Jan. 30, 1962 T. N. SALGADO 3,018,514

APPARATUS FOR THE CONTINUOUS SPINNING AND TREATMENT OF SYNTHETIC FILAMENTS

Filed June 24, 1958 3 Sheets-Sheet 1

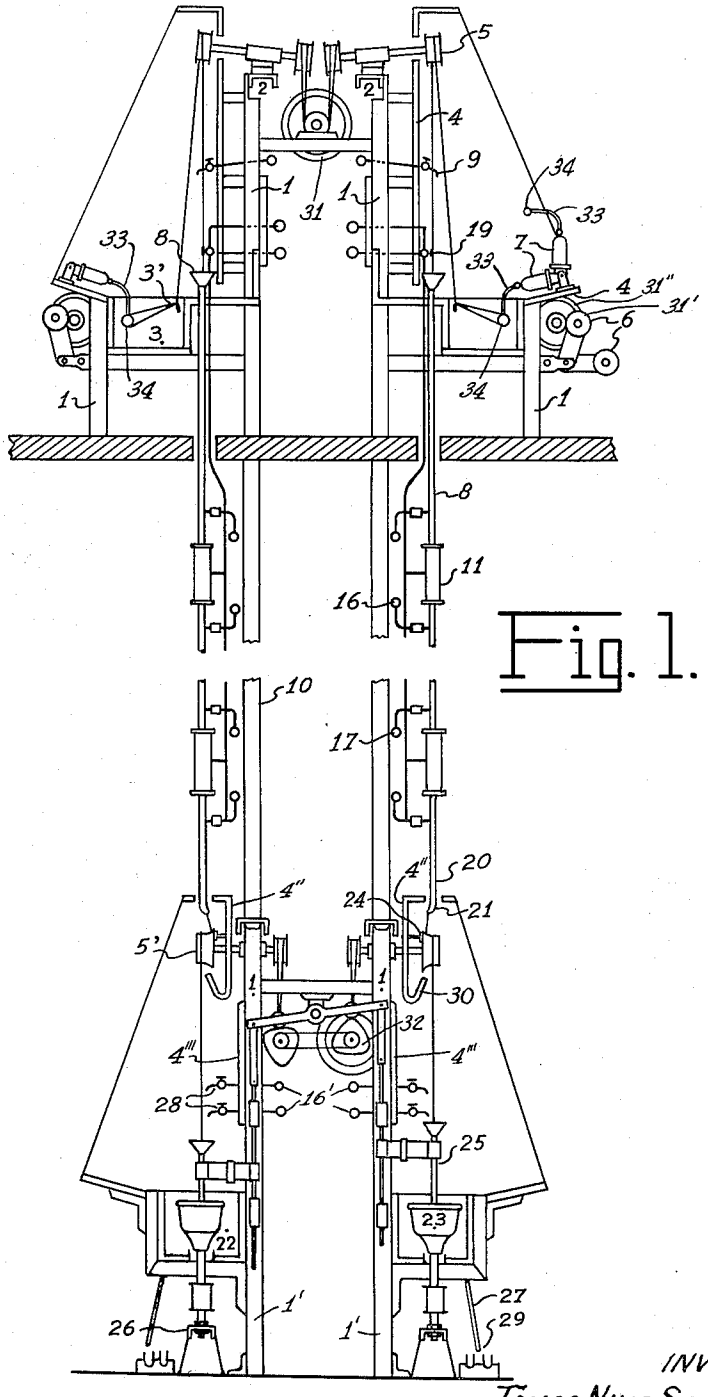


Fig. 1.

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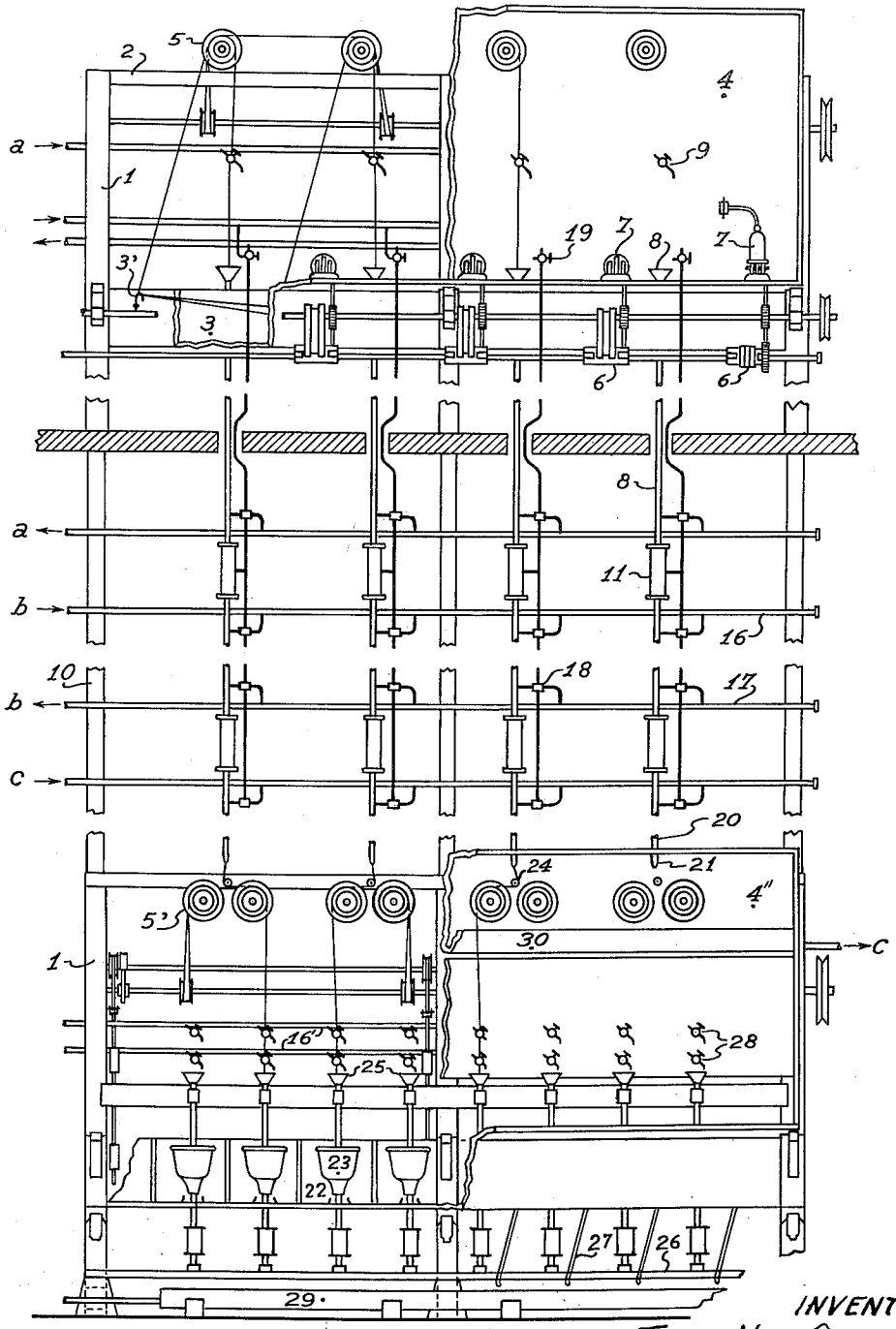


Fig. 2.

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Filed June 24, 1958 3 Sheets-Sheet 3

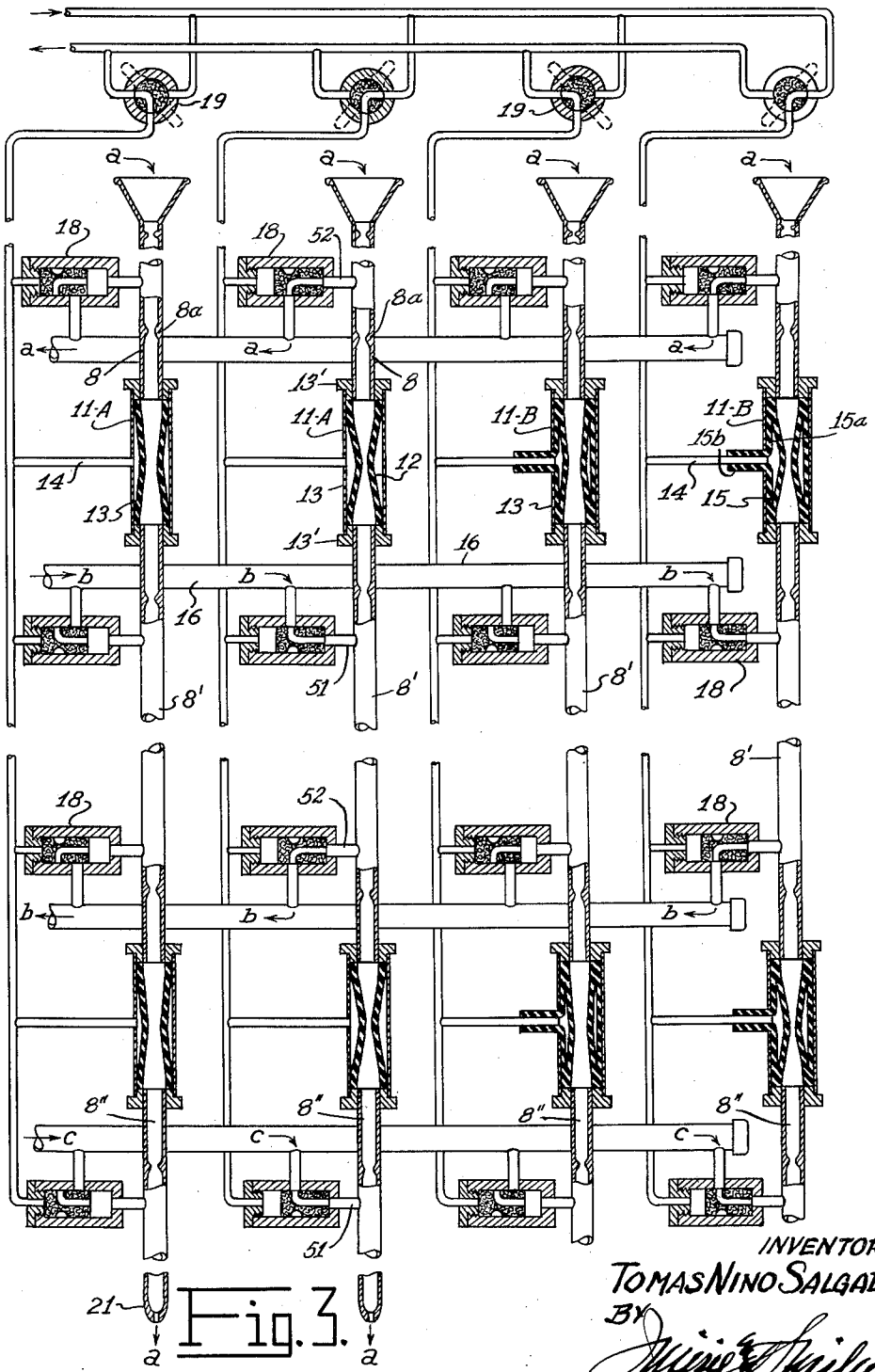


Fig. 3.

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United States Patent Office 3,018,514 Patented Jan. 30, 1962

3,018,514
APPARATUS FOR THE CONTINUOUS SPINNING AND TREATMENT OF SYNTHETIC FILAMENTS

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Filed June 24, 1958, Ser. No. 746,311
1 Claim. (Cl. 18—8)

This invention relates to a method and apparatus for the chemical spinning of synthetic filaments or threads, and particularly viscose threads. The invention enables the manufacture of the thread in a single, continuous operation which includes the simultaneous application of all necessary treatments to completely finish the viscose rayon, save only a drying process which must be added before the manufactured raw material is ready for use in the weaving of textiles or in the manufacture of rayon tire cord.

It is well known that synthetically formed filaments, after spinning, require a series of treatments for cleaning and purifying them. Usually the filaments are then bleached, and finally are treated with one or more lubricating substances which impart flexibility and softness.

All these treatments are customarily performed, separately, after the filaments, on bobbins or in skeins or cakes, have been taken out of the spinning machine. This requires manual manipulations by operators with consequent danger of touching and damaging the freshly formed delicate filaments. In addition, the treatment equipment is complicated and costly. Accordingly, present methods of manufacture are costly, yield a product of reduced quality due to the handling of the filaments, and result in a considerable loss of thread irreparably damaged by the manual handling combined with the physical action of movements and friction of the treating liquids against the filaments.

The various present day systems for the spinning and treatment of viscose thread in a continuous manner, all run the filament thread or tow over mechanical devices, such as spools or rollers, upon which it coils in helicoidal form and receives the various treatments. Such systems are extremely costly to install and maintain, and require complicated manipulations to place them in operation. These manipulations must be repeated each time the operation is stopped for any reason and, accordingly, they require highly skilled and capable operators.

A primary object of the present invention is to provide a process and machine which obviate the above stated disadvantages of current apparatus and makes it possible to avoid these drawbacks, losses and excessive costs. The machine to be described solves the problem of the continuous spinning and simultaneous treatment of viscose rayon, in a simple manner, with low installation and maintenance costs, and without need for particularly skilled operators. It has the further advantage of being adaptable, at a relatively low cost, to present-day installations operating according to the rotary centrifuge or spinning bucket system.

According to the present invention, each filament is led by a liquid current which automatically draws it through a tubular passage in which it is given the various treatments. The filaments are not touched by the operator until they are finished and then merely to take them out of the machine.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claim. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, wherein like reference characters indicate like parts throughout the several figures and in which:

FIG. 1 is a view, partially in cross-section and partially in end elevation, of a machine constructed in accordance with the invention;

FIG. 2 is a view in elevation of one operating face of the machine, showing four spinning units, with the protective panels half removed from the upper and lower sections of the machine, and

FIG. 3 is an enlarged sectional elevation of the middle section of the machine taken on line 3—3 of FIG. 2, showing schematically the operation of the separator or diameter reducing valves and of the control valves in the pneumatic valve operating system.

The drawings illustrate a machine which can be constructed with any even number of spinning units placed in two horizontal series and comprising three vertically superimposed sections. The upper section forms or spins the filaments, the middle section applies one or several of the necessary treatments to the filaments while the lower section applies one or several additional treatments and collects the filament thread in small skeins called cakes.

The upper section is preferably installed on a second floor, on a bed formed by cast iron pieces or U-section steel beams welded together to give the general form shown at 1 in FIG. 1. Several of these forms are assembled by means of other steel U beams 2 placed horizontally and bolted to them to form a rigid bed of the length required to contain the number of spinning units contemplated. Upon the bed are mounted the coagulating tanks 3 and protective panels 4, 4' made of lead covered wood, sheet iron or other suitable material. These panels protect the drive mechanisms 31, 31' for moving the Godet pulleys 5 and the feed pumps 6. Above the panels 4' which protect the pumps 6 and the mechanism 31' are located swingably mounted candle filters 7. Connected to the filters are outlet tubes 33, called goose necks, which bear the spinneret holders 34, to which the spinnerets or nozzles are attached. Behind the coagulating tanks 3 and vertically beneath the Godet pulleys 5 are the funnel entrances of the treating pipes 8 which form the midsection of the machine. Above each pipe 8 is placed a cock or faucet 9 which controls the feed of treatment liquid from a feed tank through piping that passes behind the protective panels 4.

The midsection is formed by a longitudinally disposed series of pipes 8, one for each spinning unit. Each pipe 8 preferably extends vertically downward from the upper section, may be formed of any desired cross-section, and is made of glass, plastic or other material resistant to the action of the chemical agents. The pipes may be straight, undulated or helicoidal, and are provided internally with a series of rings or guides, not shown, spaced conveniently and made of glass or porcelain, for maintaining the filament tow centered inside the pipe. The guides thus serve to prevent the tow or thread from rubbing against the walls of the pipe, and reduce the likelihood of damage from friction. The pipes 8 are mounted on an iron or wooden frame 10 of suitable shape, which is supported on the forms of the bed of the lower section.

Each of the treating pipes 8 is preferably formed of separate tubes 8, 8', 8'' (FIG. 3) interconnected by tubular chambers 11 containing cross-sectional area or diameter reducing valves for the purpose of dividing the liquid column or vein, inside the pipe, into two or more sections, in each of which may circulate a liquid differing in composition from that circulating in the contiguous section, thus preventing the different liquids from intermixing and simultaneously permitting the passage of the filament tow. The pipe cross-section reducing or separation valves 11 may suitably be formed in different ways. Two different types, which have proved to work satisfac-

torily, are illustrated in FIG. 3, and are described below.

Separator valve type **11A** comprises tube **12** made of highly elastic rubber, latex or plastic, wide at its ends and narrow in its middle, see FIG. 3, and interconnects two contiguous sections of the treatment tube **8**, **8'** or **8'**, **8''**. Outside flexible tube **12** is placed an hermetic chamber constituted by a rigid short tube **13**, larger in diameter than the tube **12**, and the ends of which are adapted to embrace the ends of the treatment tube sections **8**, **8'**, **8''** by means of rubber or plastic rings **13'**, of suitable shape, thus forming a rigid and hermetic connection. This hermetic chamber has a tube **14** connecting it through a master valve **19** with piping from a reservoir in which a vacuum has been established, said vacuum being maintained constantly at a pressure of approximately 5 millimeters of mercury. Upon applying the vacuum to the hermetic chamber by means of the master valve, the elastic tube **12**, which has a diameter of only 1 millimeter or less in its center, is distended by action of the atmospheric pressure and assumes a diameter practically equal to that of the treatment tube section **8**. When the vacuum is broken, by means of the master valve **19**, tube of valve **12** reassumes its original position and central dimension of less than one millimeter in diameter.

Separator valve type **11B** is similar to type **11A**, above described, the difference being that the elastic tubular valve **15** is integrally formed with an outer hermetic chamber **15***a* and a connection **15***b* formed of the same material as the valve. The diameter of the valve **15**, in its normal position, is practically equal to that of the treatment tube sections **8**, **8'**, **8''**, but upon the application of compressed air from a reservoir for this purpose, and by means of master valve **19**, causes the hermetic chambers **15***a* to inflate, reducing its inner walls **15** to about one millimeter or less. The pressure applied is approximately 2 kilograms per square centimeter.

As previously stated, valves **11A**, **11B** connect two contiguous sections **8**, **8'**, **8''** of the treatment pipe, in which sections, liquids having a different composition circulate. Thus, each intermediate section **8'** of the treatment pipe is provided with two connections **51**, **52** situated near its ends and through which the processing liquid is respectively fed and discharged. The upper pipe section **8** and the lower section **8''** have only one such feed connection **52**, see FIG. 3. The upper connection **51** of each section **8'** is connected through a control valve **18** to the feed piping **16** which extends from a tank, not shown, containing the processing liquid, and the lower connection **52** of each section **8'** is connected likewise through a control valve **18** to the discharge pipeline **17** for said liquid.

It is necessary that at the moment of starting the operation of a spinning unit, the circulation of different liquids be stopped in all sections **8**, **8'**, **8''** of the associated treatment pipe. Furthermore, at this moment, the pipe must have its normal diameter of from fifteen to twenty millimeters throughout its length in order to enable insertion of the filament tow. Once this insertion has been effected and once the end or tip of the filaments has been taken by the centrifuge at the lower section of the machine, it is necessary to reduce, to one millimeter or less, the diameter of all the separator valves **11** and to open simultaneously all the control valves **18** for the circulation of liquids in each of the sections **8**, **8'**, **8''** of the treatment pipe associated with the spinning unit. To make it practicable to change the position of various valves simultaneously and at the instant required, all the valves, including both the diameter reducing or separator valves **11** and valves **18** which control the treatment liquid circulation, should be of an automatic type, to be operated by some known system, either pneumatic or electric, so that the operator may, at will, simply by operating a master valve **19** or a circuit breaker within his reach, place the system either in starting position or in normal operating position.

Upon effecting reduction of area at spaced intervals in a processing pipe by means of separator valves **11**, and because of the greater diameters and pressures applied in the connections **51**, **52** for feeding and discharging treatment liquids from the resultant sections **8**, **8'**, **8''** of the processing pipe, a very satisfactory operation is obtained with a negligible minimum amount of mixing of the treatment liquids, limited essentially to the liquid necessarily carried by the filament tow in its movement.

The lower section **8''** of the processing pipe preferably comprises a flexible plastic tubing terminating at its lower end in a discharge nozzle **21**. The flexibility of this lower section enables movement of the nozzle **21** within certain limits. The nozzle **21** is provided with rounded edges on its tip to protect the filaments, and said nozzle is so moved by flexing the section as to direct the stream of liquid toward the collecting channel **30**, FIG. 2. The nozzles **21** are located in the upper portion of the lower section of the machine.

The lower section is constructed upon a bed **1'** similar in all respects to that of the upper section. On said bed **1'** are mounted the protective panels **4''**, **4'''**, the mechanical devices **32** for transmitting movements, and the two series of boxes or troughs **22** housing the centrifuges or spinning buckets **23**. Troughs **22** are formed by a pair of channels running lengthwise of the machine and each divided by partitions in order to form a series of generally cubical boxes which have openings at the centers of their bottoms for the passage of the shafts on which the centrifuges rotate. Both the panels and the boxes are covered with a sheeting made of rubber or other material resistant to the action of the chemical agents. Behind the protective panels are located the mechanical devices **32** for driving the glass Godet type pulleys **5'**, plus the device for imparting to the oscillating funnels **25** a slow, vertical movement, down and up, the amplitude of which corresponds to the depth of the Bakelite centrifuges **23**. The idler pulleys **24** have peripheral grooves, are made of glass or poreclain and do not have any mechanical drive.

Upon the steel U beams, shown at **26** in FIGS. 1 and 2, are mounted the ball bearing spindles which support and rotate the centrifuges **23**, turned by means of a belt transmission, omitted from the drawings. If desired, individual motors may be substituted to rotate the centrifuges. In either case, the centrifuge shafts extend upwardly through the bottoms of troughs **22** which collect the liquid thrown out by the centrifuges for discharge through flexible plastic tubes **27**, FIG. 2. One or more channels **29**, made of a material resistant to the action of the chemical agents, collect the liquid from the centrifuges, issuing from the tubes **27**, so it can be pumped back to the feed tanks. Channels **29** extend the full length of the machine below the level of the bottoms of the boxes **22**.

Each spinning unit requires an idler pulley **24**, FIG. 2, placed at the upper portion of the lower section of the machine with its center on the vertical line of the treatment pipe sections **8**, **8'**, **8''**. Two Godet pulleys **5'** which are mechanically driven and rotate, respectively, one toward the right and the other toward the left, are mounted on opposite sides of the idler pulley **24**. Below the Godet pulleys are two oscillating funnels **25** and two Bakelite centrifuges **23** whose centers fall in the vertical lines containing the outer points of the Godet pulleys **5'**.

A channel **30** extending along the machine as a prolongation of the bottom of protective panel **4''** and also covered with a material resistant to the action of the chemical agents, is positioned below pulleys **24** and **5'** to receive the liquid flowing from the nozzles **21** of the processing pipes **8**. Above each one of the oscillating funnels **25**, there are one or more cocks or faucets **28** fed by pipelines **16'** which extend behind the panels **4'''** and which are connected to treatment liquid feed tanks, not shown. Faucets **28** discharge said liquids to the oscillating funnels.

Process of operation.—The operation of the machine requires one or several operators on the upper floor where the upper spinning section of the machine is in-

stalled, and one or several operators on the lower floor where the lower collecting section is located. Because of the simplicity of operation, each operator can attend a large number of spinning or collecting units.

At the beginning of the operation, the operators start the mechanical devices 31, 31', 32 which drive the Godet pulleys, the feed pumps, the oscillating funnels and spinning buckets or centrifuges. Before putting a particular spinning unit in operation, an operator of the upper section first places the associated master valve 19, FIG. 3 (or circuit breaker), which operates the control valves together with the separator or diameter reducing valves, in starting position. In this position, all the separator valves 11 are open to their maximum diameter so that the diameter of the processing pipe sections 8, 8', and 8'' is generally the same throughout its length, and the valves 18, controlling the circulation of the treatment liquids, are closed. The operator then opens the associated faucet 9, and a vein or current of liquid flows through the length of the processing tube and discharges to canal 30. Next the operator connects the associated feed pump 6, pivoting it upon its support to mesh with the pinion 31'' in the drive mechanism 31', and the instant the viscose begins to flow through the spinneret, he lowers the candle filter 7 so that the spinneret 34 is introduced into the coagulating bath 3. Then the operator seizes, with his left hand, the semicoagulated viscose at the surface of the spinneret and pulls it toward hook 3'. At this moment, the filaments are formed and the operator passes them through hook 3' and over Godet pulley 5 from which they fall by their own weight forming a tow, or thread, to the inlet funnel of the processing pipe section 8.

The filament tow is carried along by the liquid current flowing through the entire length of the processing pipe, and is discharged through the nozzle 21 at the tip of the flexible tube 8''. At this moment, the operator at the lower section of the machine seizes the nozzle 21 with his left hand, and by bending the flexible part of the tube 8'', places the nozzle directly in the vertical line of one of the two oscillating funnels 25 associated therewith. The filament tow is carried along by the liquid stream, taken into the oscillating funnel and is immediately taken by the corresponding centrifuge 23. The operator, with his right hand, passes the filament tow under the idler pulley 24 and over the Godet pulley 5', whereby a certain tension is applied to the filaments.

This tension is observed by the operator of the upper section who immediately closes the associated master valve 19 which operates all the associated valves to the position of normal operation, in which the diameters of the separator valves 11 are reduced to one millimeter or less and all the valves 18, controlling the treatment liquid, are opened to circulate the various liquids in the different sections 8, 8', 8'' of the processing pipe.

The tow or thread may require a greater number of treatments than is possible to give it inside the various sections of the pipe 8, 8', 8'' and, accordingly, the present invention provides means to give the thread one or several additional treatments. The first additional treatment is given simultaneously with the passage of the thread through the oscillating funnel 25 and its collection in the centrifuge 23; the operator of the lower section opens one of the faucets 28, which discharges liquid upon the oscillating funnel, and at the same time he places the flexible outlet tube 27 from the centrifuge trough 22 over the corresponding channel 29 for collecting the liquid. This treatment is prolonged throughout the time required to fill the centrifuge, which time varies between fifteen and sixty minutes according to the thickness of the thread manufactured.

Once this period of time has elapsed and a skein or cake of from fifteen to twenty millimeters in thickness is in the centrifuge, the operator of the lower section changes the collection of the thread to the other associated centrifuge of the unit. This is done by placing the nozzle 21 vertically over the other oscillating funnel 25 and breaking the filament tow so that it may be inserted in this funnel and taken by the second centrifuge. The corresponding faucet 28 is opened to continue the first additional treatment in the second centrifuge. This treatment therefore can be made in addition to the treatments given in the various sections 8, 8', 8'' of the processing pipe without interrupting in any manner the production and treatments of filaments in the upper sections of the machine.

Now the thread accumulated in the first centrifuge in which the operation was started, may still be given one or several more additional treatments. To this purpose the operator opens for a few minutes, one after another, each one of the faucets 28 located above the corresponding centrifuge, and simultaneously moves the discharge pipe 27 to positions over corresponding canals 29, so as to separately collect the liquid from each treatment for pumping to its corresponding feed tank. The centrifugal force within the centrifuge forces the treatment liquids to pass through the thickness of the collected cake for its entire height, aided by the oscillatory movement of the funnel. By adding additional faucets 28 over each centrifuge and additional drain channels 29, still more treatments may be given the thread. After finishing the additional treatments, the operator stops the first centrifuge with a piece of cloth, uncovers it and takes out the now completely treated skein which, after drying, is ready to be used in the textile industry or in the manufacture of rayon tire cord.

The operator leaves the first centrifuge empty, covered, rotating at its normal speed, and ready to again receive the thread when the second centrifuge has been filled. At such time, the operator at the lower level, without interrupting even for a moment the production of filaments in the upper section or the treatments in the processing pipe sections 8, 8', 8'', may change the thread to be again collected in the first centrifuge. The operation is continued without interruption, changing the centrifuge at predetermined intervals of time, according to the thickness of the thread being manufactured.

Although a certain specific embodiment of the invention has been shown and described, it is obvious that many modifications thereto are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claim.

I claim:

Apparatus for the continuous spinning and treatment of a synthetic thread such as viscose, comprising means for uninterruptedly forming thread, at least two collecting units for treated thread disposed below said thread forming means, and continuous treatment means interconnecting the thread forming means and said units whereby the thread is formed, treated and collected substantially without interruption and in a continuous, sequential fashion, said treatment means comprising a vertically disposed pipe defining a lengthy, continuous tubular passage, a plurality of sealed tubular chambers interposed at spaced points within said pipe, each chamber having an inner resilient tube adapted for constriction and expansion upon variation of pressure within each chamber to divide said pipe into a plurality of substantially isolated sections, conduit means including a pressure responsive control valve for circulating different treatment fluid within each of said pipe sections between adjacent members, and pressure means for simultaneously controlling said control valve and said resilient tubes so that said control valve is open when the tubes are constricted and vice versa, and means for flowing fluid the full length of said pipe when said resilient tubes are expanded to initially feed thread from said thread forming means to one of said collection units, said collection units being separately usable to obviate interruption of

the thread forming and treatment processes when one collection unit becomes full of treated thread.

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