provided for continuously advancing the yarn to the reheating means at a predetermined speed. Withdrawal means continuously withdraws the yarn from the reheating means at a speed smaller than the predetermined speed at which the yarn is advanced to the reheating means so that the yarn, upon reaching the reheating means, is enabled to contract to an extent solely determined by the difference between the speeds at which it is advanced to and withdrawn from the reheating means.



REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claims **1–29** are now disclaimed.

* * * * *