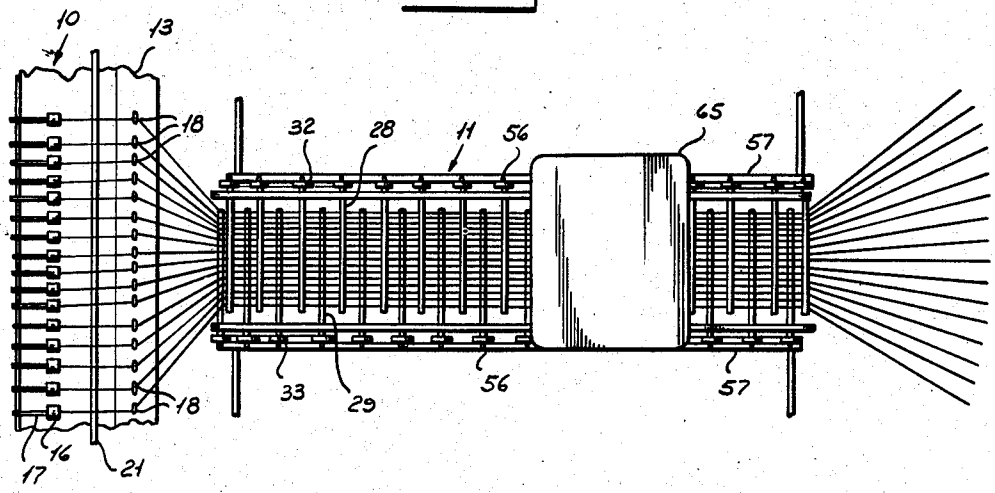
Nov. 18, 1952 H. VON KOHORN 2,618,042

METHOD AND APPARATUS FOR THE HANDLING OF CONTINUOUS MATERIALS

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Fig 2



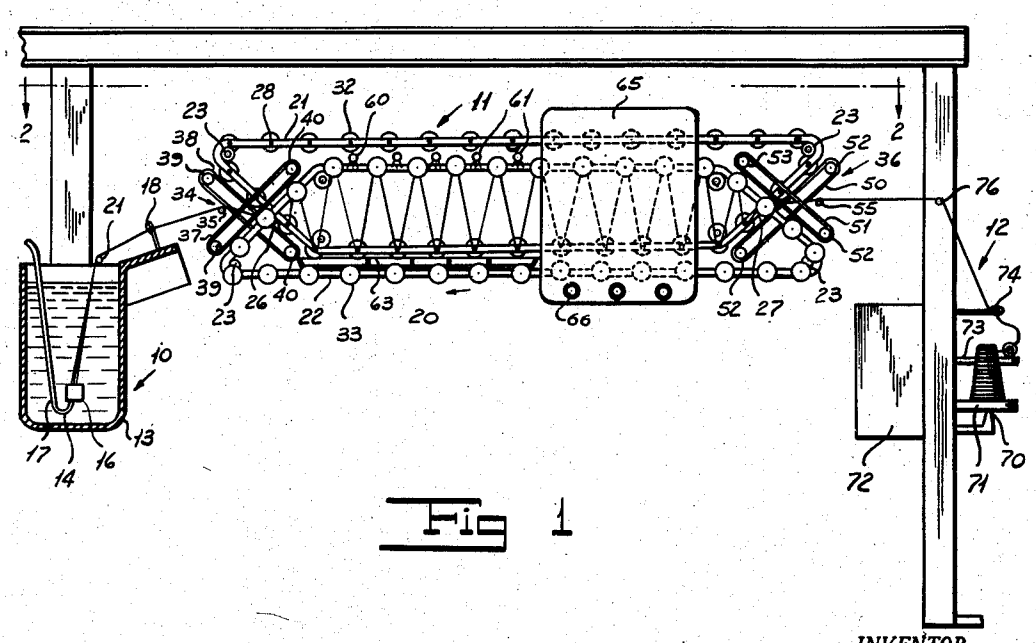




Fig 1

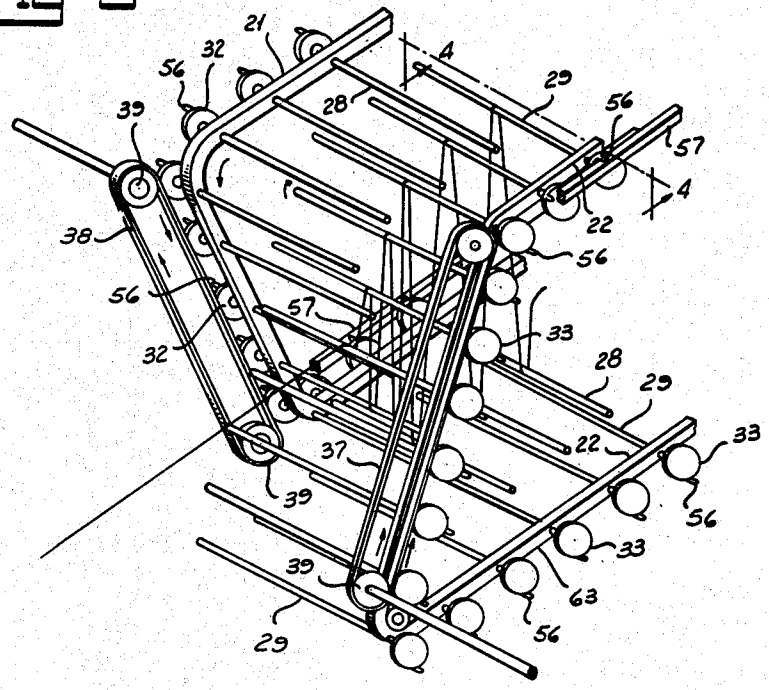
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METHOD AND APPARATUS FOR THE HANDLING OF CONTINUOUS MATERIALS

Filed Aug. 11, 1948 2 SHEETS—SHEET 2

Fig 3



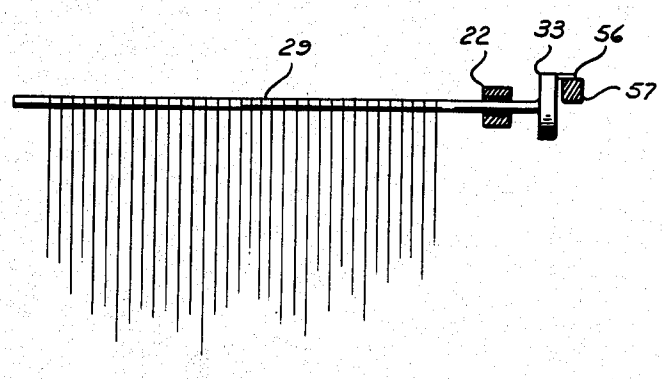




Fig 4

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## METHOD AND APPARATUS FOR THE HANDLING OF CONTINUOUS MATERIALS

Henry Von Kohorn, Westchester County, N. Y.

Application August 11, 1948, Serial No. 43,566

5 Claims. (Cl. 28—71.3)

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The present invention relates to an improved apparatus and method for the making, treating, stretching, storing and advancing of continuous materials such as threads, webs, ribbons, knitted and woven fabrics, pellicles or the like and it relates more particularly to an improved continuously advancing thread, web, ribbon, or pellicle storage device and to an improved method of continuously making, treating, stretching, storing and advancing continuous materials such as threads, webs, ribbons, pellicles or the like.

As the vicose rayon process is one of those requiring a multiplicity of operations, the vicose process as applied to the making of yarns has been chosen in order to set forth and illustrate the present invention.

In the manufacture of rayon by the viscose process, two systems are now in general use, namely, the package system and the so-called continuous spinning system. In accordance with the package system, viscose is extruded through a multi-apertured spinnerette into an acid spinbath, where the viscose is immediately coagulated to form a multifilament thread which is withdrawn, stretched between differentially driven godets, and wound into a package cake by means of a centrifugal bucket. The package is then removed and placed in a liquid aftertreating machine, where numerous liquids are successfully forced under pressure through the package in order to remove all traces of the spinbath and of sulphur, sulphides and other undesirable impurities which are present in the freshly spun rayon thread and to then avivify the thread. These liquids generally include hot water, desulphurizing solution, neutralizing solution and solutions of soap or sulphonated oils. The wet aftertreated packages of thread are then transferred to a drier, where they are subjected to a closely controlled drying atmosphere. The dried packages are then rewound or may be used in their original form.

The liquid aftertreatment of rayon thread in package form is highly time-consuming and requires numerous manual operations. In contrast to this, the liquid aftertreatment and drying of freshly spun rayon thread by the so-called continuous spinning system consumes only a few minutes and obviates the transferring of packages of thread from the spinning machine to the after treating equipment and then to the drying equipment. However, the continuous spinning machines now used or proposed possess numerous disadvantages and very few of these machines have yet been proven to be commercially feasible. One type of continuous spinning machine now in use employs a series of advancing reels for each spinning position, the freshly spun rayon thread being withdrawn from the spinbath, stretched and transported along successively lower advancing reels upon which they are subjected to the desired treating liquids, then dried and then twisted and wound. This type of spinning machine is extremely complex, very costly and difficult to maintain and service. Another type of continuous spinning machine now in use, employs canted cylinders for storing and advancing the thread. Here again, in order to subject the freshly spun rayon thread to controlled stretch and to all the aftertreatment processes required for such threads or yarns, at least one godet and several sets of canted cylinders are required, thus entailing the disadvantages already enumerated. It is interesting to note that in the continuous spinning machines above described, a completely independent system for stretching, storing and treating each separate thread is required and the threads are individually treated while traveling in a single layer along predetermined surfaces.

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Another type of continuous aftertreating machine includes an endless belt, upon which several threads are individually deposited in accumulated fashion along spaced points. The aftertreating liquids are sprayed upon the threads while they are transported by the belt. This machine has also many drawbacks. A pair of godets is required for each thread to impart the desired stretch. The threads are treated in a relaxed condition without controlled tension, thus resulting in a non-uniform product. Further, it is very difficult to subject the belt-carried threads to liquids, and to avoid the thread being washed off the belt or to avoid threads from being floated against each other to produce snarled threads. Where foraminiferous belts are employed, the liquids carry the threads through the belt openings, thereby breaking the individual filaments. Another difficulty is to secure the uniform removal of the thread from the belt.

There have been many other continuous spinning systems proposed, but none of these have as yet sufficiently evidenced their superiority over the package spinning system, to warrant their widespread commercial adoption.

In many other processes it is highly advantageous to treat threads, webs, ribbons, pellicles or the like while maintaining them under predetermined degrees of tension. For example, in the mercerization of cotton yarn, or the treating, dyeing and drying of cellulose acetate, nylon or other synthetic yarns it is desirable to maintain

these yarns during their treatment at a controlled tension. It is likewise highly desirable in the treatment of webs to impart to these webs along their lengths or warps predetermined stretches or tensions.

It is, therefore, an object of the present invention to provide an improved apparatus and method for the handling of continuous materials such as threads, webs, fabrics, pellicles or the like. Another object of the present invention is to provide an improved apparatus and method for handling a plurality of threads, so that they may be subjected to a controlled stretch and continuously advanced in a treatment zone, and while so advanced, exposed to successive treating liquids and dried.

Another object of the present invention is to provide an improved apparatus and method for handling a plurality of threads, whereby the total rate of feed of the thread is relatively large compared to the longitudinal rate of advance of the threads through the selected treating zone and whereby a controlled stretch can be imparted to the group of threads.

Another object of the present invention is to provide an improved apparatus for continuously advancing a plurality of stored threads, while imparting a controlled stretch thereto, said apparatus being simple, reliable and of low cost.

The above and further objects of the present invention will become apparent from a reading of the following description, together with the accompanying drawings, wherein

Fig. 1 is a side elevation of the improved apparatus;

Fig. 2 is a top plan view thereof;

Fig. 3 is a detailed isometric view of a portion thereof;

Fig. 4 is a sectional view along line 4—4 of Fig. 3.

The subject invention broadly includes the steps of advancing a substantially continuous material such as threads, webs, fabrics, pellicles or the like, to a predetermined point and thereafter forming the material into connected open ended loops which are longitudinally advanced as their heights or amplitudes are progressively increased. The advance of the material along its length is decreased as the amplitudes of the loops are increased. The rate of decrease in the advance of the material along its length, the rate of increase in the amplitudes of the loops and the other parameters are so correlated that the total linear advance of the material is increased as the loop amplitudes are increased. As a result the material is subjected to a predetermined stretch, which may vary in degree along the length of the yarn as desired. Preferably, in the case of threads, a plurality of threads are gathered into a planar sheet and the sheet is formed into connected open ended loops and handled as aforesaid. It is also desirable to subject the threads to the stretching operation, while they are in a plastic state. Thus, in the handling of threads produced by the viscose process, the freshly spun threads are subjected to a plasticizing agent, such as hot water, while they are being stretched.

According to a highly preferred embodiment of the present invention, there is provided two sets or series of material engaging elements. Each set is connected to a respective endless conveyor, which transports the corresponding material engaging elements along symmetrical substantially trapezoidal paths intersecting each other at lines referred to as the feed end and discharge end or intersection.

The elements of the respective sets successively cross the intersection lines. This successive crossing is preferably alternate but the invention is not limited to such alternate crossing.

The runs of the conveyors along the tops of the trapezoidal paths are from the feed to the discharge end and are substantially parallel although in some cases it may be desirable to have them converge or diverge for part of or the whole run. These runs are referred to as the feed runs. The bases of the trapezoidal paths define the return runs of the conveyors, which travel from the discharge end to the feed end.

The material engaging elements are preferably rod shaped and mutually parallel and are rotatably supported by the conveyors. Each of the material engaging elements terminates, at the conveyor end, in a friction wheel. Along the intersecting side runs of the conveyors and cooperating with the friction wheels are drive mechanisms which impart a rotation to the material engaging elements. These drive mechanisms travel at different peripheral speeds along their length whereby the elements are rotated at progressively decreasing speeds between the feed intersection and the feed runs and at progressively increasing speeds between the feed runs and the discharge intersection.

In operation a continuous material such as a plurality of threads or yarn as collected into a planar sheet or a web or pellicle or the like is fed to the feed intersection. The material is there engaged by successive elements, traveling along the alternate diverging paths and formed into connected open ended loops whose amplitudes increase as they approach the longitudinal feed runs. The material engaging elements, as they are conveyed from the feed intersection to the feed runs are rotated at progressively slower speeds. These speeds are such that the total linear advance of the material as it progresses from the feed intersection to the feed runs is preferably uniformly decreased. However, this increase may not be uniform but may vary. Thus a uniform or varying stretch may be imparted to the material as it travels from the feed intersection to the feed run.

As the loops of material are carried along the feed runs, the material engaging elements may be maintained rotationally stationary or may be rotated at constant or varying speeds, whereby to maintain a constant stretch on the material or to vary the stretch of the material. Upon the elements converging toward the discharge intersection they are rotated at progressively increasing speeds the rate of increase being in accordance with the tension if any it is desired to impart to the material. At the discharge intersection, the threads are disengaged from the elements and may there be led to suitable twisting and winding mechanisms.

During the transportation of the material between the feed and discharge ends, they may be subjected to numerous liquid treatments and drying operations.

Reference is now made to the drawings, which illustrate a preferred embodiment of the present invention as applied to the manufacture of viscose rayon yarn and wherein 10 designates the chemical spinning portion of the improved apparatus, 11 the liquid aftertreating and drying zone, and 12 the twisting and winding or coning section.

The chemical spinning section 10 consists of a suitable trough 13 through which is circulated a suitable coagulating bath of any well known type. Immersed in the coagulating bath is a plurality of extrusion devices 14, each of which comprises a suitable spinneret 16, connected by way of a conduit 17 to a suitable filter and metering pump and a source of spinning solution such as viscose or the like.

Associated with each of the extrusion devices 14 is a yarn or thread guide 18 which may be, if desired, a positively driven godet having associated therewith a suitable drive mechanism. A horizontally fixed lateral thread guide 21 extending along the length of the trough 13 is positioned above the coagulating bath and anterior to the guides 18.

The treating zone 11 includes a continuously advancing thread storage device 20 which comprises a pair of identical endless conveyors 21 and 22, which may be of any suitable type such as, for example, roller chain, and should be formed of a chemically resistant material.

The runs or paths of the belts 21 and 22 are trapezoidal, the bases and tops of the trapezoidal paths being longitudinal and substantially horizontal, although this is not necessary.

The base of the trapezoidal run traversed by the belt 21 is uppermost and constitutes the return run, while the top of this trapezoidal path is lowermost and constitutes the feed run. Moreover, the base of the trapezoidal path traversed by the belt 22 is lowermost and disposed directly below the feed run of the belt 21, whereas the upper part of this path constitutes the feed run and is disposed directly below the return run of the belt 21. The planes of the paths traversed by the belts 21 and 22 are vertical, parallel and laterally spaced.

A suitable drive mechanism, including the drive wheels 23, is associated with each of the belts 21 and 22 and drives these belts at equal, substantially constant speeds, the belt 21 being driven in a counter-clockwise direction and the belt 22 being driven in a clockwise direction. Thus the belts 21 and 22 are so driven at the feed run thereof they travel from left to right, as in Fig. 1, and at the return run from right to left. Moreover, the side runs of the belts 21 and 22 at the feed end converge from the return runs to a feed intersection 26, where they diverge to the feed runs. At the termination of the feed runs the side runs converge to the discharge intersection 27 and thereafter diverge to the return runs.

The endless belts 21 and 22 each support a plurality of regularly spaced rotatable thread or yarn engaging elements 28 and 29, respectively. The elements 28 and 29 are supported in horizontal cantilever fashion and project from the plane of the path traversed by the respective belts toward the plane of the path traversed by the other belt. The elements 28 and 29 are maintained substantially parallel to each other as they travel from the feed intersection to the feed runs, along the feed runs and to the discharge intersection. Moreover, the belts 21 and 22 are so driven that the successive elements carried by the belts alternately pass between the successive elements carried by the other belt. Each of the elements 28 and 29 extends through the respective belts 21 and 22 and terminates in a friction wheel or cot 32 and 33 respectively.

Element rotating mechanisms 34 and 36 respectively are disposed along the side runs of the belts 21 and 22 at the feed and discharge ends. The mechanism 34 includes a pair of elastic continuous belts 37 and 38, each of which is supported by positively driven pulleys 39 and 40. The belts 37 and 38 are so supported that they engage the peripheries of the friction wheels 32 and 33 which are mounted on the elements 28 and 29. Moreover, the peripheral speed of the pulleys 39 is greater than the peripheral speed of the pulleys 40 and these pulleys are driven so that the belt 37 is driven in a counter-clockwise direction whereas the belt 38 is driven in a clockwise direction. Thus the speeds of the friction wheel engaging portion of the belts 37 and 38 decrease as the belts travel from the pulleys 39 to the pulleys 40, so that a rotation which is imparted to the corresponding yarn engaging elements 28 and 29 decreases as the elements are conveyed from the end of the return run, through the feed intersection and to the feed runs.

Similarly, the element rotating mechanism 36, which is disposed at the discharge end of the yarn transporting mechanism 20, comprises two positively driven elastic belts 50 and 51 respectively, the surfaces of which engage the friction wheels 32 and 33. The belts 50 and 51 are supported by the pulleys 52 and 53, pulleys 52 being driven at greater peripheral speed than pulleys 53, and in such direction that the belt 51 is driven in a counter-clockwise direction and the belt 50 is driven in a clockwise direction and the speed of the friction wheel engaging portions of the belts increases as they travel from the pulleys 53 toward the pulleys 52. Thus a rotation is imparted to the yarn engaging elements 28 and 29, which rotation increases as the elements are transported from the feed run through the discharge intersection and to the return run.

Although the element rotating mechanisms 34 and 36 have been illustrated as extending along the entire length of the side runs of the elements 28 and 29, it is obvious that this is not necessary. All that is required is that the yarn engaging elements 28 and 29 be rotated as they travel from the feed intersection to the feed runs and from the feed runs to the discharge intersection. The drive mechanisms 34 and 36 may be accordingly modified. Furthermore, any suitable element rotating mechanism may be substituted for that illustrated and may take the form, for example, of a series of driven pulleys which rotate at different speeds and which are disposed along the tangents of the friction wheels 38 and 39 as they travel on the side runs.

Each of the friction wheels 32 and 33 may be provided with horizontally projecting lugs 56 which cooperate with the corresponding track 57 extending along the feed runs of the belts 21 and 22. The tracks 57 maintain the friction wheels 32 and 33 and the yarn engaging elements 28 and 29 rotationally stationary as they are transported along the feed runs.

A plurality of spray nozzles 60 and 61 are disposed immediately above the feed side run and the feed run of the belt 22 and extend the width of the elements 28. Furthermore, a trough 63 is disposed below the feed side run and feed run of the elements 28 and is partitioned into sections which register with the corresponding nozzles 60 and 61.

Nozzle 60 may be connected to a suitable plasticizing liquid, such as hot water, whereas nozzles 61 may be connected to sources of after-treating liquid, such as liquids for the neutral-

izing, desulphurizing, washing and avivifying of rayon yarn.

Moreover, the sections of the trough 63 may be connected to replenishing tanks so that the liquid may be re-used, or may be connected to a sewer so that the spent and used liquids may be disposed.

The yarn drying chamber 65 encloses a section of the yarn transporting mechanism 20, which follows the liquid treating section which includes spraying device 61 and the trough 63.

The drying chamber 65 is provided with openings in its side walls to permit the transporting of thread through the chamber 65. A series of heating elements 66 is positioned within the chamber 65 and a suitable air circulating system, not shown, is also provided, in order to effect the efficient and proper drying of the transported thread.

The yarn twisting and winding section 12, which follows the liquid aftertreating and drying section 11, consists of a plurality of suitably supported spindles 70, each of which is driven by an associated belt 71, which in turn is connected to a suitable drive mechanism (not shown) which is supported in the housing 72. A ring traverse mechanism 73 reciprocated by any well known system is associated with the spindles 70, as are the pig-tail guides 74, which are disposed above each of the spindles 70. A horizontal guide 76 is positioned at a higher level than the guide 74 and is provided with a plurality of grooves to accommodate the individually supported yarns discharged from the aftertreating and drying mechanism 11.

Considering now the operation of the apparatus above described, viscose or other suitable spinning solution is extruded through a plurality of spinnerets 16 into a spinbath circulating through the trough 13. The viscose is coagulated into a corresponding number of threads or yarns which are led over respective grooves in the guide 21 through guides 18 over the guide 35, where they are collected as a planar sheet of yarns and directed toward the feed intersection. At the feed intersection, successive elements 28 and 29, transported by the belts 21 and 22 respectively along the alternate side runs, engage the yarns forming the planar sheet and spread them into connected open ended loops. As the yarn engaging elements 28 and 29 diverge from the feed intersection to the feed runs, the loops are increased in amplitude. Moreover, an axially rotating motion is imparted to the elements 28 and 29 as they traverse the side feed runs, the speed of rotation diminishing from the feed intersection to the feed runs. Thus the rate of withdrawal of the yarns from the spinnerets 16 is determined by the peripheral speed of the yarn engaging surfaces of the elements 28 and 29 at the feed intersection, the rate of advance of the loops, as well as the spacing of the elements and the geometry of the side runs. The total linear advance of the yarns at any point is the sum of the advance of the yarns along the length of the yarns plus the advance of the loops. Thus the decrease in the rotation of the elements 28 and 29 as they diverge from the feed intersection compensates for the increased linear advance of the yarns attributed to the increased amplitude of the loops and the advance of the loops longitudinally. By decreasing the rotation of the elements 28 and 29 at a rate less than required to compensate for the increased amplitude of the loops, a stretch may be imparted to the yarns as they advance from the feed intersection to the feed runs. Moreover, this stretch may be uniform or varied along the length of the side runs by suitably controlling the rotation of the elements 28 and 29 in accordance with their positions along the side runs. As the sheet of yarns is transported along the feed runs, the corresponding yarn supporting elements 28 and 29 may be maintained in a non-rotating condition or may be rotated at uniform speeds whereby no stretch is imparted to the yarns which is attributed to the increased advance of the yarn along its length. On the other hand, the yarn may be further stretched or relaxed by increasing or decreasing the rotation of the elements 28 and 29 as they travel along the feed runs. Further, a relaxation or additional stretch of the yarns may be obtained at the feed runs by causing the belts 21 and 22 traveling along the feed runs to converge or diverge. For example, it may be desirable to relax the threads or yarns as they are transported through the drying chamber 65, and to this end the feed runs may converge slightly as they approach the drying chamber 65 and diverge slightly as they leave the drying chamber 65.

As the yarns are transported from the feed runs along the discharge side runs, the loops are decreased in amplitude, thus reducing the linear rate of advance of the yarns attributed to the advance of the loops. To compensate for this, while maintaining the yarns under a desirable tension, the yarn supporting elements 28 and 29 are rotated about their axes at increasing speeds as they approach the discharge intersection, the rate of discharge of the yarns at the discharge intersection being slightly greater than the peripheral speed of the yarn engaging surface of the elements 28 and 29 at the discharge intersection. It should be noted that here again varying tensions or relaxations may be imparted to the yarns at the discharge side runs by appropriately controlling the rotation of the elements 28 and 29, in accordance with their positions along the side runs. As the elements 28 and 29 cross the discharge intersection they release the yarns which are then directed to the winding and twisting mechanism.

A desirable spin bath which may be circulated through the trough 13 would have a sulphuric acid content of 11%, a sodium sulphate content of 20% and a zinc sulphate content of 0.85%, the balance being water. As a specific example, the spinnerets may each have forty holes; the metering pumps so driven and the elements 28 and 29 rotated at the feed intersection 26 that the filament yarn is withdrawn from the spin bath at the rate of 120 meters per minute and the individual filaments have a denier of approximately 3.1 and the thread a denier of 125. Thus, the spinning capacity per extruding position would be approximately five pounds in twenty-four hours. Moreover, the loops of thread, as they are transported along the parallel feed runs, impart a linear advance to the threads 150 meters per minute, the threads being at this point approximately 100 denier each.

The threads are withdrawn by the elements 28 and 29 at the intersection 26 at the rate of 120 meters per minute and the speed of rotation of the elements 28 and 29 are gradually and uniformly, although not necessarily, decreased to zero at the feed runs. Thus, there is imparted to the threads while the amplitudes of the loops of thread are increased a twenty-five percent stretch. Preceding and during the stretching

operation as aforesaid, a plasticizing solution, for example, water at 90° C. or a two percent sulphuric acid solution is sprayed upon the threads to facilitate the stretching. Thereafter, the loops of yarns are subjected to the usual liquid aftertreatment effected by sprays from the nozzles 61. This liquid aftertreatment may include the steps of washing, neutralizing, desulphurizing, avivifying, etc. As the yarns are transported through the drying chamber 65 they are dried the desired degree and thereafter transported to the discharge intersection where the yarns are separated into individual yarns by the guides 55 and 76 and led to the corresponding ring spinning devices. There the individual yarns are twisted and packaged in desired form.

Although the specific embodiment of the present invention which has been illustrated in the drawings has been described in connection with the manufacture of viscose rayon such apparatus and method is equally applicable to the treatment of all yarns, natural or synthetic, webs, ribbons, pellicles, fabrics, and the like. For example, the apparatus and method may be advantageously employed in the liquid aftertreatment, such as dyeing of acetate rayon yarn, nylon and other synthetic yarns, in the drying of all types of threads and continuous materials, and in the mercerizing of cotton yarn and fabrics. Moreover, the apparatus and method offers many desirable features when employed in the handling of fabrics, both woven and knitted, or the like, during the liquid treatment and drying thereof. The operation and method may further be employed in the coating, impregnating, drawing, stretching, shrinking, stabilizing, "sanforizing" or treatment of any kind or nature of threads, filaments, wire, rope, slivers, tows, fabrics and other materials whose length substantially exceeds their width; whether consisting of textile, natural, synthetic, metallic, plastic, mineral, animal, vegetable or any other origin and manufacture.

When there is referred to in the claims advance or movement of continuous material or yarn "along its length" what is meant is that component of movement or advance of the material or yarn along the longitudinal course or length of said material or yarn. For example the advance of the yarn from the spinneret 16 through the guides 21, 13 and 35 to the feed intersection is entirely along the length of the yarn whereas, there is no advance of the yarn along its length when it is transported by the non-rotating elements 28 and 29 while traversing parallel paths. However, between the feed intersection and the parallel runs of the elements 28 and 29 only a portion of the advance of the transported yarn is along its length which portion, depending on the rotation of the elements 28 and 29, normally decreases as the yarn is carried from the feed intersection to the parallel runs. Moreover, when advance of the loops is referred to in the claims what is meant is the advance of the loops as such and not any movement which may advance the yarn and maintain the looped course of the yarn stationary.

While the preferred embodiments of the present invention have been described and illustrated, it is obvious that numerous omissions and alterations may be made without departing from the spirit thereof.

This application is a continuation in part of the copending patent application of Henry Von Kohorn bearing Serial Number 29,963 and filed May 29, 1948, now Patent 2,570,172.

I claim:

1. The method of handling a substantially continuous material such as a thread, web, pellicle or the like, including the steps of continuously feeding said material to the intersection of the paths traversed by rotatable material engaging elements which are transported along said intersecting paths so that successive elements transported along each of said paths alternately pass between successive elements transported along the other of said paths whereby said material is engaged by successive elements and formed into zig-zag shape of increasing amplitude and positively rotating said elements whereby to control the stretch imparted to said material.

2. A continuously advancing storage device for handling a substantially continuous material, such as a thread, web, pellicle or the like, comprising two sets of rotatable material supporting elements, an endless conveyor associated with each of said sets of material supporting elements and adapted to transport said sets of elements along laterally spaced longitudinal paths which intersect each other, said conveyors being separated at said intersection a distance greater than the length of the said elements, each conveyor supporting the respective elements whereby they project with their unsupported ends toward the other conveyor and a mechanism for positively rotating said elements as they diverge from said intersection.

3. A continuously advancing storage device for handling a substantially continuous material, such as a thread, web, pellicle or the like, comprising two sets of rotatable material supporting elements, an endless conveyor associated with each of said sets of material supporting elements and adapted to transport said sets in a substantially common direction along laterally spaced longitudinal paths which intersect each other at two points which define a feed intersection and a discharge intersection respectively, and a mechanism associated with said material supporting elements for imparting a positive rotation thereto as said material supporting elements are transported along paths which diverge from said feed intersection whereby the material which is led to said feed intersection is engaged by successive elements of alternate sets of thread engaging elements and transported by said sets of elements while supported in zig-zag fashion and maintained under a controlled stretch.

4. Apparatus for the treatment of thread comprising two sets of rotatable elongated thread supporting elements, an endless conveyor associated with each of said sets of thread supporting elements and adapted to transport said sets in a common direction along laterally spaced paths which intersect each other at a feed end and a discharge end, means for guiding a plurality of spaced parallel threads to said intersection at said feed end between the converging elements whereby said threads are engaged by successive elements of the alternate sets and transported by said sets while supported in a zig-zag pattern and a mechanism associated with said rotatable elements for imparting a rotation to said elements at a predetermined progressively decreasing speed as said elements diverge from said feed end.

5. Apparatus for the treatment of thread comprising two sets of rotatable elongated thread supporting elements, an endless conveyor asso-

ciated with each of said sets of thread supporting elements and adapted to transport said sets in a common direction along laterally spaced paths which intersect each other at a feed end and a discharge end, means for guiding a plurality of spaced parallel threads to said intersection at said feed end between the converging elements whereby said threads are engaged by successive elements of the alternate sets and transported by said sets while supported in a zig-zag pattern and a mechanism for imparting a rotation to said elements at a progressively decreasing rate of speed as said elements diverge said speeds being such that the total linear advance of said thread is increased as said elements diverge whereby a stretch is imparted to said thread.

HENRY VON KOHORN.

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