

July 3, 1934.

E. J. ABBOTT

1,964,715

STRAND MANIPULATING MECHANISM

Filed Jan. 15, 1931

11 Sheets-Sheet 1

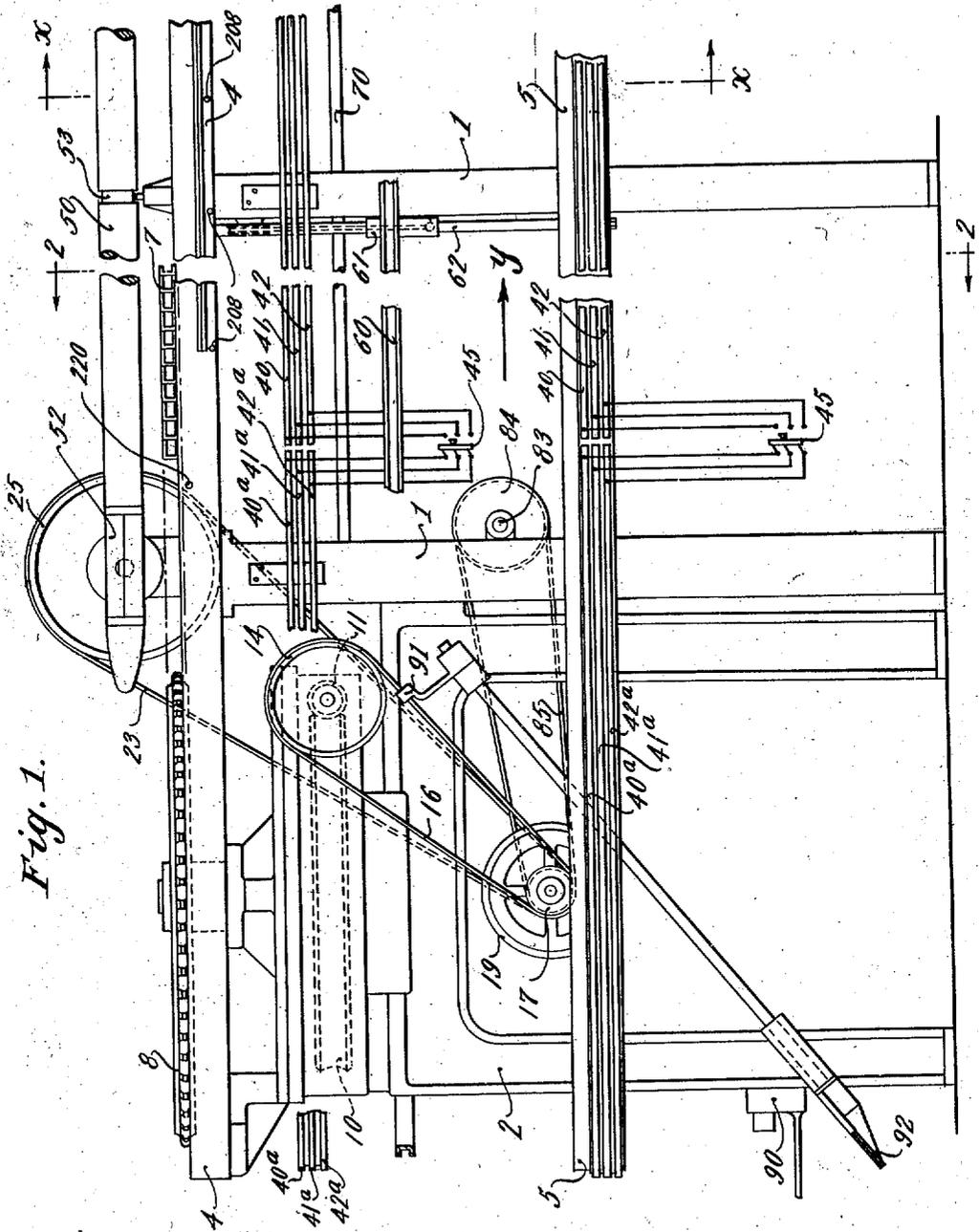


Fig. 1.

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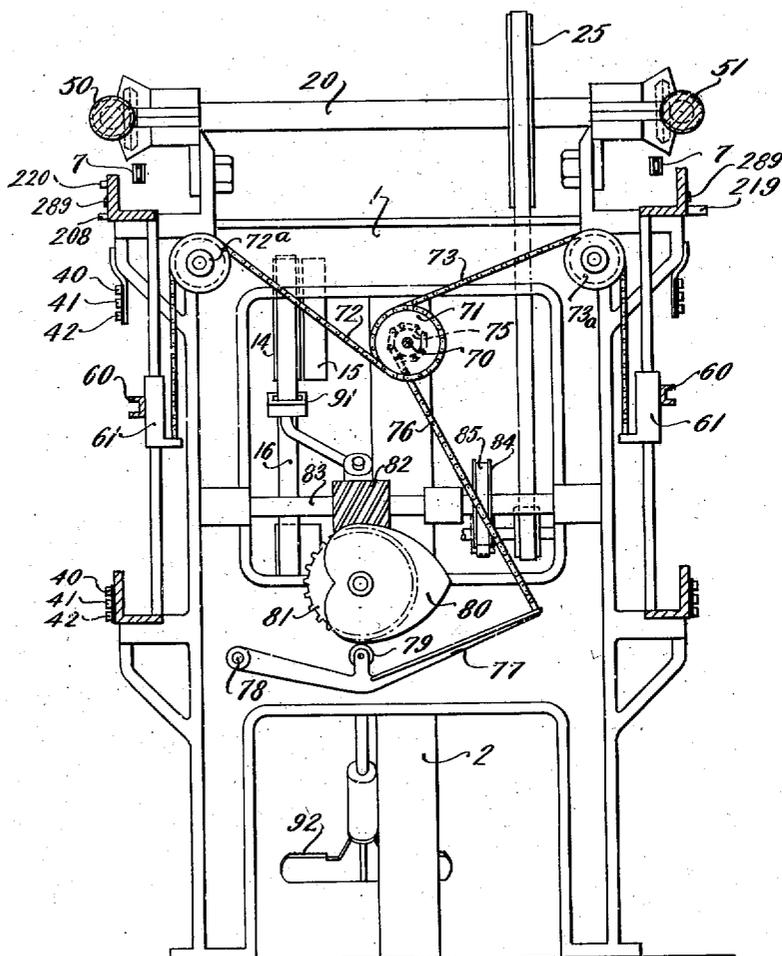
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STRAND MANIPULATING MECHANISM

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11 Sheets-Sheet 2.

Fig. 2.



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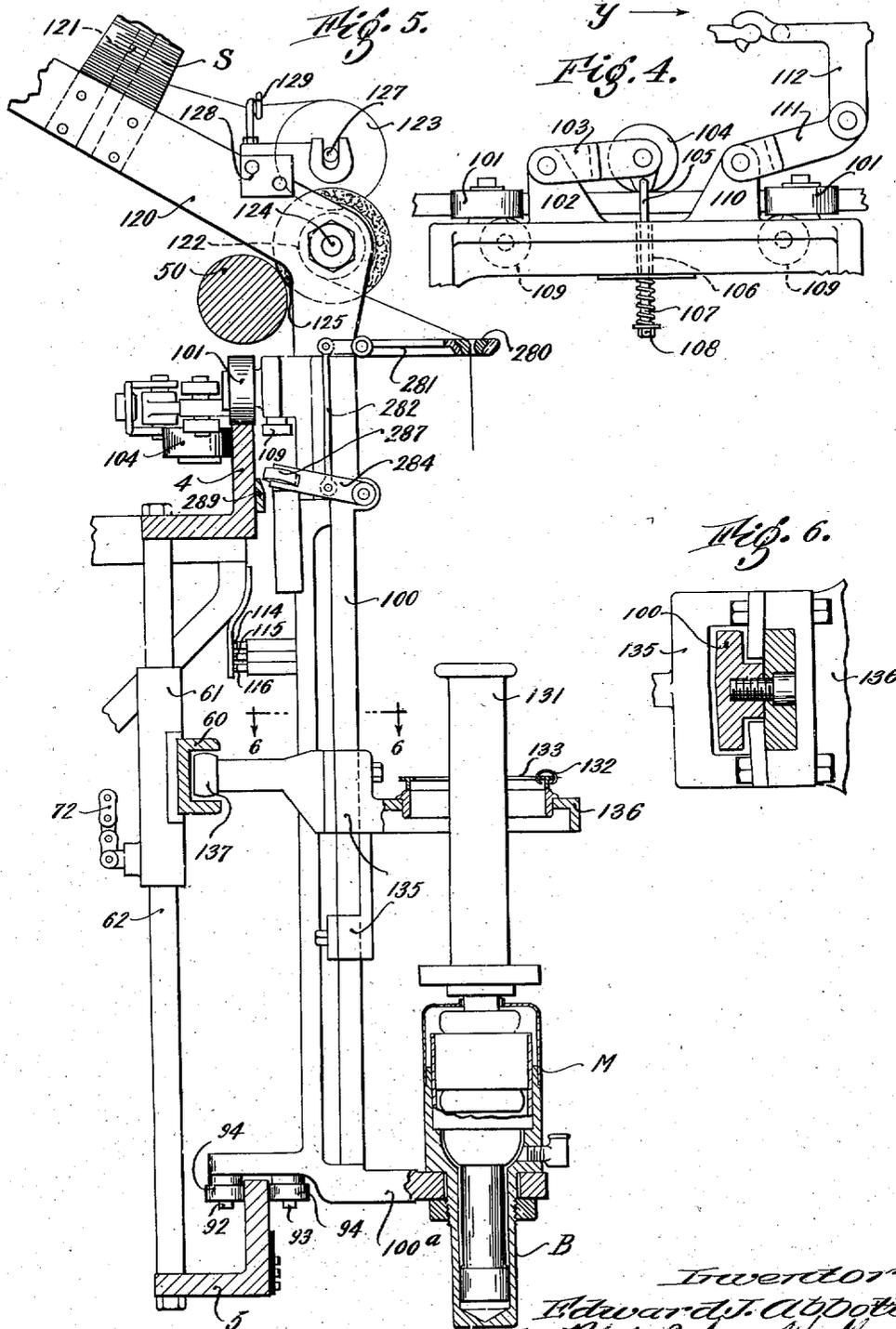
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STRAND MANIPULATING MECHANISM

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11 Sheets-Sheet 4



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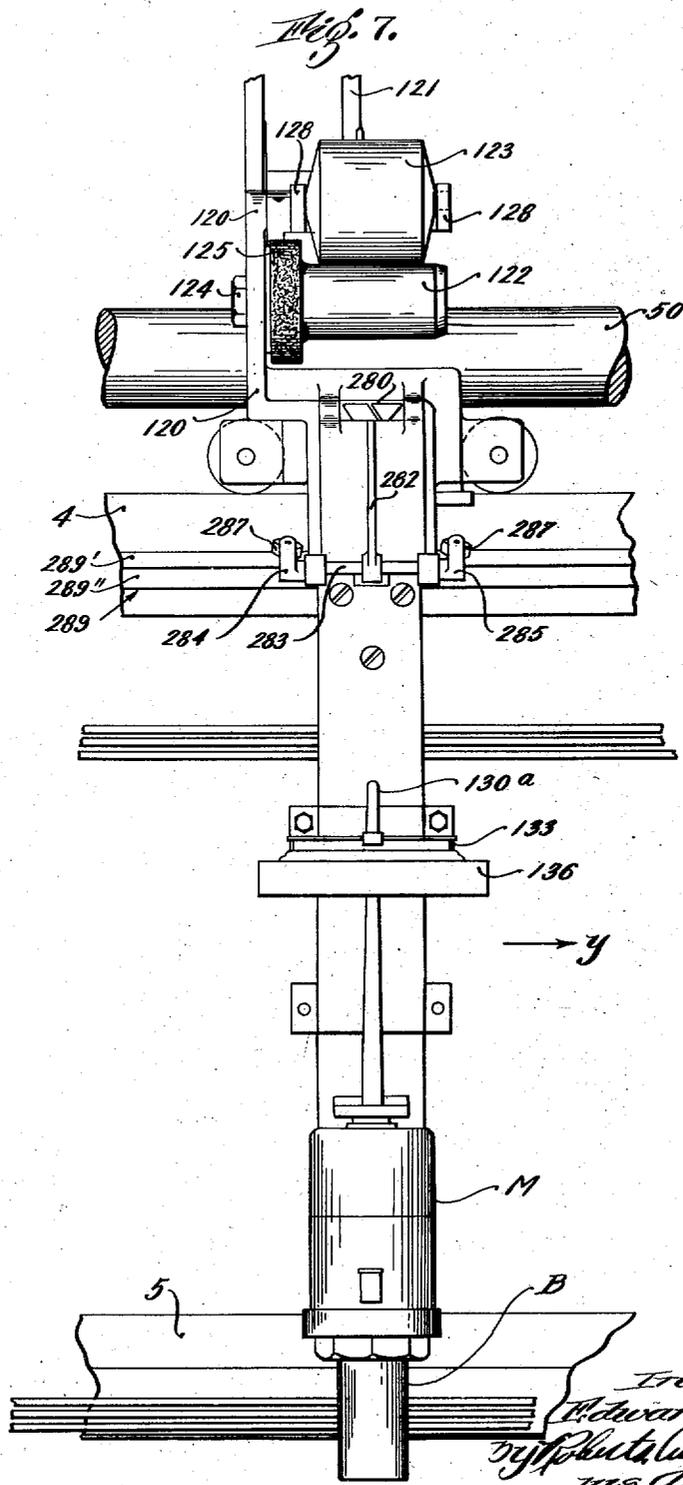
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STRAND MANIPULATING MECHANISM

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11 Sheets-Sheet 5



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STRAND MANIPULATING MECHANISM

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Fig. 8.

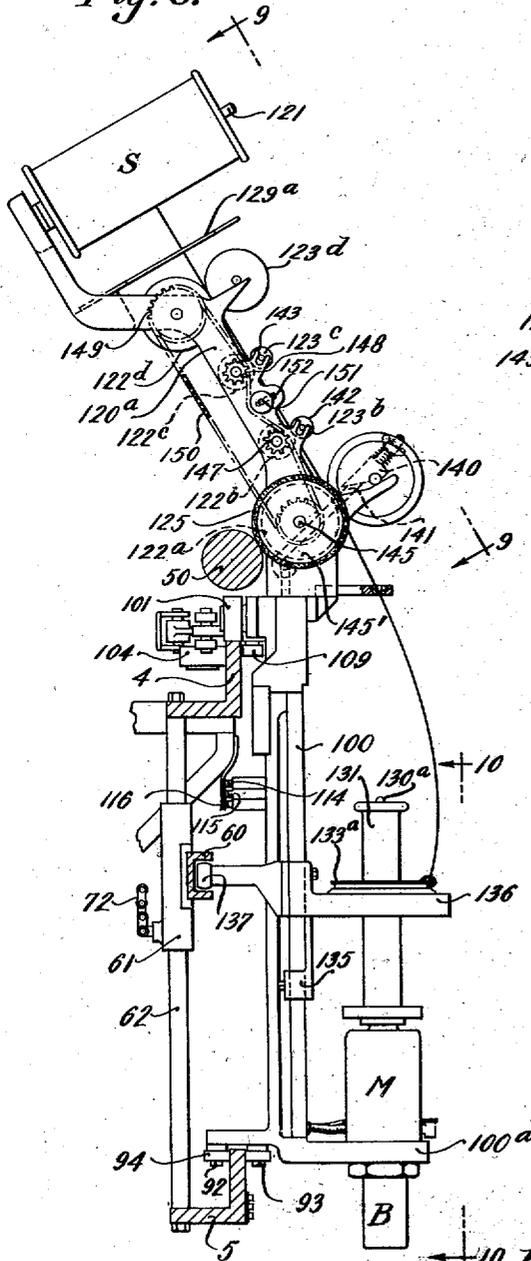


Fig. 9.

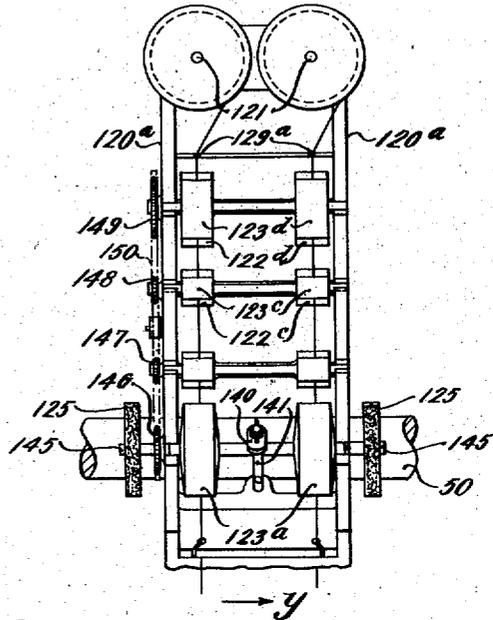
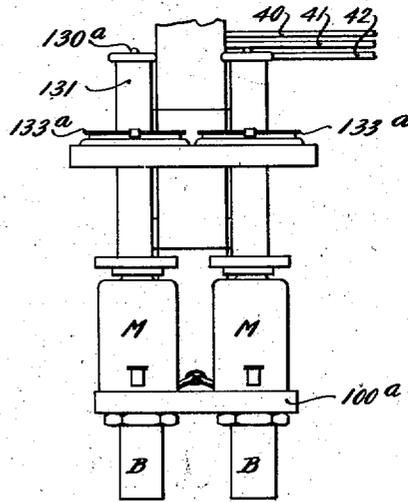


Fig. 10.



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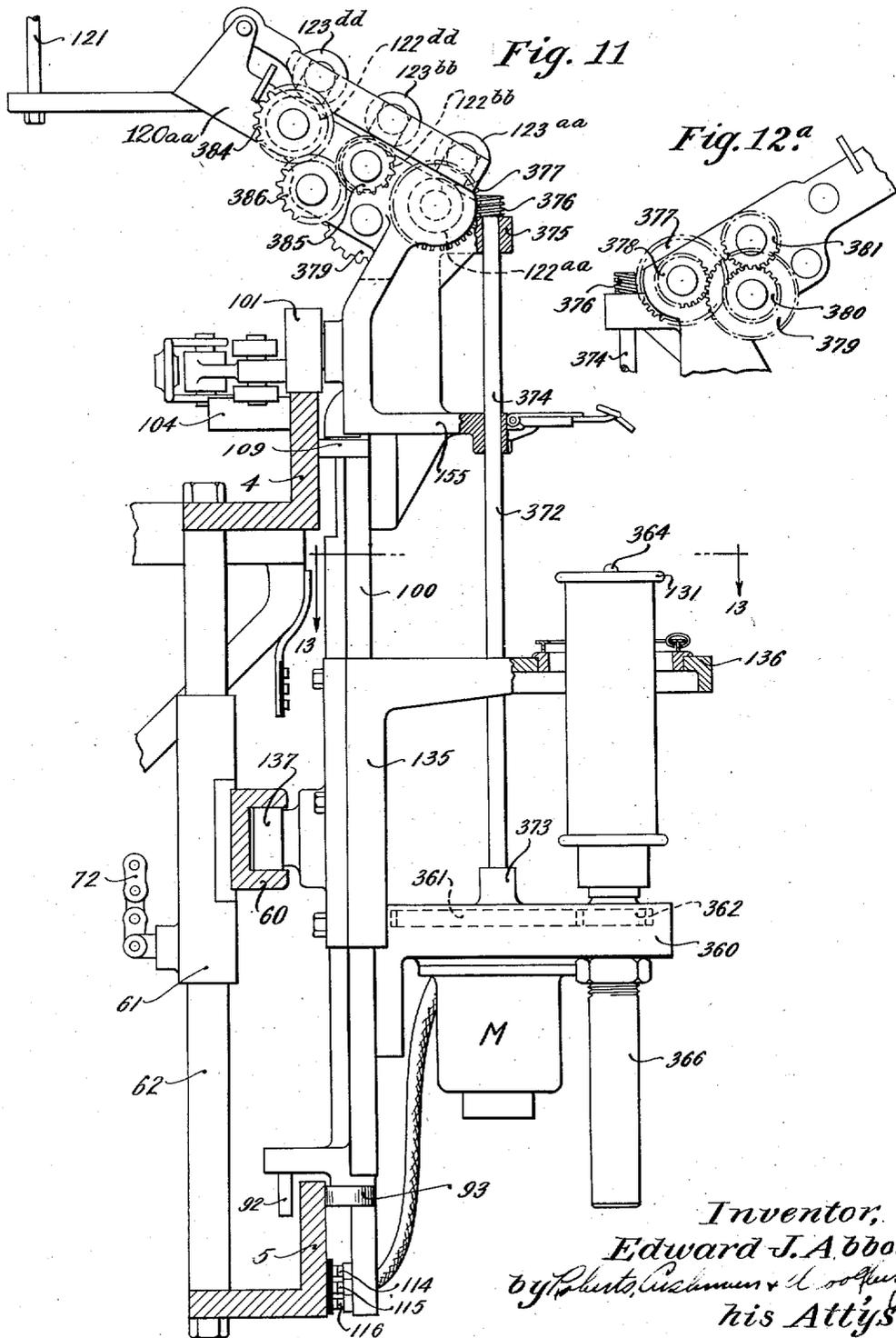
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STRAND MANIPULATING MECHANISM

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11 Sheets-Sheet 7



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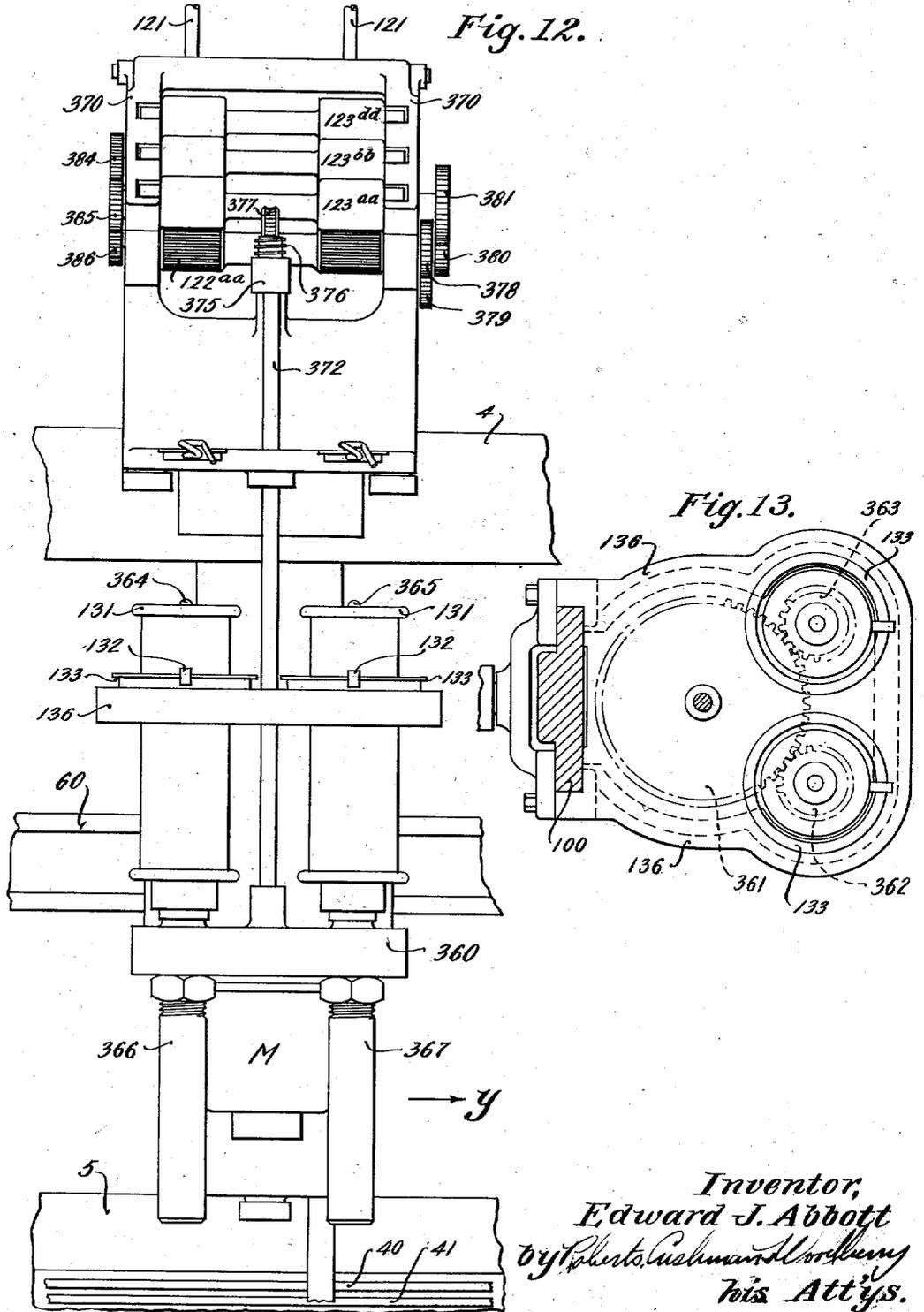
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STRAND MANIPULATING MECHANISM

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11 Sheets-Sheet 8



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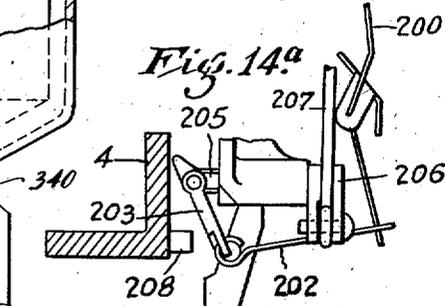
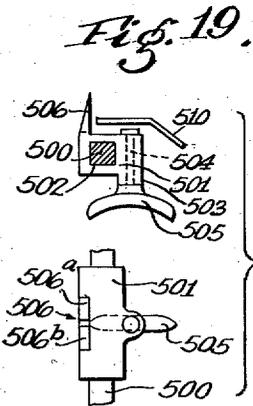
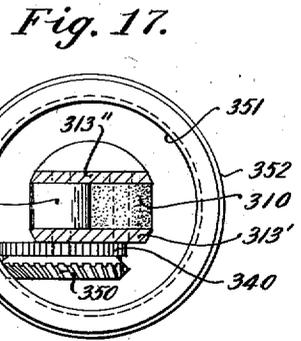
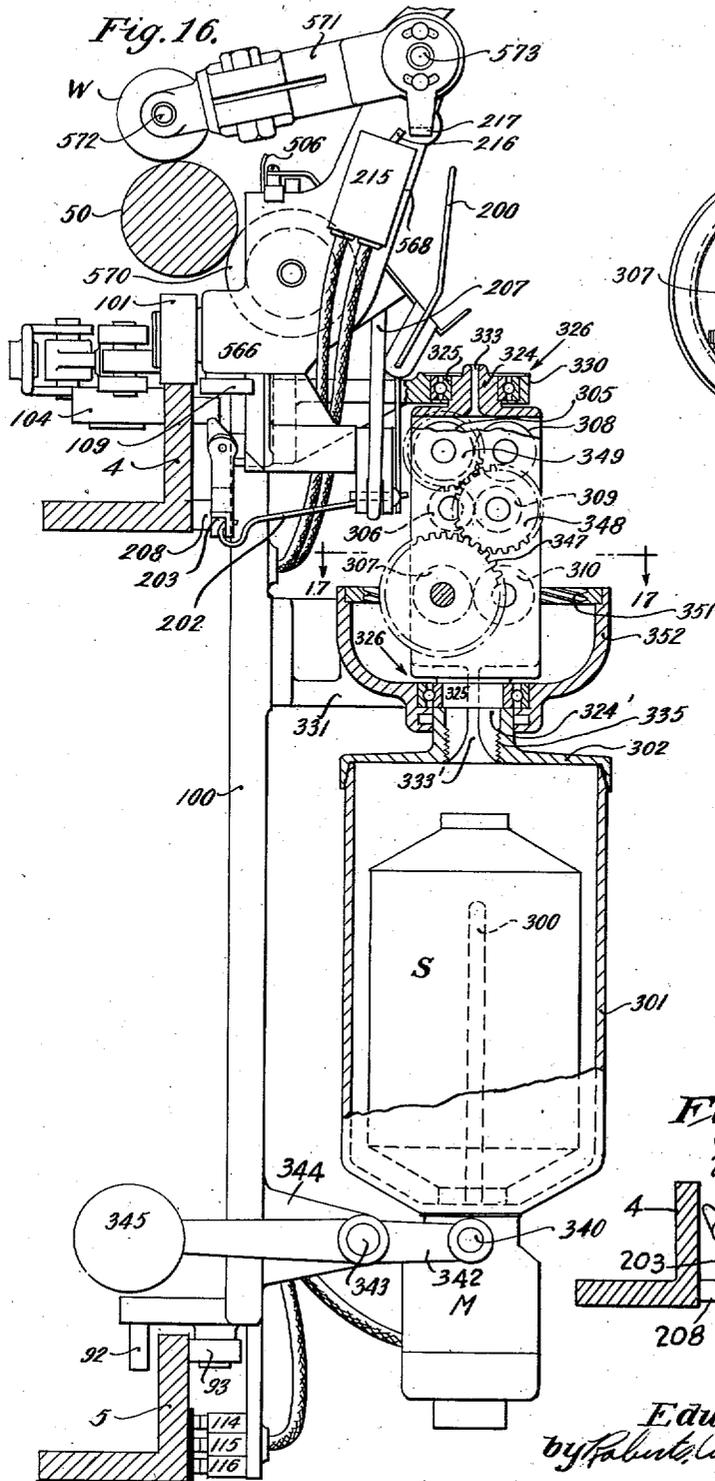
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STRAND MANIPULATING MECHANISM

Filed Jan. 15, 1931

11 Sheets-Sheet 10



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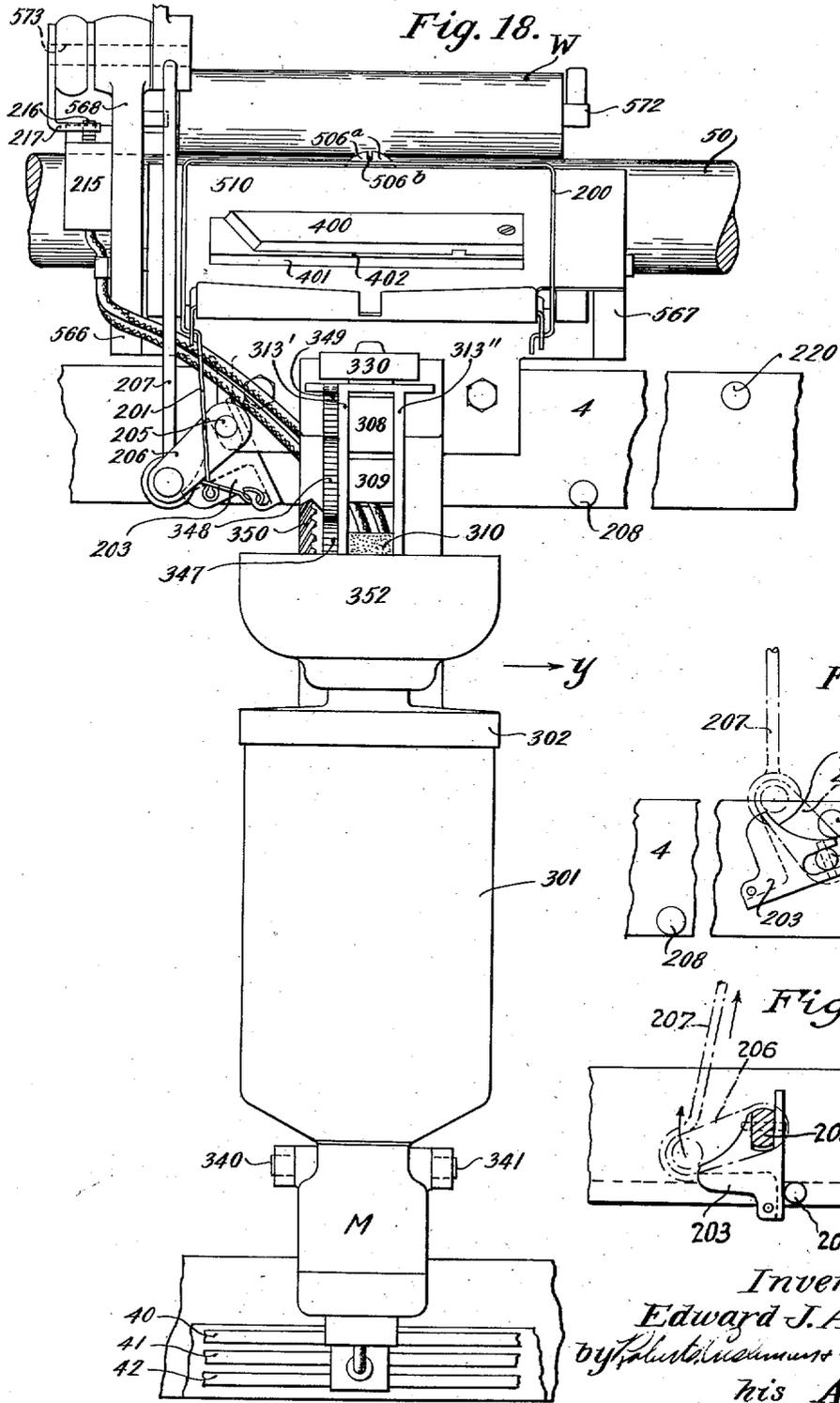
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STRAND MANIPULATING MECHANISM

Filed Jan. 15, 1931

11 Sheets-Sheet 11



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UNITED STATES PATENT OFFICE

1,964,715

STRAND-MANIPULATING MECHANISM

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Abbott Machine Company, Wilton, N. H., a corporation of New Hampshire

Application January 15, 1931, Serial No. 508,868

43 Claims. (Cl. 118—31)

This invention relates to textile machines and has for one of its objects to provide a machine including a plurality of unit spinning, twisting or drafting devices, and wherein the several spinning, twisting or drafting devices of the machine may be caused to circulate or otherwise move in a procession, to permit operations of replenishment, maintenance, cleaning, supervision or inspection to be performed in respect to the several devices at a given part of the path, a typical instance of one such operation being the piecing up of broken ends of yarn or other strand being manipulated. By attaining this object, among others, this invention obviates the necessity of much or all of the usual travel of an attendant, and transport by her of the supply and resulting strand packages, incident to the customary replenishment and supervision of present twisting, drafting and spinning machines. A subordinate object is to enable the twisting, drafting or spinning devices to operate during such circulatory motion, or during intervals between successive steps in such circulatory motion so that some of the circulatory units may be subjected to replenishment, cleaning, and/or other operations effected by an operator or automatic devices stationed at one part of the path of circulation concomitantly with the progress of the operations of drafting, spinning or twisting upon other units.

A further object of the invention is to provide for automatically effecting the stopping or starting, or both the stopping and starting, of the drafting, twisting or spinning devices at one or more predetermined points in the circulatory path of the devices for presenting the devices to an operator or to an automatic mechanism in convenient state for doffing, donning or other replenishment or supervisory operations.

Another object of the invention is to provide an improved textile machine capable of spinning or twisting a strand and producing in a single winding operation concomitantly with the spinning or twisting, a traverse-wound headless self-sustaining package or cheese constituted of overlapped layers of reversed quick-pitch spiral windings.

Another object of the invention is to provide improved organizations of driving and strand manipulating devices in textile and like machines having a multiplicity of strand-manipulating devices capable of circulatory travel. As exemplifying the improvements effected by this aspect of my invention, the high-speed driven element or elements of the units of circulatory spin-

ning or twisting machines, or the winding instrumentalities of the units of a circulatory winding machine are enabled by this invention to be driven, if desired, at rates independent of or different from each other, by a motor traveling with the unit in its circulatory path. In the case of all of these machines such improvement obviates the necessity of reliance upon adaptations of mechanical driving connections unsuited to the transmission of high-speed motion to circulatory units. My Letters Patent No. 1,609,639, December 10, 1920, discloses winding carriers driven by elongated tractor rolls extending along the guideway of a circulatory winding machine for the rewinding of a large number of yarn supply packages which may be circulated about the machine. Construction and maintenance of the patented mechanism is necessarily accurate and therefore expensive; otherwise defects of operation become limiting factors in the production of machines having more than a certain speed or more than a certain length. On the other hand by the invention explained herein, circulatory textile machines may be made of very great length and may be run at materially increased speeds. In the case of twisting or spinning machines wherein a rapid twisting or spinning motion is accompanied by a relatively slower winding or unwinding motion in respect to the strand or strands under treatment, this invention provides for effecting the twisting or spinning motion at high speed and for driving the winding or unwinding strand carriers at relatively slower winding or unwinding speeds, if desired by the employment of driving connections operated in different ways at different speeds.

My invention further provides competent mechanism for feeding one or more strands to a strand-manipulating or strand-using device capable of circulatory travel, and such mechanism may, and in some cases preferably does, include instrumentalities capable of drawing or elongating the strand preparatory to delivering it to the other strand-manipulating or strand-using device. According to this invention, the drawing devices and the spinning, twisting or winding devices are not necessarily dependent upon each other or upon a common drive device for their motions. The strand-drafting or feeding mechanism for example may be operated from one source, preferably an electric motor, movable with the drafting or feeding mechanism; whereas, the spinning, twisting or winding devices are operated from another source; in cases where the strand is drawn out or fed at a relatively slow rate, for example

the drafting or feeding mechanism may advantageously be operated by non-circulating mechanical connections such for example as the tractor rolls referred to above, and the spinning, twisting or winding devices may then be operated independently, for example by an electric motor.

A further object of the invention is to provide for the control of drive motors of traveling textile devices to effect stoppage of the motors severally upon the occurrence of abnormal conditions in the several strands being wound, unwound, twisted, spun, or drafted by the motors, such abnormal conditions including exhaustion or breakage of the strand or the presence of an imperfection, for example, a slub, therein.

Another object of the invention is to provide for controlling the individual motors of such a machine severally by the sizes of the strand packages wound or unwound by the operation of the motors. A further object is to provide for automatically restarting the motors of successive circulatory units following stoppage caused by the occurrence of abnormal conditions of the strands or by the attainment by the packages of predetermined sizes.

Another object of the invention is to provide for operating strand-manipulating units of a circulatory textile machine as the units progress about a curved end as well as along the straight sides of a guideway of the machine.

Another object of the invention is to provide improved driving connections for quick-traverse devices of the kind suitable to wind traverse-wound cheeses or Fiji packages during traveling motion in a machine, and to provide for the several control of the many traverse devices of such a machine by turning on and off motors while permitting the traverse devices during their periods of inaction to be connected to their driving motors.

My invention has for another of its objects to provide a novel form of spinning, twisting or drafting machine constituted of a plurality of individual interchangeable units independently supported by a main frame or guideway and individually removable therefrom without preventing operation of the other units of the machine. Further objects of my invention are to provide improved driving connections and improved detector and controlling devices applicable to strand-manipulating machines generally and particularly to strand-manipulating machines built according to the unit construction exemplified by the devices disclosed in this specification.

A further object of the invention is to provide if desired for the operation in synchronism of many of the corresponding parts of the several units of which the machine is constituted.

Other objects of invention, and features of advantage and novelty will be apparent from a consideration of the explanation in this specification and its drawings of typical illustrative embodiments of my invention.

For the purpose of adequately explaining the various phases of my invention, typical devices having therein various combinations of novel features are described and illustrated in this specification and its drawings. It will readily be understood by those skilled in the textile art that many features embodied in the specific machines illustrated and described herein are applicable to other commercial types or classes of strand-manipulating devices. For example, the drafting and strand-delivery devices of the spinning

machines illustrated herewith may be utilized for performing a drafting or delivery operation in respect to any suitable strand manipulating or using device, or may be used to perform a simple drafting operation on the strand. In like manner, the three twisting machines illustrated herewith show the inherent capability of sub-combinations of cooperating elements of the illustrated spinning machines to perform the essential functions of commercial twistors or doublers. Certain features relating to the driving of a winding package by means of a motor adapted to travel therewith are claimed in my copending divisional application on Winding machine, Serial No. 677,749, filed June 24, 1933.

For brevity of description, certain of the elements illustrated in certain of the figures of the drawings are herein explained by reference to similar elements which are described with particular reference to other figures of the drawings. In general corresponding reference characters are utilized to indicate corresponding parts in the various figures of the drawings, and corresponding parts in the several embodiments of the invention have in many instances been described specifically but once.

In the drawings:

Fig. 1 is a side elevation (with certain parts broken away) of one end of a framework defining a circulatory path of travel for the circulatory unit carriers of the machine, and equipped with driving connections suitable for the unit carriers of Figures 5, 6 and 7; Figs. 8, 9 and 10, Figs. 14, and 15, and Figs. 16, 17 and 18, the structure of Fig. 1 being suitable upon the removal of certain elements to operate in conjunction with the unit carriers of Figs. 11, 12 and 13, Figs. 19 and 20, and Figs. 22 and 23;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a plan view of the structure of Fig. 1;

Fig. 4 is a fragmentary view showing in plan a typical arrangement of connections for holding and moving the unit carriers in relation to the guideway of the machine;

Fig. 5 is a vertical section taken for example on the line $x-x$ of Fig. 1, illustrating a twister and its carrier in operative position in the machine;

Fig. 6 is a horizontal section on the line 6—6 of Fig. 5;

Fig. 7 is a side elevation of the mechanism of Fig. 5;

Fig. 8 is a vertical section similar to Fig. 5, illustrating a carrier having spinning mechanism thereon, this mechanism including many elements of the mechanism of Figs. 5, 6 and 7 and in addition thereto a strand-drafting device;

Fig. 9 is a side elevation of the drafting mechanism of Fig. 8, taken on the line 9—9 of Fig. 8;

Fig. 10 is a fragmentary side elevation of parts of the twisting and winding instrumentalities of the mechanism of Fig. 8;

Fig. 11 is a vertical section similar to Figs. 5 and 8, illustrating a similar unit carrier having spinning mechanism thereon, this mechanism including many of the features of the mechanism of Figs. 5 to 10, but being capable of operating without the tractor rolls of the machine, such tractor rolls being omitted in this view;

Fig. 12 is a side elevation of the mechanism of Fig. 11;

Fig. 12^a is a fragmentary elevation of certain gearing in the drafting head of the device of Figs. 11, 12 and 13, this view being taken at right angles to Fig. 12 and directly opposite to Fig. 11;

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Fig. 13 is a horizontal section on the line 13—13 of Fig. 11;

Fig. 14 is a vertical section similar to Figs. 5, 8 and 11, illustrating another form of twister and its carrier in operative position in the machine;

Fig. 14a is a fragmentary view of the stop-motion mechanism of Fig. 14 in its normal or running position;

Fig. 15 is a side elevation of the mechanism of Fig. 14;

Fig. 15^a is a diagrammatic side elevation of parts of a controlling device for certain forms of the illustrated traveling units;

Fig. 15^b is a fragmentary view like Fig. 15^a, showing a part of the stop-motion device in the act of being operated;

Fig. 16 is a vertical section similar to Figs. 5, 8, 11 and 14, illustrating another form of spinning mechanism and its carrier in operative position in the machine, this mechanism including many of the features of the mechanism of Figs. 14 and 15;

Fig. 17 is a horizontal section on the line 17—17 of Fig. 16;

Fig. 18 is a side elevation of the mechanism of Figs. 16 and 17;

Fig. 19 includes a fragmentary vertical section illustrating the traverse guide of the devices of Figs. 14, 15, 16, and 18, and the cam follower by means of which the guide is traversed, and includes also a fragmentary plan view of this traverse guide;

As will appear from a consideration of specific forms of the strand-manipulating mechanisms, all of the illustrated forms of mechanism include instrumentalities capable of effecting a winding operation, and instrumentalities capable of distributing the winding strand on a receiver such as a spool, core or bobbin, to form a wound package, the mechanisms of Figs. 14 and 15, Figs. 16, 17 and 18, including instrumentalities capable of winding a strand on a receiver or package by overlapped layers of reversed spiral windings, thus to form a headless self-sustaining strand package. The forms of mechanism of Figs. 5, 6 and 7, Figs. 8, 9, and 10, Figs. 11, 12 and 13, and Figs. 16, 17 and 18 include instrumentalities effective to unwind a supply strand mass and feed the strand to strand-manipulating or strand-using mechanism. The forms of mechanism of Figs. 8, 9 and 10, Figs. 11, 12 and 13, and Figs. 16, 17 and 18 include instrumentalities effective to draft one or more strands, these drafting instrumentalities herein (although not necessarily) performing strand unwinding and delivery functions. The forms of mechanism of Figs. 5, 6 and 7, Figs. 8, 9 and 10, Figs. 11, 12 and 13, Figs. 4 and 15, and Figs. 16, 17 and 18, include instrumentalities effective to impart a twist to, or to twist together, one or more strands, while the forms of mechanism of Figs. 8, 9 and 10 and Figs. 16, 17 and 18 include combinations of instrumentalities, effective to spin one or more strands. In the forms of mechanism of Figs. 5, 6 and 7, Figs. 8, 9 and 10 and Figs. 11, 12 and 13, the twisting during winding takes place as a consequence of the relative motion between a twisting guide and the supply and receiving packages; in the forms of mechanism of Figs. 14 and 15, and Figs. 16, 17 and 18, the twisting takes place as a consequence of a rotation of the unwinding supply mass or masses with respect to the portion of the strand approaching the winding package.

The forms of mechanism of Figs. 5, 6 and 7, Figs. 14 and 15, and Figs. 16, 17 and 18 include instrumentalities effective to stop operation of the winding instrumentalities of the mechanism upon the occurrence of an abnormal condition in the strand under manipulation, the stop-motion instrumentalities of the forms of mechanism of Figs. 5, 6 and 7, and Figs. 14, and 15, being effective also to stop operation of feeding, winding and twisting instrumentalities, or of drafting, winding and twisting instrumentalities, and that of Figs. 16, 17 and 18 being effective also to stop operation of drafting and twisting instrumentalities, as well as operation of a spinning device as a whole. From these illustrative instances, the manner of application of analogous stop-motion devices to the remaining illustrated forms of mechanism will be obvious; accordingly for simplicity of illustration, such stop-motion devices are not illustrated in the forms of the mechanism of Figs. 8, 9 and 10, Figs. 11, 12 and 13, although they may be considered to form part of these several illustrated mechanisms.

Frame, guideway and driving connections

Referring to Figs. 1, 2 and 3, a machine according to the present invention includes a guideway, herein shown as constituted of upper and lower rails 4 and 5, defining a path of circulation for a plurality of unit carriers of strand-manipulating devices. A preferable frame for the machine includes spaced transversely disposed castings 1 braced by opposite longitudinally extending portions of the rails 4 and 5 secured thereto, and longitudinally disposed end castings 2 each secured to an end transverse casting 1 and braced by semicircular end portions of the rails 4 and 5.

Figs. 1 and 3 show only one end of the frame and guideway of the present machine; the opposite end of the frame and guideway preferably being substantially the same, so that a closed path of circulation is provided.

Means is provided for moving the carriers in a procession about the machine, such motion being continued or intermittent, and in one direction or alternatively in opposite directions. Preferably, as in the illustrated machine, this means is particularly adapted for continued motion, of the carriers, (interrupted as desired), in a single direction, about the machine. Such means is shown by way of example as including a chain 7 generally parallel to the closed path defined by the upper rail 4, moving on sprocket wheels 8, of which the one shown is driven through a worm gear 10, worm 11, shaft 13, pulley 14, belt 16 and pulley 17 from an electric motor 19 or other source of power.

Means is also provided for operating a plurality of motors (usually of high speed) which furnish power for the manipulation of strands on the various movable units. In these drawings the motors are shown as being electric motors; accordingly the operating connections thereto include electrical conductors leading to these motors from a source of electrical energy. Preferably such electrical conductors take the form of rails 40, 41 and 42 disposed to furnish three-phase current to the several carriers in various positions of the carriers, whether moving or stationary. As shown, these rails are vertically superposed, and are secured to and suitably insulated from the frame or stationary portion of the machine. The length of these rails may be determined by the extent of portions of the guideway on which it is desired that the yarn-

manipulating devices of the carriers be energized. In the illustrated machine, provision is made for energizing those circulatory devices which occupy the straight runs of the guideway and for alter-

5 natively energizing or deenergizing the devices occupying the semicircular end portions of the guideway. For this purpose, the end portions 40^a, 41^a and 42^a (mainly semi-circular in outline) of the rails, are preferably electrically discontin-

10 uous from the main or straight portions of these rails. In some instances of operation, the end portions 40^a, 41^a and 42^a of the conductor rails may be deenergized, thus to stop and start the electrically driven instrumentalities on the carriers successively as predetermined parts of the path of circulation are reached. In other instances, the end portions 40^a, 41^a and 42^a at one or both ends of the machine may be energized by connecting them in parallel with the main portions of the rails 40, 41 and 42, conveniently by means of switches, the switch for this purpose at the illustrated end of the machine being diagram-

15 matically shown at 45.

In certain of the circulatory carriers adapted to be used on this machine, it is convenient to provide for receiving the electric current from rails near the upper part of the carrier; in other of the carriers, the electric current is more conveniently received near the lower end of the carrier. Accordingly the machine of Figs. 1, 2 and 3 is shown as having two duplicate sets of conductor rails so that either of the two sets may be used, as is expedient, or either of the two sets may be dispensed with if only carriers which receive their electric current at the same level are utilized.

In the use of certain types of circulatory carriers for effecting such strand-manipulating operations as spinning, twisting or drafting which involve a multiplicity of operative motions of strand handling elements, mechanical connections may advantageously be utilized simultaneously to provide in respect to the several carriers at least one motion of the desired operation. The machine is accordingly shown in Figs. 1 and 2 as provided with a pair of longitudinally extending tractor rolls 50, 51 (omitted in Fig. 3), mounted in anti-friction bearings in end housings 52 which are detachably connected to the end frame castings 1, and supported at intervals by anti-friction bearing housings 53 which are detachably connected to intermediate frame castings 1. Rotation of the tractor rolls may be induced by a cross-shaft 20 acting through bevel gearing within the end housings 52, the cross shaft being rotated at an appropriate speed by the motor 19 through a driving pulley 22, belt 23 and a pulley 25 on the shaft 20. Obviously the speed of the tractor rolls may be regulated by the provision of suitable gearing, change speed devices, or by the mere substitution for the driving pulley 22 and pulley 25 of other pulleys having a different ratio of diameters.

The tractor rolls 50 and 51 and their bearings and driving connections may be removed from the machine or dispensed with to provide room for the passage of carriers with which these elements are not utilized.

Certain of the unit carriers of the present machines include, as hereinafter more fully described, a device capable of effecting a relative motion of a spinning or twisting strand and of a strand package being built up therefrom, such as to distribute the spun or twisted strand evenly in building up the strand package. Such mecha-

nism preferably includes on the frame of the machine, a lifter rail 60 (preferably of U-section as shown) extending about the machine and affixed to a plurality of sleeves 61 sliding on vertical guide rods 62 which extend between the rails 4 and 5 at intervals around the machine. For causing the lifter rail to rise and fall, an oscillating shaft 70 may be provided longitudinally of the machine, this shaft having at intervals thereon sprockets 71 adapted as the shaft oscillates to wind up and unwind parts of chains 72 and 73 running over pulleys 72^a and 73^a and connected to opposite sleeves 61 of the lifter rail 60. The longitudinal shaft 70 may conveniently be caused to oscillate by the provision thereon of a drum 75 to which is attached and on which runs a chain 76 connected to a lever 77 which is pivoted to the frame at 78 and carries a cam follower 79. A cam 80 driven through gear wheels 81 and 82 from a cross-shaft 83 is adapted to oscillate the lever 77 and hence the shaft 70 and connected lifter rail 60. The cross-shaft 83 may conveniently be driven through a pulley 84, belt 85 and pulley 86 from the motor 19, (Fig. 3). The above described lifter rail need not be used in connection with certain of the circulatory carriers about to be described, and may in those cases be disconnected from the motor 19.

By causing the chain 7, the tractor rolls 50 and 51 and the lifter rail 60 to derive their operating power from a common motor 19; all of these devices (or less than all if some are dispensed with), may be caused to operate in synchronism and be controlled by a single switch, herein indicated diagrammatically at 90. Preferably the energization of the conductor rails 40, 41 and 42 is simultaneously controlled by this same switch. For stopping and starting the circulation of carriers by the chain 30 independently of the other operations of the machine, the machine preferably includes a belt-shifter 91 controlled by foot pedals 92 and adapted to shift the belt 16 from the pulley 14 to a loose pulley 15 and vice versa.

General construction of the circulatory units or carriers

As a preliminary to an explanation of the strand manipulating devices of the illustrated circulatory units or carriers, certain common features of these units or carriers will be explained. The general construction of the machine is preferably such that the numerous strand-manipulating units of the machine, each including a unit frame, are independently supported by the main frame of the machine, are readily removable therefrom, and are interchangeable. The various units, intended for use in cooperation with frame, guideway and driving parts such as described, may be individually constructed, the various parts of the unit being affixed thereto, and the unit being tested and adjusted before assembly of the several units on the guideway of the machine. In this way accuracy of manufacture and standardization of the units of the machine may be assured. The independent support of the various units by the main frame of the machine insures that the relations of the various parts of a given spinning, twisting or drafting unit will not be affected by slight distortion of the long main frame and guideway structural elements. By means of this "unit construction" of multiple spinning, twisting or drafting machines, the main frame of the machine may be relatively light considering the fact that the

units may continually move around the frame, the individual spinning, twisting and drafting units of the machine depending for proper alignment upon the rigidity of their individual unit frames rather than upon rigidity of the main frame of the machine.

The employment of individual spinning, twisting or drafting units, each having a unit frame, facilitates the construction of a machine wherein a plurality of such devices may be conveyed in a path for convenience and added efficiency of operation. Particularly, the unit construction of the illustrated multiple spinning, twisting and drafting machines, facilitates the circulation of the individual devices of the machine about a closed path, the individual units of the machine being adapted to be articulated for passage about curved portions of the guideway.

Referring to any of Figs. 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, wherein the same reference characters are employed to designate similar parts, the carriers or units of the various machines preferably include an upright unit frame portion 100 bridging the distance between the upper and lower guide rails 4 and 5, and having in association therewith a pair of anti-friction rolls 101, 101 adapted to run on the upper rail 4 and to support the carrier therefrom. (See Fig. 4.) For holding the carrier on the lower rail 5, the lower end of the frame is preferably provided with vertical depending studs 92, 93 on opposite sides of the vertical flange of rail 5, one or both of these studs preferably carrying an anti-friction roller 94 adapted to run on a face of the vertical flange of rail 5.

The head portion of the unit frame of the carrier is preferably arranged to have limited motion with respect to and to be yieldingly urged toward the upper rail 4, a typical preferred construction for this purpose being shown in Fig. 4. The head portion of the carrier is preferably provided as shown in Fig. 4, with a rearwardly projecting lug 102 above the plane of the rail 4 having pivotally mounted thereon a link 103 which carries an anti-friction roll 104 adapted to bear against the inner face of rail 4. Link 103 is provided with a lug into which is hooked a tractor rod 105 extending through a bore 106 in the head portion of the carrier and provided with a spring 107 adjustable by a nut 108. The spring 107 yieldingly urges the roll 104 toward the head of the carrier and against the inner face of the rail 4. Inward motion of the head portion of the carrier thus induced may be limited by contact of some driven part of the strand-manipulating devices of the carrier with a tractor roll 50 or 51, such part of the strand-manipulating device being thus held in frictional contact with the tractor roll, to be driven thereby. For guiding the unit or carrier around the curved ends of the machine where the tractor rolls do not extend, or in the case of the machines of Figs. 11, 12 and 13, wherein the tractor rolls are eliminated, a pair of anti-friction rolls 109 are provided on the carrier in position to bear against the outer face of rail 4 in such case to oppose the action of spring 107.

To enable the carrier to be moved about the machine by the chain 30, a lug 110 is provided on the rear of the head portion of the carrier, having pivotally mounted thereon a tractor link 111 which is in turn pivotally connected to a lateral extension 112 of one of the links of chain 30. By first disconnecting this tractor link 111 from its associated chain link 112, as by removing a suitable

pivot pin or the like, the unit constituted of the carrier frame and the strand-manipulating devices thereon may be lifted from the guideway and main frame of the machine. This may be accomplished without disturbing any of the numerous other similar strand-manipulating units of the machine or their driving connections, as will readily be apparent from a consideration of any of the illustrated forms of units. Thus any of the units of the machine may easily and quickly be removed for repair, adjustment or the like, without preventing operation of the remaining units of the machine.

For receiving current from the conductor rails 40, 41 and 42 (and 40^a, 41^a and 42^a if the latter portions are provided and energized) each carrier has mounted thereon three brushes 114, 115 and 116, disposed either to slide along the respective conductor rails of the upper set as in the devices of Figs. 5, 6 and 7, and Figs. 8, 9 and 10, or along the respective conductor rails of the lower set as in the devices of Figs. 11, 12 and 13, Figs. 14 and 15, and Figs. 16, 17 and 18.

Each of the units or carriers is also shown as provided with an electric drive motor M (preferably of the 3-phase type) adapted to operate some or all of the strand-manipulating instrumentalities of the unit, and operable by current received from the above conductor rails and brushes.

The circulatory strand-manipulating devices. Down-twisting

Referring to Figs. 5, 6 and 7, the strand-manipulating mechanism illustrated therein is intended primarily for twisting and rewinding one or more textile strands. An upward and inward extending arm 120 forming a portion of the frame of the carrier is shown as provided with means for holding one or more single or multiple wound supply strand packages S, this holding means for example taking the form of a pin or pins 121 suitable to retain a cop, bobbin, core, tube, or other wound strand mass.

For delivering the strand or strands from the supply under proper tension for twisting, the device is provided with a lower delivery roll 122 and an upper delivery roll 123 frictionally driven therefrom. The lower delivery roll 122 turns on a suitable internal bearing which is secured to the extension arm 120 by means of a bolt 124. The left hand end of roll 122 is enlarged (Fig. 7) and this enlarged end is provided with a tire 125 of suitable friction material such for instance as cork, the tire 125 being adapted to contact with the rotating tractor roll 50 or 51 to drive the delivery rolls therefrom while the carrier is either stationary or in motion along the guideway. A suitable spindle pin 127 for the upper delivery roll 123 is retained with vertical freedom of motion in the slotted ends of a forked bracket 128 fast to the extension 120, so that gravity urges the upper roll yieldingly against the lower roll. One or more suitable strand guides 129 are preferably provided to guide the moving strand or strands between the supply package S and the delivery rolls.

Mounted on the unit or carrier, I provide motor driven means for winding and twisting the strand or strands thus delivered, such means preferably in this instance being of that class of devices which operate by winding the strand or strands on over the end of a suitably rotating strand receiver such as a bobbin or the like and comprising essentially a strand guide and a ro-

tating strand receiver. As instances of such co-operating instrumentalities may be cited the cap of a cap-spinning or twisting machine, the flyer of a fly spinning or twisting machine, or the ring-traveler of a ring spinning machine together with the strand-receiving bobbins with which these strand-guiding elements cooperate. It will be understood that in such over-end twisting or spinning the strand under manipulation frictionally engages the strand-guiding element and winds on the strand-receiving element; a driving force applied to one of these elements may suffice to effect the rotary travel of both. Commonly the angular velocities of these elements differ sufficiently (for example because of greater frictional drag encountered by one of these elements), to provide an adequate linear rate of winding, while the angular velocity of the strand about a circuitous path defined by the guide is sufficient to apply a substantial twist to the length of strand running thereto from the supply.

In the present instance, by way of example a strand receiver in the form of a bobbin 131 is shown as arranged to be rapidly rotated on a suitable spindle 130^a by an electric motor M, the strand or strands winding upon the bobbin passing through and being guided by a traveler 132 on a spinning ring 133. The motor M may conveniently be mounted on a horizontal bracket 100^a extending from the unit frame upright 100, the motor shaft being directly connected to the spindle 130^a. Preferably provision is made for the motor shaft and the spindle 130^a to center themselves at high speeds in the manner of a spinning spindle, for example by mounting the motor shaft in a suitable bolster B which may form part of the motor casing.

The motor M is suitably connected to the brushes 114, 115, and 116, to receive current from the conductor rails 40, 41 and 42 while the carrier is either moving or stationary.

For distributing the twisted strand or strands with respect to the winding bobbin, means is provided for effecting a relative traversing motion of the strand-receiving bobbin 131 or the like with respect to the strand-guiding traveler 132. In the illustrated device such means includes a slide 135 vertically movable on the vertical member 100 of the carrier, the slide having as a lateral extension thereon a ring rail 136 which carries a ring 133 having the traveler 132, the slide having thereon an anti-friction roller follower element 137 adapted to extend into the U-shaped lifter rail 60. Thus vertical movement of the lifter rail, while the carrier is either moving or stationary effects the distribution of the twisted strand or strands axially on the bobbin.

Detector and controlling devices

Preferably means is provided for stopping the operation of the feeding rolls 122 and 123, and for cutting off the supply of current to motor M, or either of these operations severally, upon the occurrence of an abnormal condition in the strand under manipulation. Such an abnormal condition may be a condition of the strand which may be detected by a suitable detector, some instances being exhaustion or breakage of the strand, excessive tension or slack in the strand, or objectionable imperfections in the strand. The part of this specification headed "Other detector and controlling devices" deals with means for detecting certain of such abnormal conditions of the strand and means for detecting such conditions. In the present instance of Figs. 5, 6 and

7, the abnormal conditions in the strand as a consequence of which the feed rolls and motor may be stopped are lack of sufficient tension in the strand, or exhaustion or breakage of the strand. The strand in passing from the delivery roll 122 to the traveler 132 preferably passes through a pot-eye 280 which is carried by a lever 281 in position to define a projecting angle in the main path of the strand, the normal tension of the strand thus tending to hold this lever 281 in the illustrated horizontal position, against any suitable stop not shown. The opposite end of lever 281 is connected by a link 282 to a horizontal rod 283 (Fig. 7) joined at its ends to spaced lower levers 284 and 285, this arrangement being such that the levers 284 and 285 are normally held in the inclined positions shown. Each of these levers carries in a bifurcation at its end an anti-friction roll 287, these rolls being slightly inclined downwardly in the direction of motion of the carrier with respect to the rail 4. Mounted on the outer vertical face of rail 4 at a level such as normally to clear the rolls 287, a cam-rail 289 is provided having the upper portion 289' of its lateral face inclined upward and away from the rolls 287. The lower portion 289'' of the lateral face of the cam-rail may be vertical, and is preferably of a width to afford a path for rolls 287.

In the normal travel of the strand through the pot-eye 280, under sufficient tension, the rolls 287 are held free of the cam-rail 289. Upon breakage or exhaustion of the strand or the occurrence of slack therein, the levers 284, and 285, the link 282, and the rolls 287 drop, (raising the pot-eye) and permit the rolls 287 to ride on the inclined surface 289' of the cam rail 289. Movement of the carrier then causes the rolls 287 to work down this inclined surface, which exerts a camming action thereon tending to force the rolls 287 and upper portion of the carrier outwardly from the frame of the machine, until the rolls ride on the vertical portion 289'' of the cam rail. This outward motion of the upper portion of the carrier disengages the cork tire 125 of the lower delivery roll from the tractor roll 50 or 51, and also disengages the brushes 114, 115 and 116 from the conductor rails 40, 41 and 42, stopping both feeding, twisting and winding of the strand. If in lieu of a single pair of feed rolls, a plurality of draft rolls are employed as in the form of mechanism of Figs. 8, 9 and 10, these draft rolls may likewise be stopped. Preferably the cam rail 289 is in two sections each approximately coextensive in length with a tractor roll 50 or 51, the cam rail not being needed at the semi-circular ends of the machine. Preferably as shown in Fig. 1 the cam rail begins at a sufficient distance beyond the beginning of the energized straight sections of conductor rails 40, 41 and 42 to permit winding to start the strand to be put under tension, (thus raising the rolls 287) before the rolls 287 reach the beginning of the cam rail.

As will readily be apparent from a consideration of other forms of the present invention, described below, the above described type of stop-motion mechanism may if desired be applied to the other forms of my invention.

Down-spinning

The spinning mechanism of Figs. 8, 9 and 10 is shown as constituted of the devices for twisting and rewinding described in connection with the mechanism of Figs. 5, 6 and 7 with the exception that these parts are arranged in duplicate for simultaneously forming two strand packages, 150

the two spindles 130^a being herein shown as driven from separate motors M, and the two rings 133^a being carried on a common ring rail 136^a operated by the previously described builder motion.

5 In the mechanism of Figs. 8, 9 and 10, the strand delivery function of the delivery rolls 122, 123 of the previously described unit is assumed by a suitable strand drafting device mounted on the carrier and adapted to cooperate with the twisting and winding instrumentalities to produce a spun strand from roving or the like. Preferably such a strand drafting device includes a set of lower draft rolls 122^a, 122^b, 122^c and 122^d journaled in spaced inclined extensions 120^a of the head of the carrier, and a set of upper rolls 123^a, 123^b, 123^c and 123^d adapted to press against strands passing over the lower set of draft rolls. As shown, the journals of the front and rear upper rolls 123^a and 123^d are retained by lateral projections from the extensions 120^a of the carrier, the front upper roll 123^a being held forcibly against its companion lower roll 122^a by means of a spring pressed yoke 140 sliding on a rod 141 which is secured to the head of the carrier. The intermediate upper rolls 123^b and 123^c have their journals received in opposite slotted projections 142 and 143. The shaft 145, which is fast to and turns with the lower front roll 122^a, may carry opposite tractor wheels 145' of enlarged portions carrying tires 125 adapted to contact with the tractor roll 50 or 51, thus effecting rotation of the front lower roll 122^a. Shaft 145 preferably also carries, fast thereon, a sprocket wheel 146. Similar sprocket wheels 147, 148, and 149 respectively are associated in like manner with the remaining lower draft rolls, these sprocket wheels being of requisite diameters to cause the lower draft rolls to turn at progressively increased surface speeds as the sprocket wheels are driven by a common chain 150 actuated by the sprocket wheel 146.

An idler roll 151 having its journal adjustably retained in a slot 152, may serve to take up slack of the chain 150, for example to allow for substitution for sprocket wheels 146, 147, 148, and 149 of similar wheels of various sizes.

The device of Figs. 8, 9 and 10 is shown as equipped with a pair of pins 121 suitable to receive supplies 5 of strands to be drafted, spun or twisted, and suitable guides 129^a for guiding the strands, to the draft rolls.

While the devices for drafting, twisting and winding are illustrated in Figs. 8, 9 and 10 in cooperative relationships for effecting spinning, my invention obviously contemplates in some instances the elimination of the drafting device (as in Figs. 5, 6 and 7). In addition my invention contemplates the employment of a drafting device as the primary strand-manipulating device of the carrier, if desired in association with any form of device to wind up, further manipulate, or use the drafted strands.

Down-spinning; drive of strand delivery and twisting instrumentalities jointly from traveling motor

The mechanism of the unit or carrier of Figs. 11, 12, 12^a and 13 resembles in many respects the mechanism of the carriers of Figs. 5, 6 and 7 and Figs. 8, 9 and 10, and differs therefrom principally by the driving of the strand drafting instrumentalities from the same motor M which serves to drive the winding package and to effect the twisting motion imparted to the strand. In the use of this unit, the previously described mechanical

connections constituted of the tractor rolls 50, 51 may be dispensed with; Figs. 11, 12, 12^a and 13 show the machine without these rolls and their bearings.

In the device of Figs. 11, 12, 12^a and 13, the motor M is shown as mounted on the lower face of a hollow bracket 360, which receives within it a gear wheel 361 driven by the shaft of the motor. Gear wheel 361 meshes with each of two smaller gear wheels 362 and 363 respectively fast on spindles 364 and 365 which are mounted in suitable bolsters 366 and 367. Each of the spindles 364 and 365 is suitable to receive a core, tube, bobbin or other receiver for a winding strand mass. The ring rail 136 of Figs. 5 to 10, as shown in Figs. 11 and 12, is suitably arranged to traverse the strand on bobbins on the spindles 364 and 365, which may conveniently be located at a somewhat higher level than the corresponding spindles of the previously described devices.

The device of Figs. 11, 12, and 13, may be provided with strand-drafting mechanism in the form of a lower set of forward, intermediate and rear draft rolls 122^{aa}, 122^{bb}, 122^{dd} having their journals received in bearings in spaced extensions 120^{aa} of the head of the carrier, and an upper set of forward, intermediate and rear draft rolls 123^{aa}, 123^{bb} and 123^{dd} having their journals slidably mounted in slots in a frame 370 which is pivotally mounted at 371 to the extensions 122^{aa}. The lower set of rolls is preferably driven from the motor M by the provision of a vertical shaft 372 mounted in bearings 373, 374 and 375 in brackets 360, 155, and upper head portion of the carrier respectively, this shaft being suitably connected at its lower end to the shaft of motor M, and being connected to drive the draft rolls from its upper end. As shown in Fig. 11 the upper end of shaft 372 carries at its upper end a worm gear 376 meshing with a gear wheel 377 (Fig. 12) fast on the forward lower draft roll 122^{aa}. This draft roll also carries a gear wheel 378, (Fig. 12^a) meshing with an idler gear 379 which carries a pinion 380. Pinion 380 in turn meshes with a gear wheel 381 fast on the shaft of intermediate roll 122^{bb}. Rear roll 122^{dd} is driven from intermediate roll 122^{bb} by gear wheels 384, 385 fast to these respective rolls, and meshing with a suitable idler gear 386, as shown in Fig. 11. The ratios of the various gear wheels described above is such that the lower intermediate roll is driven at a greater surface speed than the lower rear roll but at a less speed than the lower forward roll. Preferably the rolls of the upper set are held by gravity against the strands being drafted and are driven frictionally from the lower rolls through these strands.

The operation of the strand drafting twisting and winding instrumentalities of the device of Figs. 11, 12 and 13, will be obvious from the previous explanation of analogous mechanism. In the operation of this device which relies only upon motor M for the power for its drafting, twisting and winding motions, and requires no tractor rolls 50 or 51, the unit may be operated continuously about the complete circuit of the guideway of Figs. 1, 2 and 3, including the curved end portions thereof. For such operation the switches 45 at each end of the machine may be thrown to energize the semi-circular end sections 40^a, 41^a, and 42^a of the conductor rails, or if desired the end sections at only one end (for instance the operator's end of the machine) may be deenergized so that the carrier as it traverses

this section is inactive, for greater ease of replenishment and supervision.

Up-twisting

5 The traveling unit of Figs. 14 and 15 is suited primarily to effect a twisting operation on one or more strands by a relative motion of the supply package with respect to the winding strand. Accordingly, the device preferably includes the electric motor M, and bolster B of the devices of Figs. 5 to 10. The motor driven spindle, indicated in Figs. 14 and 15 by the reference character 370, is in this instance particularly adapted to receive and rotate the core of an unwinding supply package. The motor M may for example rotate a supply package S mounted on the spindle 370 at about 6000 revolutions per minute. If a plurality of strands are to be twisted together, the unit may include similar means for rotating additional supply packages each having one or more strands thereon.

In conjunction with this mechanism for rotating the unwinding supply package the unit or carrier includes suitable means for drawing off the strand or strands from the rotating supply package or packages and for winding the twisted resultant strand into a package on a suitable receiver or core. In the preferred form of the illustrated carrier, such drawing-off and winding means is shown as including mechanism for rotating a winding package to wind a strand thereon and means for imparting a traversing motion to the strand leading thereto, to cause the wound strand to lie in overlapped layers of reversed spiral windings, thus to form a Fiji wound headless self-sustaining package.

Preferably a suitable strand guide is provided between such traversing mechanism and the unwinding supply package for confining the traversing motion of the strand to that portion thereof adjacent to the winding package while preventing the traversing motion from disturbing the whirling balloon effect set up by unwinding from the rapidly rotating unwinding supply package. Such guide is herein shown as an eye 371 carried by a cover plate 510 on the head of the carrier.

The mechanism for drawing off the strand from the supply or supplies and for winding the resultant twisted strand may be similar to the winding mechanism described in my copending application Serial No. 476,776, filed August 21, 1930, entitled Machine and method for preparing yarn packages, and will now be described, by way of example, as thus constructed. The upper part or head 65 of the carrier frame may thus include outwardly projecting parallel end-plates 566, 567 spaced apart to provide room between them for a rotary traverse cam 570 (Figs. 14 and 20) hereinafter described. One of the end plates of the head 65 may be extended as shown at 568 to provide a bearing 569 for a stud 573 on a lever arm 571 carrying a spindle 572 for a winding core or carrier W.

65 The length of the lever arm 571 is such that the surface of the winding core W or the winding thereon is in surface contact with one of the tractor rolls 50 or 51 throughout the winding operation. The position of the stud 573 is such as to permit the use of an arm 571 of a length such as to sweep a sufficient arc for the expected radius of the carrier W and the winding upon it. In normal operation the weight of the arm 571 and its attachment holds the winding mass firmly in frictional contact with

the upper surface of the tractor roll 50 or 51.

The arm 571 may be made in parts, comprising a tubular portion 571^a split at 571^b and having lugs bored for a pinch bolt 571^c, the tubular clamp so formed taking over an end piece 571^d carrying the spindle 572. On loosening the pinch bolt 571^c the part 571^d may be universally adjusted to vary the distance between stud 573 and spindle 572, and also to vary the angle of the spindle 572, for example from parallelism with the axis of the roll 50 or 51 to an angle corresponding to that of a suitable cone carrier for winding a conical package.

The traverse cam 570 is most clearly shown in Fig. 20. Referring to this figure, the traverse cam 570 is shown as provided with a crossed spiral cam groove 570^a, preferably of rectangular cross section, and at each end the cam 570 may be provided with a friction ring 570^b of cork, cork composition, felt, rubberized felt, rubber aggregated ground cork, or any other durable friction material, said rings projecting slightly beyond the cylindrical surface of the cam body and being frictionally held against one of the tractor rolls 50, 51 by connections explained above (see Fig. 4) which urge the head portion of the carrier toward the rail 4 and roll 50 or 51.

Referring to Figs. 14 and 21, the head 65 carries a polished steel bar 500, united at its ends to the plates 566 and 567 respectively and forming a slideway for a light casting 501 having an opening at 502 for a slide bearing on the bar 500 and provided with a lug 503 bored for a pin 504 having secured to its lower end an arcuate follower 505 engaging the cam groove 570^a of the cam 570. Integral with the casting 501 is a yarn guide 506 having lateral cam slopes 506^a (Fig. 15) and a central yarn notch 506^b.

The head 65 is preferably provided with a sheet metal cover plate 510 which includes a substantially flat horizontal portion overhanging bar 500 and having a straight edge parallel to the axis of the motion of the cam 570 and the tractor rolls. The cover plate also includes a part which slopes downwardly and outwardly as indicated in Figs. 14 and 15, the lower end of this portion carrying the guide eye 371. If it is desired to inspect the strand for slubs, a suitable slub detector, catcher or breaker may conveniently be mounted on the cover plate, such device being shown by way of example as constituted of parallel spaced wide blades 400 and 401 defining a narrow throat 402 for the passage of the strand but not for undesired imperfections thereon, in the manner described in my above mentioned application and in my application Serial No. 484,993, filed September 29, 1930, entitled Slub detector, catcher or breaker. In the form illustrated, this slub catcher is suited to cause breakage of the resultant twisted strand upon the occurrence of an undesired imperfection therein incapable of being removed by passage through the throat 402 of the slub catcher.

Other detector and controlling devices

Preferably means is provided for cutting off the power of the individual driving motor M, stopping driving of the winding package, shifting the position of the winding package (in supplement to the normal travel of the package core) to a more convenient position for attention by an operator or automatic replenishment, doffing, end-finding or tying-in mechanism, and removing the winding strand from the traversing mechanism, or any of these functions severally,

upon the occurrence of an abnormal condition in the winding strand. Such abnormal conditions may consist of breakage or exhaustion of the strand, slack or absence of tension in the strand or the occurrence of an enlargement such as a slub in the strand, or any other abnormal condition which may be detected by suitable devices responsive thereto. In the preferred illustrated form of Figs. 14 and 15, the slub catcher constituted of blades 400 and 401 is effective to induce breakage of the strand when a slub incapable of being removed by the blades is encountered. A feeler in the form of a wire bail 200, is pivotally mounted on the cover plate 110 of the head so as to be held down by a strand passing from the slub-catcher to the winding package. Fig. 14 shows the strand broken, and the feeler in its elevated position. A depending extension 201 of this feeler is suitably connected, as by a wire link 202, to a dog 203 which is pivotally mounted on a pin 204 extending transversely of a shaft 205 which turns in a boss on the head of the carrier. The opposite or outer end of shaft 205 carries a bifurcated arm 206 which receives and is adapted to operate a lifter rod 207 connected at its upper end to the pivoted package-carrying arm 571 of the head. At suitable intervals along the upper rail 4, pins 208 are provided for swinging the dog 203, shaft 205 and arm 206 and thereby operating the lifter rod 207 to swing arm 571 in a clockwise direction from the position of Fig. 14. In the normal operation of the device, the feeler member 200 held down by the strand normally passing to the winding package, retains the dog 203 in an inclined position indicated in Fig. 14^a wherein the pins 208 are cleared. Upon the occurrence of slack breakage, exhaustion or a slub, however, the feeler 200 rises, the dog 203 drops to the position of Fig. 14, wherein it can strike and be rotated by a pin 208 as indicated in Fig. 15^b. This rotates the crank arm 206 and the lifter rod 207 is thus raised to impart to the winding package a shifting motion supplemental to the normal travel of the package in its path, the illustrated device being arranged so that the winding package is swung through an angle of about 60° in a clockwise direction from the position of Fig. 14. An electric switch 215, actuable by a switch lever 216, is shown as disposed in the electric circuit leading from the brushes 114, 115, and 116 to the motor M. The arm 571 is enabled to operate this switch by the provision on arm 571 of a switch-actuating arm 217 adapted to move the lever 216 to turn off the switch upon sufficient clockwise movement of the arm 71. Thus in the form of device of Figs. 14 and 15, the current is turned off from the motor M upon the occurrence of abnormal conditions in the winding strand.

Means is preferably provided for controlling the motor M in accordance with the attained size of the winding package, and such means may include certain of the connections serving to control the switch 216. In the normal growth of the winding package, the package-carrying arm 571 and switch-actuating arm 217 are gradually moved in a clockwise direction by the increase in diameter of the package. When the package attains a predetermined size, the switch-actuating arm 216 will actuate the switch 215 to turn off the current to motor M. By mounting the switch-actuating arm 217 for angular adjustment on the package-carrying arm 571, for example by means of screws 230 and 231 passing through arcuate slots 232 and 233 on the switch-actuating arm, (this feature being best shown in

Fig. 19) the device may be accurately set to operate the switch upon the attainment by the winding package of any desired size. When the package attains a predetermined size and the motor M has ceased to operate, the non-rotation of the unwinding package S serves to indicate to an operator that the winding package of that carrier is full.

Obviously the means for cutting off the power of motor M may be simplified by connecting the feeler 200, or whatever detector it is desired to use, directly to a motor controlling switch. In addition the devices for stopping driving of the winding package by moving it away from its tractor roll, and for removing the winding strand from its traverse device may be utilized separately from such means for controlling the motor M, such devices apart from their cooperation with such motor-controlling means being herein illustrated in the forms described and claimed in my above application, Serial No. 476,776.

The machine may also be capable of cutting off the power of the individual driving motor M, stopping the driving of the winding package and its core W, shifting the position of the winding package to a more convenient position for attention thereto and removing the winding strand from the traversing mechanism, or any of these functions severally, upon the attainment by the individual carrier of a predetermined part of its circulatory path. The parts described above as controlled by the feeler 200 and link 202 for performance of these functions upon the occurrence of abnormal conditions in the winding strand may cooperate with suitable abutments at points on the guideway so as to be actuated when the carrier attains a predetermined part of its path. Referring particularly to Fig. 2, the upper rail 4 of the guideway may have thereon at any desired point a pin 219 similar to the previously described pins 208 but long enough to contact with and actuate the dogs 203 of the carriers even when the dogs are held out away from the rail by the normal winding of the strands. Such pins may be stationed just in advance of the end bearings 52, 53 of the tractor rolls 50, 51 there serving in conjunction with the operative connections on the several carriers to remove the winding package from the tractor rolls 50 and 51 before the end bearings 52 or 53 are reached, and simultaneously to stop the motor M. The motors M of the several carriers may also be stopped just before the ends of the tractor rolls are reached by virtue of the carrier current brushes of the carrier passing onto energized end sections of 40^a, 41^a and 42^a of the current conductor rails.

The frame of the machine (Figs. 2 and 3) is shown by way of example as provided with one of the above described pins 219, at a point on the rail 4 lying between the ends of the energized straight portions of conductor rails 40, 41, 42, by means of which pin the above described controlling functions may be performed in respect to the several carriers at a point at which the conductor rails 40, 41, 42 would otherwise cause the motor M to be driven.

It will readily be apparent that the operations of cutting off the power of the individual driving motor M, stopping the rotation of the winding package, shifting the winding package to a more convenient position for attention thereto, and removing the winding strand from the traversing mechanism, may be initiated manually by merely lifting the package-carrying arm 150

571, regardless of the position of the carrier or of the condition of the winding strand.

Means is preferably provided for automatically starting the individual driving motor M, starting the winding package, (as by shifting it into driven contact with a tractor roll 50 or 51) and restoring the winding strand, or a replenished supply strand substituted therefor, into operative relation to the traversing mechanism, so that the twisting or spinning operation and the winding and unwinding operations incident thereto may automatically be resumed after stoppage in any of the ways explained above. The controlling device, preferably including as described above, the dog 203, shaft 205, arm 206, lifter rod 207, package-carrying arm 571, switch-actuating arm 217 and switch 215, may be actuated for accomplishing such resumption of operation by the provision of a suitable upper pin 220 disposed at any desired point on the rail 4 in position to detain the upper portion of dog 203, thus to operate these parts in the reverse direction from that previously described. As shown in Fig. 15^a, the dog 203 is provided with a curved cam-surface 203^a on one side, which is brought uppermost when the dog has been swung by a lower pin 208 or 219. In this position this curved surface 203^a is in position to strike the above-described upper pin 220 and swing the dog 203 in a counter-clockwise direction. Through movement of the dog in this direction, the shaft 205, arm 206, lifter rod 207, package-carrying arm 571, switch-actuating arm 217 and switch 215 are operated to restore the package into its usual winding position, restore the strand into position to be picked up by the traverse eye 506 and to energize the motor M of the carrier unit. In the use of a carrier adapted to cooperate with a tractor roll 50 on 51 a pin may be provided near the beginning of each tractor roll, to institute resumption of operation after the carrier has passed the semi-circular end of the machine. The frame illustrated in Figs. 1, 2 and 3 also is shown as provided with one of these pins 220 disposed at a point somewhat beyond pin 219, to cause resumption of operation stopped when pin 219 is encountered. The various pins 208, 219 and 220 are preferably detachably affixed at convenient points about the machine; their positions may thus be altered to suit the requirements of inspection, control and replenishment for a given length of machine, kind and length of strand being handled and character of operation being performed thereon. These pins may be removed when the carrier units of Figs. 5 to 13, are employed.

Up-spinning

The strand-manipulating device of the unit of Figs. 16, and 17 is adapted particularly for up-spinning,—that is spinning characterized in that a twist is imparted to the strand by rotating the unwinding supply package with respect to the strand which winds on a suitable receiver.

The carrier of Figs. 16 and 17 includes the winding, traversing and controlling devices of the carrier of Figs. 14 and 15, which devices it is unnecessary to describe a second time.

As in the mechanism of Figs. 16 and 17, a motor M serves to drive a spindle 300, adapted to carry the unwinding supply package S. For drawing off the strand from the unwinding supply package S and for elongating the strand in connection with the spinning operation, a set of draft rolls is interposed between the rapidly rotating package S and the winding package core W, this set

of draft rolls being adapted to turn bodily with the unwinding supply package, so that twisting by rotation of the unwinding package takes effect in the length of strand running from the draft rolls to the winding package.

In the illustrated device, the motor M has fast on its drive shaft a spindle 300, suitable to hold an unwinding supply package S (for example a cheese as shown) and also a cylindrical container 301 for the supply package, the container being normally closed at its top by a detachable cover 302 which frictionally engages the container 301 so that the cover 302 rotates with the container 301 and spindle 300.

The draft rolls are shown as composed of forward, intermediate and rear rolls 305, 306 and 307 respectively which correspond in some respects to the lower draft rolls of a spinning frame, and forward, intermediate and rear rolls 308, 309, 310 which correspond in some respects to the upper draft rolls of a spinning frame. Preferably the draft rolls are embraced by and have their journals retained in bearings in opposite plate-like portions 313' and 313'' of a bodily rotatable frame 313. The roll frame 313 is provided at its top and bottom with reduced cylindrical portions 324 and 324' each of which extends within and is fast on an inner race 325 of an anti-friction bearing indicated generally by the reference character 326. The upper and lower bearings 326 are retained respectively by upper and lower brackets 330 and 331 which extend laterally from vertical member 60 of the carrier frame. The cylindrical end portions 324 and 324' of the frame 313 are provided with strand-guiding openings 333 and 333' respectively, the lower opening 333' having a flaring entrance mouth to receive the strand from the supply package S, and the upper opening 333 with a slightly flaring exit mouth to accommodate the twisting strand leading from the draft rolls to the winding package core W. The frame 313 and its contained strand-drafting mechanism is arranged to rotate in unison with the unwinding supply package S, preferably by the provision of a screw connection 335 between the frame 313 and the cap 302 of the supply holder or container 301. The pitch of the screw connection 335 is such that normal rotation of the cap 302 by the holder 301 screws this connection tight.

In the illustrated machine the rolls 307, 309, and 305 are geared together by intermeshing gear wheels 347, 348, and 349 fast on their respective journals, the ratio of these gears being such that the rear roll 307 and the rear roll 310 rotate at relatively low surface speeds, intermediate rolls 306 and 309 rotate at somewhat higher surface speeds, and forward rolls 305 and 308 rotate at still higher surface speeds.

Preferably means is provided for driving the drafting device from the motor M which rotates the unwinding supply package. The journal of roll 307 of the device of Figs. 16, 17 and 18 is provided, in addition to the above gear wheel 347, with a spur gear wheel 350 (Fig. 17) which meshes with a relatively stationary spiral ring gear 351, to be driven thereby as the frame 313 is rotated. The ring gear 351 may conveniently be carried by a cup-shaped enlargement 352 of the bracket 331.

The operation of the spinning mechanism of this unit will now be obvious. Rotation of the unwinding supply package S and the described draft rolls by the motor M, results first in pulling

off the strand from the package S, second, elongating the strand as it passes through the rolls, third, delivering an elongated strand from the rolls to the winding instrumentalities, and fourth, constantly effecting a rotation with respect to the winding instrumentalities of the portion of the strand being delivered, thus to impart a twist to the strand.

Provision is preferably made for disengaging the supply holder or container 301 from its cover 302, and for enabling the container 301 and spindle 300 to be swung to a position wherein the supply package may be replenished. As shown, the casing of the motor M is provided with opposite trunnions 340, 341 pivotally mounted in a forked bracket 342 which is pivotally mounted at 343 on a projection 344 of the upright 60 of the carrier. A weight 345 which counterbalances the motor M, supply package S and container 301 therefor normally urges the motor and casing upward so that the casing frictionally engages its cover 302 as shown in Fig. 16. When it is desired to replenish the supply package S, the container 301 may be depressed (thus disengaging or uncoupling it from its cover) and swung in a clockwise direction in Fig. 1 to expose the spindle 301 for doffing of a depleted supply package core and donning of a fresh supply package. After such replenishment of the supply, the supply holder or container 301 may be returned to its normal position, the detachable coupling between the holder and the drafting device being reengaged, so that these two elements may rotate in unison.

The arrangement whereby the container 301 engages its cover 302 to drive the strand-drafting mechanism constitutes an illustrative example of a friction or yielding clutch that may be interposed between the driving motor M and the strand-drafting mechanism. Such a clutch serves to prevent breakage of parts in case of stoppage of the drive rolls.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A textile machine having therein a plurality of devices for spinning strand material, each of said devices including strand drafting and twisting instrumentalities, means for moving said spinning devices in a procession in a predetermined path, whereby donning, doffing, or other operations of replenishment, supervision or the like, may be performed on the devices at a predetermined part of the path, stop motion devices associated with the several spinning devices, and means for operating the stop motion devices severally upon the occurrence of an abnormal condition in the strand of any of the several spinning devices.

2. A textile machine having therein means for moving a winding strand mass and a supply strand mass in a predetermined path, strand-spinning mechanism including cooperating drafting, twisting and winding instrumentalities movable with said strand masses in said path, said strand-spinning mechanism including a drive motor adapted to move in said path.

3. A textile machine having therein a plurality of strand-spinning devices, means for moving the spinning devices in a procession in a predetermined path, said spinning devices including motors movable therewith, and means operable by the motors for imparting a twist to the spinning

strands, in combination with means responsive to the occurrence of an abnormal condition in the strand of any of said devices for stopping the motor of the device wherein the abnormal condition occurs.

4. A textile machine having therein cooperating drafting and twisting instrumentalities, means for moving said instrumentalities in a predetermined path, means for operating said instrumentalities in various positions in said path, and means for concomitantly stopping both said instrumentalities upon the completion of twisting and drafting of a predetermined quantity of strand by said instrumentalities.

5. A textile machine having therein means for moving a plurality of strands in a procession in a predetermined path, spinning devices operable with respect to the several strands and including cooperating drafting and twisting instrumentalities movable in said path with the strands, said spinning devices including as driving mechanism electric motors movable therewith, and a stationary electric conductor adapted to supply current to said motors in a part only of said path.

6. A textile machine having therein a strand spinning device, means for moving said device in a predetermined path, means for operating said device in a plurality of positions in said path, including means for rotating the spinning supply package, means for stopping said rotation upon the occurrence of an abnormal condition in the strand being spun, and means for starting said rotation upon the attainment of a predetermined part of said path.

7. A textile machine having therein a plurality of strand twisting devices, including means for guiding a winding strand onto a winding package over the end thereof to twist the strand, means for conveying said devices in a procession in a predetermined path to present them for donning, doffing or other operations of replenishment, supervision or maintenance at a predetermined part of the path and means for causing rotation of the winding packages during such twisting, in various parts of said path.

8. A textile machine having therein a plurality of holders for the unwinding and winding strand masses of a plurality of twisting pairs, means for winding the strands from the unwinding to the winding strand masses of the respective pairs, and means for effecting a relative rotation of the masses of a pair so as to impart a substantial twist to the strand, in combination with means for moving the pairs of holders in a procession in a circulatory path for donning of supply strands, doffing of twisted strand masses, or other operations of replenishment, supervision or maintenance at a predetermined part of the path.

9. A textile machine having therein a plurality of strand-manipulating devices each including means for rewinding a strand from a supply package onto a receiving package, and a guide acting on the strand between the packages to impart a substantial twist to the strand, in combination with means for causing the strand-manipulating devices to move in a procession in a predetermined path, and means for causing a relative motion between the guide and the packages to wind and impart a substantial twist to the strand in various positions in the path whereby the several devices may be subjected to doffing, donning or other operations of replenishment, supervision or maintenance at a predetermined part of the path.

10. A textile machine having therein means

- for moving a winding strand mass and a supply strand mass in a predetermined path, and strand-twisting mechanism of the type which acts to wind the strand from the supply mass onto the winding strand mass, said strand-twisting mechanism including a drive motor adapted to move in said path with said strand masses.
11. A textile machine having therein means for circulating a textile strand about the machine, and strand-rewinding mechanism of the type which acts to wind said strand from a supply mass onto a winding strand mass, said mechanism including a drive motor and connections therefrom for rotating the supply mass to twist the strand during such rewinding, the motor being adapted to circulate about the machine with the strand.
12. A textile machine having therein a plurality of devices for twisting strand material, means for circulating the twisting devices in a procession about the machine, whereby donning, doffing, or other operations of replenishment, supervision or the like may be performed on the devices at a predetermined part of the path, stop motion devices associated with the several twisting devices, and means for operating the stop motion devices severally upon the occurrence of an abnormal condition in the strand of any of the several twisting devices.
13. A textile machine having therein a twisting device, means for moving said device in a predetermined path, means for operating said device in various positions in said path, including means for rotating the twisting supply package and means for stopping rotation of said supply package upon the completion of twisting a predetermined quantity of strand thereby.
14. A textile machine having therein a strand-twisting device including instrumentalities effective to wind the twisted strand into a strand package, means for moving the twisting device in a procession in a predetermined path, means movable with the twisting device for holding the strand package while permitting the package to be shifted supplemental to said processional motion, in combination with means acting in accordance with such shifting of the package to stop the twisting device.
15. A textile machine having therein a plurality of carriers adapted to hold a winding and an unwinding strand mass, means for moving the carriers in a procession in a predetermined path, and means for winding strands from the unwinding onto the winding masses and for concomitantly imparting twist to the several strands, said means including electric motors on the several carriers and connections whereby the motors are effective to impart said twist to the winding strand of the carrier, in combination with means responsive to the attainment by any of the winding masses of a predetermined size for stopping the motor which normally twists the strand winding thereon.
16. A textile machine having therein a strand twisting device, means for moving said device in a predetermined path, means for operating said device in a plurality of positions in said path, including means for rotating the twisting supply package means for stopping said rotation upon the occurrence of an abnormal condition in the strand being twisted, and means for starting said rotation upon the attainment of a predetermined part of said path.
17. A textile machine having therein a plurality of strand-handling devices, means for conveying said devices in a procession in a circulatory path, means including electric motors adapted to circulate with the several devices for imparting a twist to the strands carried thereby, and stationary electric conducting means adapted to supply operating current to said motors in a part only of said path of circulation.
18. A textile machine having therein means for moving a supply strand mass in a predetermined path of elongated shape, in combination with means for rotating a supply mass for twisting the strand, means for rewinding the twisted strand into a package, and connections from a source of power to the means for rotating the supply mass permitting driving of the supply mass at various places in said path.
19. A textile machine having therein a plurality of devices for drafting textile strands, in combination with means for moving the drafting devices in a procession in a circulatory path of elongated shape whereby the devices may be subjected to doffing, donning or other operations of replenishment, supervision or the like at a predetermined part of the path, and means for driving the drafting devices in various positions in said path.
20. A textile machine having therein a plurality of devices for drafting strand material, means for circulating the draft devices in a procession about the machine whereby donning, doffing or other operations of replenishment, supervision or the like may be performed on the devices at a predetermined part of the path, stop motion devices associated with the several drafting devices, and means for operating the stop motion devices severally upon the occurrence of an abnormal condition in the strand of any of the several drafting devices.
21. A textile machine having therein means for moving a supply strand mass in a predetermined path of elongated shape, and strand-drafting mechanism for elongating said strand, said drafting mechanism including a drive motor adapted to move in said path with said strand mass.
22. A textile machine having therein a drafting device, means for moving said device in a predetermined path, means for operating said device in various positions in said path, means for detecting the completion of drafting of a predetermined quantity of strand and means for stopping the device upon the actuation of said detecting means.
23. A textile machine having therein means for moving a plurality of strands in a procession in a predetermined path, devices for drafting the several strands, said devices being movable with the strands in said path and severally including as driving mechanism an electric motor movable therewith, and a stationary electric conductor adapted to supply current to said motors in a part only of the said path.
24. In a textile machine having a plurality of devices for manipulating strands and means for conveying the devices in a procession, the combination with said devices and conveying means of holders movable with the strand manipulating devices, said holders being adapted to carry unwinding supply strand masses for the several devices, and mechanism for unwinding and feeding to the several strand-manipulating devices the strands of the respective supply masses.
25. In a textile machine having a plurality of devices for manipulating strands and means for conveying the devices in a procession, the com-

- ination with said devices and conveying means of holders movable with the strand-manipulating devices, said holders being adapted to carry unwinding supply strand masses for the several devices, a plurality of feeders acting to unwind the strands of the supply masses and to feed said strands to the strand-manipulating devices, means for detecting an abnormal condition in the strands feeding to the several strand-manipulating devices, and means for stopping the individual feeder normally acting on a strand upon the detection of an abnormal condition in the strand.
26. A textile machine having therein a plurality of strand-manipulating devices, holders of strand supply masses for the respective strand-manipulating devices, means for moving the strand-manipulating devices and said holders in a circulatory path, feeding mechanism acting to unwind and feed to the strand-manipulating devices the strands of the supply masses, and means for operating the unwinding and feeding mechanism during motion of the strand-manipulating devices in said path.
27. In a textile machine having a device for manipulating strands, and means for conveying the device in a predetermined path, the combination with said device and conveying means of a holder movable in said path with the strand-manipulating device, said holder being adapted to carry an unwinding supply strand mass for the strand-manipulating device, a strand feeding device movable with the strand-manipulating device, and an elongated rotary tractor roll disposed to operate said feeding device in various positions in said path.
28. In a textile machine having a device for manipulating strands, and means for conveying the device in a predetermined path, the combination with said device and conveying means of a holder movable in said path with the strand-manipulating device, said holder being adapted to carry an unwinding supply strand mass for the strand-manipulating device, a strand feeding device movable with the strand-manipulating device, an elongated rotary tractor roll disposed to operate said feeding device in various positions in said path, a detector of exhaustion or breakage of the strand, and means actuable by the detector for preventing operation of the feeding device by said tractor roll.
29. A textile machine having therein means for holding a strand receiver for rotation about a vertical axis, means for twisting a strand and concomitantly winding it on the receiver, a traverse device for effecting a relative vertical traverse of the winding strand and the receiver, means for moving the receiver, the winding and twisting means and the traverse mechanism in a predetermined path, and means for operating the traverse device in various parts of said path.
30. A textile machine having therein means for twisting a textile strand, an electric motor for operating said twisting means, means for moving the motor and twisting in a predetermined path, and electric connections including a conductor rail disposed along said path and a brush movable with the motor, for operating the motor in various positions in said path.
31. A textile machine having therein means for drafting a textile strand, an electric motor for operating said drafting means, means for moving the motor and drafting means in a predetermined path, and electric connections including a conductor rail disposed along said path and a brush movable with the motor, for operating the motor in various positions in said path.
32. In a textile machine of the type having a carrier for a winding pair and means for moving the carrier in a predetermined path of elongated shape, a live spindle for one strand mass of the winding pair and a holder for the other strand mass of the winding pair, a motor on the carrier for rotating the live spindle, and means for operating the motor in various positions of the carrier in said path, the holder and live spindle being so disposed with respect to each other and the speed of the motor being such as to impart a substantial twist to the strand of the winding pair.
33. A twisting or spinning machine having therein a device for rapidly rotating a supply strand mass, in combination with means for so holding a receiving strand mass that a strand leading thereto from the rotating supply mass will receive a twist, means for moving said device and said means in a predetermined path during twisting of the strand, and a rotary driving element not partaking of said motion and disposed to contact with and rotate the receiving mass during such motion.
34. A textile machine having therein holders for unwinding and winding strand masses, a guide comprising a revoluble part adapted to engage the strand between said masses, means for moving the holders and guide in a predetermined path about the machine, and means operable during such motion to rotate the winding strand mass and revolve the strand-engaging part of said guide at different angular velocities thereby to twist and wind the strand.
35. A textile machine having therein a carrier, means on the carrier for manipulating a strand, an electric motor on the carrier for operating the strand-manipulating means, means for moving said carrier in a predetermined path, means including a relatively stationary electric conductor and a brush on the carrier for supplying current to the motor in various positions of the path, and means acting in response to breakage or exhaustion of the strand on the carrier to remove said brush from the said conductor.
36. A textile machine having therein a strand drafting device, and means whereby the drafting device may be moved in a path, in combination with an elongated rotary tractor roll not partaking of said motion and arranged along said path to drive the drafting device in various positions of the latter in the path.
37. A strand-manipulating machine having therein a rotatable holder for a strand, means for rotating the holder, means actuable to draw off the strand from the holder while the latter rotates so as to twist the strand, and a mounting for the holder permitting the holder to swing from its normal position for convenience in replenishing the strand supply.
38. A strand-manipulating machine having therein a rotatable holder for a strand to be spun, mechanism for rotating the holder, a drafting device disposed to elongate a strand from the holder, and connections for transmitting motion to the drafting device from the holder, said connections including a disengageable coupling.
39. A strand-manipulating machine having therein a rotatable device for holding a strand to be spun, a bodily rotatable device for drafting the strand from the holder, drive means for one of said rotatable devices, and means for pressing

the holder against said drafting device whereby the two rotate in unison.

40. A textile machine having therein holding means for a strand to be spun, including a rotary part, drafting means for the strand including a rotatable part, means for driving one of said parts, and friction means for transmitting movement of the driven part to the other part.

41. A textile machine having therein a pair of opposed draft rolls and means for winding a strand delivered from the draft rolls, in combination with frictional driving means for rotating one of said draft rolls including a rotary driving element with relation to which said draft roll is movable longitudinally so as to be driven thereby at different locations in the machine, and means whereby the other draft roll is driven frictionally from the first roll.

42. In combination with the high speed winding and twisting devices of a spinning, twisting or other strand-manipulating machine, feeding

mechanism acting to unwind from a supply mass a strand to be twisted and wound by the said devices, means for causing said devices and mechanism to travel in a predetermined path during operation thereof, and means for stopping said feeding and winding devices upon the occurrence of an abnormal condition in the strand.

43. A textile machine having therein a strand-manipulating device, means for conveying the device in a predetermined path, means including a feed roll movable in said path with said device for supplying a strand thereto, a rotatable traction element operatively associated with said feed roll to drive said feed roll, said traction element being of a different diameter than its associated feed roll, and an elongated rotary roll extending along said path in position to engage and drive the said traction element to operate the feed roll in various positions in said path.

EDWARD J. ABBOTT.

CERTIFICATE OF CORRECTION.

Patent No. 1,964,715.

July 3, 1934.

EDWARD J. ABBOTT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 11, line 130, claim 8, after "path" insert the word of elongated shape; page 12, line 2, claim 10, after "path" insert of elongated shape; line 9, claim 11, after "machine" insert in a path of elongated shape; and line 104, claim 20, for "draft" read drafting; page 13, line 65, claim 30, after "twisting" insert means; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of September, A. D. 1934.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)

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