Jan. 16, 1951 R. W. STANLEY 2,538,283

APPARATUS FOR SPINNING ARTIFICIAL FILAMENTS

Filed Aug. 14, 1946

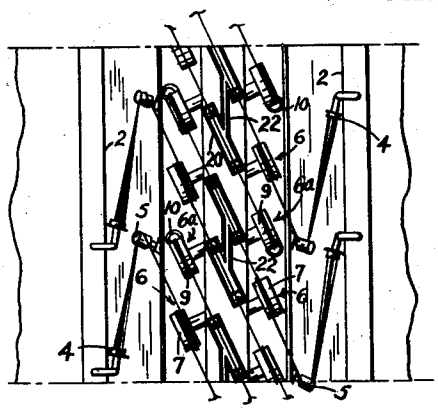


Fig. 3

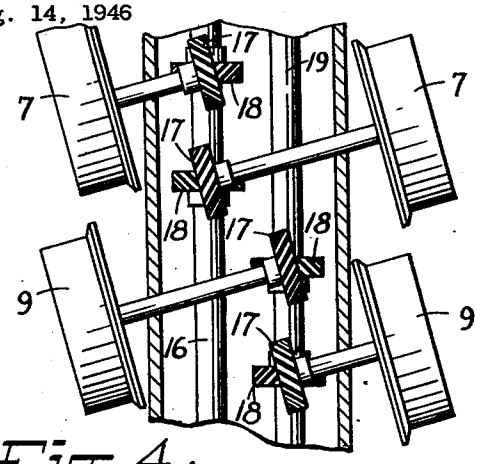


Fig. 4

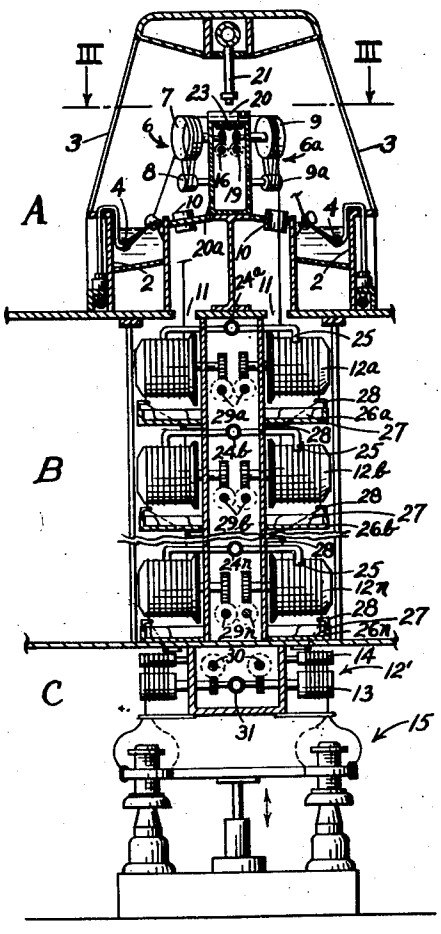


Fig. 1

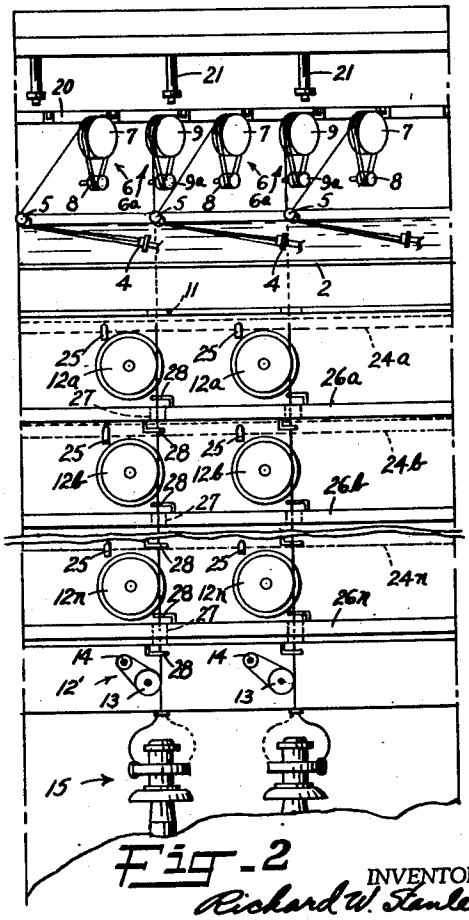


Fig. 2

INVENTOR.
Richard W. Stanley

BY

Carl A. Castellan
ATTORNEY.

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APPARATUS FOR SPINNING ARTIFICIAL FILAMENTS

Richard W. Stanley, Drexel Hill, Pa., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

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14 Claims. (Cl. 18—8)

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This invention relates to improved apparatus for spinning artificial filaments and is particularly concerned with apparatus of the type which may be used for continuously spinning, stretching, after-treating with liquids to wash, bleach, lubricate, etc., drying and collecting filaments. This application is a continuation in part of my application Serial No. 530,681, filed April 18, 1944, now abandoned.

Many arrangements of the various devices needed for continuously spinning, stretching, treating, drying, and collecting have been heretofore proposed but they are generally characterized by one or more disadvantages, such as requiring an inordinate amount of floor space; inefficient use of treating liquids, and especially of the coagulating liquid, inconvenient disposition of the various devices which may need the attention of the operators, and so on.

It is an object of the present invention to provide an improved continuous spinning machine in which the various operations are performed in a highly efficient manner with respect to the utilization of space, liquids and labor. Other objects and advantages will be apparent from the drawing and the description thereof hereinafter.

In the drawing,

Figure 1 is a transverse cross-section of a machine embodying the invention,

Figure 2 is a front elevation thereof, partially in cross-section,

Figure 3 is a plan view thereof, and

Figure 4 is a plan view of certain of the driving connections.

As illustrated, the machine occupies three working decks or floor levels designated A, B and C from top to bottom, though two or more such decks may be used instead. In general, the spinning and stretching is performed on the top deck A, liquid-treatment is performed on the middle deck B and drying and collecting is accomplished on the lowermost deck C. This division of operations is the most preferable, but it is to be understood that it is capable of some variation. Thus the drying may be shifted to the middle deck B or one or more of the liquid treatments may be performed on the lowest deck C. In special instances where only one or two liquid treatments are desired or necessary for a particular type of yarn, it is possible to combine the sections of the machine shown in decks B and C in the drawing into a single deck.

In accordance with the general aspects of the invention, the spinning machine comprises two

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working faces throughout all sections thereof. In order to economize space and at the same time provide efficient operation and convenience to the operators, each of the multiple-filament threads formed in the spinning bath on one side of the machine passes above the bath through one of a plurality of substantially parallel horizontal paths crossing an intermediate vertical plane of the machine at an acute angle, preferably less than 45°, then descends substantially vertically in a zone between the central plane and the other working face to the liquid treating, drying and collecting devices which are arranged in substantially direct vertical super-position. The travel of the filaments is controlled by thread-advancing devices disposed at each end of the horizontal path and projecting substantially at right angles to the vertical plane containing the path so that special auxiliary guides are unnecessary to direct the filaments to and from the thread-advancing devices. Advantageously, the filaments may pass through a liquid treating bath as they travel across the intermediate plane of the machine, thereby reducing the number of subsequent treating stages and devices. In the latter case, adequate liquid treatment is obtained even at high speeds because of the long path taken by the thread in its path directed across the machine at an acute angle; thus the machine is adapted to high speed spinning of high tenacity filaments without requiring an increase in machine width beyond that which is convenient and efficient to tend. In a preferred but more specific embodiment, each working face is provided with a spinning bath and the filaments formed in one spinning bath cross over to the other side of the machine in horizontal paths which alternate with, are substantially parallel to, and lie in approximately the same plane as that which contains the paths of the filaments proceeding from the bath on the other side, all of the paths crossing the central vertical plane of the machine at an acute angle, preferably less than 45°, and then the filaments descend substantially vertically to the after-treating section on the side of the machine other than that from which they originated.

Other relationships between the various parts of the machine which co-operate to provide an exceptionally efficient continuous machine will appear in the more specific description hereinafter.

In the preferred embodiment shown, the spinning deck A comprises two spinning bath troughs 2 each of which extends the length of the ma-

chine and is accessible to the operators working on its respective side of the machine. The working faces of the machine may be provided with sash 3 to hinder the escape of vapors and gases to the atmosphere about the machine. Spinnerets 4 are arranged in the bath so that the filaments pass therethrough at an acute angle, preferably about 10° to 20°, to the length of the machine, and proceed around the guides 5, each of which is preferably rotatably mounted with its axis substantially perpendicular to the plane containing both the approaching and departing courses of the filaments with respect thereto, from which they proceed upwardly to and around the thread-advancing devices 6 carried by the supporting means 20*a* extending the length of the machine in the region intermediate of the two working faces and back of the trough 2. The devices 6 which may comprise simply the godets 7 and rotatable guides 8 canted with respect thereto, are disposed in the region extending between the working face and the supporting means above the trough 2, and they may partially or even completely overhang the trough 2, though as specifically shown, they are disposed laterally offset from a position directly above the trough and away from the adjacent working face.

From the devices 6, the threads proceed to similar thread-advancing devices 6*a* carried on the other side of the supporting means preferably at approximately the same level as the devices 6 but offset longitudinally of the machine from the respective devices 6 from which the respective threads proceed so that the paths of the threads between devices 6 and 6*a* make an acute angle to a vertical plane extending longitudinally of the machine. The devices 6*a* comprise godets 9 and the rotatable rollers 9*a* canted with respect thereto from which they descend substantially vertically through suitable passages 10 provided in the frame and through suitable passages 11 provided in the floor to the liquid treatment deck B. It will be noted that the courses taken by each thread from its respective guide 5 to its device 6, from its device 6 to the device comprising godet 9 and roller 9*a* and then downwardly therefrom, lie either substantially in a single plane or in a plurality of planes which are substantially parallel to one another. As shown, each pair of thread-advancing devices (that is, 6 and 6*a*) associated with a given thread are disposed so that they project in opposite directions but substantially at right angles to the vertical plane containing the path of the thread therebetween. As a result of these relationships as well as that established between the guide 5 and the courses of thread approaching and departing therefrom, the thread is substantially free of any tendency to slide axially of the periphery of the several guides and godets as it is withdrawn therefrom.

The arrangement in deck A facilitates lacing which may be accomplished by having one operator on one side of the machine to lace up the thread-advancing devices 6 and another to receive the thread from the first and to lace up the devices 6*a*. Since the devices extend from the supporting frame 20*a* in opposite directions, the travel of the thread in a helical path about the devices 6 and 6*a* is always from the supported end to the free end of the thread-advancing devices when they are cantilever as shown and always toward the operator who tends the particular row of devices. When both sides of the machine are provided with a coagulating trough and spinnerets, the operators may work together even more efficiently by lacing up adjacent units, both operators taking threads from a spinneret and after lacing the respective guides 5 and devices 6, exchanging the leading ends of the threads and the lacing up device 6*a*.

In deck B, each of the threads proceeds over one, or in succession over a plurality of, thread-advancing, thread-storage devices which are represented as the thread-advancing reels 12*a*, 12*b*, . . . 12*n* on each of which the thread is subjected to a different liquid treatment. As the threads are discharged from deck B, they proceed substantially vertically downwardly through suitable passages through the floor and/or frame of the machine to the deck C in which each thread proceeds about a thread-advancing device 12' which may comprise the steam-heated, driven drum 13 and the rotatable idler 14 canted with respect thereto. From its respective drier, each thread then proceeds to any suitable collecting device 15, shown specifically as a ring twisting device. Any other type of twister is used, such as a cap twister, spinning bucket, and the like, or the threads may be collected by simply winding without twisting.

With reference again to deck A, and in particular to Figure 4, the godets 7 on both sides of the machine are driven by a common shaft 16 running the length of the machine and gears 17 and 18 while the godets 9 are driven by a similar shaft 19 by similar gears 17 and 18. The shafts 16 and 19 may be driven at the same speed or at different speeds. By driving godets 9 at higher speed than godets 7, the threads may be stretched as they pass therebetween. This driving means is enclosed and protected in the housing or supporting frame 20*a*.

A plurality of troughs 20 carried on the supporting frame 20*a* may be arranged at an acute angle to the central plane of the machine to correspond to the direction of travel of the threads. These may be fed by the nozzles 21 arranged above the channels 22 which connect alternate pairs of adjacent troughs 20. The troughs 20 are provided at each of their ends with overflow boxes which are connected to the common drain line 23 and the end walls of which are slotted from the top to permit passage of the threads entering and leaving the troughs without permitting the liquid in the trough to flow over the machine.

A plurality of supply lines 24*a*, 24*b*, . . . and 24*n* supply the several liquids to the liquid-treating devices 12*a*, 12*b*, . . . and 12*n* respectively, nozzles 25 being connected thereto by branch lines. Troughs 26*a*, 26*b*, . . . 26*n* are positioned below the devices 12*a*, 12*b*, and 12*n* to collect the liquids which drain therefrom which may then be recirculated. These troughs may be notched at 27 to permit the thread being discharged from one of the devices 12 to pass down to the next device below, suitable guides 28 being provided, where necessary, to control the disposition of the thread on the devices between which the transfer occurs.

Suitable pairs of drive shafts 29*a*, 29*b*, . . . 29*n* running the length of the machine are provided to drive the devices 12. The pair of shafts 30 serve to drive the drums 13 through hollow stub shafts which may be supplied with steam from the steam header 31.

Numerous advantages are obtained by the arrangement constituting the continuous spinning machine of this invention. When it is desired to stretch the filaments shortly after their

withdrawal from the spinning bath, this stretching is greatly facilitated by passing the filaments while they are subjected to the stretching tension through a liquid bath, such as a plasticizing bath of hot water, hot dilute acid, or the like, in the horizontal portion of their travel. The use of a horizontal bath at this stage provides efficient use of the treating liquid without sloppiness.

The direction of the filaments as they cross over through their horizontal paths at an acute angle to the central plane of the machine provides a great saving of space and places the various devices within easy reach of the operators. This also makes it possible to use a long immersion stretch bath and still have everything within easy reach of the operators. The machine may be used for wet spinning cuprammonium cellulose, cellulose esters, vinyl resins, and the like but is particularly valuable for the spinning of viscose.

By directing the threads from opposite sides of the machine in parallel paths across the central plane at an acute angle so that those from one side alternate with those from the other side, it is possible to use narrow spinning baths and obtain long immersion therein, such as by guiding the threads at an acute angle to the length of the machine, thereby avoiding extreme width in the machine resulting from the use of wide spinning baths. Again, this same arrangement of the spinning section or deck makes it possible to make a maximum use of the space and supporting framework needed by the other sections of the machine, such as the liquid-treating, drying, and collecting sections thereof without inordinate width or excessive crowding in the spinning section.

While preferred embodiments of the invention have been disclosed, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and being disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets in the troughs, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated.

2. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and being disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets in the troughs, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets and directing them in said

region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated, and generally horizontal trough means arranged to receive the threads as they are directed through said substantially horizontal paths.

3. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and being disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets in the troughs, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle of less than 45°, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated, and generally horizontal trough means arranged to receive the threads as they are directed through said substantially horizontal paths.

4. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and being disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets in the troughs, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads substantially vertically downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated; an after-treatment section having two working faces and comprising a plurality of vertically superposed thread-advancing devices arranged below the spinning section to receive the threads discharged from the spinning section; a collecting section having two working faces and arranged substantially directly below the after-treatment section; the several threads passing through the devices on the lateral face of the after-treating and collecting sections opposite to the lateral face of the spinning section containing the trough from which the threads originated.

5. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two narrow troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced

apart and disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets disposed in the troughs, means adjacent the troughs and spaced longitudinally thereof from the spinnerets therein for guiding the threads issuing from the spinnerets at an acute angle to the length of the machine, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets about said guide means and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated.

6. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two narrow troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart and disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets disposed in the troughs, means adjacent the troughs and spaced longitudinally thereof from the spinnerets therein for guiding the threads issuing from the spinnerets at an acute angle to the length of the machine, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets about said guide means and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated, and generally horizontal trough means arranged to receive the threads as they are directed through said substantially horizontal paths.

7. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two narrow troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart and disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets disposed in the troughs, means adjacent the troughs and spaced longitudinally thereof from the spinnerets therein for guiding the threads issuing from the spinnerets at an acute angle to the length of the machine, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets about said guide means and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated, and generally horizontal trough means arranged to receive the threads as they are directed through said substantially horizintal paths, said withdrawing and directing means comprising means for stretching the threads as they pass through the trough means.

8. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and being disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets in the troughs, means comprising two rows of thread-advancing devices disposed in the region above the level of the troughs and intermediate their outer walls for withdrawing the threads from the spinnerets and directing them in said region through substantially parallel horizontal paths crossing the central plane of the spinning section of the machine at an acute angle, said means being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated, and generally horizontal trough means arranged to receive the threads as they are directed through said substantially horizontal paths, said withdrawing and directing means comprising means for stretching the threads as they pass through the horizontal paths.

9. A machine for the continuous wet spinning and treating of artificial threads comprising a spinning section having two narrow troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and disposed adjacent the two lateral faces of the spinning section of the machine, spinnerets disposed in the troughs, means adjacent the troughs and spaced longitudinally thereof from the spinnerets therein for guiding the threads issuing from the spinnerets at an acute angle to the length of the machine, supporting means extending the length of the machine disposed in the region above and intermediate the outer walls of the two coagulating troughs, generally horizontal trough means carried by the supporting means; a plurality of thread-advancing devices arranged in said region on each side of the supporting means and adjacent the trough means carried thereby for drawing the threads from the spinnerets; additional thread-advancing devices in said region on each side of the supporting means and adjacent the trough means carried thereby for drawing the threads in substantially horizontal paths from the first-mentioned thread-advancing devices through the trough means, means for operating the second-mentioned thread-advancing devices at higher speed than the first so that the threads are stretched as they proceed through the trough means, the second-mentioned thread-advancing devices being arranged to discharge the several threads downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated.

10. A machine for the continuous wet spinning and treating of artificial threads compris-

ing a spinning section having two narrow troughs for receiving a coagulating liquid extending the length of the machine, being laterally spaced apart, and disposed adjacent the two lateral faces of the spinnnig section of the machine, spinnerets disposed in the troughs, means adjacent the troughs and spaced longitudinally thereof from the spinnerets therein for guiding the threads issuing from the spinnerets at an acute angle to the length of the machine, supporting means extending the length of the machine disposed in the region above and intermediate the outer walls of the two coagulating troughs, generally horizontal trough means carried by the supporting means; a plurality of thread-advancing devices arranged in said region on each side of the supporting means and adjacent the trough means carried thereby for drawing the threads from the spinnerets; additional thread-advancing devices in said region on each side of the supporting means and adjacent the trough means carried thereby for drawing the threads in substantially horizontal paths from the first-mentioned thread-advancing devices through the trough means, means for operating the second-mentioned thread-advancing devices at higher speed than the first so that the threads are stretched as they proceed through the trough means, the second-mentioned thread-advancing devices being arranged to discharge the several threads substantially vertically downwardly through a zone of the spinning section between the central plane thereof and the spinning bath trough on the lateral face of the machine other than that of the spinnerets from which the threads originated; an after-treatment section having two working faces and comprising a plurality of vertically superposed thread-advancing devices arranged below the spinning section to receive the threads discharged from the spinning section; a collecting section having two working faces and arranged substantially directly below the after-treatment section; the several threads passing through the devices on the lateral face of the after-treating and collecting sections opposite to the lateral face of the spinning section containing the trough from which the threads originated.

11. A machine having two working faces for continuously producing artificial thread comprising a housing extending throughout the length of the machine intermediate of the working faces thereof, a plurality of spinnerets spaced at intervals along one working face of the machine, means for applying a coagulating liquid to the spinnerets, a plurality of thread-handling devices mounted on one side of the housing and projecting therefrom toward the first-mentioned working face of the machine for withdrawing the threads upwardly from the spinnerets to a level above the housing, means in the housing for driving at least some of the devices, a plurality of thread-advancing devices mounted on the housing and projecting from the other side of the housing toward the other working face of the machine, means in the housing for driving the thread-advancing devices to advance thread from their ends near the housing to their ends away from the housing, and trough means supported on top of the housing for applying a liquid to the threads as they pass from the thread-handling devices to the thread-advancing devices.

12. A machine for the continuous wet spinning of artificial threads comprising an upper and a lower section; the upper section having two working faces for continuously producing artificial thread comprising a housing extending throughout the length of the machine intermediate of the working faces thereof, a plurality of spinnerets spaced at intervals along one working face of the machine, means for applying a coagulating liquid to the spinnerets, a plurality of thread-handling devices mounted on one side of the housing and projecting therefrom toward the first-mentioned working face of the machine for withdrawing the threads upwardly from the spinnerets to a level above the housing, means in the housing for driving at least some of the devices, a plurality of thread-advancing devices mounted on the housing and projecting from the other side of the housing toward the other working face of the machine, means in the housing for driving the thread-advancing devices to advance thread from their ends near the housing to their ends away from the housing, said thread-advancing devices being arranged to discharge the thread directly downwardly therefrom to the lower section, and trough means supported on top of the housing for applying a liquid to the threads as they pass from the thread-handling devices to the thread-advancing devices.

13. A machine having two working faces for continuously producing artificial thread comprising a housing extending throughout the length of the machine intermediate of the working faces thereof, a spinning bath compartment extending longitudinally of the machine adjacent one working face thereof, a plurality of spinnerets in the bath compartment spaced at intervals along one working face of the machine, a plurality of thread-handling devices mounted on one side of the housing and projecting therefrom toward the first-mentioned working face of the machine for withdrawing the threads upwardly from the spinnerets to a level above the housing, each of said devices being disposed above the bath on a horizontal axis inclined obliquely to the length of the machine and perpendicular to a plane including the course of filaments extending between the spinneret and the device and to a plane including the course of the filaments ultimately discharged from said device, means in the housing for driving at least some of the devices, a plurality of thread-advancing devices mounted on the housing and projecting from the other side of the housing toward the other working face of the machine on horizontal axes parallel to those of the thread-handling devices, each thread-advancing device being spaced from a corresponding thread-handling device in a direction longitudinally of the machine and said thread-advancing device having a thread-receiving portion directly opposite the thread-discharging portion of the corresponding thread-handling device, such portions lying in a common horizontal plane and in a common vertical plane at right angles to the axes of the corresponding devices, and means in the housing for driving the thread-advancing devices to advance thread from their ends near the housing to their ends away from the housing.

14. The machine of claim 13 in which the upper level of the thread-handling devices is at a level higher than the housing and is at sub-

stantially the same height as the upper level of the thread-advancing devices.

RICHARD W. STANLEY.

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