

April 20, 1954

E. J. ABBOTT
TEXTILE MECHANISM

2,675,971

Filed May 11, 1948

26 Sheets-Sheet 1

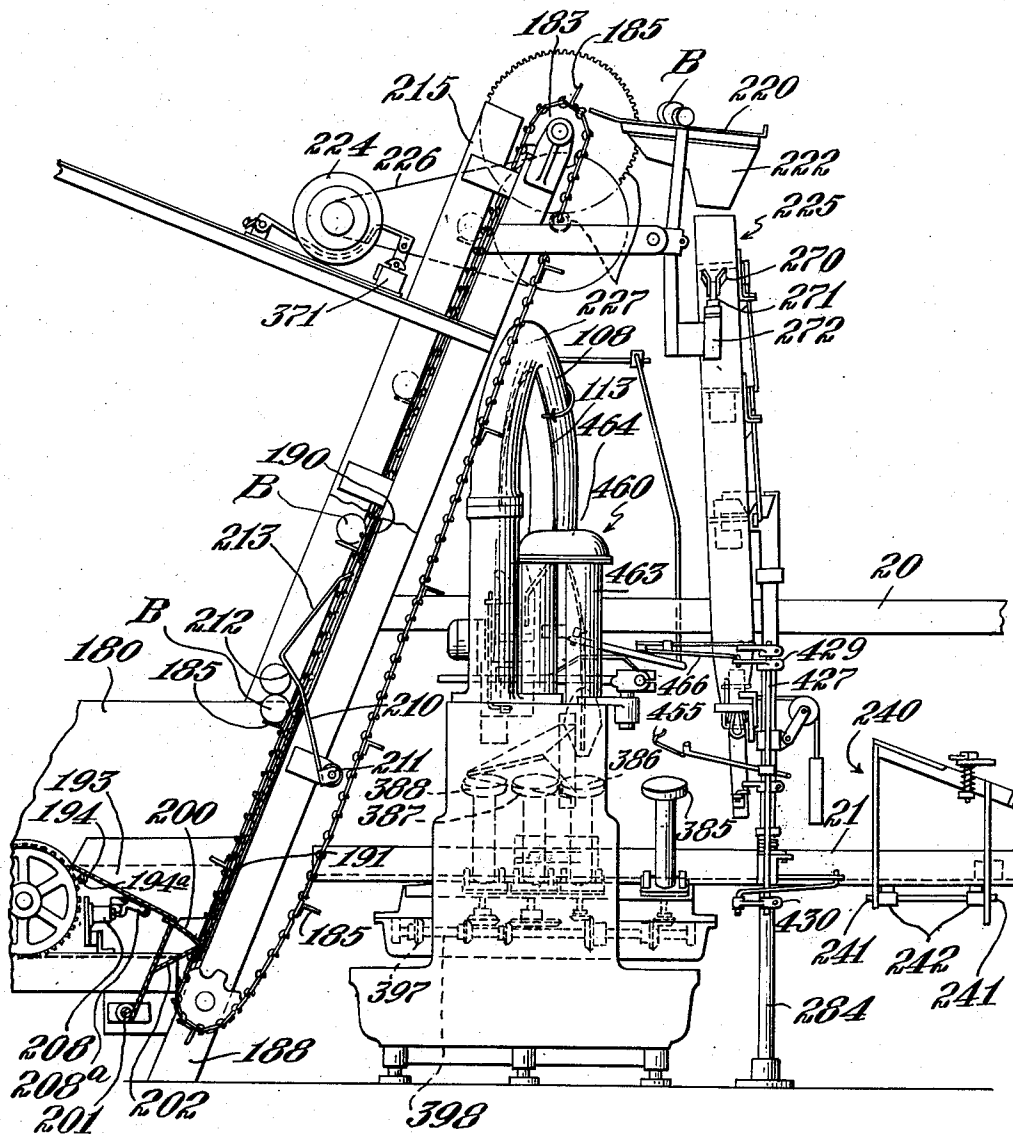


Fig. 1

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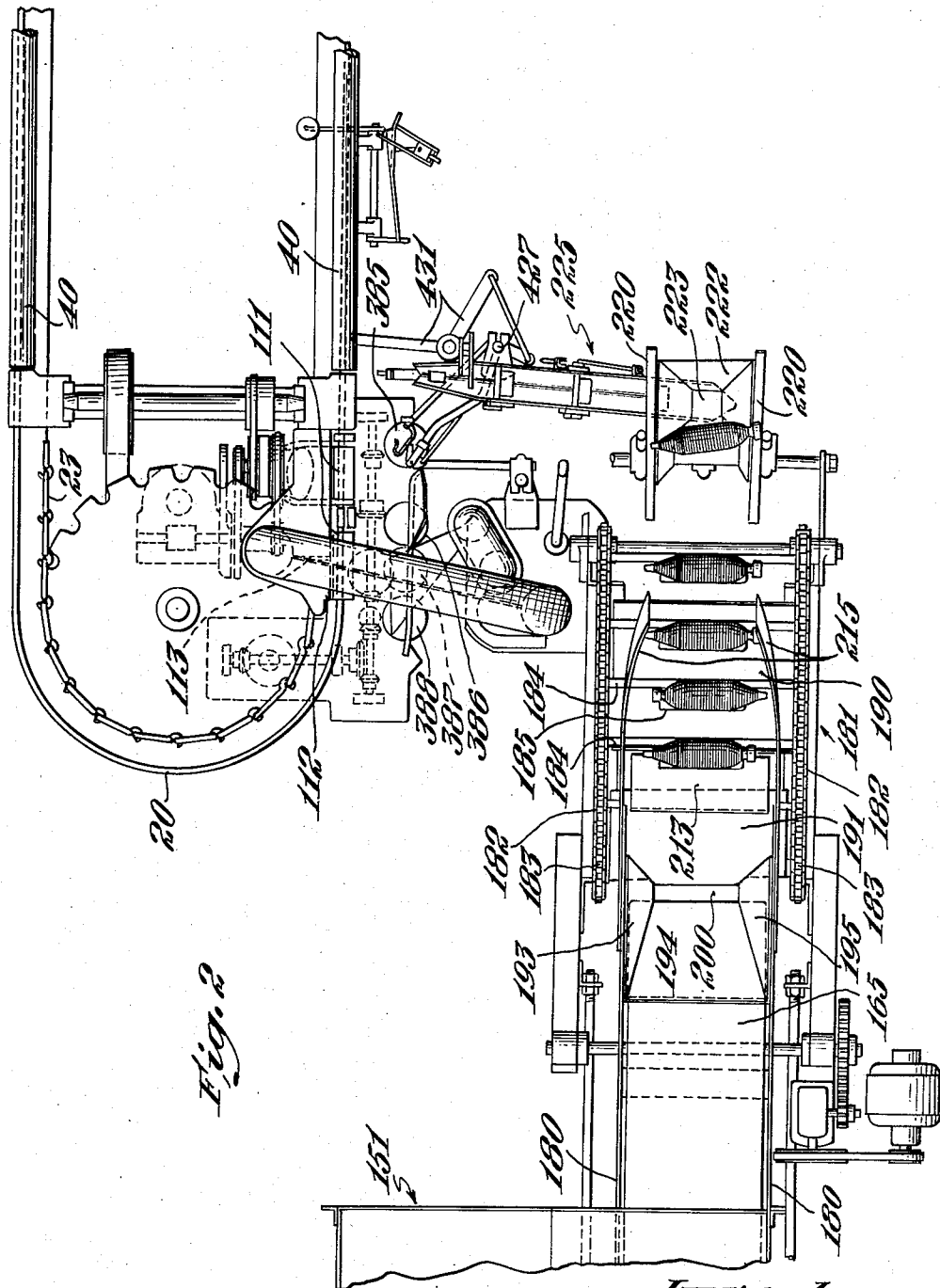
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26 Sheets-Sheet 2



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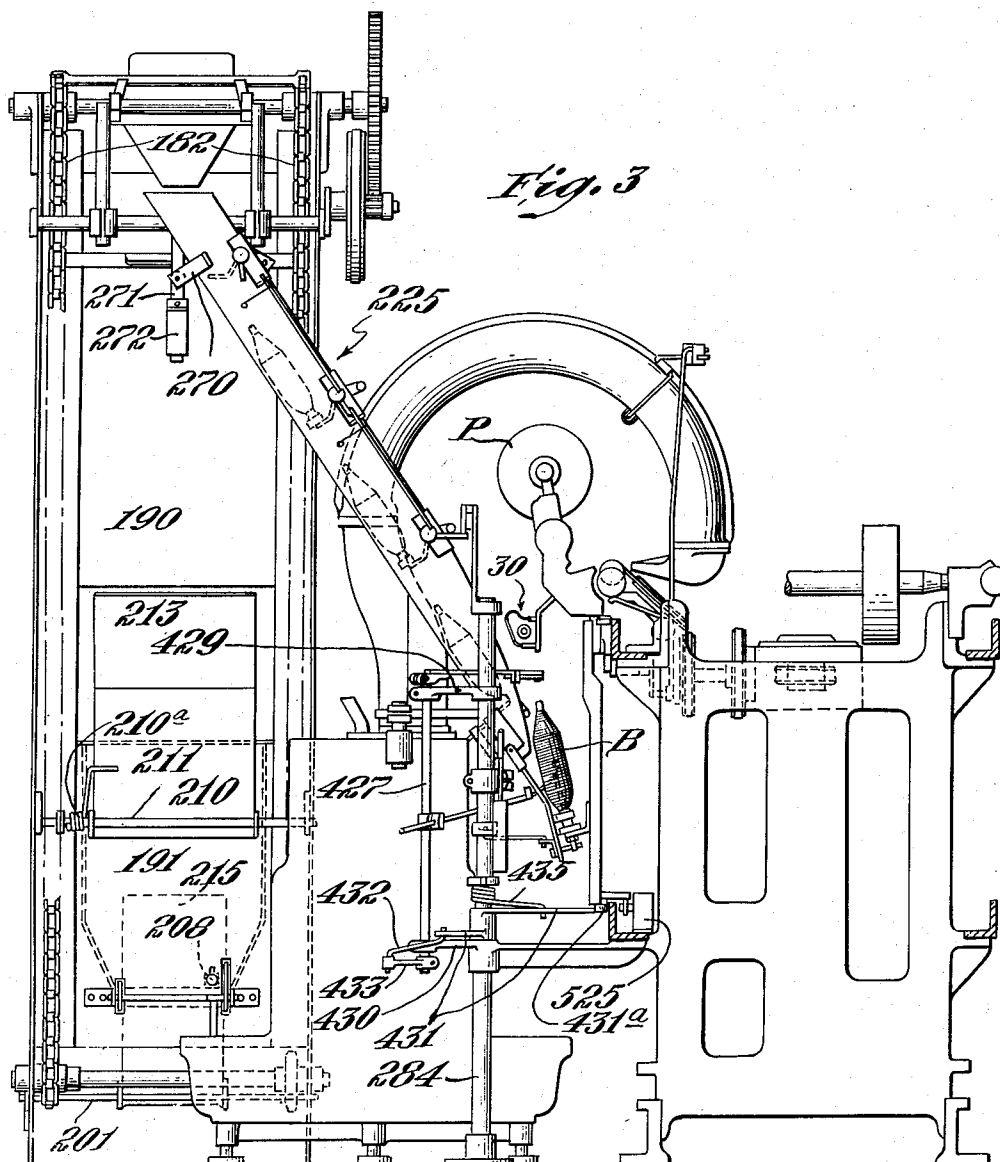
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26 Sheets-Sheet 3



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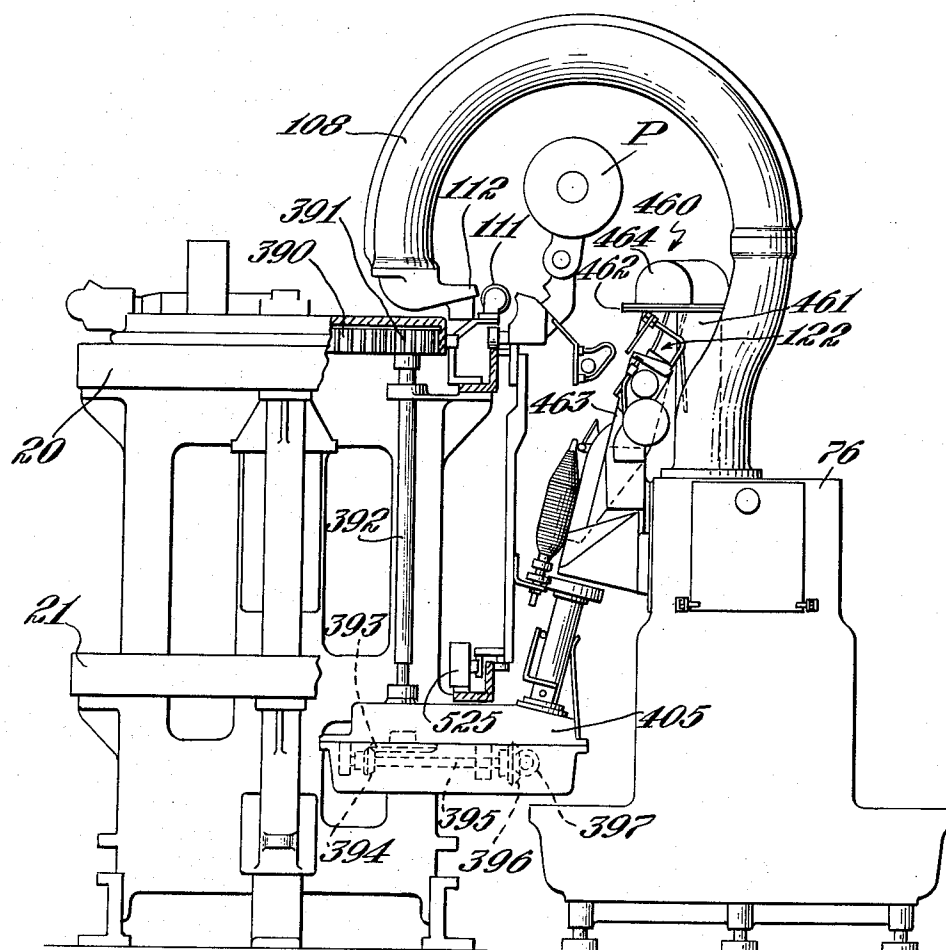


Fig. 4

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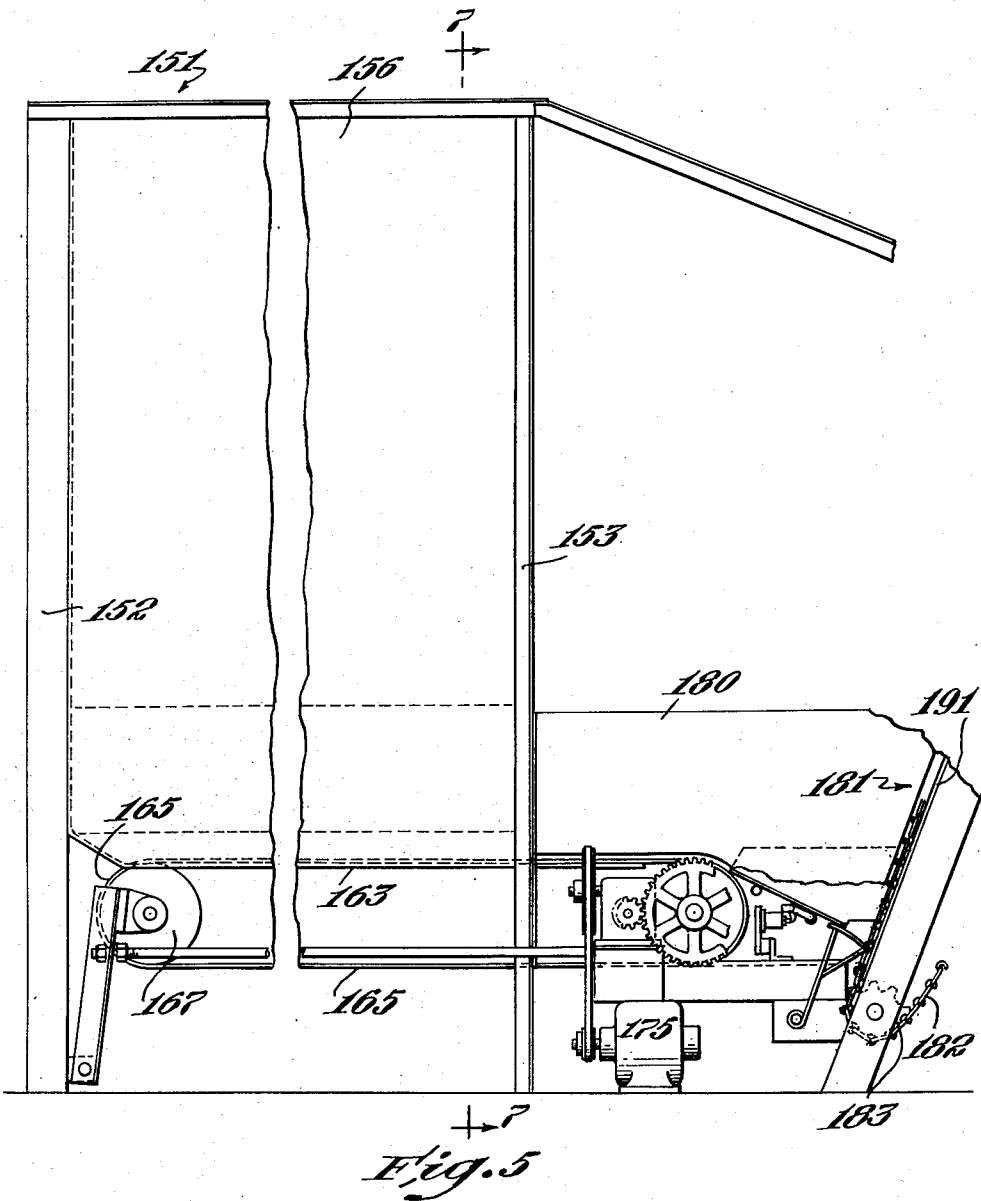


Fig. 5

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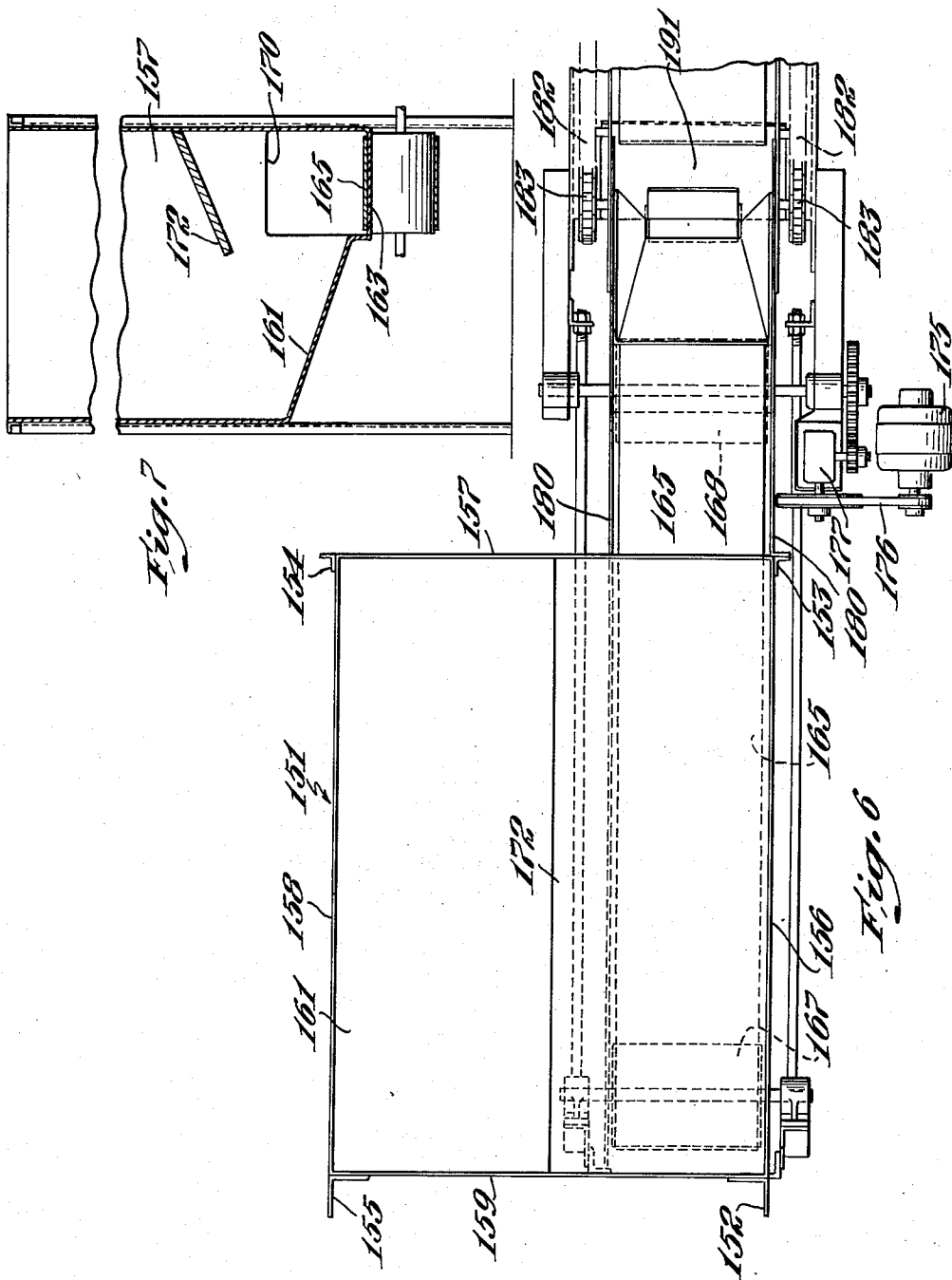
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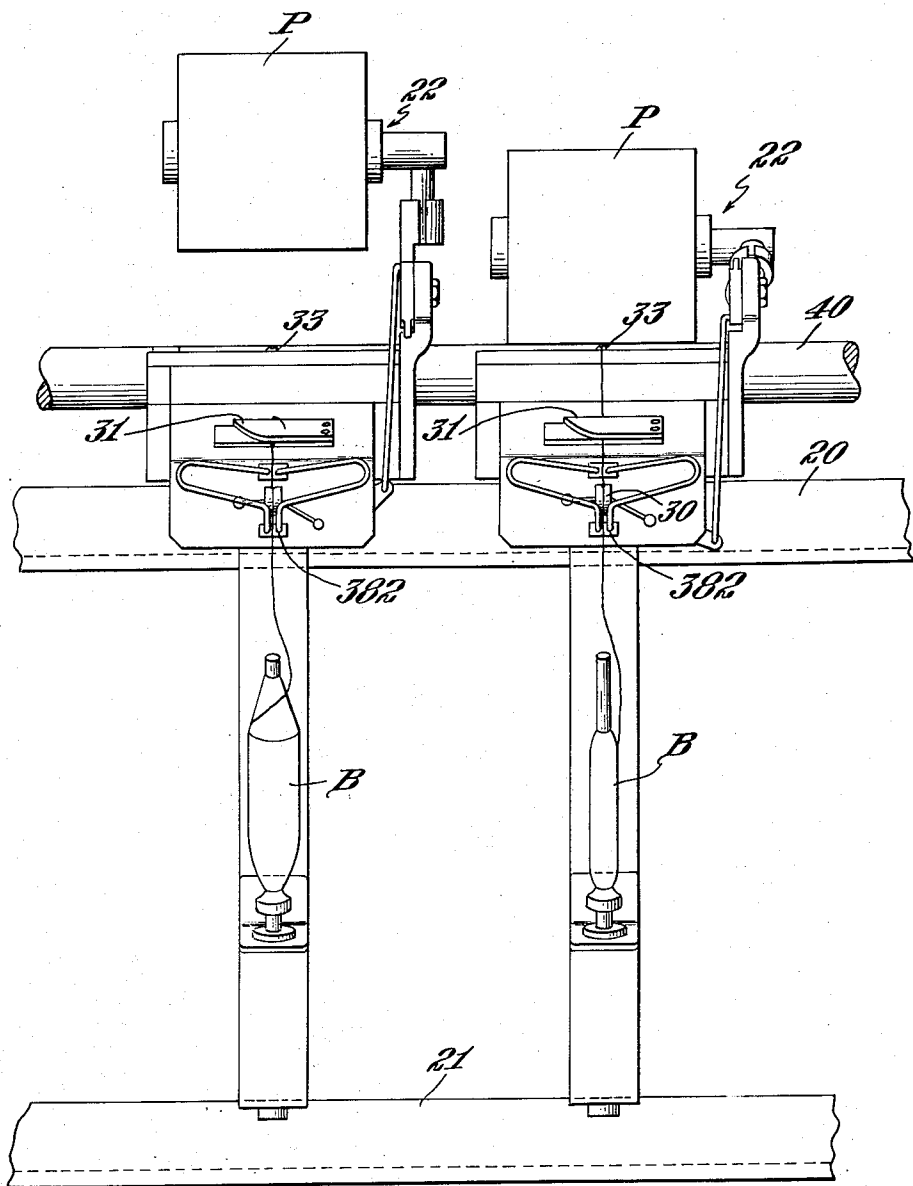


Fig. 8

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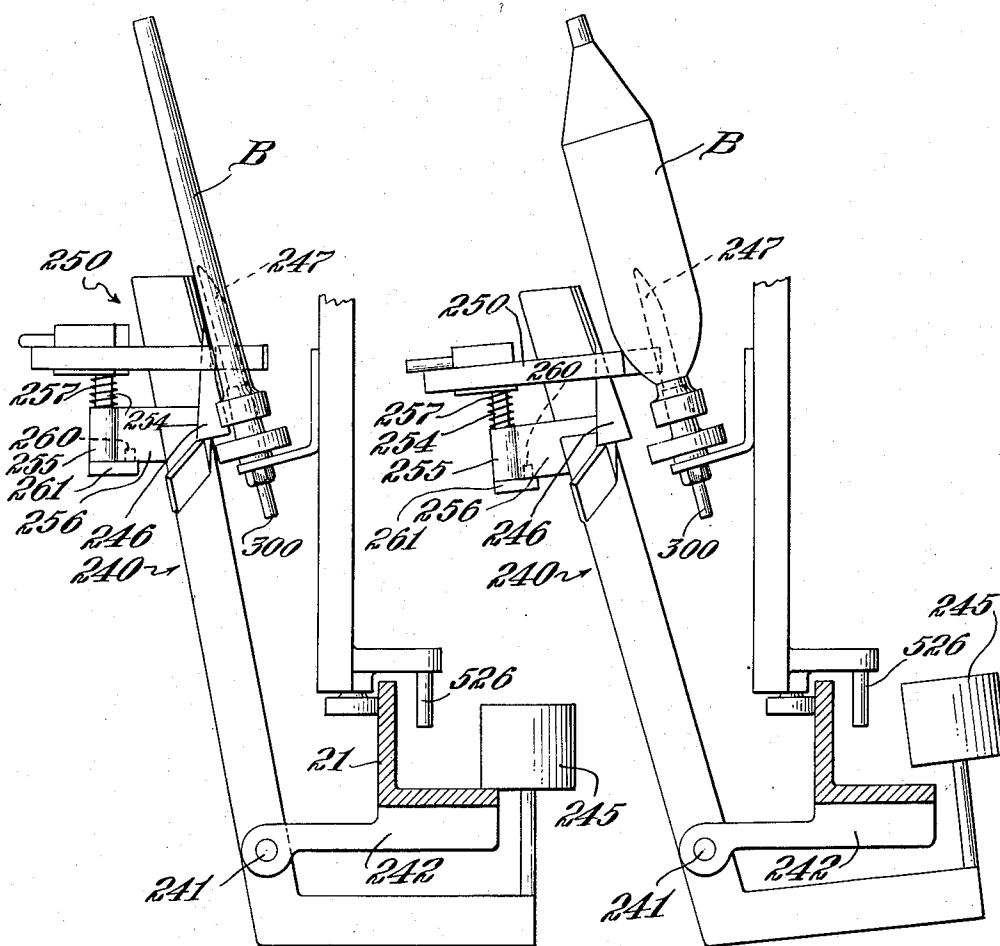


Fig. 9

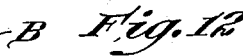
Fig. 10

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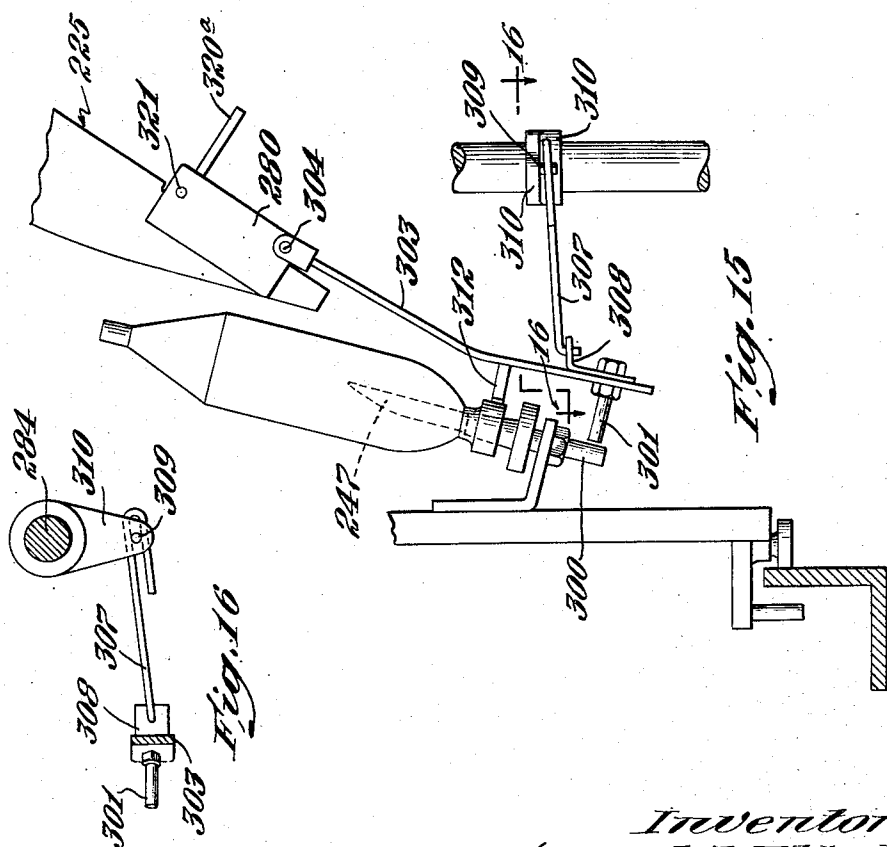
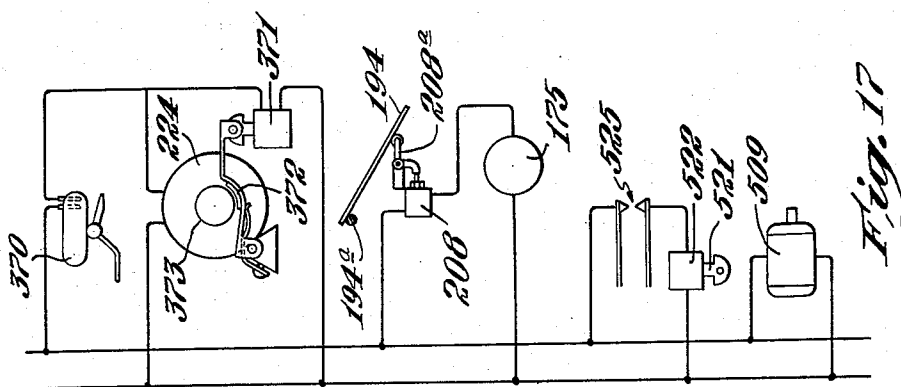
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26 Sheets-Sheet 11



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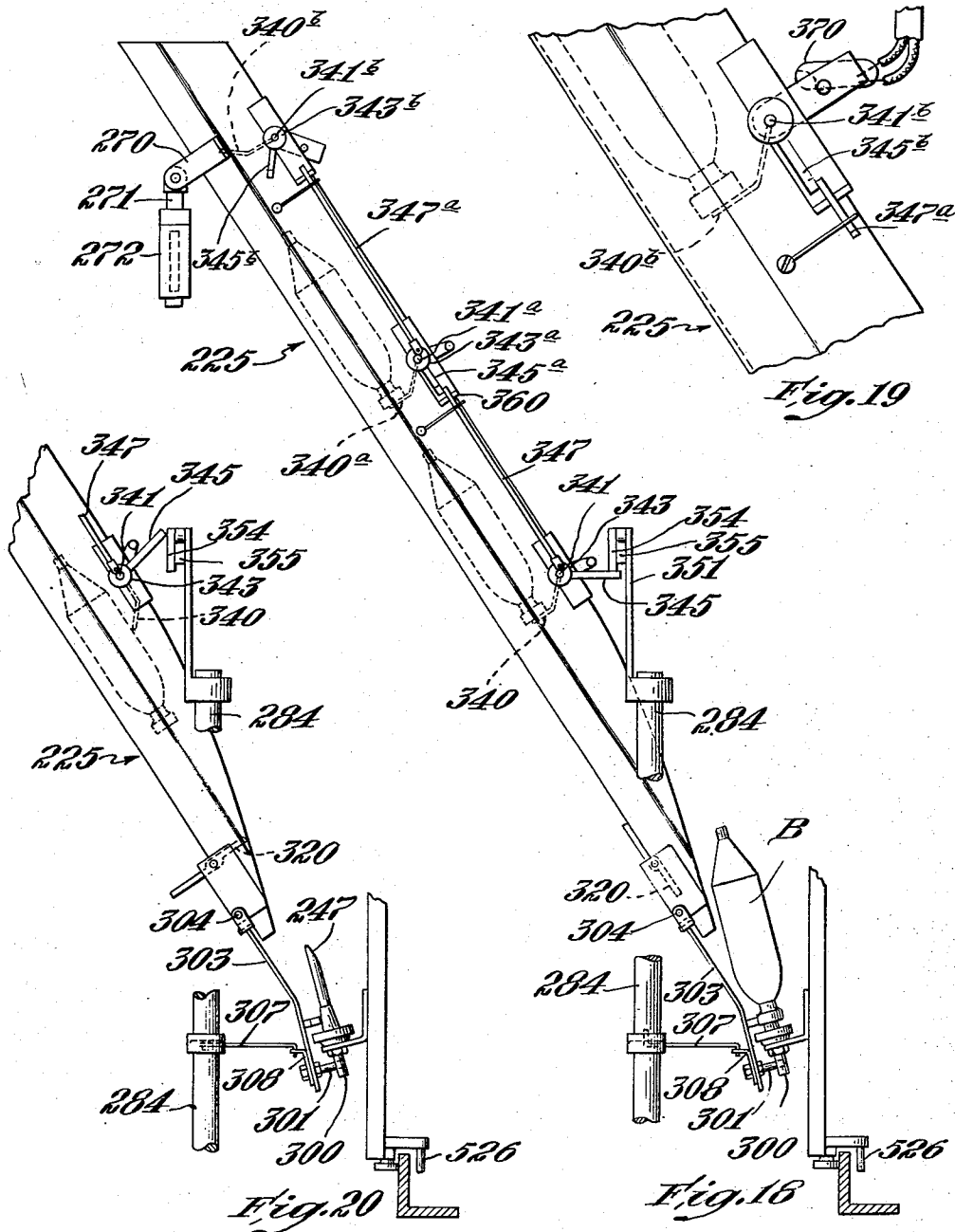
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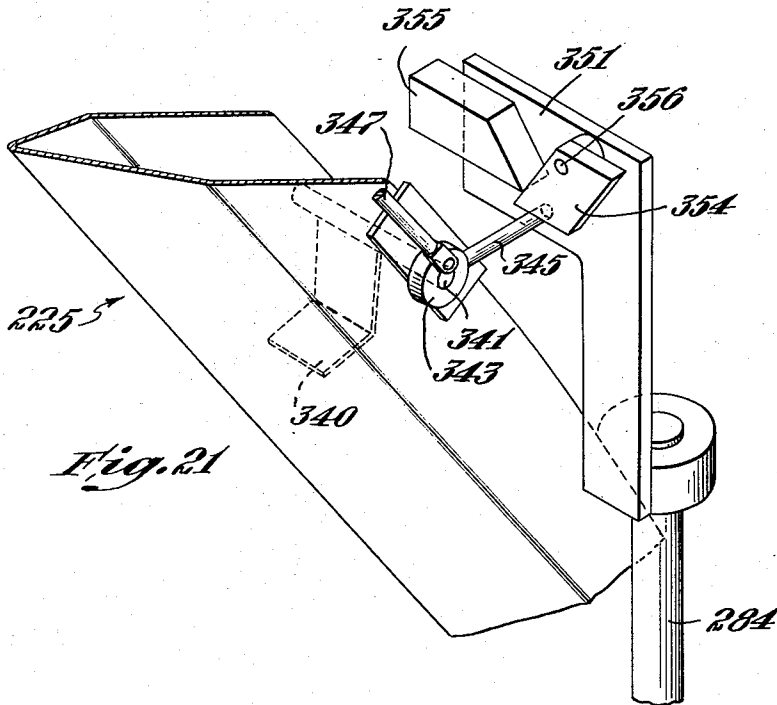


Fig. 21

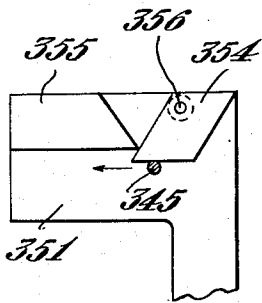


Fig. 22

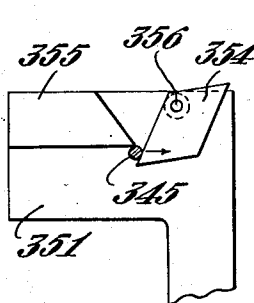


Fig. 23

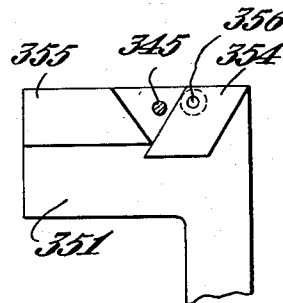


Fig. 24

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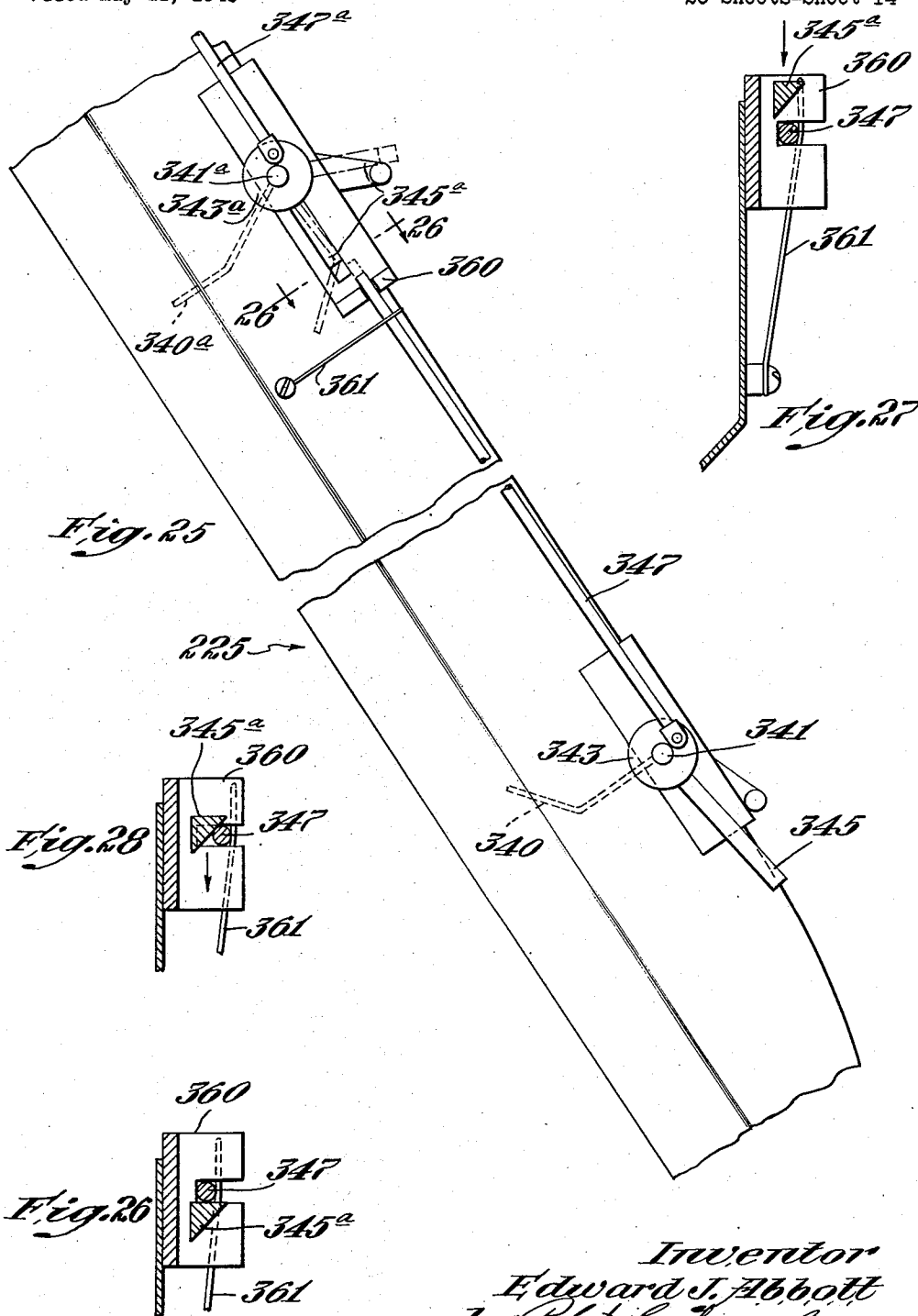
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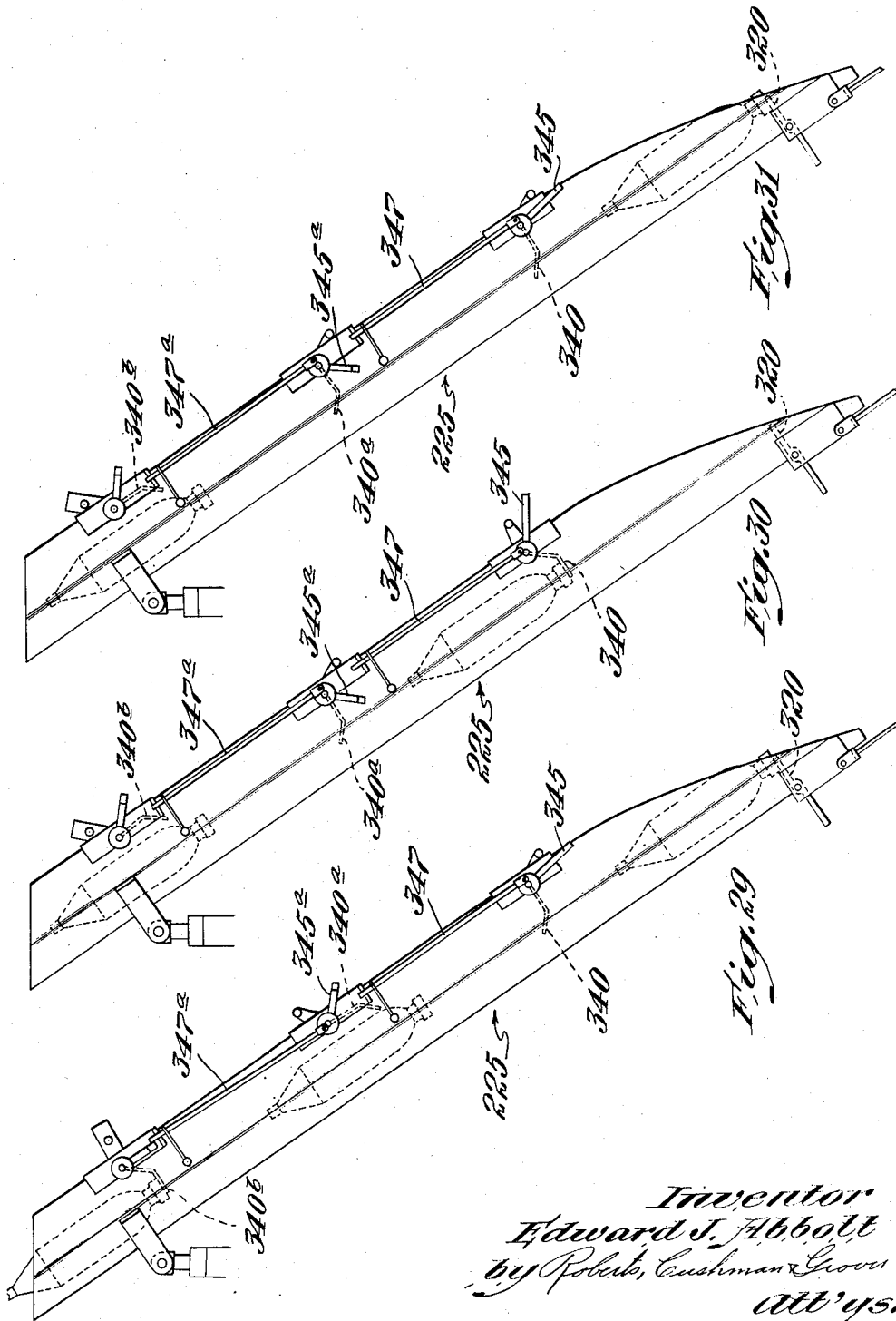
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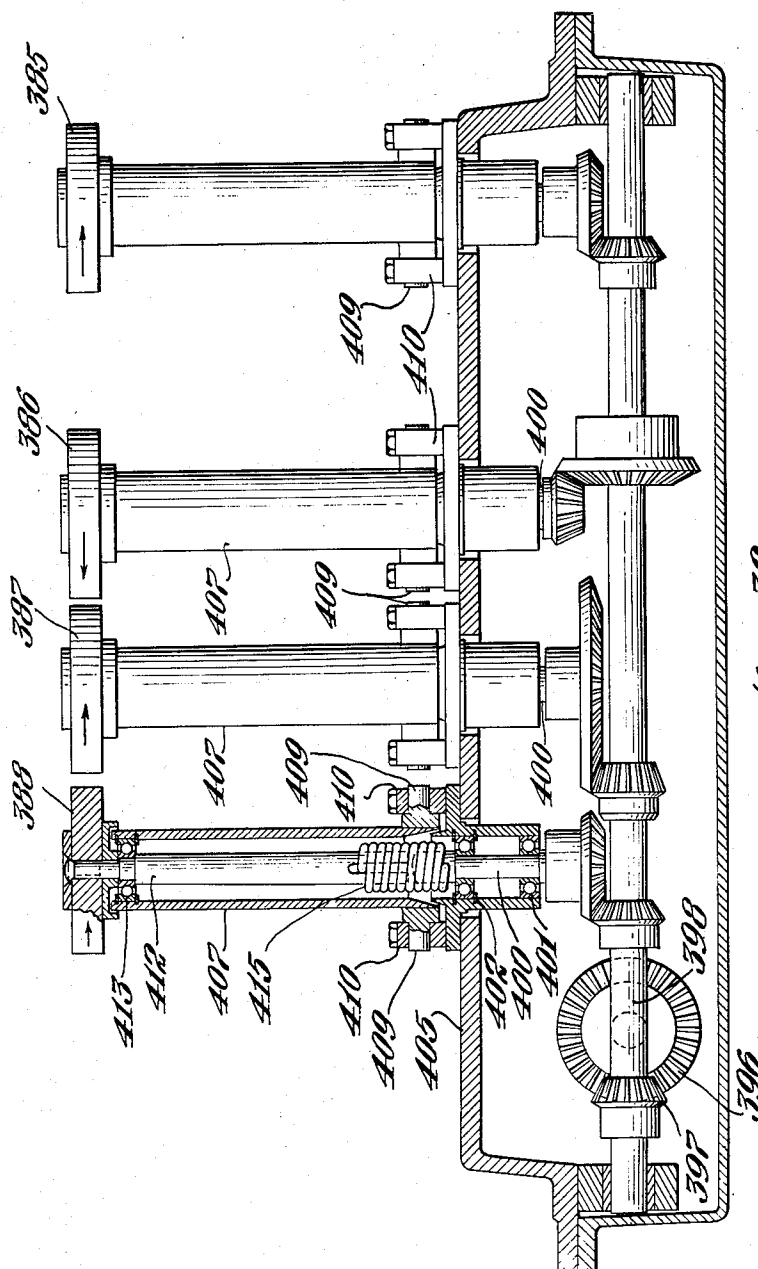


Fig. 32

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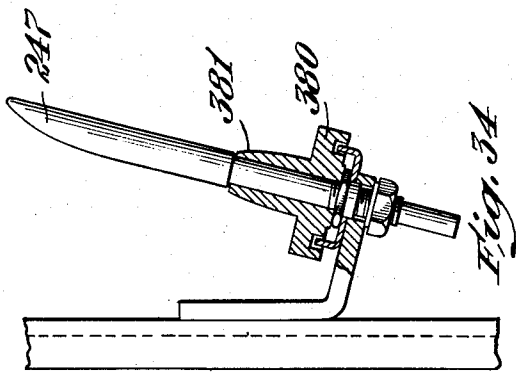
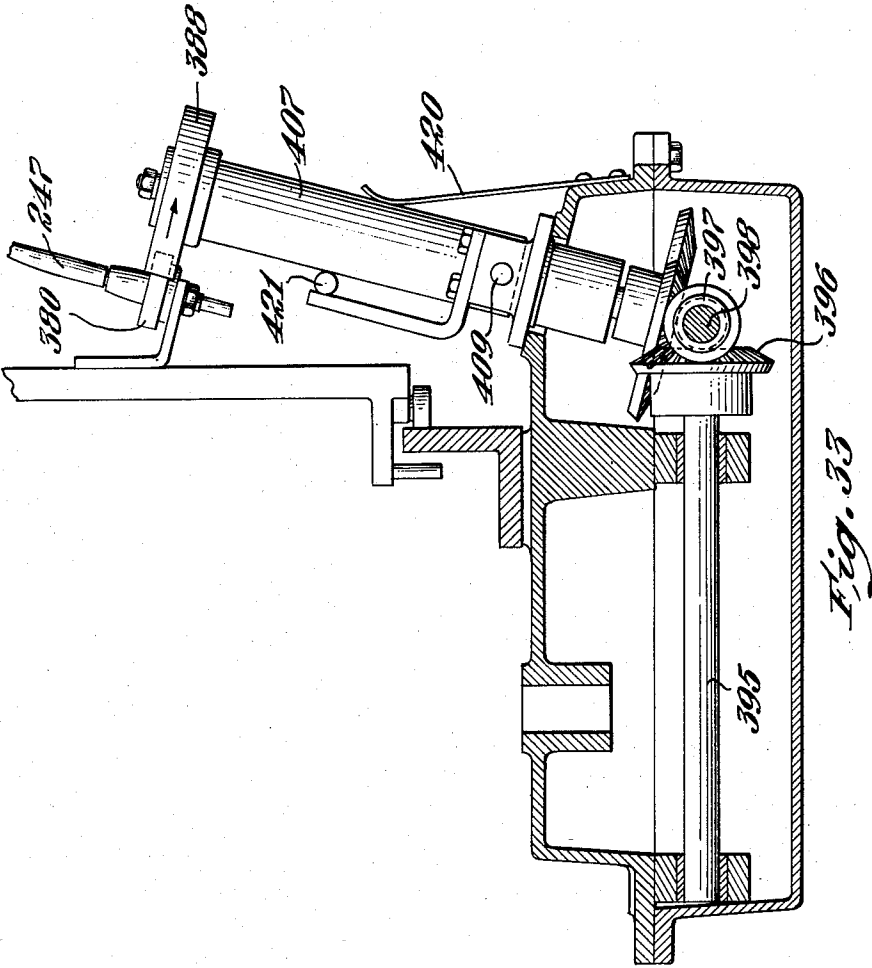
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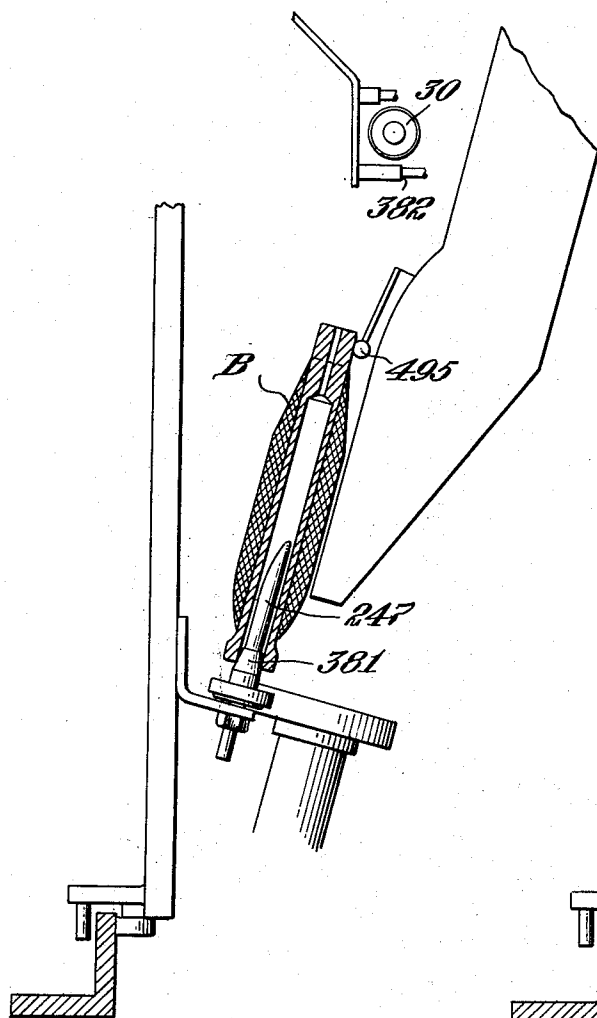


Fig. 35a

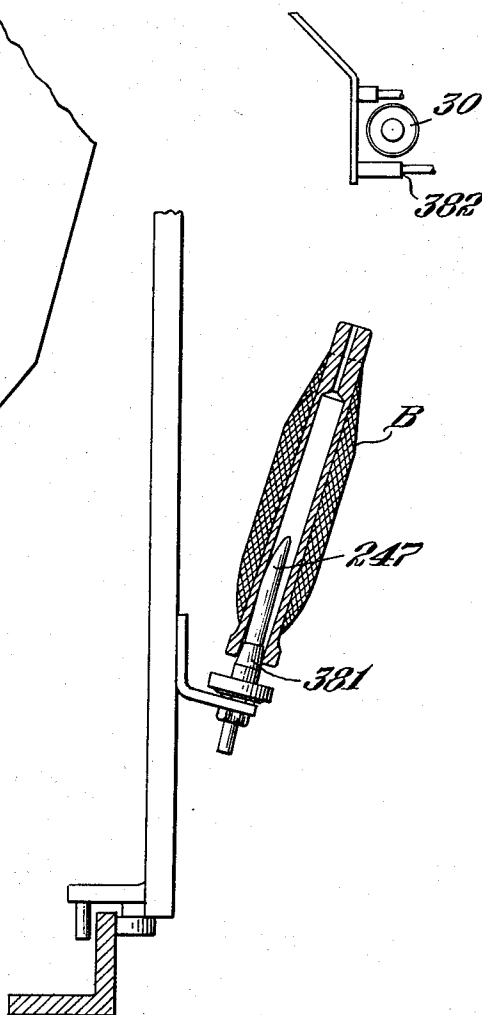


Fig. 35

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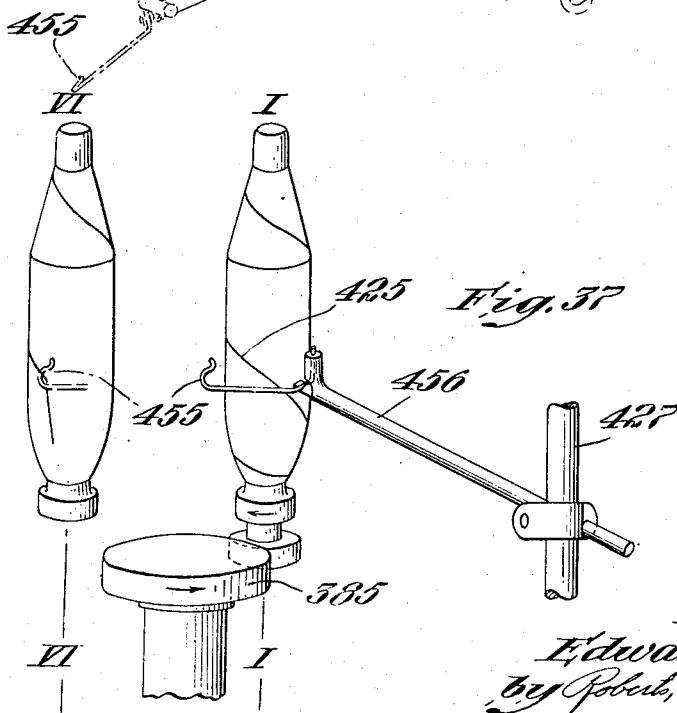
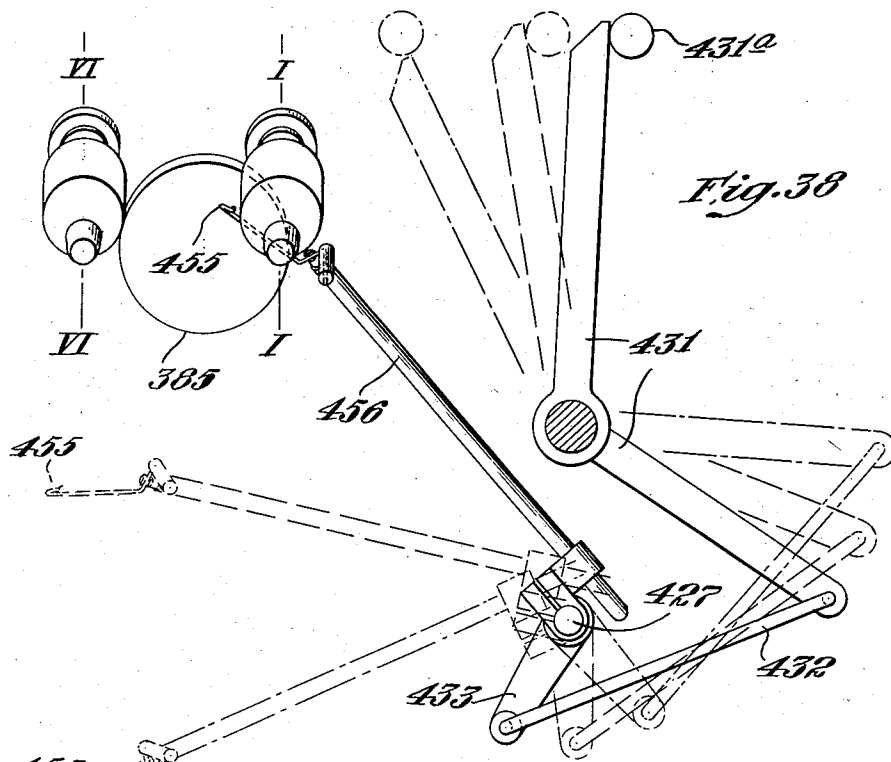
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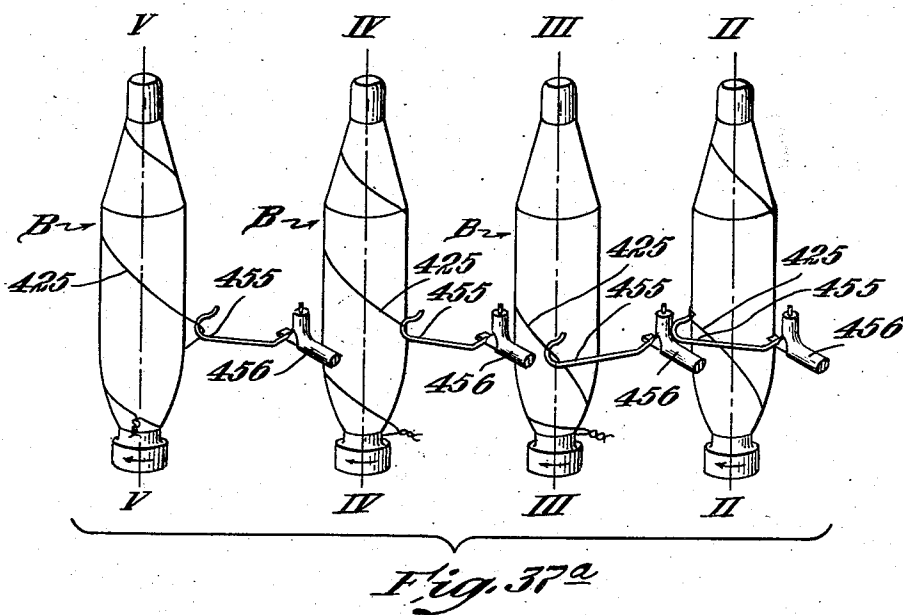
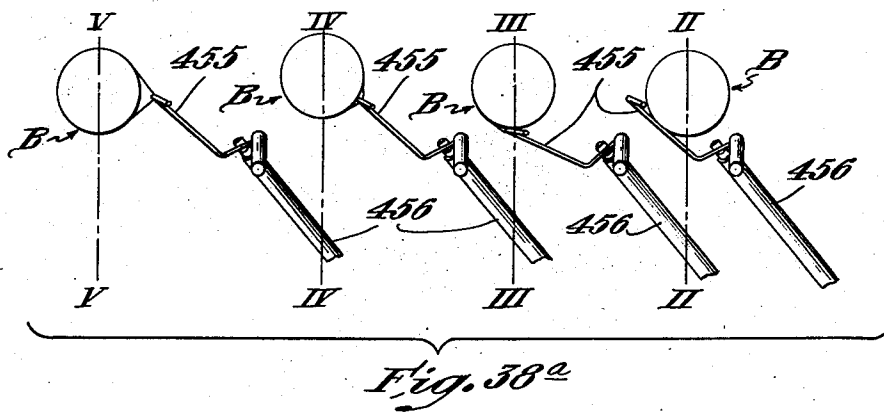
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26 Sheets-Sheet 21



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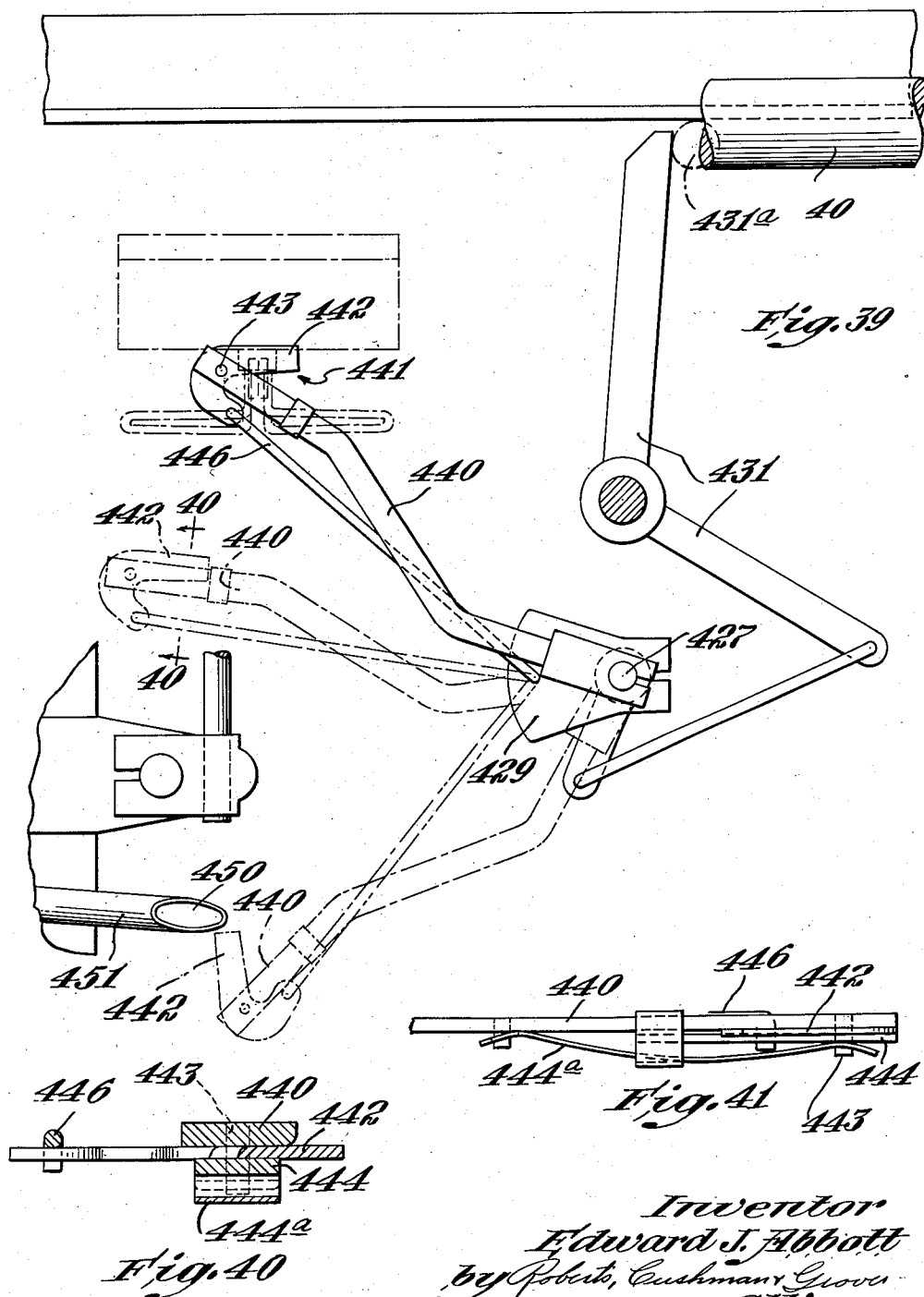
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26 Sheets-Sheet 22



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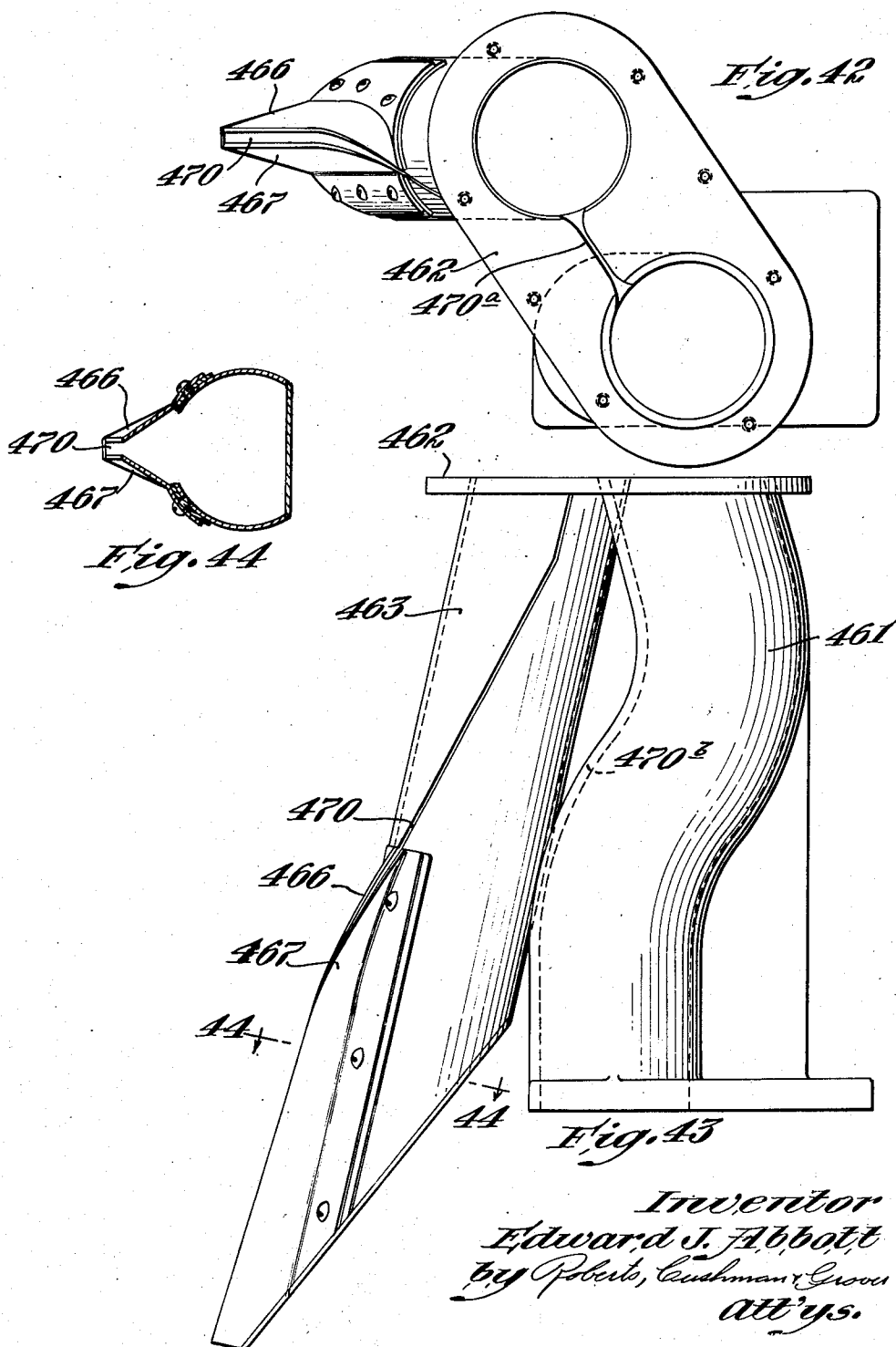
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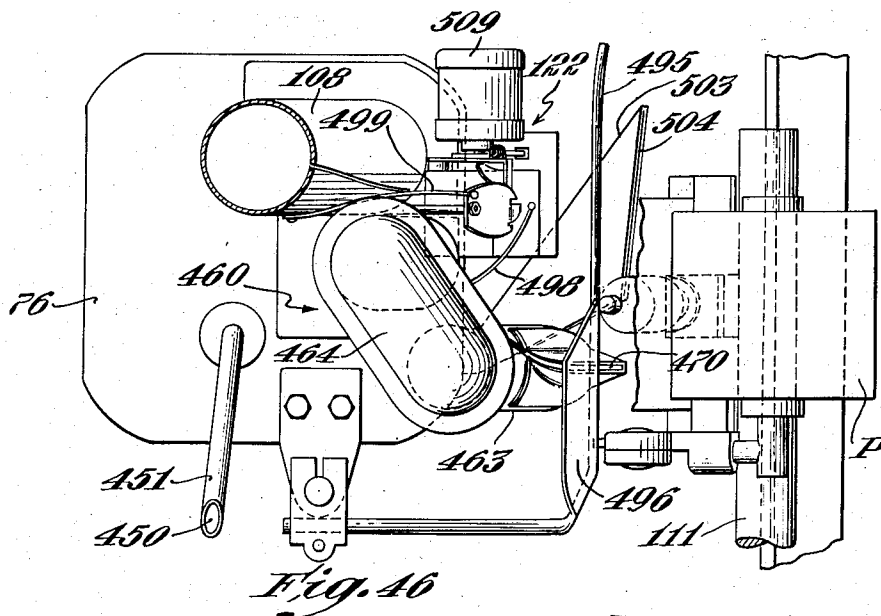
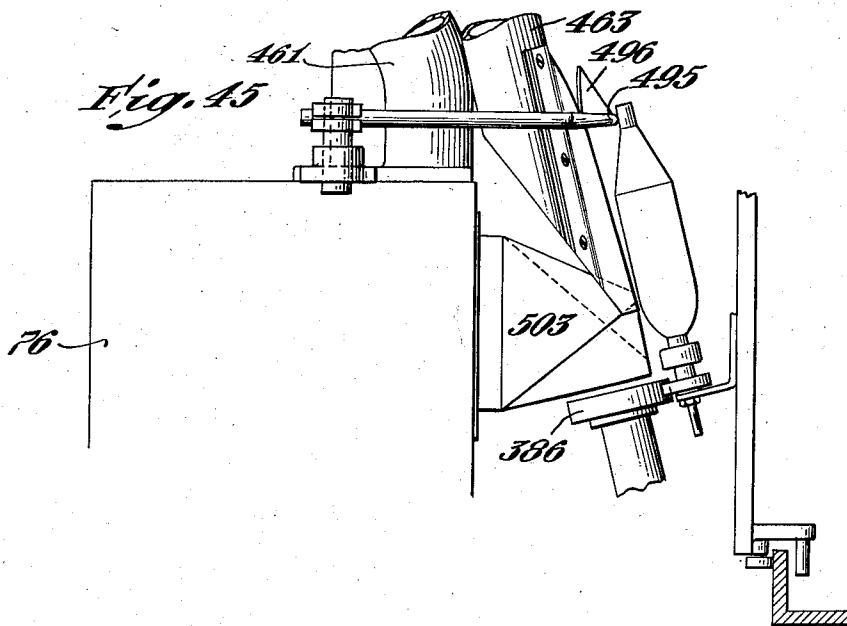
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26 Sheets-Sheet 24



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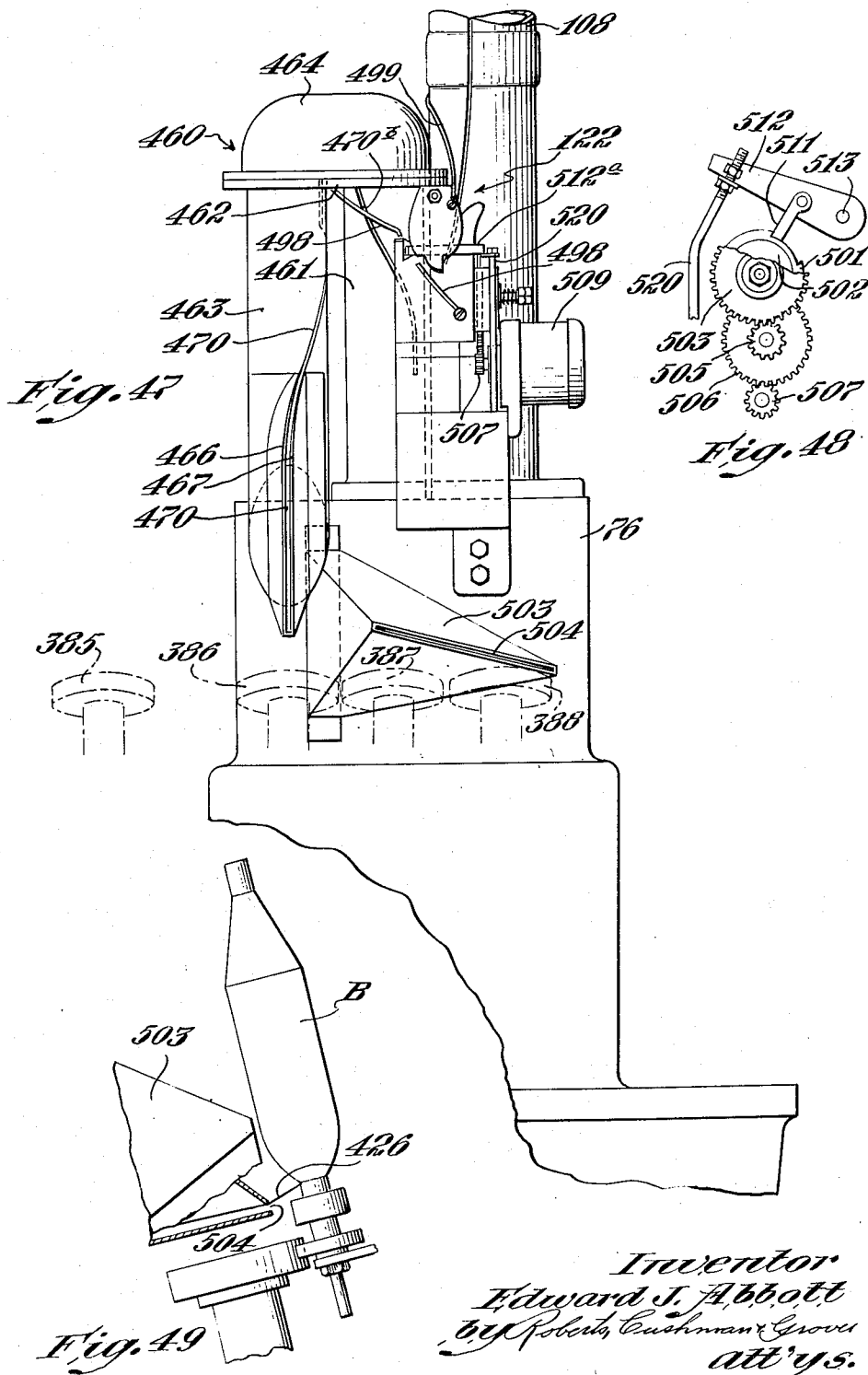
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26 Sheets-Sheet 25



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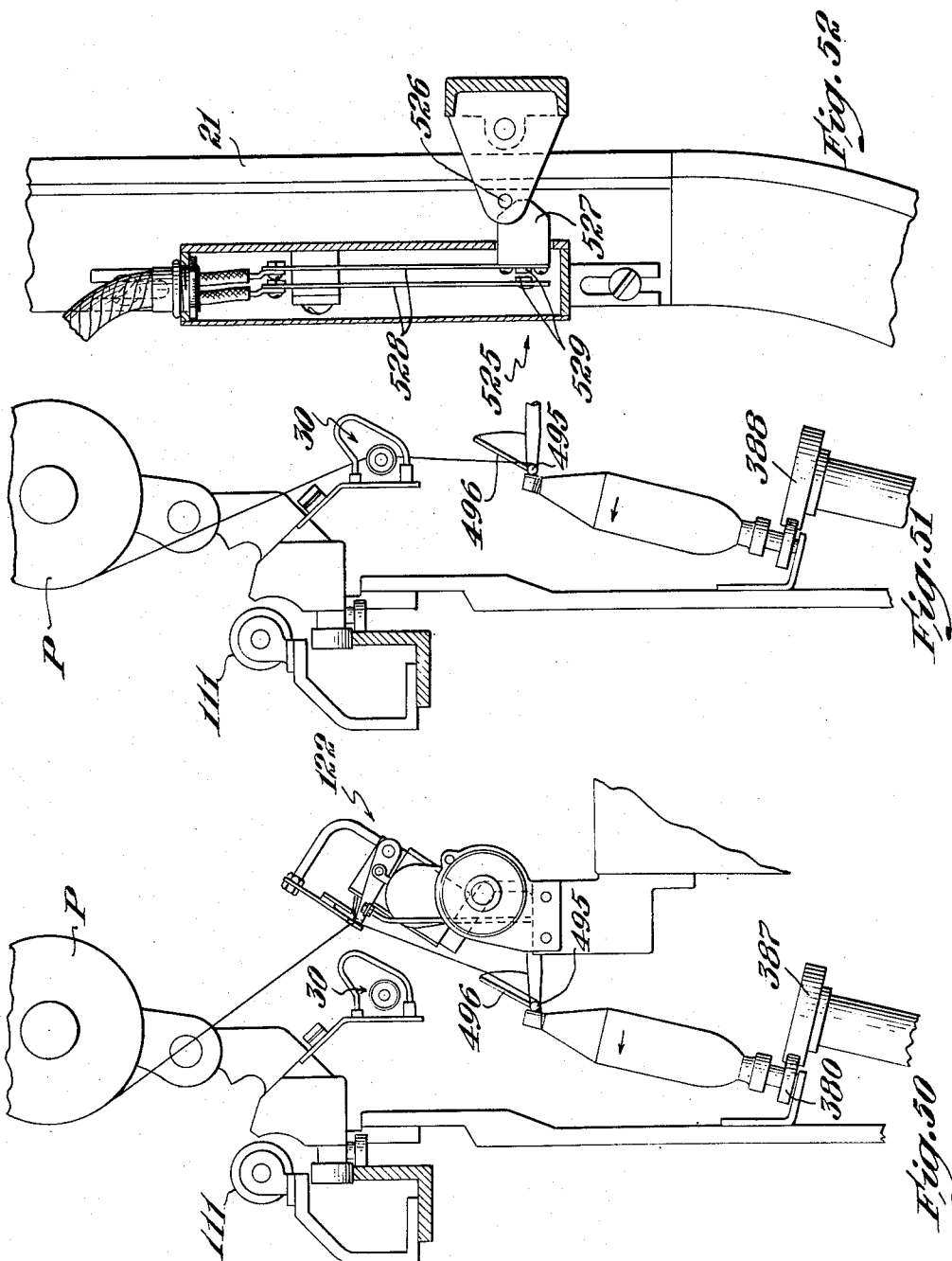
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26 Sheets-Sheet 26



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UNITED STATES PATENT OFFICE

2,675,971

TEXTILE MECHANISM

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Application May 11, 1948, Serial No. 26,329

39 Claims. (Cl. 242—35.6)

1

This invention relates to textile mechanism and more particularly to such mechanism involving handling of bobbins of thread or yarn to be unwound.

One of the principal objects of the invention is to provide improved mechanism for automatically delivering fresh supply bobbins to thread-using devices, such as winding units, and automatically associating the thread of such newly delivered bobbins with thread-withdrawing mechanism. The invention aims to accomplish these results with bobbins in the condition in which bobbins are furnished by the spinning operation, the ends of threads of such bobbins not having been found and the bobbins themselves being in a mixed-up mass.

Many of the features of the present invention are of general applicability to textile machines which withdraw thread from bobbins and in which it may be desired to provide for automatic delivery of supply bobbins and automatic association of the leading ends of threads of the new bobbins with the mechanism which withdraws thread from the bobbins. The invention is particularly adapted to automatic winding, and will be so explained in this specification.

While many advances have been made in which automatic handling of bobbins and the automatic tending of such thread-using machines as winding machines, the usual practices in the textile industry require certain manual operations in the use of bobbins of the kind customarily produced by spinning machines.

It will be understood that thread or yarn first exists as such in the spinning machine where it receives a sufficient twist to enable it to withstand tension and where it is wound on a bobbin.

The great bulk of spinning machines rotate the winding bobbin on a spindle located inside a ring, which ring serves as a guide for a traveler through which the spinning yarn is led on its way to the rotating bobbin. The necessary distribution of the thread on the bobbin is obtained by relative movement of the ring and bobbin, and customarily the last wound portion of the main body of thread is the upper or tip portion of the bobbin.

Removal of the bobbin from its spindle usually involves lowering the spinning ring to or below the base of the bobbin, producing an open spiral of thread on the outside of the main wound body of thread, often followed by winding a few additional turns of thread around the base of the bobbin below the main wound body of thread before rotation of the spindle and bobbin are stopped. The spindle and bobbin then being

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stopped, the operative quickly pulls the full bobbin up off the spindle, looping one or more turns of the thread about the spindle, and then breaks off the thread between the spindle and the removed full bobbin. A new empty bobbin is then placed on the spindle. When the spindle is then started the portion of thread extending between the traveler and spindle is then guided onto the bobbin and the operation continues until this bobbin is then complete.

The wound thread on such a bobbin usually has two ends twisted together or entangled. From the interior of the wound body of thread there extends a tail portion which is the part of thread that was initially contacted with the original empty bobbin. On the exterior of the wound body of thread is the open spiral and frequently around the base of the bobbin are a few additional turns, as referred to above. Both of the ends of thread of the bobbin have twist, and they tend to rotate and twist together, so that the bobbin has no single free end of thread. Under these conditions the last wound end of thread of the bobbin from the spinning machine is not available for simple lifting from the surface of the body of wound thread and unwinding therefrom. The operation of finding and freeing these last wound ends manually requires considerable dexterity.

Moreover the bobbins produced by spinning machines are customarily thrown into a box at the time they are removed from the spindles by the operative, and so the usual batch of bobbins from a spinning machine is a mixed-up mass.

In an automatic winding machine having a magazine for holding reserve supply bobbins and provision for holding their ends of thread separate, and employing an operative to attend to feeding bobbins to such magazine, the operative can take bobbins singly from such a mixed-up mass and, guided by eye, manually seize and break the exterior spiral and pull off some thread from the bobbin, putting the pulled-off end of thread into the thread-end holding means and putting the bobbin into the magazine, right-end-to, all the same quick operation. An automatic winding machine having many of the features of U. S. Patent No. 2,177,763 is extensively used and receives bobbins by this method. Although this method of furnishing supply bobbins is thus extensively used, it has the disadvantage of requiring the operator to give close attention to the magazine, and so when her attention is required elsewhere about the machine, the magazine will soon exhaust.

Although end-finding mechanisms for bobbins

are known, the complexity of dealing with bobbins in the condition in which they are customarily supplied by spinning machines is so great that bobbins in this condition are manually fed as outlined above. The practical necessity for feeding bobbins and handling their threads manually at the magazine results in the capability of the machine to use the thread of the bobbins being limited by the rate at which the operative can perform the necessary manual operations at the magazine. The invention aims to avoid this limitation on the capacity of thread-using machines, such as automatic winding machines, and aims to free the operative from the need for close attention to the magazine and allow practically all of her time to be available for general supervision of the running machine.

An advantage of the invention resides in the greater rate at which bobbins can be supplied by the present invention as compared to the usual manual handling. A further advantage resides in the ability of a machine of this invention to maintain on hand a larger supply of bobbins than can be conveniently reached or handled by a human operative.

A preferred advantageous feature of the invention involves the automatic delivery of full bobbins, with their ends of thread as yet unfound, to such winding units as require new bobbins, and the automatic finding of the ends of threads of such newly delivered bobbins and also the ends of threads of partly exhausted bobbins on the several winding units, so as to render all operations of finding ends completely automatic and to concentrate these operations in mechanism that operates upon bobbins which are on the several individual units.

The preferred form of machine has provision for rotating a supply bobbin on each unit of the machine to facilitate finding its end of thread both in case the bobbin on the unit is a newly delivered bobbin and in case the bobbin on the unit is a bobbin that has been partially exhausted by unwinding and of which the end of thread has broken.

Without any manual finding of ends the bobbins can be automatically placed in the unit and automatically unwound to exhaustion. Thus the bobbins can flow from a mixed mass of bobbins to all of the individual units of the machine entirely automatically, and as required by exhaustion of the bobbins of each individual unit. With this system of operation, applied to the rewinding of thread from bobbins into larger packages, in the interval between delivery of a new bobbin to a unit of the machine and beginning of unwinding of the newly delivered bobbin, it is assured that the wound package on the unit contains the thread of a definite whole number of bobbins. This renders it easy to remove wound packages from the various units of the machine in a definite uniform condition as to yarn content.

Other objects of the invention and features of advantage will be apparent from this specification and its drawings wherein the invention is explained, by way of example and in its preferred form, as applied to automatic winding.

In its preferred form as illustrated in this application, the invention is embodied in a multiple unit automatic winding machine, and portions of the mechanism of the winding machine are utilized in preparation of the new bobbins for unwinding. Thus bobbins in the condition in which they are supplied by spinning machines,

and with their ends of threads not yet freed or found, are automatically placed on the bobbin holders of the individual winding units and there operated on by mechanism that frees the leading ends of their threads and associates these with the threads of the winding bobbins of the respective winding units.

Also in the preferred forms of the invention, delivery of the new bobbins to the bobbin holders of the winding units is determined by the condition of the old bobbins last subjected to unwinding, the condition of exhaustion or non-exhaustion of an old bobbin determining whether or not a new bobbin will be automatically delivered to the winding unit. Portions of the thread-handling mechanism which operate on the threads of newly supplied bobbins which may be bobbins in the condition furnished by spinning machines, are adapted and combined with other mechanism so as to operate also on the threads of those partly exhausted bobbins that are not replaced by new bobbins.

In the accompanying drawings:

Fig. 1 is a side elevation of an end portion of the track of the winding machine, the delivery portion of the bobbin-supplying mechanism (partially broken away), and the end-finding and uniting mechanism;

Fig. 2 is a plan view of the apparatus of Fig. 1;

Fig. 3 is a right end view partly in vertical section through the track of the winding machine showing the apparatus of Figs. 1 and 2;

Fig. 4 is a left end view of the winding machine and end-finding and uniting mechanism of Figs. 1, 2 and 3, the bobbin-supplying mechanism being omitted from this figure;

Fig. 5 is a side elevation of the bobbin hopper of the bobbin-supplying mechanism, this bobbin hopper lying to the left of the portion of the bobbin-supplying mechanism shown in Fig. 1;

Fig. 6 is a plan view of the apparatus of Fig. 5;

Fig. 7 is a vertical sectional view taken on the line 7—7 of Fig. 5;

Fig. 8 is a side elevation of a portion of the track of the winding machine, on a larger scale than Fig. 1, showing two of the traveling winding units;

Fig. 9 is a fragmentary vertical sectional view taken from the right of Fig. 1, showing bobbin feeling and doffing mechanism;

Fig. 10 is a view similar to Fig. 9 showing the bobbin doffing mechanism as displaced out of operative position by contact of the bobbin feeler with a non-exhausted bobbin on the winding unit;

Fig. 11 is a fragmentary view in plan showing the bobbin feeling and doffing mechanism as encountered by an exhausted bobbin, the initial position of the bobbin as it encounters the bobbin feeler being shown in full lines, and a subsequent position of the bobbin as it is in the act of being doffed being shown in broken lines;

Fig. 12 is a view similar to Fig. 11 showing the bobbin feeling and doffing mechanism as encountered by a bobbin carrying a substantial amount of thread;

Fig. 13 is a fragmentary detail view from the same point of view as Fig. 1 showing the lower portion of the bobbin-delivering chute;

Fig. 14 is a left side view of the apparatus of Fig. 13 showing also an empty bobbin peg of a passing winding unit;

Fig. 15 is a view generally similar to Fig. 14 but omitting certain structure, showing the lower

portion of the chute as encountering a passing winding unit carrying a bobbin;

Fig. 16 is a fragmentary horizontal sectional view taken on the line 16—16 of Fig. 15;

Fig. 17 is a wiring diagram showing various of the electrical controls of the machine;

Fig. 18 is a view from the same point of view as Fig. 3, showing the bobbin-delivering chute and a portion of a passing winding unit which has received a new bobbin from the lowermost gate of the chute;

Fig. 19 is a fragmentary view of an upper portion of the chute, showing the uppermost gate and a mercury switch controlled thereby;

Fig. 20 is a view similar to Fig. 18 showing the lower portion of the chute, the bottom gate being closed and empty, the next to the bottom gate being in the act of discharging a bobbin to the bottom gate, and a winding unit having an empty bobbin peg traveling away from the observer and about to engage the bottom portion of the chute;

Fig. 21 is a perspective view of a portion of the chute at the region of the next to the bottom gate and of a control mechanism therefor;

Figs. 22, 23 and 24 are diagrams showing successive positions of portions of the control mechanism for the next to the bottom gate;

Fig. 25 is a view from the same point of view as Fig. 18, showing the second and third gates from the bottom of the chute and the interlocking connections therebetween;

Fig. 26 is a detail sectional view taken on the line 26—26 of Fig. 25, showing the third gate from the bottom as locked in a bobbin-retaining position;

Fig. 27 is a view similar to Fig. 26 showing the same gate unlocked;

Fig. 28 is a view similar to Figs. 26 and 27 showing the locking parts in a position intermediate to those of Figs. 26 and 27;

Fig. 29 is a view from the same point of view as Fig. 18 showing the bobbin-delivering chute at a slightly later point in its cycle of operation, the bottom gate now holding a bobbin, the second from the bottom gate being empty and about to receive a bobbin which is passing through the third from the bottom gate, and the top gate having received a bobbin;

Fig. 30 is a view similar to Fig. 29 showing the second from the bottom gate holding a bobbin, the third from the bottom gate being empty and locked so that it can retain a bobbin, and the top gate discharging a bobbin to the third from the bottom gate;

Fig. 31 is a view similar to Figs. 29 and 30 showing the bottom gate retaining a bobbin which has been discharged to it by the second from the bottom gate, the second from the bottom gate being empty, and the third from the bottom gate being empty and unlocked so that a bobbin passing through the top gate can pass freely through such third gate to such second gate;

Fig. 32 is a side elevation partly in vertical section of an assemblage of four bobbin-rotating devices, the left or fourth one of the bobbin-rotating devices being shown in vertical section;

Fig. 33 is a diagrammatic view from the left of Fig. 32 partly in vertical section and with some parts omitted, showing the fourth bobbin-rotating device engaging the bobbin holder of a passing winding unit;

Fig. 34 is a view partly in vertical section on a larger scale than Fig. 33, showing the rotatable bobbin holder of a winding unit;

Fig. 35 is a fragmentary diagrammatic view

taken from the left side of a winding unit showing a bobbin, in vertical section, in its normal position on its bobbin-holding peg on a winding unit;

Fig. 35^a is a view similar to Fig. 35 showing the bobbin aligned with the axis of the bobbin-holding peg during rotation of the bobbin.

Fig. 36 is a left side elevation showing the rotatable bobbin holder of the winding unit engaging a bobbin rotating device of the machine and showing a thread-engaging hook engaging an outer spiral of thread on the bobbin; this figure also diagrammatically shows a bobbin of yarn having an outer spiral and having its leading end of thread twisted with an inner tail portion of thread, as is often the case when bobbins are delivered from a spinning machine;

Fig. 36^a is a side elevation of a bobbin showing the leading end of thread not only twisted with an inner tail portion of thread but also first wrapped several times around the base of the bobbin, as also frequently occurs;

Fig. 36^b is a fragmentary view of the thread-engaging hook taken from above and parallel to the supporting arm for such hook;

Fig. 36^c is a view similar to Fig. 36^b but taken at right angles thereto.

Figs. 37 and 38 are diagrammatic views in the nature of a front elevation and a plan view partly in horizontal section, respectively, showing two positions of the bobbin of Fig. 36 and corresponding positions of the thread-engaging hook, Fig. 38 also showing an additional third position of the hook;

Figs. 37^a and 38^a are diagrams in the nature of a front elevation, and an upper end view, respectively, showing the bobbin in positions intermediate the two positions of Fig. 37 and showing corresponding positions of the hook;

Fig. 39 is a diagrammatic view partly in plan and partly in horizontal section showing three positions of thread cutting and clamping and conveying mechanism, and operating mechanism therefor;

Fig. 40 is a sectional view through the cutting and clamping blades of the mechanism of Fig. 39 showing these closed;

Fig. 41 is a fragmentary elevation of the cutting and clamping blades of the mechanism of Fig. 39;

Fig. 42 is a plan view of the suction conduit and nozzle for the leading ends of threads of the bobbins, the cap being omitted from the top of this conduit;

Fig. 43 is a detailed view of the suction conduit of Fig. 42, as viewed from the left of Fig. 1;

Fig. 44 is a sectional view on the line 44—44 of Fig. 43;

Fig. 45 is a view taken from the right of Fig. 1 showing the suction nozzle for the leading ends of threads of bobbins, the suction nozzle for the tail end portions of threads of bobbins and certain associated parts;

Fig. 46 is a plan view showing a winding unit, the suction nozzle for the leading ends of threads of bobbins, the suction nozzle for the tail end portions of threads of bobbins, a portion of the suction conduit for found threads of packages, and thread-uniting mechanism;

Fig. 47 is an elevation taken from the inside of the machine looking out, that is opposite in point of view to Fig. 1, showing the suction nozzles and the portions of suction conduit and thread-uniting mechanism of Fig. 46, and also indicating the positions of the four bobbin-rotating devices;

Fig. 48 is a fragmentary view, from the right

side of Fig. 47, showing actuating and controlling mechanism for the thread-uniting mechanism;

Fig. 49 is a fragmentary view from the left of Fig. 47, partly in vertical section and partly broken away, showing one of the bobbin-rotating devices, a bobbin on its holder on a passing winding unit, and the suction nozzle for the tail end portions of threads;

Fig. 50 is a view partly in vertical section and with many parts removed, taken from the left of Fig. 1, showing a winding unit and the third bobbin-rotating device, and showing the threads from the package and bobbin of the winding unit as engaged in the thread-uniting knotter;

Fig. 51 is a view similar to Fig. 50 showing the same winding unit as having progressed to the fourth bobbin-rotating device, the threads of the bobbin and package having been united; and

Fig. 52 is a diagrammatic view partly in plan and partly in horizontal section showing a portion of a passing winding unit engaging an electrical switch to initiate operation of the knotter.

The invention is shown in the drawings as applied to a multiple unit winding machine of the type in which mechanism is periodically associated with the various winding units to unite a supply of thread to the end of thread of the winding package. More particularly the preferred embodiment of the invention includes a plurality of winding units brought into association with such uniting means by travel of the winding units in a procession past the uniting means, and includes numerous features of certain prior United States patents hereinafter mentioned.

The winding machine as in Patent No. 2,177,763 may include upper and lower guide rails 20, 21 constituting an endless track along which a plurality of winding units 22 are conveyed by an endless chain 23 to which the units are flexibly connected. In the present application the units are arranged to travel clockwise around the machine as viewed in plan. Thread from a supply bobbin B passes upwardly through suitable guides and a tension device 30 and slub catcher 31 and thence, during winding, through a suitable reciprocating traverse eye 33 and thence onto a guiding package P. In normal winding package P rests on and moves along one of two rotary tractor rolls 40 and is thus rotated in a winding direction as it travels. Upon breakage or exhaustion of the thread of an individual unit, the package of that unit is automatically lifted from the tractor roll to the elevated position shown for the left unit of Fig. 3 by any suitable package lifting mechanism such as that of Patent No. 2,135,485. Also those traveling packages of which the supply thread is not broken or exhausted are similarly automatically lifted to an elevated position upon reaching the portion of the apparatus shown in Fig. 1, so as to approach the automatic tending mechanism of the machine in an inactive non-winding condition.

The illustrated machine includes package end-finding mechanism of the general construction of that of Patent No. 2,177,763 and containing the improvements of Patents Nos. 2,238,923 and 2,309,085. This package end-finding mechanism includes an unwinding tractor roll 111 (Fig. 2) in prolongation of a winding tractor roll 40, and a suction nozzle 112 (Fig. 4) located adjacent to the unwinding roll 111 and communicating with a curved suction tube 108 which bridges the path of the winding units and terminates in a suction box 76. A slot 113 (Figs. 1 and 2) extends from the mouth of the suction nozzle 112 along the

inner portion of the curved suction tube 108 to the suction box 76.

A package P of the passing unit is automatically lowered onto the unwinding roll 111 by package-lowering mechanism such as that of Patent No. 2,135,485. On roll 111, the package P rotates in the unwinding direction and delivers its end of thread to the suction nozzle 112 from whence the end of thread travels through the curved suction tube 108 to suction box 76. The package P is then automatically lifted again to its inactive elevated position, and if necessary can be braked to stop its rotation.

The slot 113 permits a portion of the thus found thread to extend in a more direct path from the package P to the end of slot 113 and so enter into thread uniting mechanism, preferably a knotter, indicated at 122, Fig. 4. The package passes around the curved end of the machine in its elevated position. Upon reaching the other tractor roll 40, the package is automatically lowered again onto that roll for further winding rotation.

The mechanism for finding the end of thread of the package and conveying this thread to the knotter, outlined above and described more fully in certain of the aforesaid patents, has relieved the operative of much arduous labor in tending machines of this type, has enabled the thread-uniting operation to be performed more rapidly than when end finding and tying were done by hand, and has enabled the winding units to be moved past the operative's station much faster than in the case of manually tended machines. However such mechanism has not been utilized to its fullest advantage because of the nearly continuous work required of the operative in keeping the machine properly supplied with fresh bobbins, properly arranged, and with their thread ends found, to replace the continually exhausting supply bobbins of the winding units.

A preferred form of mechanism of the present invention includes a hopper for a mixed mass of bobbins, mechanism for removing bobbins from the mixed mass in the hopper, mechanism for arranging the bobbins in orderly formation and for delivering the bobbins singly and right end into a magazine, herein shown as a chute, from which the bobbins are delivered automatically, as required, to the individual units of the machine.

The bobbin hopper indicated generally at 151 in Figs. 2, 5 and 6 is preferably of a size to hold several hundred, or if need be, several thousand, bobbins of yarn which have been doffed from spinning spindles and which are received in the bobbin hopper in an unarranged state.

Referring to Fig. 6, the hopper may include vertical frame members 152, 153, 154 and 155 and sheet metal vertical walls 156, 157, 158 and 159. The bobbins may be dumped into this hopper from the top by means of a power lift box or other elevating and dumping means.

The bottom 161 of the hopper, which is elevated above the floor, slopes downwardly to a depressed portion 163 (Figs. 5 and 7) which underlies the upper run of a conveyor belt 165. As shown in Fig. 5, the belt 165 runs on two pulleys 167 and 168, the pulley 167 being beneath the hopper and the depressed bottom 163 of the hopper being suitably cut away to admit the upper portion of the pulley 167 and the entering belt 165. As shown in Fig. 7, the wall 157 of the hopper is cut away at 170 to form an exit for bobbins carried by the upper run of the belt 165.

As indicated above, a very large number of bobbins can be held by the hopper. An inclined shield 172, Fig. 7, extending the length of the hopper above the conveyor belt sustains the weight of the large body of bobbins above the conveyor, preventing this weight from bearing on the conveyor. The slope of this shield 172 deflects bobbins to the side of the belt, breaking up jams of the bobbins, and prevents the flow of bobbins to the conveyor belt from being shut off by tendency of a deep mass of bobbins to form bridges immediately over the conveyor belt.

A motor 175 acts through a belt drive 176 and reduction gearing 177 to drive the pulley 168 and belt 165. Means are provided for controlling the motor in such manner as to provide a controlled flow of bobbins from the hopper, as hereinafter described.

The bobbins delivered by the conveyor belt 165 are confined by vertical walls 180 (one of which is removed in Figs. 1 and 5) at the right end of which an endless conveyor 181 is located. Conveyor 181 includes spaced endless chains 182 running on two sprockets 183, with cross pieces 184 interconnecting the chains and carrying slats 185, each of a width slightly less than the overall length of a bobbin. The conveyor 181 is mounted in inclined angle pieces 188 which are connected by backing plates 190 and 191 lying beneath the upper run of the conveyor.

At the bottom of the conveyor 181, the backing piece 191 and inclined plates 193, 194 and 195 (Fig. 2) form a pit or hopper into which the bobbins fall from the belt 165, such hopper being much smaller than the large hopper 151 and being intended to hold only a very few bobbins at any one time and to present these to the inclined conveyor 181.

A gate 200 is pivoted at 201 (Fig. 1) and normally closes an opening at the bottom of the pit through which the conveyor slats 185 are adapted to move upwardly in entering the pit. Gate 200 is provided with an inclined portion 202 adapted to be swung to open the gate by contact with a passing slat 185, entry of the slat into the pit then permitting the gate to swing to closed position. Thus the opening at the bottom of the pit is always closed, either by the gate or by a slat, and the bobbins are unable to slide into or through this opening.

It will be observed that the four sides of the pit diverge upwardly from the slat-receiving bottom, so that bobbins cannot be jammed by the conveyor against the sides of the pit.

Mechanism for controlling the horizontal conveyor belt 165, so as to maintain only a few bobbins in the pit, may include a pivotal mounting 194^a for the inclined plate 194 (Fig. 1) and a switch 208 having an actuating crank-arm 208^a which is spring-pressed upwardly against the pivoted plate 194. The presence of a desired small number of bobbins on the plate 194 slightly depresses plate 194 which acts through the switch crank-arm 208^a to open the switch 208. As shown in the wiring diagram of Fig. 17, switch 208 controls the motor 175, so that opening the switch 208 de-energizes the motor 175 and stops the action of the horizontal conveyor belt 165. When the pit becomes nearly empty, the plate 194 is raised slightly by the switch crank-arm 208^a, and the switch 208 accordingly closes, energizing the motor 175 and driving the conveyor belt 165 until the presence of a few bobbins on the plate 194 again causes the motor 175 to be deenergized. The pivoted plate 194 and switch-

ing mechanism just described constitute one example of various types of detecting mechanism that can be employed to start the conveyor belt 165 when bobbins are required in the pit and to stop the conveyor belt when a desired small number of bobbins are present in the pit.

Maintaining only a few bobbins in the pit avoids undue tumbling of the bobbins by the inclined conveyor 181 and consequent entanglement of the threads of different bobbins. Maintaining only a few bobbins in the pit also facilitates picking up of bobbins by the slats of the conveyor 181, reduces the frequency of a slat failing to pick up a bobbin, and reduces the opportunity for a slat to pick up more than a single bobbin.

It will be understood that it is not essential and is not contemplated that each slat of the conveyor will always pick up a bobbin each time it passes through the pit, and hence the bobbins carried by the bobbin elevating mechanism are not necessarily regularly spaced. The detector mechanism described above will however insure that any lack of bobbins in the pit will immediately bring about a replenishment by causing the horizontal conveyor 165 to deliver several bobbins from the hopper.

Part way up the bobbin-elevating conveyor a swinging plate 210 is pivotally mounted at 211 (Figs. 1 and 3) so as to swing under the influence of a spring 210^a through the upper run of the conveyor between the backing plates 190 and 191. Swinging plate 210 includes an inclined portion 212 adapted to strike any bobbin carried by the conveyor excepting a bobbin lying horizontally directly upon a slat 185. In particular, the inclined portion 212 of the swinging plate strikes and knocks off any bobbin which is standing upon its end, and strikes and knocks off any bobbin that is lying on top of another bobbin being carried upwardly by a slat 185. Each cross piece 184 of the conveyor is adapted to engage the swinging plate 210 and prevent the plate from striking and knocking off any single bobbin lying horizontally on a slat 185.

An extension 213 of the swinging plate 210 depresses the plate as this extension is held down by a passing cross piece 184 of the conveyor, and then upon release of this extension by that cross piece, allows the plate to swing out to the position of Fig. 1 and dislodge any surplus or misplaced bobbins on the next successive slat.

At the upper end of the bobbin elevating conveyor, side guide plates 215 converge until these side guide plates are distant only slightly more than the overall length of the bobbin, so as to engage the bobbins at one end or the other, and center them on the conveyor. At the top of the conveyor, as the slats 185 pass over the upper sprocket 183, the bobbins roll off the slats onto downwardly sloping spaced rails 220. The two rails 220 are spaced sufficiently far apart to receive the wound yarn portion of the bobbins between them, the tip portion of the bobbin resting on one or the other of the rails depending upon the direction in which the particular bobbin faces, and the base portion of the bobbin resting on the opposite rail.

The bobbin elevating conveyor is driven by an electric motor 224 which acts through a belt 226 and reduction gearing 227 connected to the top sprocket 183. As will be subsequently described, means are provided for controlling the motor 224 so as to cause the bobbin elevating conveyor to deliver a bobbin to the rails 220 whenever a bobbin chute, subsequently described, can accommodate a further bobbin.

A funnel 222 having a centrally located mouth 223 is located between the rails 220, and a bobbin chute indicated generally at 225 (Fig. 1) is located to receive bobbins from the mouth 223 of the funnel 222.

The downwardly inclined rails 220 are adapted to deliver all of the bobbins downwardly into the funnel 222 and bobbin chute 225 with the base portion of each bobbin lowermost regardless of the directions in which the base and tip portions of the various individual bobbins extend while on the bobbin elevating conveyor and on the rails 220. Bobbins are generally constructed with their base portions somewhat larger in diameter than their tip portions. Thus as a bobbin rolls down the slightly inclined rails 220, its base portion will move faster than its tip portion and will accordingly roll off its rail 220 and start down into the funnel 222 while the tip portion of the same bobbin is still held by its rail 220. Thus the base portion of each bobbin is started down through the mouth 223 and into the bobbin chute 225 before the tip portion of the same bobbin, with the result that each bobbin in the chute has its base directed downwardly. The discharge of bobbins by the rails 220 is facilitated by arranging the rails 220 so that as they slope downwardly they also diverge slightly.

The operation of the chute in delivering bobbins to the passing winding units is preferably controlled by the traveling movement of the winding units past the chute and also by the detected condition of the bobbins carried by the winding units as they approach the automatic tending mechanism. By this latter control, unnecessary feeding of bobbins by the chute is avoided and the bobbins are caused to remain on their winding units until exhausted or nearly exhausted.

Mechanism for detecting the condition of the bobbins on the approaching units preferably includes feeler mechanism that feels each individual bobbin as the bobbin is held by a bobbin peg on its traveling unit.

A yoke 240 pivoted at 241, 241 to brackets 242 extending from the lower rail 21 is normally held in the position of Fig. 9 by a counterweight 245, in position for an upper inclined portion 246 of the yoke to extend into the path of the bobbins of the passing units and exert an upward camming action to lift the bobbin upwardly from its bobbin holding peg 247 as shown at the left of Fig. 11, thus discharging the bobbin by allowing it to fall from the winding unit.

A feeler 250, having spaced parallel arms 251, 252 is secured to a shaft 254 which is rotatable in a sleeve 255 carried by a bracket 256 extending from the yoke 240. The feeler 250 is yieldingly urged to the position of Fig. 11 by a spring 257 (Figs. 9 and 10.) A stop pin 260, carried by an arm 261 at the bottom of shaft 254, is adapted to engage the bracket 256 to stop the feeler in this position of Fig. 11.

Since the arms 251, 252 of the feeler are spaced far enough apart to receive an empty bobbin between them, passage of an empty bobbin from the right-hand position to the left-hand position in Fig. 11 swings the feeler 250 idly about its pivot, leaving the yoke 240 in its active or doffing position in which its upper inclined portion 246 engages and lifts the bobbin from its peg 247 as shown at the left on Fig. 11.

On the other hand, the two arms 251, 252 on the feeler are sufficiently close to each other so that when the longer arm 252 is engaged by a

non-exhausted bobbin, as in Fig. 12, the shorter arm 251 is swung into engagement with the thread on the bobbin. The bobbin then acts on the shorter arm 251 to push the feeler outwardly, which swings the yoke 240 outwardly away from the bobbin path as shown in Fig. 12 and allows the bobbin to pass without being engaged by inclined portion 246; accordingly the non-exhausted bobbin is not removed from its peg.

As a consequence, only non-exhausted bobbins are carried past the bobbin-feeding chute by the traveling units, the bobbin pegs 247 of the remaining traveling units arriving empty at the bobbin-feeding chute.

As shown in Fig. 1, the chute 225 is mounted near its upper end on a bracket 270 which is held by a vertical shaft 271 pivotally mounted in a bearing 272, so that the upper end of the chute can pivot beneath the funnel 222. The lower end of the chute, as shown in Figs. 13 and 14 carries bearing plates 280, 280 which are slidable on a horizontal rod 281 mounted upon a bracket 283 which is carried by a stationary vertical support 284. In being operated to discharge a bobbin, the bottom end of the chute is slidable to the left in Fig. 13 a short distance along the rod 281, opening the gate mechanism, subsequently described, to release a bobbin to a passing winding unit. A counterweight 290 operates through a cord 291 to retain the chute normally in the position of Fig. 13.

Movement of the chute to the left in Fig. 13 to discharge a bobbin is brought about by engagement of a pin 300 on a passing winding unit with a pin 301 best shown in Fig. 14.

Pin 301 is carried by a depending strip 303, Figs. 13 and 14, which is pivoted at its top on a shaft 304 carried by the bearing plates 280, 280. Strip 303 is yieldingly urged inwardly toward the path of the winding units by a spring 305 so as to project the pin 301 into the path of the passing pins 300 of the winding units.

The lower end of strip 303 is constrained to an arcuate motion as it is moved by a passing winding unit. As shown in Figs. 16 and 15 a link 307, pivotally connected to a bracket 308 on strip 303, has a sliding fit on a pin 309 carried by a stationary bracket 310. Thus, movement of the strip 303 to the left in Fig. 13 by a passing winding unit retracts the pin 301 from the pin 300 after a short distance of travel and allows the strip 303 and chute 225 to be returned by the counterweight to their position shown in Fig. 13.

When a passing unit carrying a non-exhausted bobbin encounters the bobbin feeding chute as shown in Fig. 15, a cam projection 312 on the strip 303 is engaged by the base of the bobbin and pushes the strip 303 outwardly away from the unit so that, as shown in Fig. 15, the pin 301 is prevented from being engaged by the pin 300. In this situation, strip 303 and chute 225 remain in their inactive positions of Fig. 13 as a winding unit passes, no bobbin being discharged by the chute.

The chute 225 which conveys bobbins from the funnel 222 to the passing winding units preferably has a generally V-shaped bottom adapted to align the bobbins longitudinally and a plurality of bobbin-detaining stops or gates adapted to retain the bobbins spaced apart endwise. The chute is preferably, as shown, an open chute, as distinguished from a closed tube, and this construction coupled with the fact that the bobbins in the chute are always kept separated endwise substantially precludes any jamming of a bobbin

in the chute even when bobbins of various sizes, bobbins with pointed ends, and partly wound bobbins, or bobbins having any combination of these characteristics, are employed.

Although various numbers of stops for retaining bobbins in the chute may be used, the preferred illustrated form of machine includes four such stops, each in the form of a gate, and for convenience these will be referred to as the bottom gate, the second from the bottom or second gate, the third from the bottom or third gate, and the top gate.

The bottom gate 320, Fig. 14, is pivotally mounted in an opening near the bottom of the chute upon a shaft 321 that extends across between the plates 280, 280. In its normal closed position the gate 320 extends approximately at right angles to the length of the chute, engaging and supporting the base of a bobbin a short distance above the path of the bobbin pegs 247 of the passing winding units.

A tail portion 320^a of the gate 320 extends outside the chute in general prolongation of the gate, and in the normal inactive position of the chute the tail portion 320^a extends beneath and is held down by a bracket 325 (Figs. 13 and 14) which extends from the previously mentioned stationary bracket 233.

A slight movement of the bottom portion of the chute to the left in Fig. 13 and toward the observer in Fig. 14, as caused by the chute-actuating pin 301 being engaged by the pin 300 of the passing unit, shifts the tail piece 320^a beyond the left end of bracket 325, whereupon the tail piece can rise and the gate 320 can be opened by the weight of its retained bobbin. The lowermost bobbin in the chute is thus quickly discharged by the gate 320, close to the bobbin peg 247. The bottom portion of the chute is meanwhile moving with the winding unit to which it is delivering the bobbin, so that the bobbin is guided onto the peg.

Upon discharge of the bobbin by the gate 320, the tail piece 320^a, which is heavier than the gate 320, returns the gate to closed position.

After the bobbin has been guided onto the peg, the pin 301 is retracted out of engagement with the pin 300 of the unit, and the counterweight 290 quickly restores the lower portion of the chute to the position of Fig. 13, with the tail piece 320^a again beneath the level of the bracket 325 so that the gate is prevented from opening.

Thus the operation of the bottom gate 320 is conditioned upon the chute encountering a winding unit which does not already carry a bobbin. When such a winding unit, lacking a bobbin, is encountered, the bottom gate opens quickly during a short distance of travel of the chute with the winding unit, and the chute then quickly returns into position to cooperate in similar manner with the next succeeding winding suit which does not already carry a bobbin.

The second gate cooperates with the bottom gate to deliver a fresh bobbin to the bottom gate after the latter has closed and before the bottom gate can be opened by the next succeeding winding unit and, as will hereinafter appear, the second gate also cooperates with the gates which are located above it to initiate passage of bobbins through these several gates, in spaced relation and in time to insure that the second gate will hold a bobbin at each time at which it may be opened in timed relation to the opening of the bottom gate.

Preparatory to explanation of the preferred construction of interrelated bobbin stops controlling bobbins in the chute, it may be explained that detection of absence of a bobbin at a stop (for instance the second gate) controls the unlocking of the next preceding stop (for instance the third gate). While in broader aspects of the invention, it is not essential that the gate itself shall constitute the detector element for detecting absence of a bobbin at such gate, the mechanism is simplified and made more certain in operation by such preferred feature of construction. With this in view, such gate is preferably mounted so as to swing not only from a bobbin-holding position to a bobbin-discharging position, but also for swinging movement in the opposite direction to an empty position, which movement to an empty position or presence of the gate in empty position is indicative of absence of a bobbin at the gate and so constitutes the gate itself as a detector of such absence of a bobbin.

The second gate 340, Figs. 18 and 21, is fastened to a transverse shaft 341 extending across the chute in position for the gate 340 normally to lie well above the tip end of a bobbin held by the bottom gate 320. A hub 343 fast on the shaft 341 has integral therewith a holding arm 345 and hub 343 also serves as a crank arm to hold and operate a reciprocating latch rod 347.

The weight of a bobbin resting against gate 340 normally holds the gate in the position of Fig. 18.

A plate 351 carried at the upper end of rod 284 carries two holding blocks 354 and 355, the lower faces of which are adapted to engage the holding arm 345. Holding block 354 is pivotally mounted on plate 351 at 356, and when engaged from beneath by the holding arm 345 as shown in Fig. 21 is held against holding block 355. During movement of the chute with a traveling winding unit, the holding arm 345 engages first the bottom of holding block 354, Fig. 21 and then the bottom of holding block 355, during which time the holding arm 345 is restrained to hold the gate 340 closed. At nearly the end of the return movement of the chute, the holding arm 345 strikes the left end portion of the holding block 354, as shown in Fig. 23, and tilts this block slightly about its pivot 356. As the pivoted holding block 354 separates from the stationary holding block 355, the holding arm 345 rises in between these blocks as shown in Fig. 24. Such rise of the holding arm 345 allows gate 340 to be opened by the bobbin pressing against it, and allows this bobbin to be discharged down the chute to the then closed bottom gate 320. Upon discharge of the bobbin by the gate 340, and in the absence of a bobbin at this gate, holding arm 345 drops down between and beneath the holding blocks 354 and 355, carrying the gate 340 to a position as shown in Fig. 35 in which it extends across the chute but lies above its bobbin-holding position. This position of the gate may be referred to as its empty position. When a bobbin is subsequently delivered to gate 340 from above, the gate is moved by the bobbin to its bobbin-holding position of Figs. 18 and 21 but cannot move farther to discharge such bobbin until a subsequent cyclic movement of the chute.

As indicated above, the second from the bottom bobbin stop, that is gate 340, initiates the flow of bobbins through preceding bobbin stops, that is gates 340^a and 340^b.

The third gate and the top gate indicated respectively at 340^a and 340^b are similar to the second gate and are mounted on shafts 341^a and 341^b which carry hubs 343^a and 343^b as shown in Fig. 18.

Latch rod 347, which as explained above is operated by the hub 343 of the second gate, extends through a slotted bracket 360 (Figs. 18 and 25) and in the closed position in which the second gate is shown in Fig. 18, the upper end of latch rod 347 extends far enough up the chute so as to be able to overlie the outer end of a holding arm 345^a on the hub 343^a of the third gate as shown in Fig. 18.

The latch rod 347 is pivoted on the hub 343 of the second gate at such an angular position that counterclockwise movement of the hub 343 in discharging a bobbin from the second gate, as in Fig. 20, will shift the latch rod 347 still farther toward the hub 343^a of the third gate and so increase the extent of overlap of the latch rod 347 and the holding arm 345^a of the third gate.

Swinging of the second gate 340 to its empty position of Figs. 25 and 29, upon discharge of a bobbin thereby, retracts the latch rod 347 beyond the end of the holding rod 345^a of the third gate, leaving this holding rod free to be raised and leaving the third gate free to be opened by the influence of a bobbin, either then or later engaging such third gate 340^a. When the third gate discharges the bobbin to the second gate, the force of the bobbin against the second gate restores the second gate to its position of Fig. 18, again projecting the latch rod 347 into position to engage the holding arm 345^a of the third gate.

As shown in Figs. 26, 27 and 28, the holding rod 345^a of the third gate has its outer end portion cut away on a bevel so as to enable this holding arm to force the latch rod 347 laterally out of its way as the holding arm 345^a swings downwardly after the third gate has discharged a bobbin. A hair spring 361 is adapted to restore the latch rod 347 after such lateral displacement, so that the latch rod again overlies the holding arm 345^a.

It will thus be observed that the second and third gates and their connecting mechanism cooperate to latch the third gate in holding position in case the second gate receives a bobbin, and to cause the third gate to be unlatched, so that it is free to permit passage of a bobbin, at the times when the second gate is empty but in position to detain a bobbin.

The fourth or top gate 340^b is similar to the third gate 340^a and is controlled by the third gate by latching means identical with those by which the second gate controls the third gate and indicated by similar reference characters.

The shaft 341^b of the top gate in addition carries a mercury switch 370 (Fig. 19) which tilts with the gate and is open in all but the empty idle position of the top gate and is closed in that position. When the top gate assumes this empty idle position, as in Fig. 18, due to absence of a bobbin after discharge of a bobbin, the mercury switch 370 thus closes. As indicated in the wiring diagram of Fig. 17, the mercury switch 370 is in the circuit of the motor 224 which operates the bobbin elevating conveyor, and is also in the circuit of a solenoid 371 which when energized will remove a spring-pressed brake 372 from a brake drum 373 on the shaft of the motor 224. Thus when the mercury switch 370 is closed, the brake is removed from the motor and the motor is operated to operate the bobbin elevating conveyor until the top gate is engaged by a bobbin

newly fed to it by the bobbin elevating conveyor.

If, after it has discharged a bobbin, either the second gate or the third gate fails to receive a new bobbin and assumes its empty position, the one or more gates above such gate become unlatched, in succession if there are more than one.

In the case in which the top gate lacks a bobbin and initiates action of the bobbin elevating conveyor, and before the top gate is again supplied with a new bobbin, the second gate for instance becomes empty, then with both the third and top gates unlatched, the bobbin next supplied to the chute will pass freely through the unlatched top and third gates, as in Fig. 31, and will then be halted by the second gate. The next bobbin, as in Fig. 30, will then pass freely through the unlatched top gate and will then be halted by the third gate as shown in Fig. 18. The next bobbin will be halted by the then latched top gate, as shown in Fig. 19, with the result of holding the mercury switch open and permitting no further operation of the bobbin elevating conveyor 181 until the top gate next discharges its bobbin and swings back to idle empty position.

Reviewing the manner of flow of the bobbins to the individual units of the machine, it will be observed that the bobbin-feeding chute 225 delivers bobbins to the individual units of the machine as called for by these individual units, each unit that lacks a bobbin receiving a bobbin from the chute. The chute is adapted to maintain a reserve supply of bobbins, in orderly arrangement and in spaced relation. The bobbin-elevating conveyor 181 is adapted to fill up the chute, and the chute can then deliver several bobbins to passing units even though the supply of bobbins delivered by the conveyor 181 may become irregular. In the chute 225 the entering bobbins close ranks forwardly, filling the space defined by the second from the bottom gate, then the space defined by the third from the bottom gate, and finally the space defined by the top gate, whereupon retention of a bobbin by the top gate stops the conveyor 181. The conveyor 181 thus delivers bobbins to the chute as called for by depletion of the reserve supply of bobbins held in the chute.

The conveyor belt 165 removes bobbins from the mixed mass in the hopper 151 and delivers these bobbins to the pit or smaller hopper at the base of the conveyor 181 as called for by depletion of a small reserve of bobbins at that point by the action of the conveyor 181.

Upon leaving the region of the chute, each winding unit carries a bobbin, either an old but unexhausted bobbin or a new bobbin which has been supplied by the chute, and in preparation for starting winding on each unit, the bobbin of each unit is subjected to a number of operations which involve rotation of the bobbin.

As shown in Fig. 34 the bobbin peg 247 near the bottom of a winding unit is surrounded by a rotatable hub 380 having a tapered bobbin-engaging portion 381 adapted to enter into the hole at the bottom of the bobbin and center the bottom of the bobbin, the weight of the bobbin driving the bobbin into snug fit with the tapered portion 381 notwithstanding differences in size of the holes of various bobbins. In normal winding the hub 380 and the bobbin carried thereby do not rotate, but the hub and its bobbin can be rotated in either direction by bobbin-rotating mechanism subsequently described.

The bobbin-holding peg 247 is small enough in diameter to fit loosely within the interior cavity

(Fig. 35) of various sizes of bobbins. The peg 247 and the tapered rotatable bobbin-engaging portion 381 have their axis inclined at an angle such that when the base of the bobbin is centered by the tapered portion 381 and the top of the bobbin leans by gravity to the right against the upper portion of the peg, as shown in Fig. 35, the axis of the bobbin is pointed toward the yarn-engaging surface indicated at 382 to which the unwinding yarn runs from the bobbin.

Preparatory to rotation of the bobbin, the tip portion of the bobbin is brought into contact with a guide rod 495, subsequently further described, which displaces the top of the bobbin to the left to the position of Fig. 35^a, aligning the axis of the bobbin with the axis of the peg 247 and tapered portion 381. The bobbin can then be rotated at high speed without departing from alignment with its peg and the tapered portion 381, and without likelihood of its being thrown off during rotation.

The illustrated machine herein described employs four steps or stages of rotation of the bobbins on their winding units, each of which steps or stages cooperates in preparation of the bobbins for unwinding, and it is preferred to employ each of these steps or stages of rotation. However individual benefits result from each such step or stage of rotation and the machine does not necessarily require the four such steps or stages that are present in the preferred form of machine.

The illustrated machine includes four cork-surfaced friction drive wheels 385, 386, 387 and 388, Figs. 1, 2, 32 and 47, engageable with the rotatable bobbin hubs 380 of the traveling winding units. The friction drive wheels are shown as receiving their driving power through a set of connections which include an internal gear 390 on the chain-driving sprocket of the machine, Fig. 4, a pinion 391, vertical shaft 392, cooperating bevel gears 393 and 394, shaft 395, cooperating bevel gears 396 and 397 and a horizontal shaft 398 (Figs. 4 and 1). Stub shafts 400 corresponding to the respective friction drive wheels are mounted in anti-friction bearings 401, 402 and connected by bevel gearing to the horizontal shaft 398, each such stub shaft 400 extending slightly above the top of a gear casing 405 in which the above described gearing is mounted.

Hollow sleeves 407, above the respective shafts 400, are mounted on shafts 409 which are adapted to rock in bearing blocks 410. Each friction drive wheel is carried at the upper end of a shaft 412 which is rotatably mounted in anti-friction bearings 413 in the upper end of sleeve 407 and which abuts at its lower end the corresponding shaft 400 and is flexibly connected to that shaft 400 by a coil spring 415.

As a result of this construction, while the machine is in operation, each friction drive wheel 385 to 388 inclusive is constantly driven. The several friction drive wheels extend into the path of the passing rotatable hubs 380 of the winding units and may be displaced outwardly as they are contacted by these hubs, each sleeve 407 and each friction drive wheel being moved outwardly or to the right in Fig. 33 as a rotatable hub 380 passes by. A spring 420 urges each sleeve 407 inwardly into the path of the passing hubs 380, each sleeve 407 normally coming to rest against a horizontal stop rod 421 as shown in Fig. 33.

Referring to the arrows showing the directions of rotation of the friction drive wheels 385, 386, 387 and 388 in Fig. 32, it will be seen that the friction-drive wheel 386 rotates in one direction

which corresponds to a clockwise rotation as viewed in plan, and other friction drive wheels 385, 387 and 388 rotate in the opposite direction which corresponds to a counterclockwise rotation as viewed in plan.

Bobbins produced by spinning machines are normally wound right-hand, and the machine is shown as arranged to accommodate such bobbins. Thus the first, third and fourth friction drive wheels 385, 387 and 388 rotate the bobbin in the direction in which it was wound on the spinning machine, or in a direction to wind its thread onto the bobbin, and the second friction drive wheel 386 rotates each bobbin in the opposite or unwinding direction. The effects of these several rotations of the bobbin will be explained in detail, in their order. It may be mentioned here that the first rotation, in a winding direction, facilitates the freeing of an end of thread of a newly supplied bobbin, the second rotation, in an unwinding direction, facilitates delivery of thread into the bobbin-thread suction nozzle, and the third and fourth rotations, both in a winding direction, tighten the thread, thus aiding in positioning it for uniting and preventing slack in the united thread.

Many of the old bobbins that have not been exhausted during a trip around the machine will have their thread extending into the slub catcher 31 and broken above the slub catcher as in the left unit of Fig. 8, as a result of a slub being caught in between the blades of the slub catcher. The machine includes means for removing such slubs from the slub catcher, cutting off the part of the thread containing the slub and allowing the end of thread which is attached to the bobbin to hang freely so that it can readily be engaged by the bobbin end-finding suction nozzle.

In the case of a newly fed bobbin however, the outer or leading end of thread will usually be in the condition in which it was placed by operation of the spinning machine, and this is most typically in the form of an open spiral 425 wound down from the top of the bobbin to or nearly to the base of the bobbin. Fig. 36 shows such open spiral 425 wound nearly to the base of the bobbin and Fig. 36^a shows the thread as wound in such open spiral extending all the way to the base portion of the bobbin and there wrapped around the bobbin itself. The bobbin also has an inner tail end of thread, indicated at 426 in Fig. 36, and this inner tail end usually extends out from underneath the wound mass of thread on the bobbin and has usually become entangled or twisted in with the outer or leading end of thread near the base of the bobbin as shown diagrammatically in Figs. 36 and 36^a. The machine includes means for freeing the outer end of thread of a new bobbin, so that it can be dealt with by the bobbin end-finding suction nozzle.

In the illustrated machine the mechanisms for freeing the leading end of thread, in these two situations of old and new bobbins, preferably operate simultaneously and at the same place, so that whichever type of bobbin is encountered, a leading end of thread will be properly free by the time the bobbin encounters the suction end-finding nozzle.

In the illustrated form the two end freeing mechanisms are operated by a common vertical actuating shaft 427, Figs. 1, 2, 3, 38 and 39, rotatably mounted in stationary brackets 429 and 430 (Fig. 3) which extend from the vertical sup-

port 234. Shaft 427 is oscillated by a double crank arm 431, Fig. 38, of which the inner end is engaged by a roller 431^a on each passing winding unit as shown in Fig. 3, a link 432 and a crank 433 secured to the bottom of the shaft 427. After passage of the winding unit through a few inches of travel, the double crank 431 disengages the winding unit, and the shaft 427 and associated parts are returned by means of a spring 435.

An arm 440 (Fig. 39), fastened on the actuating shaft 427, carries a thread-cutting and clamping bill indicated generally at 441 including a blade 442 pivoted at 443 to the arm 440 and operating between the arm 440 and a lower blade 444. A spring 444^a urges lower blade 444 against pivoted blade 442 and pivoted blade 442 against arm 440. Pivoted blades 442 is connected by a link 446 to the stationary bracket 429. In the normal inactive position of the arm 440 and bill 441, shown in full lines in Fig. 39, the blade 442 lies open in position to receive the thread on the approaching winding unit below the tension disks 33. Rotation of the shaft 427 swings the arm 440 in a counterclockwise direction as viewed in Fig. 39, whereupon the relative movement between link 446 and arm 440 closes the movable blade 442, cutting the thread between blade 442 and lower blade 444 because blade 442 is sharpened to a cutting edge where it bears against lower blade 444 (Fig. 40), and clamping the thread between blade 442 and arm 440 because these parts are not sharpened where they bear against each other. The portion of thread initially extending down from the cutting and clamping bill to the bobbin is, following such cutting, no longer held by the bill but is free to fall and then be drawn in by the suction nozzle 470 subsequently described. The end portion of thread initially extending from the bill up to the slub catcher is however held clamped between blade 442 and arm 440 of the bill. Further rotation of the arm 440 and travel of the winding unit draws this clamped portion of thread out from between the tension disks and then draws this portion of thread and its slub out from the slub catcher. Continued rotation of the arm 440 carries this end portion of thread and its slub near to the entrance 450 of a suction tube 451 which extends into the suction box 76. At or about the time this portion of thread reaches the region of the opening 450, the link 446 causes the thread-engaging portion of movable blade 442 to clear the thread-engaging part of the arm 440, thus releasing this portion of thread and its slub so that these are immediately sucked into the opening 450. The arm 440 and its blades then return to position to receive the next thread.

While the combined cutting and clamping bill 441 described above is preferred, in some situations the bill may be simplified so that it amounts only to a hook acting to pull the thread outwardly away from the winding unit, thus pulling the slub from the slub catcher and the thread from the tension device and allowing the thread to fall into position to be taken by the suction nozzle 470 subsequently described, without cutting the thread. It will be understood that when threads are tied by the knotter subsequently described, a short slub lying at the end of the thread will be eliminated by the knotting operation since the knotter cuts off the end portions of the threads in tying the knot.

Referring to Figs. 36, 37 and 38, hook 455,

carried by an arm 456 which is swung by the shaft 427, engages with the surface of the bobbin B on the winding unit at about the same time that the thread at the slub catcher, if present, is engaged by the bill 441 of Fig. 38. As the bobbin approaches the hook 455, the bobbin-holding hub 330 is engaged by the first friction drive wheel 335 and the bobbin begins to be rotated in a winding direction as indicated at position I—I in Fig. 37. If the bobbin is a newly supplied bobbin, this rotation brings the spiral 425 of thread on the bobbin into the hook 455, the action of the hook upon the spiral of thread taking place between the positions indicated at I—I and VI—VI of Figs. 37 and 38 and including the intermediate positions of Figs. 37^a and 38^a.

The hook is preferably mounted so as to press lightly and yieldingly against the main body of wound thread of the bobbin, in position for the point of the hook to intervene between the main body of thread and the outer spiral 425.

The hook is also preferably mounted so as to shift its thread-engaging point lengthwise of the bobbin during contact with the mass of wound thread, but with such shift taking place slowly enough so that the hook traces a spiral of less pitch than the outer spiral of thread 425 so that this shifting movement of the hook does not prevent it from engaging with and staying in engagement with the spiral. Such lengthwise shift of the hook prevents its point from remaining at a given circular convolution of the thread of the main body of wound thread, and prevents the point of the hook from digging into such body.

The hook 455 is formed of bent wire having a portion 455^a (Figs. 36, 36^b and 36^c) pivotally mounted in a housing 456^a projecting from the end of the arm 456. A plunger 456^b slidable lengthwise in a bore in the arm 456 is yieldingly urged by a spring 456^c against a portion 455^b of the hook (Fig. 36^b) to swing the hook around the axis of its pivot portion 455^a until the portion 455^b engages against a stop surface 456^d of Fig. 36^c.

Hook 455 is lightly and yieldingly held against the main body portion of wound thread of the bobbin as in position I—I of Figs. 37 and 38 and can move outwardly toward the observer in Figs. 37 and 37^a as it is deflected by the passing bobbin while the bobbin moves through position II—II of Figs. 37^a and 38^a to position III—III of Figs. 37^a and 38^a.

The point of the hook 455 intervenes between the outer spiral of thread 425 and the main body of wound yarn at about position II—II of Figs. 37^a and 38^a. Outward swinging of the hook to position III—III of Fig. 37^a causes the hook to move downwardly, due to the inclination of the axis of the pivot 455^a which is best seen in Fig. 36. The hook thus moves downwardly in contact with the body of wound thread on the bobbin, the path of the hook with relation to the rotating bobbin being a spiral path of less pitch than the outer spiral of thread 425, and thus allowing thread to seat in the bottom of the hook. The downward movement of the hook insures that the point of the hook will not remain for any appreciable length of time in contact with any single circular convolution of the wound thread of the bobbin and tend to dig into the main body of thread.

From about position III—III of Fig. 37^a onward, the point of the hook is no longer in engagement with the body of wound thread, and

as the bobbin continues to move past the hook to position IV—IV of Figs. 37^a and 38^a, the hook returns to its original level.

As the bobbin approaches the position VI—VI of Figs. 37 and 38, hub 380 leaves contact with the friction drive wheel 385 and rotation of the bobbin ceases. Just before the bobbin reaches this position VI—VI, the double crank arm 431 is actuated by a roller 431^a of a passing winding unit to rotate the shaft 427 and swing the arm 456 and hook 455 outwardly away from the bobbin, the hook reaching its broken line positions of Figs. 37 and 38 at the position VI—VI of the bobbin.

Separation of the hook and the bobbin by this outward swinging removes the outer spiral of thread from entanglement with the tail portion, either disentangling this leading end, or breaking it or the tail portion with which it is entangled, and leaving the leading end of thread of the bobbin as indicated in position VI—VI of Fig. 37, removed from the base portion of the bobbin. The hook 455 continues to swing to the dot and dash line position of Fig. 38, insuring that the hook is disengaged from the freed leading end of thread.

If the outer spiral of thread on the bobbin has merely been slightly entangled with the tail portion 426 as in Fig. 36, the action of the hook will in most cases merely pull the leading end of thread from the tail portion, but if the leading end of thread has been wrapped several times around the base of the bobbin as in Fig. 36^a, the action of the hook will most likely break the outer spiral of thread 425 near the base of the bobbin. Such breakage will also usually occur in case the outer spiral of thread is badly entangled with the tail portion. In each such case the leading end of thread of the bobbin will be freed from entanglement with the inner end portion of thread of the bobbin and will be removed from the region of the base, ready for reception by the bobbin-thread suction conduit subsequently described.

Although the action of the hook has been described particularly in connection with freeing an end of thread that lies in a spiral and is either twisted with a tail portion of thread or wrapped around the base of the bobbin or both, the hook may act to prepare the leading end of thread even though this leading end does not lie in any predetermined pattern on the outside of the bobbin and even though it is not twisted in with the tail portion or wrapped around the base of the bobbin. A leading end of thread lying loosely on the outside of the bobbin will be separated from the bobbin when it is engaged by the hook, and an entanglement of the leading end of thread that may lie upon the bobbin in an irregular formation will be broken when engaged by the hook. Thus although the hook is peculiarly adapted for treatment of bobbins having exterior thread formations such as shown in Figs. 36 and 36^a, the hook, more broadly, is adapted to distinguish between the convolutions of thread of the main wound body of thread (these being substantially circular and tightly bound) on the one hand, and the leading end portion of thread, on the other hand, and to separate such leading end portion from the convolutions of thread of the main wound body and facilitate the leading end portion being taken in by the suction conduit.

In addition to its action in preparing a leading end of the main portion of the thread for recep-

tion by the bobbin-thread end-finding nozzle, the hook 455 is also useful in preparing the tail portion of thread for action of tail-severing mechanism which is preferably included as subsequently described, by disrupting entangled connection between the tail portion and the leading end of the main length of thread of the bobbin. As indicated, this disruption of entangled connection may take the form of withdrawal of the leading end portion, without breakage, from entanglement with the tail, in which case the tail is left hanging down from the base. Also, disruption of the entangled connection between the tail portion and leading end of the main length occurs even though the action of the hook may break the thread either in the spirally wound portion or farther down where this thread may be wound around the base of the bobbin as in the bobbin of Fig. 36^a. In this case of breaking the thread, a new leading end of the main wound portion of thread is created by such breakage, and though a remnant of the formerly leading end may still be entangled with the tail, the tail and such remnant may together be acted on by the tail-severing mechanism, subsequently described, separately from the leading end of thread.

The bobbin suction conduit indicated generally at 460, Fig. 47, is of generally inverted J-shape and mounted on the suction box 76 so as to receive suction therefrom. This suction conduit is preferably constructed in three portions. A short portion 461 extends upwardly from the suction box 76 and is fitted into a horizontal plate 462, Fig. 43. Another longer tube 463 extends downwardly from the plate 462, and as shown in Fig. 4 is inclined inwardly toward the path of the bobbins of the winding units. A cap 464 is seated on the plate 462, causing the suction in tube 461 to be communicated to the downwardly extending tube 463.

As shown in Figs. 47, 42 and 44 the lower portion of tube 463 is provided with outwardly extending flanges 466 and 467 which define a nozzle slot 470 between them. Slot 470 continues upward to the top of tube 463 from which point it merges into a slot 470^a in the plate 462 as shown in Fig. 42. Slot 470^a in the plate 462 in turn merges with a slot 470^b in tube 461, and this latter slot continues downwardly to and slightly below the level at which thread is received into the knotter indicated generally at 122, Fig. 47.

The slot 470 at the bottom of tube 463 constitutes a suction nozzle for receiving the thread of the bobbin whether this thread has been cut by the bill 441 or freed from the bobbin by the hook 455. This suction nozzle is located in alignment with the second friction drive wheel 386, as indicated in Fig. 47, and at a height such that the main full diameter portion of the surface of the wound thread of the bobbin is subject to the suction of the nozzle, but the portion of the bobbin adjacent to its base is subject to little or none of such suction. Thus whether the outer end of thread of the bobbin has been freed, by means of the cutting and clamping bill 441 as in the case of an old partly unwound bobbin or by means of the hook 455 as in the case of a newly supplied bobbin, such outer end of thread is adapted to be taken by the suction nozzle. Drive wheel 386 rotates the bobbin quickly in an unwinding direction, the free end of thread thus unwound being immediately drawn into the suction nozzle and proceeding through the connecting slots 470, 470^a and 470^b. A horizontal bar 495 and an inclined plate 496 carried thereby (Figs.

45 and 46) prevent the bobbin thread from being pulled off over the upper end of the bobbin and cause the thread to unwind laterally from the bobbin as the thread passes into the suction nozzle. A guide wire 498, shown in Fig. 46 and partly broken away in Fig. 47, extends down from the plate 452 to below the entrance for the thread into the knotter and aids in directing the bobbin thread into the knotter.

The wound end of thread of the package P is carried into the knotter 122 of the suction conduit 108 as explained in Patent 2,177,763. A guide wire 499, Figs. 46 and 47, may be provided to assist in directing the package thread into the knotter.

Although the leading end of the bobbin thread which is drawn in through the suction nozzle slot 470 travels along the connected series of slots 470^a and 470^b, a following portion of the thread extends in a more direct path from the bobbin to this end of thread which travels in the bobbin-thread suction conduit, and the suction conduit and guide wire 498 are so shaped as to guide this portion of thread into the knotter 122. The series of slots 470, 470^a and 470^b thus constitute an exit through which a portion of the thread can leave the bobbin-thread suction conduit so as to extend in this more direct path which carries the thread into the knotter.

In order to insure that the portion of thread intended to enter the knotter shall with certainty leave the suction conduit, and also shall seat firmly in the knotter, the third friction drive wheel 387 is preferably employed to engage and rotate the rotatable bobbin hub 380 of the traveling unit after this hub has left the preceding friction drive wheel 386. Drive wheel 387 is adapted to rotate the hub 380 in a direction to rotate the bobbin in a winding direction, the rod 495 guiding the thread onto the tip of the bobbin as shown in Fig. 50. This draws the thread away from the suction conduit, first, insuring that the portion of thread that follows the end of thread into the suction conduit will leave the conduit through its slot, and so extend into the proper path to enter the knotter, and secondly, insuring that the thread will tighten so as to seat properly in the knotter. Provision for thus insuring the departure of thread from the suction conduit enables the suction conduit to be condensed into a short width, lengthwise of the machine, and to carry the end of thread in a path which otherwise might not permit proper departure of the following portion of thread from the conduit, that is, a nearly vertical path up the tube 453 followed by a nearly vertical path down the tube 461. The shortening of the widthwise extent of the suction conduit is advantageous in permitting the mouth of the suction conduit to be near enough to the knotter, lengthwise of the machine, so that these devices need accommodate the thread of only a single one of the closely spaced traveling winding units at one time.

The principle of winding thread back onto a bobbin or the like to draw a portion of the thread from a suction conduit, or to tighten the thread, or to aid in preparing the thread for uniting, is herein shown as applied to the leading end of the thread of the supply bobbin. The same principle can also be similarly applied to a receiving bobbin or package, such as one which is partly wound and is to be further wound, and the trailing end of thread of such receiving bobbin or package.

In the particular machine illustrated, rotation of the supply bobbin by drive wheel 387 in addi-

tion to aiding in positioning the thread for uniting also assists in the tail severing operation which is preferably employed as subsequently described.

With the thread which extends from the bobbin and the thread which extends from the package P both in the knotter 122, the knotter is then actuated to tie these threads. The actuation of the knotter is preferably timed, by mechanism subsequently described, to tie the threads while the bobbin hub 380 is temporarily inactive between the wheels 387 and 388.

The knotter 122 preferably operates according to the principle described in Patent No. 1,965,023 and includes driving mechanism similar to that described in Patent No. 2,146,713.

Thus the knotter bills and thread-closing mechanism of the knotter are shown as driven by a central shaft on which is fastened a plate 501, Fig. 48, in frictional contact with friction material 502 which is fastened onto the cooperating side face of a gear 503 freely rotatable on the central shaft. Gear 503 is constantly driven through a pinion 505, a gear 506 and a pinion 507 by a constantly rotating motor 509 (Figs. 46, 47 and 17). Plate 501 and the central knotter shaft are held against rotation by engagement in a notch of the plate by a latch 511 carried by an arm 512 that is pivoted at 513 to the knotter frame. A lifter rod 520, connected at its upper end to the arm 512 and at its lower end to the armature 521 of a solenoid 522 (Fig. 17), is adapted to lift the arm 512 and release the latch 511 from the notch plate 501 whenever the solenoid 522 is energized. Simultaneously with lifting of the arm 512, a thread-clamping element 512^a (Fig. 47), which constitutes an angular extension of arm 512, clamps the two threads which extend into the knotter. Upon release of the latch 511 from the notch in plate 501, the central shaft of the knotter makes one revolution, causing the knotter to tie the knot. At the end of one revolution of the plate 501, the solenoid then being de-energized, the latch 511 again falls into the notch of plate 501, detaining this plate against further rotation, and simultaneously allowing the clamping element 512^a to release the now tied threads.

The knotter is operated in timed relation with its travel of the winding units by a switch 525, Figs. 34, 52 and 17. A pin 526 extending downwardly from the winding unit engages a cam-shaped switch actuating member 527, Fig. 52, carried on the outer one of a pair of fiat springs 528, forcing this spring inwardly. The two springs 528, 523 carry cooperating contact elements 529, 529 adapted to close an electric circuit through the springs 528 upon member 527 being pressed inwardly.

As shown in the wiring diagram, Fig. 17, switch 525 is in series with solenoid 522, so as to energize the solenoid for an instant at the passage of each winding unit and thus actuate the knotter.

As in the knotters of Patents 1,965,023 and 2,146,713, knotting of the two threads is accompanied by cutting off the tails of the knot, and as in Patent No. 2,146,713 and Patent No. 2,177,763, the cut-off knot tails are carried away into the suction box 76.

Upon passing the knotting position, the bobbin hub 380 reaches the fourth friction drive wheel 388 which rotates the hub 380 and bobbin B slowly in a winding direction. This rotation winds a portion of the thread which extends between the bobbin and package onto the bobbin,

as indicated in Fig. 51, the rod 495 guiding this thread onto the tip portion of the bobbin. In this manner the slack is taken out of the thread between the package and bobbin, minimizing the formation of kinks in the thread and removing any that may have already formed, and also again tensioning the thread and drawing the thread in between the disks of the tension device 30. Rotation of the bobbin by drive wheel 388 further assists in the tail-severing operation subsequently described.

Reference has been made to the inner tail portion 426 of thread which may originally have been twisted or entangled with the leading end portion of the outer spiral of thread. After the action of the hook 445 the tail portion may be free of any entanglement or may have twisted or entangled therewith a remnant of the outer thread broken off by action of the hook.

It is preferred to provide for severing this inner tail portion close to the bobbin, in preparation for unwinding from the bobbin, so as to prevent any possibility of this tail portion entangling with the main unwinding thread. As shown in Figs. 45, 46, 47 and 49, the suction box 76 is provided with a nozzle 503 projecting inwardly adjacent to the path of the base portions of the passing bobbins and there having a mount in the form of a slot 504 extending along such path of travel, the mouth being nearly horizontal but inclined slightly to the horizontal as shown in Fig. 47 so as to search for tail portions of threads at the base portions of the passing bobbins.

A tail portion of thread at the base of a bobbin is presented to slot 504 by rotation of the bobbin by the drive wheels 387 and 388, and enters a short distance into the nozzle 503. The suction of nozzle 503 pulls out and straightens the tail portion and quickly removes its twist back to the point where the tail portion emerges from under the main wound mass of thread of the bobbin. The tail portion then quickly frays off close to the wound mass of thread and its frayed fibers are carried away into the suction box 76. In the event that a remnant of the original leading end of thread of the bobbin has remained entangled with the tail portion, such remnant can be drawn in by the nozzle 503 along with the tail portion, whereupon when the tail portion is frayed off close to the wound mass, as just described, the remnant, which may also fray, will also be carried away into the suction box 76.

It will be observed that in the preferred form of machine shown the tail portions of thread are presented to the generally horizontal suction nozzle 503 by the same rotation of the bobbin that is employed to wind the main body portion of thread back toward the bobbin to tighten this main body portion. However this is not essential in the broader aspects of the invention, and the tail portions can be presented to tail-severing mechanism independently of rotation of the bobbin caused by drive wheels 387 and 388.

If the tail portions of the bobbins are quite short, the direction of rotation of the bobbin during presentation of the tail portion to the tail-severing nozzle may be immaterial. However in the event that longer tails may be encountered, then during presentation of the tail portion to the tail-severing nozzle, it is preferred that the rotation of the bobbin (as here shown) shall be in a direction opposite to the direction in which it has been rotated by the drive wheel 388 at the bobbin-thread suction nozzle. With a long tail there is a tendency of the tail to wind up around

the base of the bobbin when the bobbin is rotated by the fast moving drive wheel 386. Accordingly subsequent rotation in a reverse direction at the tail-severing nozzle 503 is adapted to pay out such wound tail portion as the tail portion is acted on by suction at that nozzle.

In some cases it may be desirable to eliminate the tail severing action and leave the tail portions and any remnants entangled therewith wound around the bases of the bobbins below the main body of wound thread, in the condition in which these portions are placed by the rotation of the bobbin at drive wheel 386. In this event the suction nozzle 503 may be omitted so that the wound tail portions, and any remnants entangled therewith, are not drawn off but remain wound on the bobbin bases.

Upon leaving the fourth drive wheel 388 of the illustrated machine, the winding unit passes around the end of the machine and upon reaching the straight course of track the package P is lowered onto the rotating tractor roll 49 and normal winding of the thread beings, as in the machine of Patent No. 2,177,763.

I claim:

1. Bobbin-handling mechanism for textile machines comprising means for progressively arranging bobbins of an unarranged mass into a systematic formation, a series of bobbin holders adapted to hold bobbins as their threads are used, means for successively delivering bobbins from said formation to the bobbin holders, means for rotating the bobbins around their axes as they are held by said bobbin holders, and means engageable with the surfaces of the wound bodies of thread during such rotation to free an end of the thread thereof.

2. A textile machine of the type including a plurality of traveling winding units each adapted to wind a thread from an unwinding supply mass onto a winding package, the units successively entering a winding zone in which such winding takes place, means for supplying unwinding supply masses successively to the said units in advance of their entry into the winding zone, means past which the winding units travel, arranged to act successively on the newly supplied supply masses to find their ends after they have been supplied to the winding units and in advance of their initial entry into the winding zone, and means for uniting the found end of the supply mass to the thread of the package preparatory to winding from the mass onto the package in the winding zone.

3. A textile machine having therein a plurality of traveling winding units each including a holder for a winding package and a holder for an unwinding supply mass, means adapted to act on the packages of the several units for finding the ends of the packages, thread-uniting means adapted to act on the found package end, and mechanisms, past which the winding units travel, operating in sequence and in advance of the operation of the uniting means upon the found package end of a unit, for supply a fresh unwinding supply mass to its holder in the unit, then finding the end of the newly supplied supply mass, and then presenting such found end of the supply mass to the uniting means for union with the found end of the package.

4. A multiple unit winding machine having therein a plurality of traveling winding units each including a holder for an unwinding bobbin and means for winding thread from said bobbin onto a winding package, means acting succes-

sively on the several units to replace an exhausted bobbin in said holder with a fresh bobbin, bobbin end-finding means past which the winding units travel and acting upon the newly-supplied fresh bobbins of the several units in succession to find an end of thread thereon, and means operating successively upon the found threads of the several units for uniting such found thread to the thread of the package.

5. A multiple unit winding machine having therein a plurality of traveling winding units each including a holder for an unwinding bobbin and means for winding thread from said bobbin onto a winding package, feeler means adapted to feel the body of thread on the bobbins of the several successive units, bobbin-removing means adapted to act successively on the several units to remove the bobbin from its holder, said bobbin-removing means being controlled by said feeler means so as to remove exhausted bobbins and to allow non-exhausted bobbins to remain in their holders, bobbin-supplying mechanism adapted to supply a fresh bobbin to any unit from which the bobbin has been removed, bobbin end-finding means past which the winding units travel and acting upon the newly-supplied fresh bobbins of the several units in succession to find an end of thread thereon and means operating successively upon the found threads of the several units for uniting such found thread to the thread of the package.

6. A winding machine having therein a holder for an unwinding bobbin, means for winding thread from the bobbin onto a winding package, means for automatically detecting exhaustion of the thread of the supply bobbin, means for automatically replacing the exhausted bobbin held by said holder with a fresh bobbin, means for rotating the fresh bobbin around its axis in an unwinding direction while such fresh bobbin is held by said holder, an end-finding nozzle adapted to receive the end of thread unwound from the rotated bobbin and means for uniting the found end of thread to the end of thread of the package.

7. A textile machine having therein a bobbin holder adapted to hold an unwinding supply bobbin, means for winding thread from the bobbin onto a package while the bobbin is held by said holder, means for delivering a bobbin to said holder, means for rotating the bobbin around its axis after such delivery and a member engageable with the surface of a wound body of thread on the thus rotating bobbin to free the end of thread thereof.

8. In combination with mechanism adapted to withdraw thread from a bobbin, means for disrupting entangled connection between a tail portion of thread of the bobbin and the leading end of the main length of thread of the bobbin, means operative after said entangled connection has been disrupted for automatically associating said leading end with said withdrawing mechanism, and means operative after said entangled connection has been disrupted for severing said tail portion of the thread.

9. A textile machine including means for disrupting entangled connection between a tail portion of thread of the bobbin and the leading end of the main length of thread of the bobbin, and means operative after said entangled connection has been disrupted for severing said tail portion.

10. A textile machine including means for disrupting entangled connection between a tail portion

tion of thread of a bobbin and the leading end of the main length of thread of the bobbin, and means for tensioning said tail portion and simultaneously removing twist therefrom, to fray off said tail portion close to said bobbin.

11. A textile machine including means for disrupting entangled connection between a tail portion of thread of a bobbin and the leading end of the main length of thread of the bobbin, and suction means arranged to hold said tail portion out away from the bobbin and simultaneously remove twist from the tail portion adjacent to the bobbin, to weaken said tail portion until it frays off.

12. A textile machine including a suction end-finding nozzle disposed to search a portion of the large diameter surface of a wound bobbin to draw in the leading end of thread of the bobbin, and a further suction nozzle disposed to search the region of the base of the bobbin to draw in the tail portion of the thread of the bobbin.

13. A textile machine including means for removing the leading end of thread of a wound bobbin from the region of the base of the bobbin, and thread severing means arranged to operate on a tail portion of a thread extending from the bobbin near the base thereof.

14. A textile machine including a plurality of winding units each including a holder for an unwinding supply bobbin, bobbin-delivering mechanism associated with the several units in succession for delivering supply bobbins to the bobbin holders of said units, means for rotating the bobbins around their axes while held by said holders, and a suction nozzle disposed adjacent to the level of the base portions of the bobbins to receive the inner tail portions of thread of said bobbins during such rotation.

15. A textile machine including a plurality of traveling winding units each including a holder for an unwinding supply bobbin, and a suction nozzle having a mouth extending along the path of travel of the winding units adjacent to the level of the base portions of the bobbins held by said holders in position to receive inner tail portions of the threads of supply bobbins held by the bobbin holders of the passing winding units.

16. In combination with mechanism adapted to withdraw thread from a wound bobbin, means for automatically associating the leading end of thread of a new bobbin with said withdrawing mechanism including means for rotating said bobbin in an unwinding direction to pay out said leading end, said rotation of the bobbin tending to wind a tail portion of its thread thereupon, and mechanism for thereupon rotating the bobbin in a winding direction to throw off the wound up tail portion.

17. A textile machine including means for disrupting entangled connection between a tail portion of thread of a wound bobbin and the leading end of the main length of thread of the bobbin, means for rotating said bobbin in an unwinding direction to pay out said leading end, said rotation of the bobbin tending to wind said tail portion thereupon, and mechanism for thereupon rotating the bobbin in a winding direction to throw off the wound up tail portion.

18. A textile machine including a suction end-finding nozzle disposed to search a portion of the large diameter surface of a wound bobbin to draw in the leading end of thread of the bobbin, means for rotating said bobbin in an unwinding direction to pay out said leading end, said rotation of the bobbin tending to wind a tail portion of its

thread thereupon, and mechanism for thereupon rotating the bobbin in a winding direction to throw off the wound up tail portion.

19. A textile machine having therein a bobbin holder adapted to hold an unwinding supply bobbin, means for winding thread from the bobbin onto a package while said bobbin is held by said holder, and means for finding an end of thread of a bobbin held by said holder, said end-finding means including means for rotating the bobbin around its axis while said bobbin is held by said holder.

20. A winding machine including a plurality of bobbin holders adapted to hold bobbins being unwound, means for winding thread from bobbins held by said holders onto winding packages, means for transferring bobbins to said holders, means for finding the ends of threads of the bobbins while held by said holders, said finding means including means for rotating around the bobbin axis, said holders and the bobbins delivered thereto, to facilitate such finding, and means for uniting the found threads of said bobbins to the threads of said packages.

21. A winding machine including a plurality of bobbin holders adapted to hold bobbins being unwound, means for winding thread from bobbins held by said holders onto winding packages, means for transferring bobbins to said holders, means for finding the ends of threads of the bobbins while held by said holders, said finding means including means for rotating the bobbins around their axes after delivery to said holders and suction mechanism for reception of threads of the rotated bobbins, and means for uniting the found threads of said bobbins to the threads of said packages.

22. In combination with bobbin end-finding mechanism, a bobbin holder constructed so as to support a bobbin for over-end unwinding, said holder including a rotatable portion rotatable about the bobbin axis and adapted to rotate a bobbin therewith, means for depositing a bobbin on said holder, and means for rotating said rotatable portion to rotate the bobbin about the bobbin axis during end-finding.

23. In combination with bobbin end-finding mechanism, a bobbin holder constructed so as to support a bobbin for over-end unwinding, said holder including a rotatable portion rotatable about the bobbin axis and adapted to engage the base of the bobbin and tapered to center said base, and means for rotating said tapered portion to rotate the bobbin about the bobbin axis during end-finding.

24. In combination with bobbin end-finding mechanism, a bobbin holder constructed so as to support a bobbin for over-end unwinding, said holder including a rotatable portion rotatable about the bobbin axis and adapted to engage the base of the bobbin and tapered to center said base, means for rotating said tapered portion to rotate the bobbin about the bobbin axis during end-finding and means engageable with the tip portion of the bobbin to steady the tip portion during said rotation.

25. A textile machine having therein a holder for an unwinding supply bobbin, means for winding thread from the supply bobbin onto a winding package while the bobbin is held by said holder, said holder being rotatable about the supply bobbin axis, means frictionally engaging the holder for rotating said holder in a direction to unwind thread from the supply bobbin, and

an end-finding nozzle adapted to receive the thread thus unwound.

26. In a textile machine, a winding unit including means for holding a bobbin and means for winding thread from the bobbin onto a winding package, thread uniting mechanism, means for conveying an end of thread from the bobbin to the uniting mechanism, and means for rotating the bobbin about the bobbin axis in a winding direction while held by said holding means to wind onto the bobbin a portion of thread extending therefrom.

27. In a textile machine including means for winding thread from a supply mass onto a winding package, means for rotatably holding such supply mass, a suction conduit adapted to receive an end of thread attached to said supply mass and shaped to carry said end in an indirect path, the conduit having a slot to permit a following portion of the thread to leave the conduit through said slot, and means for rotating the supply thread mass to wind thread after the end has been received by the conduit, to insure that such following portion so leaves the conduit through said slot.

28. In a textile machine, means for rotatably holding a thread carrier adapted to hold a thread mass, pneumatic means for conveying an end of the thread of said mass away from said carrier, thread-uniting means adapted to operate upon the conveyed thread, and means for winding a portion of the conveyed thread back onto the thread carrier preparatory to operation of the thread-uniting means.

29. In a textile machine, means for rotatably holding a thread carrier adapted to hold a supply thread mass, winding means adapted to wind thread from the supply thread mass, pneumatic means for conveying an end of the thread from said mass away from said carrier, thread-uniting means adapted to operate upon the conveyed thread, and means for winding a portion of the conveyed thread back onto the thread carrier preparatory to operation of the thread-uniting means.

30. In a textile machine adapted to wind thread from a supply mass of thread onto a winding package of thread, means for associating an end of thread which is attached to a supply mass and an end of thread which is attached to the winding package, means for uniting the associated ends of thread, and means for thereupon rotating the supply mass in a direction to wind a portion of the thread onto the supply mass.

31. In a textile machine adapted to wind thread from a supply mass of thread onto a winding package of thread, an end-finding nozzle adapted to receive thread from the supply mass, and means for rotating the supply mass first in an unwinding direction to deliver thread to the nozzle and then in a winding direction to tighten the delivered thread.

32. In a textile machine arranged for over-end delivery of a thread from a bobbin, means for winding said thread onto a winding package, thread-uniting mechanism, means for conveying an end of thread from the bobbin to the uniting mechanism, means for rotating the bobbin to unwind the thread therefrom for such conveyance of said end, and a thread guide movable relatively to the bobbin into and out of cooperative relation therewith to prevent over-end delivery of the bobbin during such conveyance of the end of thread and to permit over-end delivery from the bobbin during normal winding.

33. In a textile machine arranged for over-end delivery of a thread from a bobbin, means for winding said thread onto a winding package, thread-uniting mechanism, means for conveying an end of thread from the bobbin to the uniting mechanism, means for rotating the bobbin in a winding direction to wind onto the bobbin a portion of thread extending therefrom, and a guide cooperating with the bobbin to direct said portion of the thread onto the rotating bobbin from the side thereof.

34. In a textile machine arranged for over-end delivery of a thread from a bobbin, means for winding said thread onto a winding package, thread-uniting mechanism, means for conveying an end of thread from the bobbin to the uniting mechanism, means for rotating the bobbin in a winding direction to wind onto the bobbin a portion of thread extending therefrom, and a thread guide movable relatively to the bobbin into and out of cooperative relation therewith to direct the thread onto the bobbin from the side thereof during such rotation of the bobbin and to permit over-end delivery of the thread from the bobbin during normal winding.

35. In a textile machine, a winding unit adapted to wind thread from a bobbin onto a winding package, thread-uniting means periodically presented to said unit, means for rotating the bobbin in cooperation with the operation of the thread-uniting means, and a guide movable relatively to the bobbin tip into and out of contact therewith to steady the bobbin during such rotation while permitting over-end delivery of the thread from the bobbin to the package during normal winding of the thread.

36. In a textile machine, a winding unit adapted to wind thread from a bobbin onto a winding package, the unit including a bobbin peg adapted to extend into the interior of the unwinding bobbin, means at the base of the peg shaped so as to center the base of the bobbin while the bobbin is loose on the upper portion of the peg, means periodically presented to the winding unit for rotating said bobbin, and a member engageable with the tip of the bobbin during such rotation, said member being positioned to align the bobbin with the axis of the bobbin peg.

37. In a textile machine a winding unit adapted to wind thread from a bobbin onto a winding package, the unit including a bobbin peg adapted to extend into the interior of the unwinding bobbin, a rotatable bobbin-engaging element at the base of the peg shaped to enter a bottom opening in the bobbin and center the base of the bobbin while the bobbin is loose on the upper portion of the peg, means periodically presented to the wind-

ing unit for rotating said bobbin-engaging element and the bobbin engaged thereby, and a member engageable with the tip of the bobbin during such rotation, said member being positioned to align the bobbin with the axis of the bobbin peg.

38. Bobbin end-finding mechanism comprising in combination means for rotating a bobbin in a winding direction, a thread-engaging member arranged to hook onto an exterior spiral portion of thread constituting the leading end portion of thread of the bobbin so that such rotation of the bobbin frees the leading end of thread, and means, operating upon the freed leading end after such winding rotation, for carrying the freed end away from the bobbin.

39. Bobbin end-finding mechanism comprising in combination means for rotating a bobbin in a winding direction, a thread-engaging member arranged to hook onto an exterior spiral portion of thread of the bobbin, means for causing a relative movement separating the thread-engaging member from the bobbin while the thread-engaging member is hooked onto the thread, and means, operating upon the freed leading end of thread after such winding rotation, for carrying the freed end away from the bobbin.

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