Oct. 23, 1962 S. FÜRST 3,059,867

DEVICE FOR READYING OF YARN ENDS, PARTICULARLY IN YARN-WINDING MACHINES

Filed Sept. 24, 1959 3 Sheets-Sheet 1

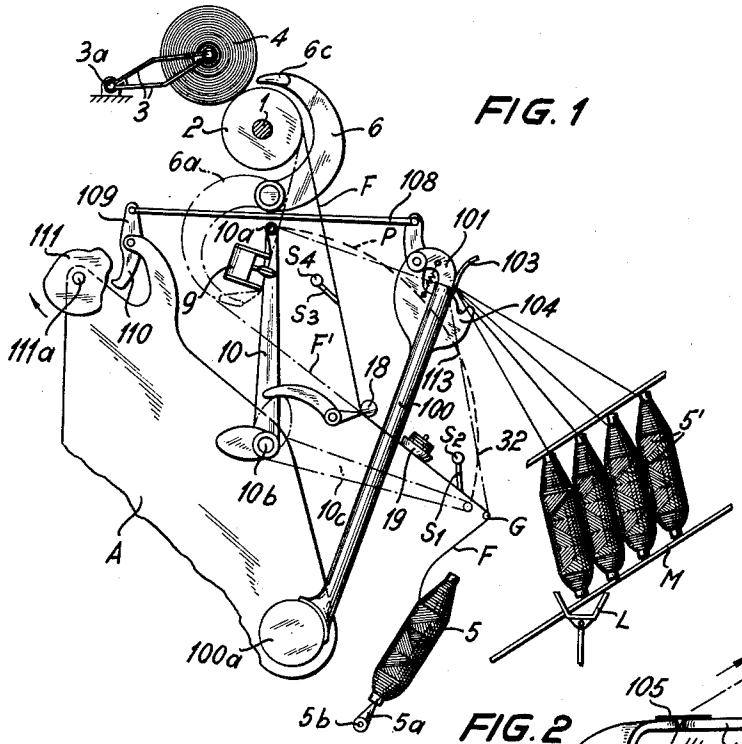



FIG. 1

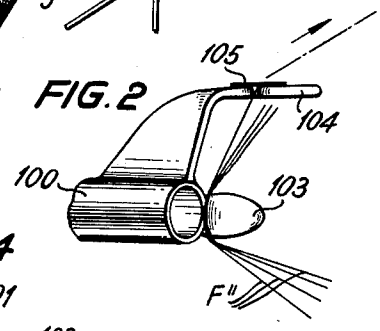



FIG. 2

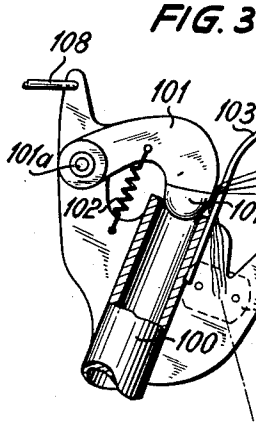



FIG. 3

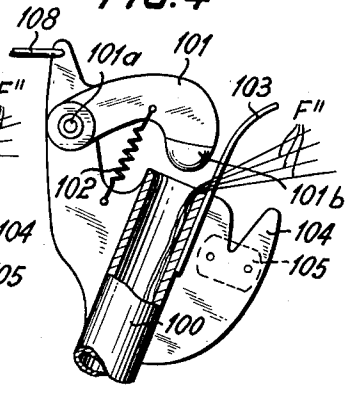



FIG. 4

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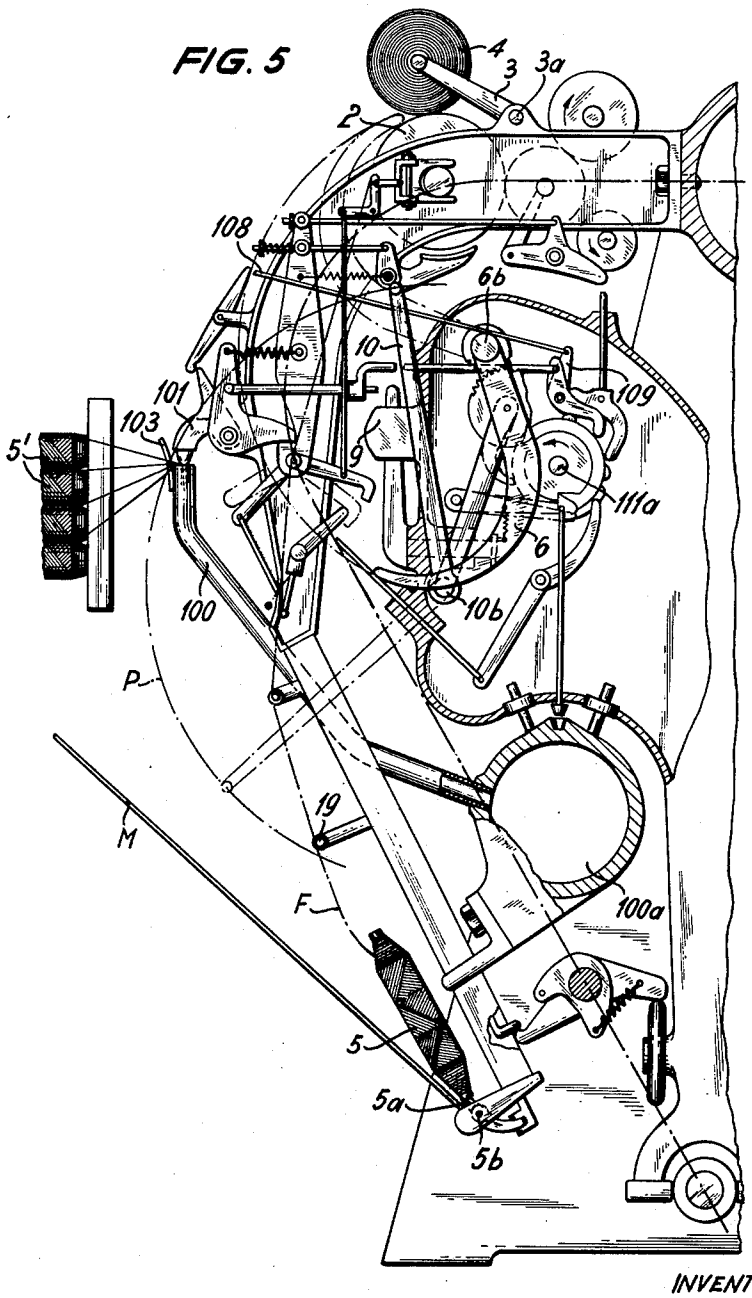
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FIG. 5




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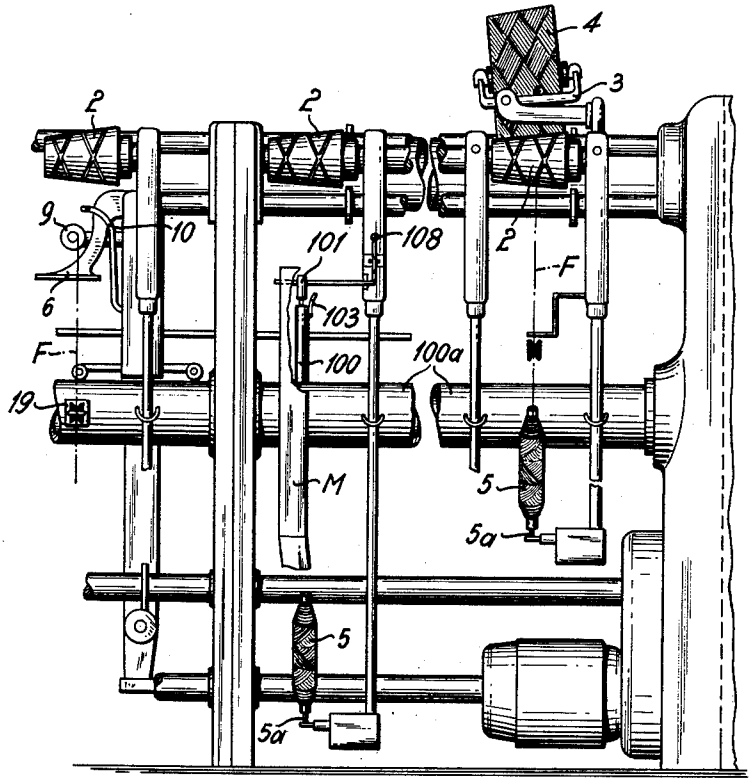
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DEVICE FOR READYING OF YARN ENDS, PARTICULARLY IN YARN-WINDING MACHINES

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FIG. 6




INVENTOR

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# DEVICE FOR READYING OF YARN ENDS, PARTICULARLY IN YARN-WINDING MACHINES

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10 Claims. (Cl. 242—35.6)

My invention relates to machines for winding yarn from spinning cops or other yarn-supplying coils into larger yarn packages, such as cross-wound coils or "cheeses," of the particular shape and size desired for further fabrication of the yarn. In a more particular aspect, the invention concerns a method and device for readying the yarn ends of a number of yarn-supply coils available in a magazine.

The yarn coils, particularly cops, to be unwound and rewound in a winding machine, are kept available in a magazine from which they are sequentially dispensed in accordance with the demand, whereafter each dispensed coil passes to an unwinding position. Heretofore, with manual servicing of the unwinding machine, it was necessary to seek the yarn end of the supply coil, after its passage to the unwinding position, and then to tie the yarn end together with the yarn end coming from the new yarn package being wound. In known automatic winding machines, the replenishment of a depleted supply coil and the necessary yarn-seeking and yarn-tying operations are automatically performed, but the seeking and seizing of the yarn end from a new supply coil involves considerable difficulties. It is therefore preferable to pull the yarn end off the supply coil before placing the coil into the magazine, and to fix the yarn end in a holder or other readying device. Devices have been disclosed for this purpose in my U.S. Patent 2,733,870, issued February 7, 1956, and in U.S. Patent 2,750,125, issued June 12, 1956, to keep such yarn ends in readiness within a suction air channel. However, it has been found in practice that prolonged action of a current of suction air on the yarn ends may cause the ends of a number of adjacent coils to become intertwined or interfelted, thus resulting in a so-called "rat tail" or matted rope-like body which slowly increases in thickness and may eventually clog the suction air channel. On the other hand, if many suction nozzles are provided, each holding only a few yarn ends, the effect of the air current in each nozzle is so intense that it may dissolve or separate the yarn into its components or, in any event, tends to considerably reduce its thickness and strength.

It is an object of my invention to eliminate the just-mentioned deficiencies.

To this end, and in accordance with a feature of the invention, the yarn ends being kept in ready position are only temporarily subjected to a current of suction air. In the intermediate periods of time, they are held in the previously occupied position either by their own weight or by a mechanical clamping operation. The temporary action of the suction air current is effected preferably before and during the supply-coil exchanging operation and only for a period of time sufficient for the yarn end to be seized by a gripper and to be conveyed to the knotter. In the event of yarn breakage, too, the suction air current may be caused to act upon the yarn ends only during the period of activity of the yarn-seeking and knotting devices.

An embodiment of a yarn winding machine incorporating the invention by way of example is illustrated on the accompanying drawing, in which:

FIG. 1 shows schematically a lateral view of a winding station which may form part of a multi-station machine.

FIG. 2 is a perspective view, substantially from the front, onto the nozzle opening and clamping means of the yarn-end readying device forming part of the same winding station.



FIGS. 3 and 4 are partly sectional lateral views of the same suction nozzle and clamping means in two different operating conditions respectively.

FIG. 5 is a side view and FIG. 6 a front view of another construction.

The novel method of the invention is performed as follows: When filling the supply-coil magazine M of the winding machine, the yarn end of each supply coil 5′ is first passed to clamping holder members 103, 101. Subsequently, for example, shortly prior to a suction operation, the mechanical clamping action is reduced or loosened, and the suction air current through tube 100 is made effective immediately before the yarn end F″ can become dislocated. After the yarn ends are sucked into the suction air nozzle 100, the ends, now located in the proper ready position, are again subjected to mechanical clamping and the action of the suction air current is discontinued. This mode of operation has the advantage that it is merely necessary for the attendant to bring the yarn ends to the holder member for clamping therein when he places the supply coils into the magazine. The subsequent sucking of the yarn end into the suction nozzle 100 can take place shortly prior to the next following coil exchange, the necessary current of suction air being switched on in uniform time intervals. Consequently, no manual operation of a suction valve is required, and the fixing of the yarn end in the correct ready position takes place irrespective of the particular operating condition of the individual winding station at the moment of coil replenishment, and the yarn end will always reliably enter into the suction nozzle at a sufficiently early time.

A device according to my invention for performing the novel method described above is preferably provided with periodic control means, such as from cam 111, which control or switch the supply of suction air current to the yarn-entraining suction nozzle 100 in cooperation with predetermined operating conditions of the machinery. At least one mechanical clamping device 101 is coordinated to the suction nozzle 100 and is also controlled to operate during given intervals of time, particularly in alternating relation to the sucking action of the nozzle 100.

The winding station according to FIG. 1 is provided with a drive shaft 1 which continuously rotates at constant speed as long as the machine is in condition for operation. The shaft 1 carries a yarn-guiding drum 2 cooperating with a take-up spool 4 journalled on a carrier frame 3 which is pivoted at 3*a* so that the spool 4, under its own weight and the weight of the carrier frame 3, rests against the periphery of the guiding drum 2. As a result, the take-up spool 4 is entrained by drum 2 to rotate at a constant peripheral speed regardless of the diameter of the body of yarn being built-up on the spool, and the yarn F travelling through a guiding groove of the drum is reciprocated along the spool 4 in a direction parallel to its axis in order to produce the desired cross-wound yarn package. During the winding operation, the yarn F is unwound from a supply coil, such as a cop 5 which is speared up on a mandrel 5*a* mounted on a pivoted support 5*b*. The yarn F coming from the cop 5 passes over a stationary guide G, a tensioner 19 and a yarn cleaner 18 to the drum 2.

When the yarn of cop 5 becomes exhausted, the yarn portion between guide G and tensioner 19 slackens. This is sensed by a yarn feeler schematically represented at S–1, which is normally biased by gravity or spring force against the yarn F and which turns clockwise about its pivot point S–2 to signal the depletion. The turning movement of feeler S–1 then serves to initiate the coil-exchanging operation in the conventional manner as

described in Patent Nos. 2,733,870 and 2,769,599. Another yarn feeler or guard is schematically shown at S–3. In the event of yarn breakage, the length of yarn between the guiding drum **2** and the cleaner **18** or tensioner **19** becomes slack or vanishes so that the feeler S–3, normally biased against the taut yarn, turns counterclockwise about its pivot S–4. This pivotal deflection initiates a yarn-seeking and tying operation, also in the conventional manner.

When the feeler S–1 signals the exhaustion of the yarn supply from cop **5**, the depleted cop **5** is doffed, the mandrel **5***a* is turned a small amount clockwise, and an escapement lock L is actuated to release the next following cop from the magazine M, so that the latter cop drops onto the mandrel **5***a* where it is speared up, whereafter the mandrel turns counterclockwise into the unwinding position shown in FIG. 1 occupied by the cop **5**. Further details of this coil exchange are described in my copending application Serial No. 704,983, filed December 24, 1957, now abandoned.

After a new coil from magazine or slideway M has reached the unwinding position **5**, a hollow suction arm turns from the dot-and-dash position **6***a* to the full-line position **6**. This arm has its hollow pivot portion **6***b* connected with a source of suction air and carries a suction nozzle **6***c* with a slit opening extending along the entire axial length of the take-up spool **4**. Due to the suction effect, the yarn end from spool **4**, then lifted off the yarn-guiding drum **2**, is entrained into the interior of the suction arm **6** which thereafter turns downward back to the position **6***a* in which the yarn end from the take-up spool **4** is placed in front of a knotting device **9**. During the same interval of time, another hollow suction arm **10**, carrying a suction nozzle **10***a*, moves downward to the dot-and-dash position **10***c* about its hollow pivot **10***b* through which it is connected with the same source of suction air. The nozzle **10***a* of arm **10** then seizes, in the manner more fully described below, the yarn end from the new supply coil **5** and thereafter turns counterclockwise back to the illustrated full-line position of FIG. 1, where it places the yarn end from coil **5** against the knotter, which thereafter ties the two yarn ends together, so that the winding operation can continue.

A similar yarn-seeking and tying operation is performed by the suction arms **6**, **10** and the knotter **9** in the event of yarn breakage signalled by response of the guard S–3, except that in this case no coil exchange is performed.

As far as described above, the winding station is in accordance with prior art or prior disclosures. For example, reference may be had to U.S. Patent No. 2,750,125 of Furst et al., No. 2,769,599 of Furst, No. 2,733,870 of Furst, and copending application Serial No. 757,757 of Manfred Rühl, filed August 28, 1958 and application 798,406, filed March 10, 1959 of Furst, all assigned to the assignee of the present invention and all more fully illustrating and describing such winding stations.

In accordance with the present invention proper, the machine is further provided with a suction tube **100** whose bottom portion is firmly mounted at **100***a* on the frame structure A of the machine and which remains in fixed position during the machine performance. The lower portion **100***a* of tube **100** is connected to the same source of suction as the suction arms **6** and **10**. Cam operated valve means **101** can be connected through members **108**, **109** for timed coordination with shaft **11***a* to periodically open tube **100** for a flow of air induced from a source of vacuum to tube **100** through duct **100***a*. It is sufficient to have a continuous connection of the source of vacuum to tube **100**. Each suction nozzle **100** cooperates with two mechanical clamping devices **101**, **103** of which one (**103**) fixed the yarn end before it is sucked into the suction nozzle, for example when inserting the supply coil into the magazine, whereas the second clamping device **101** serves for retaining the yarn end after it is entrained by air into such nozzle. One of the two clamping devices is located at the rim of the suction nozzle **100** and designed as a clamping spring **103**, whereas the other clamping device is designed as a cover member **101** and simultaneously operates as a control valve for the suction nozzle. The suction opening at the upper end of tube **100** forms a valve together with a cover member **101***b* (FIG. 3) mounted on an arm **101** which is pivoted at **101***a* and biased downward by a spring **102**, thus tending to keep the suction opening of tube **100** closed. The upper end of tube **100** also carries a leaf-spring **103** resiliently resting against or urged toward the arm **101** when the latter is in the closed position shown in FIG. 3. The leaf-spring **103** is horn-shaped so that the respective yarn ends F″ coming from the supply coils **5**′ (FIG. 1) in magazine M can conveniently be clamped between leaf-spring **103** and arm **101** as the corresponding coils are each being loaded into the magazine.

According to another feature of my invention, one and the same control device **111** is provided for controlling the supply of the suction air to the nozzle and also for actuating the clamping means **101** in a given time relation to the nozzle performance.

The closure arm **101** is linked by a control rod **108** with a lever **109** pivoted to the machine frame structure A and forming a follower **110** for cooperation with a control cam **111** on a cam shaft **111***a*. Rotation of cam **111** acting through lever **109** and rod **108** causes the opening and closing of arm **101** with its cover **101***b* in dependence upon the particular operating condition of the winding station. The rotation occurs when the yarn is broken and the mechanism for knotting and seeking the yarn end begins to operate or in accordance with any other desired operating program of the winding machine controlling rotation of shaft **111***a*. Whenever a lobe of cam **111** pushes against the follower **110**, lever **101** is caused to turn counterclockwise, and the opening of the suction tube **100** is released so that the mechanical clamping action of the yarn ends F″ between the closure arm **101** and the leaf-spring **103** is terminated (FIG. 4). Opening of the upper end of tube **100** in which a lower air pressure exists because of its connection to a source of suction at **100***a*, then causes a current of air to flow or be drawn from above into the suction tube **100**, with the effect of entraining yarn ends F″ into the tube, as schematically shown in FIG. 4. After a short interval of time, further rotation of cam **111** causes arm **101** to return to the closed position of FIG. 3 and to now act to terminate the air flow into tube **100** while simultaneously imposing a mechanical clamping effect upon the yarn end or ends sucked into the tube. Arms **10** and **6** are controlled by respective cams on shaft **111***a* of control cam **111**.

As mentioned above, the depletion of a supply coil **5** causes feeler S–1 to initiate a coil exchange during which the suction arm **10** moves clockwise downwardly. This motion is along the path P of the broken-line circle shown in FIG. 1. The yarn end F″ of the coil **5**, which was just previously slipped from magazine M onto the mandrel **5***a*, now extends from the guide G to the edge of opening or readying nozzle of suction tube **100** where its end remains clamped fast mechanically between arm **101** and leaf spring **103**. Consequently, the suction nozzle **10***a* of arm **10**, during its downward motion, finds the yarn end along path P at the location denoted by 32. Simultaneously with the downward motion of suction arm **10**, further rotation of cam **111** eliminates, for a short interval of time, the clamping of the yarn end by the closure arm **101**, and by opening closure **101***b* causes a current of air to flow into tube **100** during the same interval. The arm **10**, when now returning counterclockwise upwardly to the illustrated full-line position operating simultaneously with arm **6**, entrains the yarn

end toward the knotter **9** to position F' so that the two yarn ends can be tied together by the knotter in the known manner described above. Thereafter the winding operation is again initiated and the yarn then runs automatically into the tensioner **19** and the cleaner **18** with the aid of the conventionally available guiding means. In this condition, the winding operation takes place until a new coil exchange becomes necessary and again causes the above-described cycle of operations to be performed.

To facilitate the residual amount of manual operation required when filling the magazine M with cops, a cutter blade, for example, a razor blade **105**, is mounted on a projection **104** in fixed relation to the opening of the suction tube **100**. It is preferable to provide the yarn cutter **105** or other severing device in the vicinity of the nozzle mouth for shortening the protruding length of yarn when inserting the yarn. When the attendant puts a coil 5' into the magazine and places its yarn end F'' between the leaf-spring **103** and the arm **101**, he need only pull the excessive length of yarn lightly against the blade **105** in order to shorten the yarn down to proper length.

As shown, the yarn end extending from the readying nozzle of tube **100** to the supply coil **5** on mandrel *5a*, is preferably clamped between spring **103** and closure member **101***b*, in the immediate vicinity of the readying nozzle. However, if desired, the yarn may be clamped fast by a clamping device at a different location and along the yarn path P, for example at the intersection point denoted by **113** in FIG. 1, between the inlet nozzle of tube **100** and the supply coil **5**, such clamping being effected when the new supply coil **5** drops from the magazine down onto the mandrel *5a*. After the yarn end from coil **5** held fast in position **113** is tied together with the yarn end coming from the take-up spool, the clamping at point **113** is released, whereafter the yarn remainder is sucked off of the clamp during the next following suction pulse entering into the nozzle tube **100**.

FIGS. 5 and 6 illustrate how the invention may be incorporated into a winding machine which is provided with a travelling servicing unit, of the type further described and illustrated in my copending application Serial No. 798,406, filed March 10, 1959. The same numerals and character designations refer to similar parts as those used in the illustrations previously described above.

The method and devices according to the invention secure a reliable and trouble-free performance of the winding operation in automatic yarn-winding machines and thus greatly contribute toward simplifying and improving the manufacture of textile products.

Another advantage of the invention is a considerable reduction in air consumption and thus a correspondingly reduced power requirement.

It will be obvious to those skilled in the art, upon a study of this disclosure, that my invention permits of various modifications and hence may be embodied in apparatus other than particularly illustrated and described herein, without departing from the essential features of my invention and within the scope of the claims annexed hereto.

I claim:

1. In a winding machine, in combination, magazine means for holding a plurality of full bobbins carrying yarn, suction means located spaced from said magazine means for entraining and holding the yarn ends of said full bobbins, means for consecutively moving said full bobbins from said magazine means to an unwinding position, and control means for temporarily and intermittently actuating said suction means to entrain and hold said yarn ends.

2. In a winding machine, in combination, magazine means for holding a plurality of full bobbins carrying yarn, suction means located spaced from said magazine means for entraining and holding the yarn ends of said full bobbins, means for consecutively moving said full bobbins from said magazine means to an unwinding position, and control means for temporarily and intermittently actuating said suction means to entrain and hold said yarn ends during an interval immediately prior to and during movement of one of said full bobbins from said magazine means to said unwinding position.

3. A winding machine according to claim 2, and including mechanical clamping means for holding said yarn end of at least one of said full bobbins in proximity to said suction means during the intervals when said suction means is inactive.

4. In a winding machine, in combination, magazine means for holding a plurality of full bobbins carrying yarn, suction means located spaced from said magazine means for entraining and holding the yarn ends of said full bobbins, means for consecutively moving said full bobbins from said magazine means to an unwinding position, holding means for receiving and clamping the respective yarn ends as each full bobbin is loaded into said magazine means, said holding means being located at least temporarily in proximity to the inlet of said suction means for entrainment of said yarn ends by the latter, said suction means and said holding means being mutually cooperative so that yarn ends are released from said holding means simultaneously as they are entrained and held by said suction means, and control means for temporarily and intermittently actuating said suction means to entrain and hold said yarn ends.

5. In a winding machine, in combination, magazine means for holding a plurality of full bobbins carrying yarn, suction means located spaced from said magazine means for entraining and holding the yarn ends of said full bobbins, means for consecutively moving said full bobbins from said magazine means to an unwinding position, first clamping means for receiving and clamping the respective yarn ends as each full bobbin is loaded into said magazine means, said first clamping means being located at least temporarily in proximity to the inlet of said suction means for entrainment of said yarn ends by the latter, said suction means and said first clamping means being mutually cooperative so that said yarn ends are released from said first clamping means simultaneously as the same are entrained by said suction means, second clamping means for subsequently clamping said yarn ends within said suction means, and control means for temporarily and intermittently actuating said suction means to entrain and hold said yarn ends.

6. In a winding machine having a plurality of winding stations, in combination, magazine means for holding a plurality of full bobbins carrying yarn, suction means having an inlet nozzle located spaced from said magazine means for entraining and holding the yarn ends of said full bobbins, means for consecutively moving said full bobbins from said magazine means to an unwinding position at one of said stations, a source of suction air connected to said suction means, and control means for switching on and off the flow of air through said nozzle, said control means being active to switch on said flow of air only temporarily and during a predetermined operating condition of said one station.

7. A winding machine according to claim 6, and including at least one mechanical clamping means for receiving and clamping the respective yarn ends as each full bobbin is loaded into said magazine means, said clamping means being located at least temporarily in proximity to said nozzle of said suction means for entrainment of said yarn ends by the latter, the flow of air through said suction means under control of said control means and said clamping means being respectively operative at mutually alternate times for holding said yarn ends.

8. A winding machine according to claim 7, said control means comprising a closure member for closing off said inlet nozzle, and means operatively joining said

closure member with said clamping means for actuation of the latter to clamp said yarn ends in said clamping means when said closure member is in closed position in said nozzle, and to release said yarn ends from said clamping means when said closure member is out of said nozzle.

9. A winding machine according to claim 7, said control means comprising a closure member for closing off said inlet nozzle, one surface of said closure member forming also a portion of said clamping means, said clamping means including resilient means mounted in proximity of said nozzle and cooperating with said one surface of said closure member for clamping said yarn ends therebetween when said closure member is in closed position in said nozzle.

10. In a winding machine, in combination, magazine means for holding a plurality of full bobbins carrying yarn, suction means having an inlet nozzle located spaced from said magazine means for entraining and holding the yarn ends of said full bobbins, means for consecutively moving said full bobbins from said magazine means to an unwinding position, clamping means for receiving



and clamping the respective yarn ends as each full bobbin is loaded into said magazine means, a yarn-severing device mounted in proximity to said inlet nozzle for shortening said yarn ends during the loading and clamping operation, said clamping means being located in proximity to said nozzle means for entrainment of said yarn ends by the latter, said suction means and said clamping means being mutually cooperative so that said yarn ends are released from said clamping means simultaneously as the same are entrained into said nozzle by said suction means, and control means for temporarily and intermittently actuating said suction means to entrain and hold said yarn ends.

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