Oct. 3, 1967 R. D. LIVINGSTON 3,345,004

MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Fig. 1.

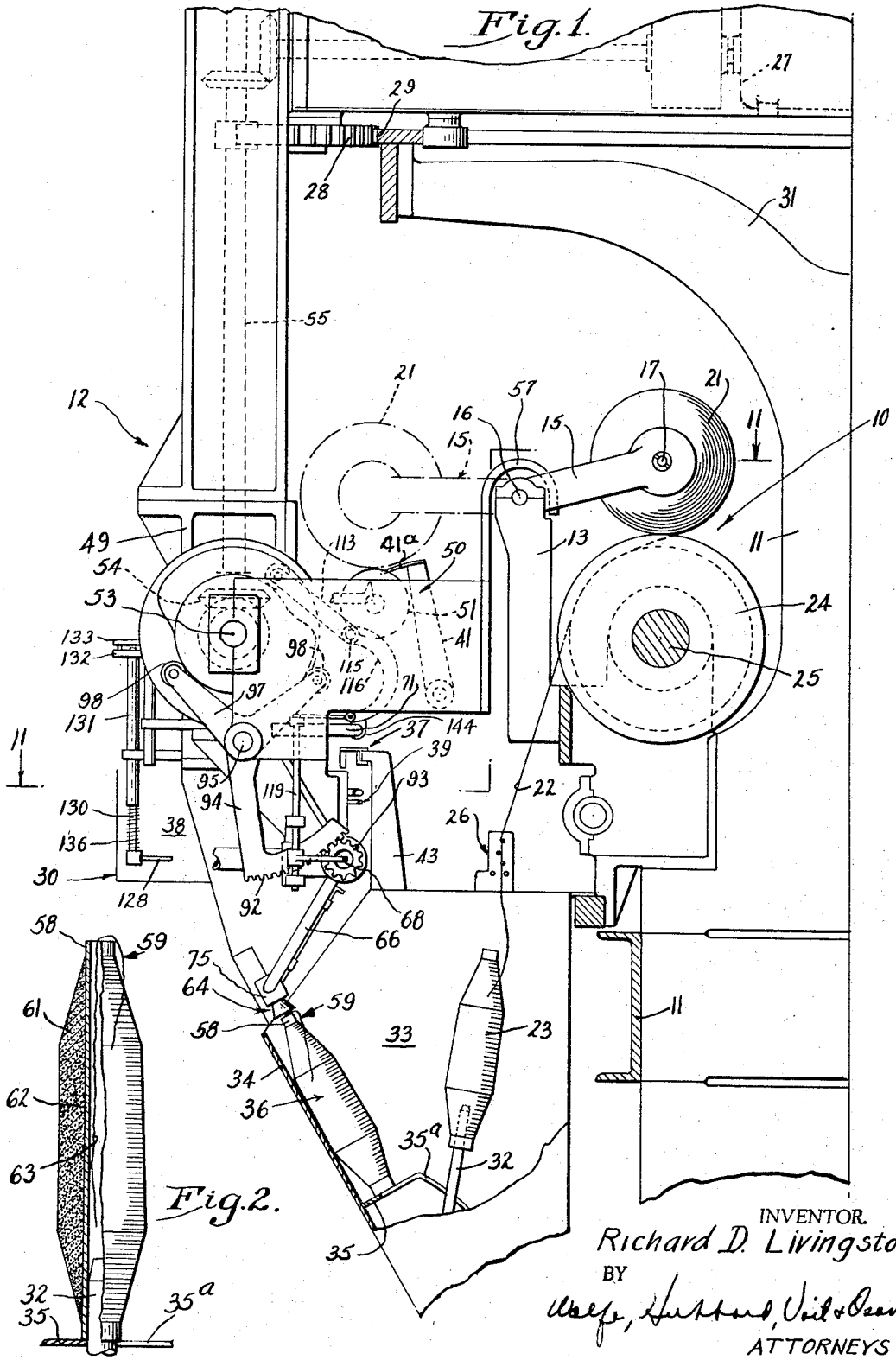

Fig. 2.

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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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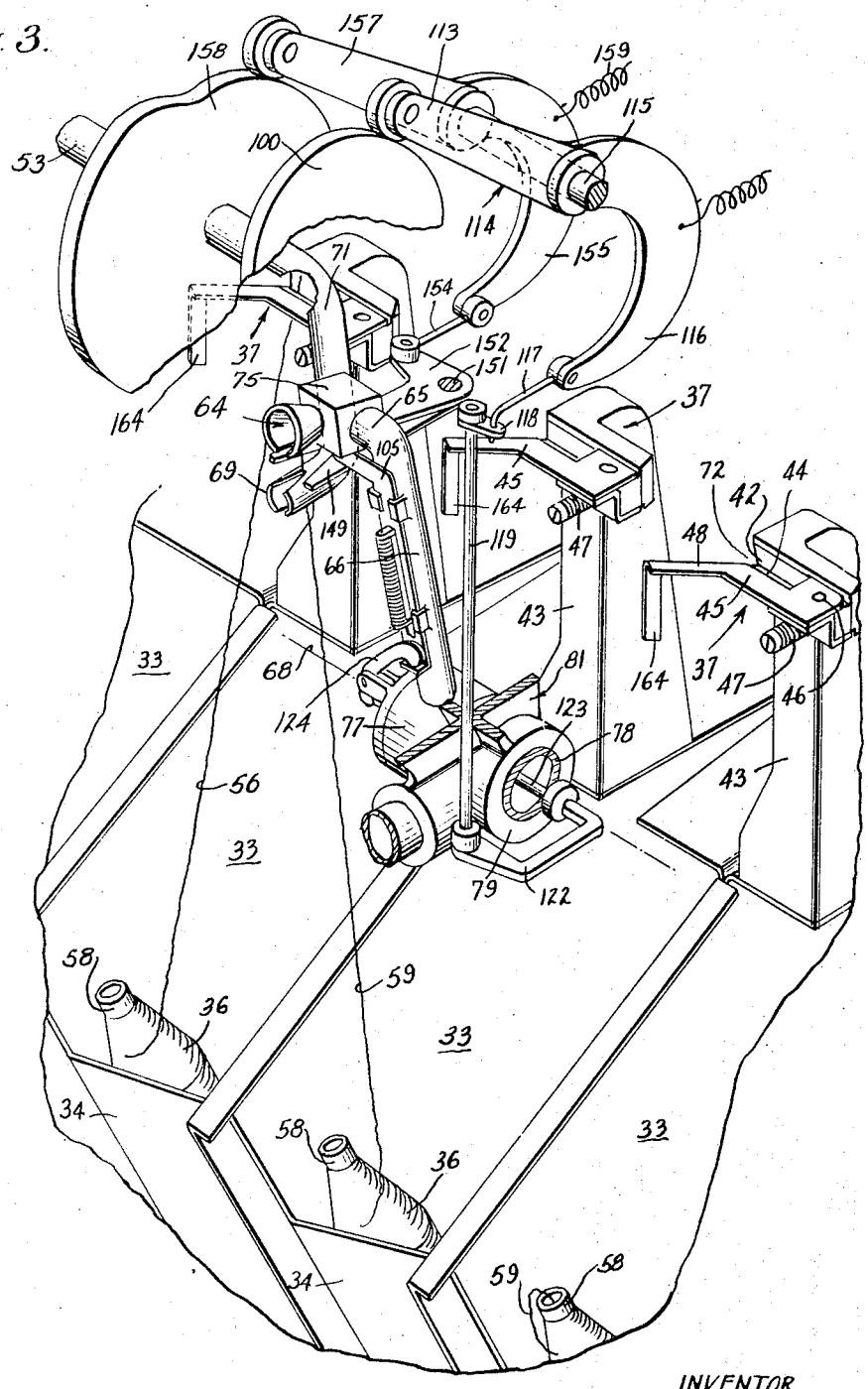
Fig. 3.



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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Fig. 5.

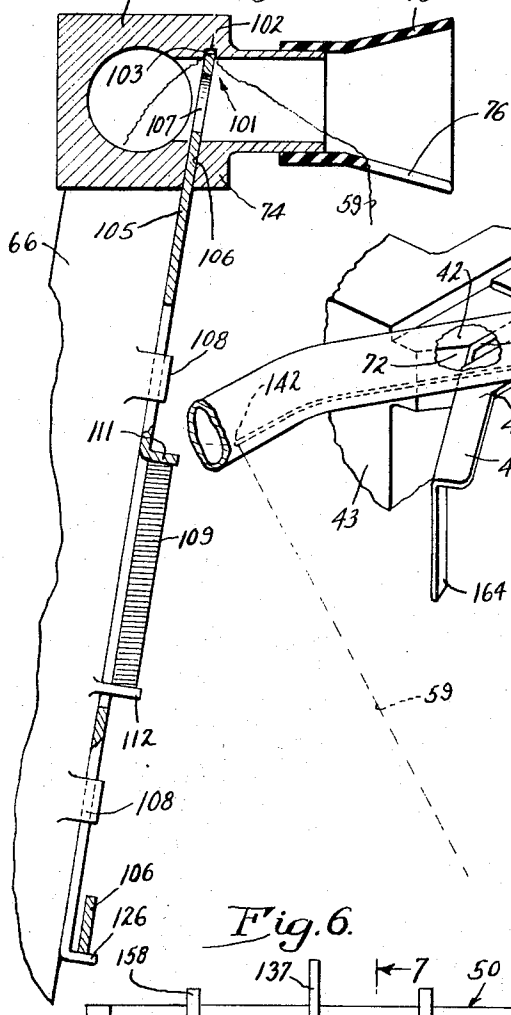


Fig. 4.

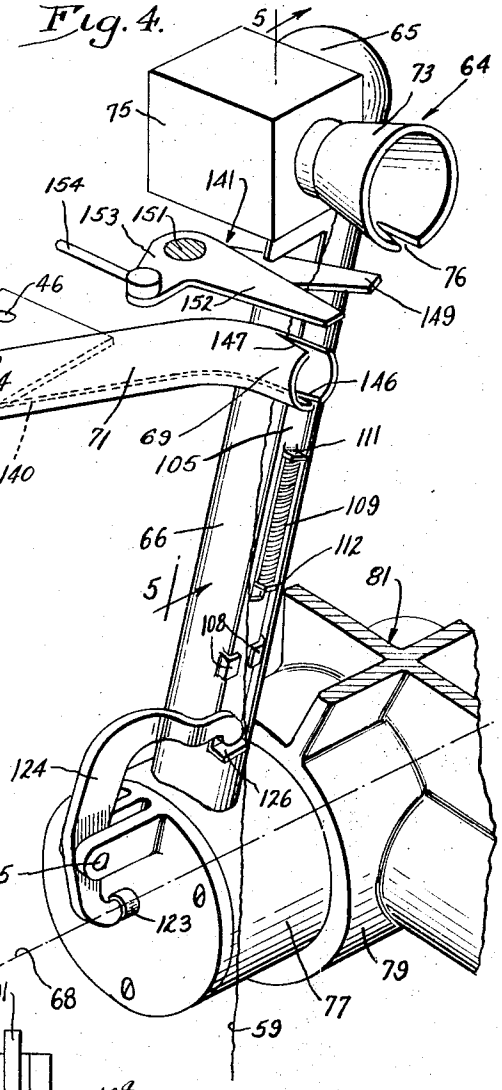
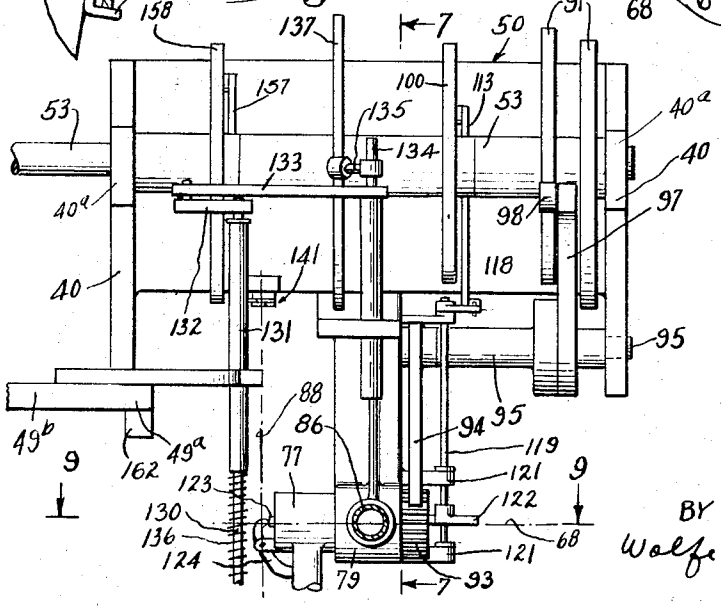


Fig. 6.



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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Fig. 7.

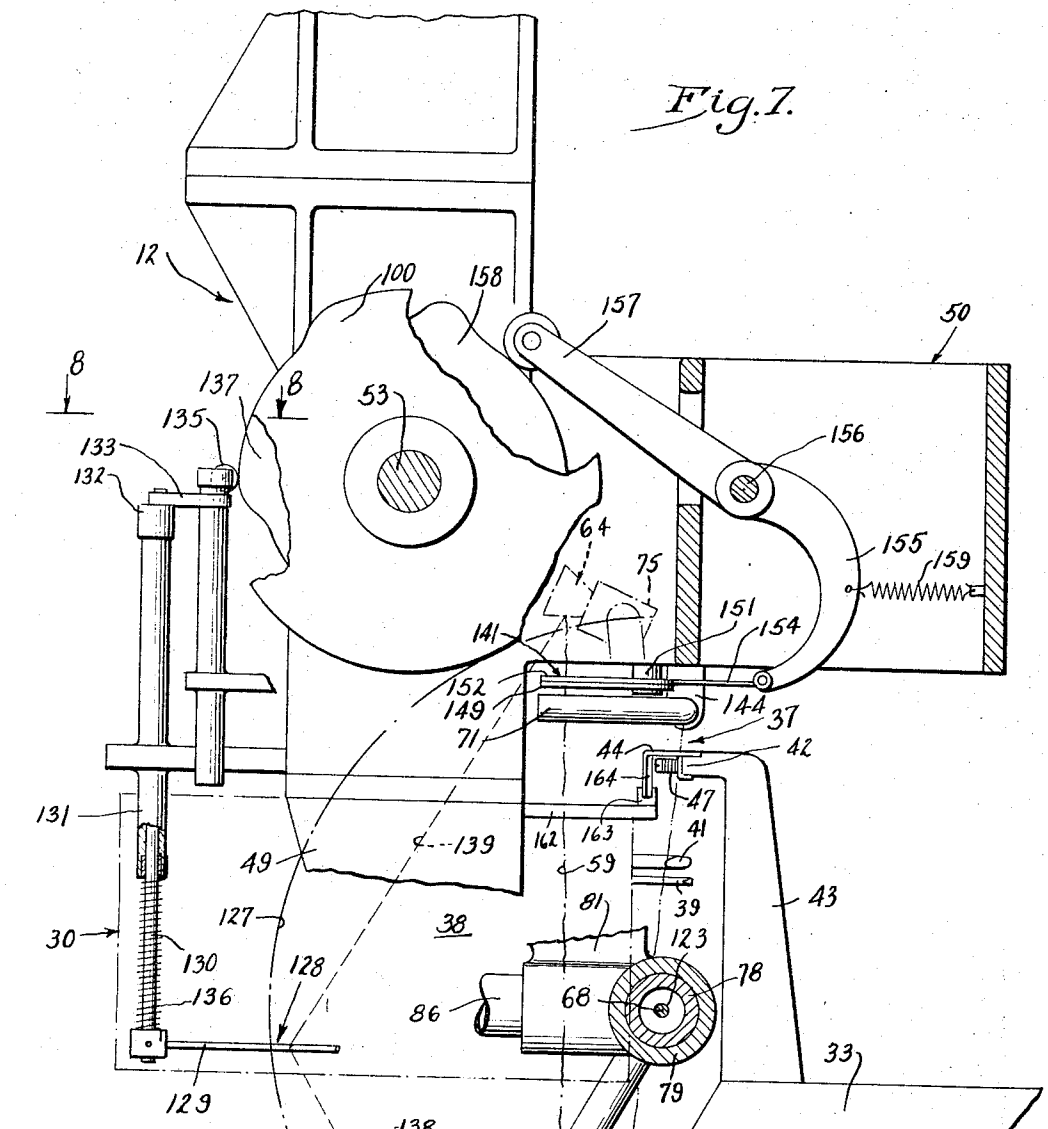
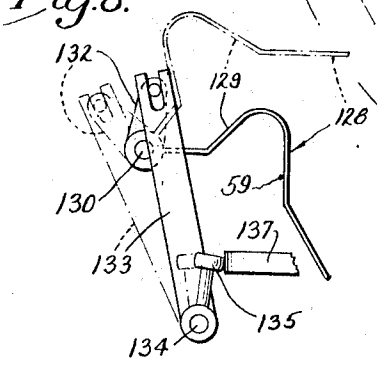


Fig. 8.



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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Fig. 10.

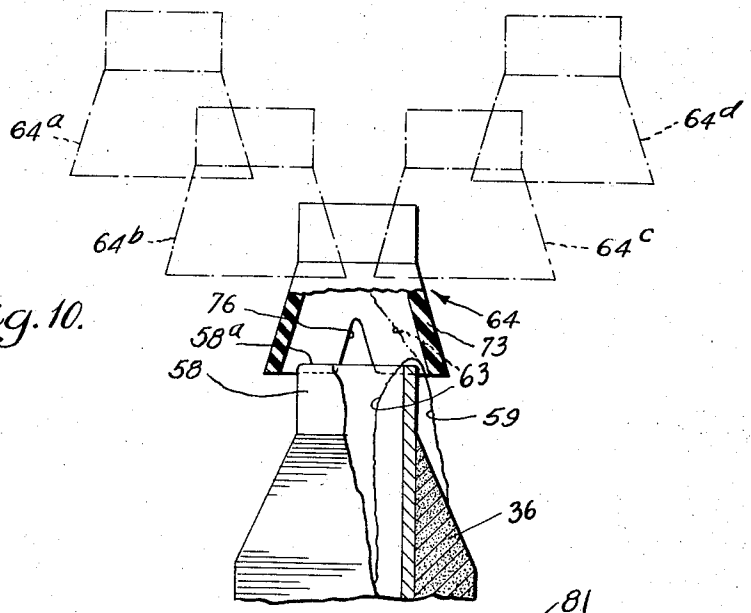
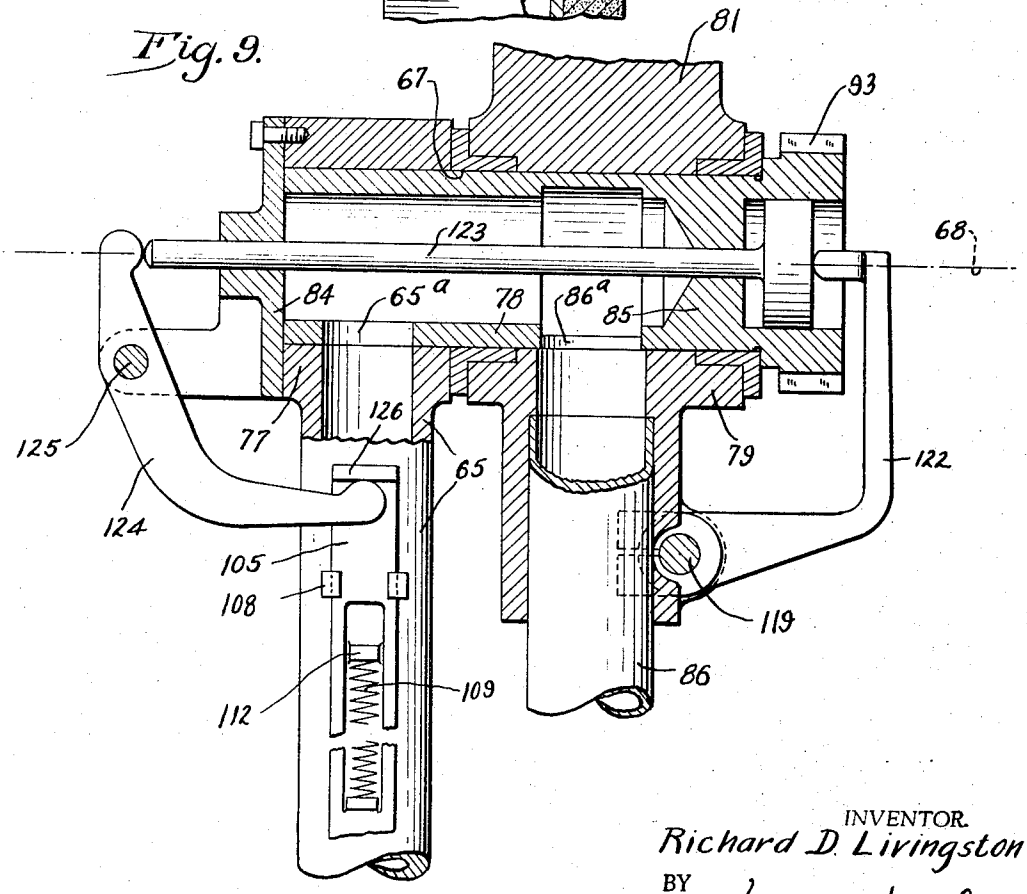


Fig. 9.



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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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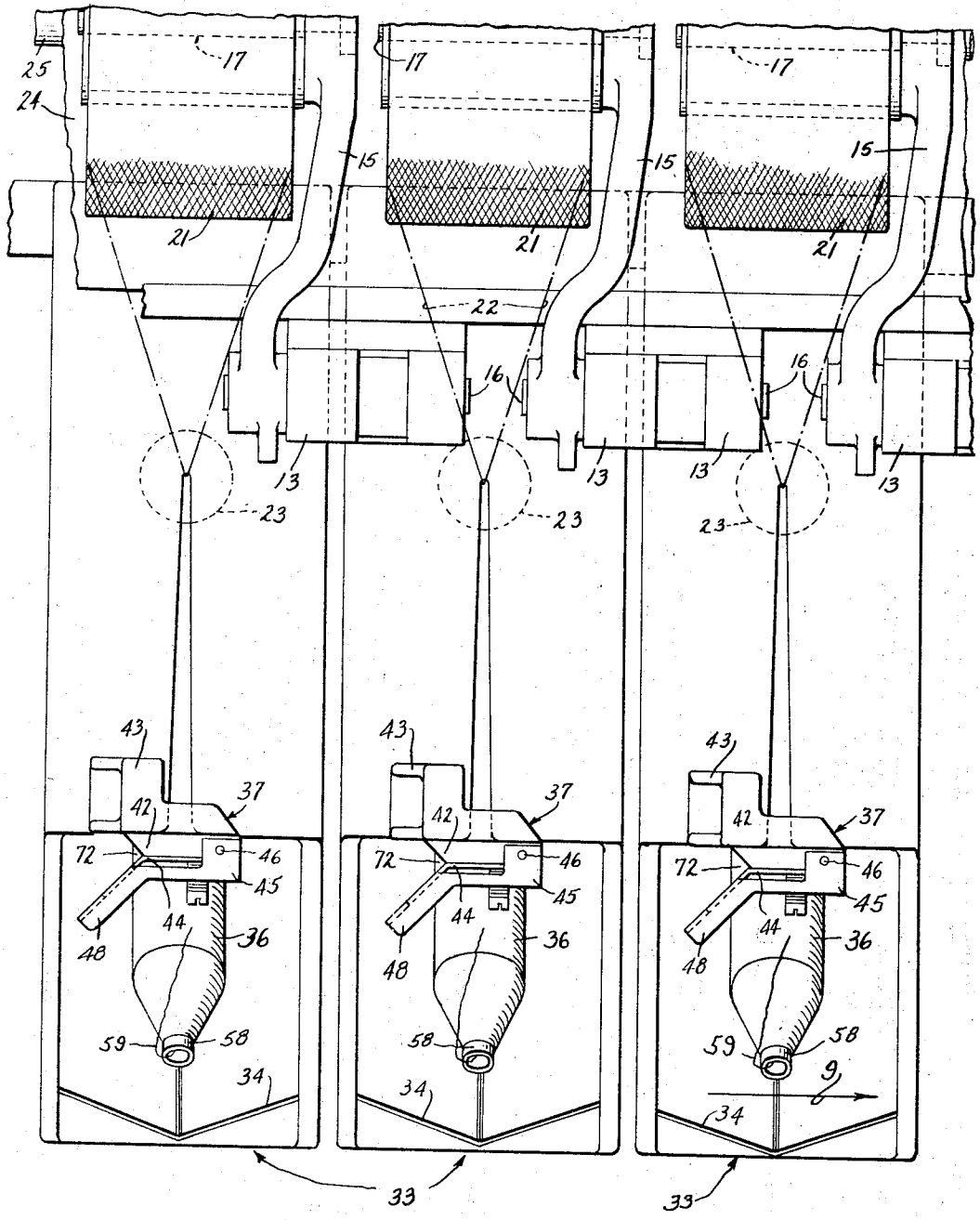

Fig. 11.

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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Fig. 12.

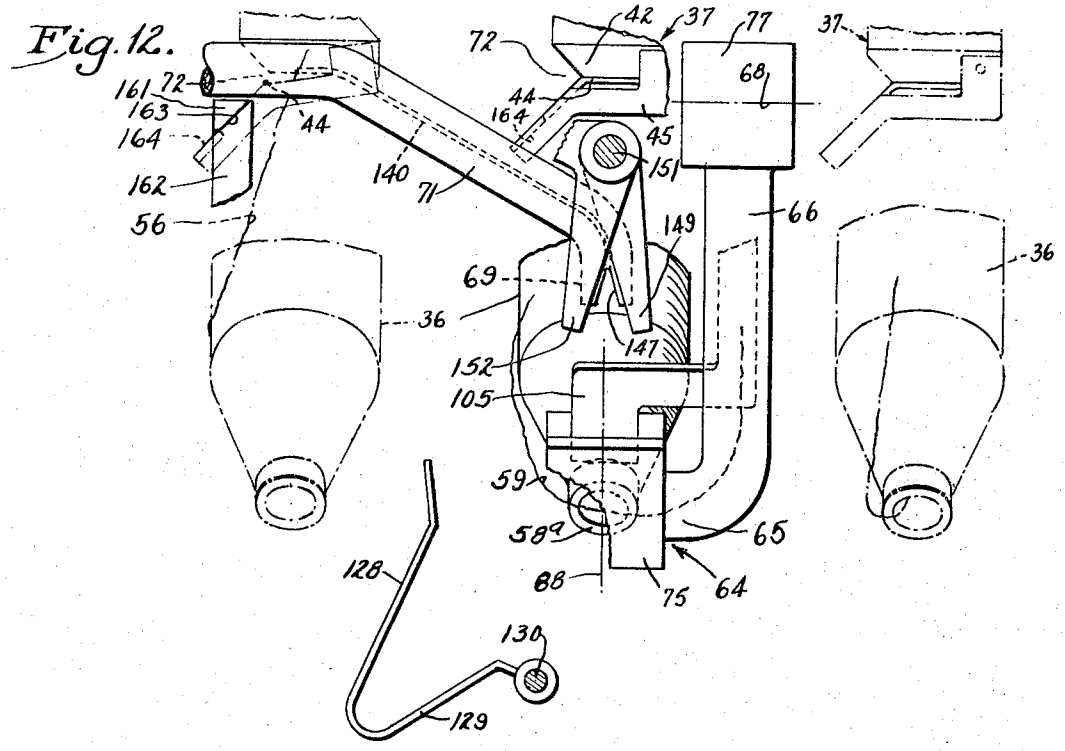
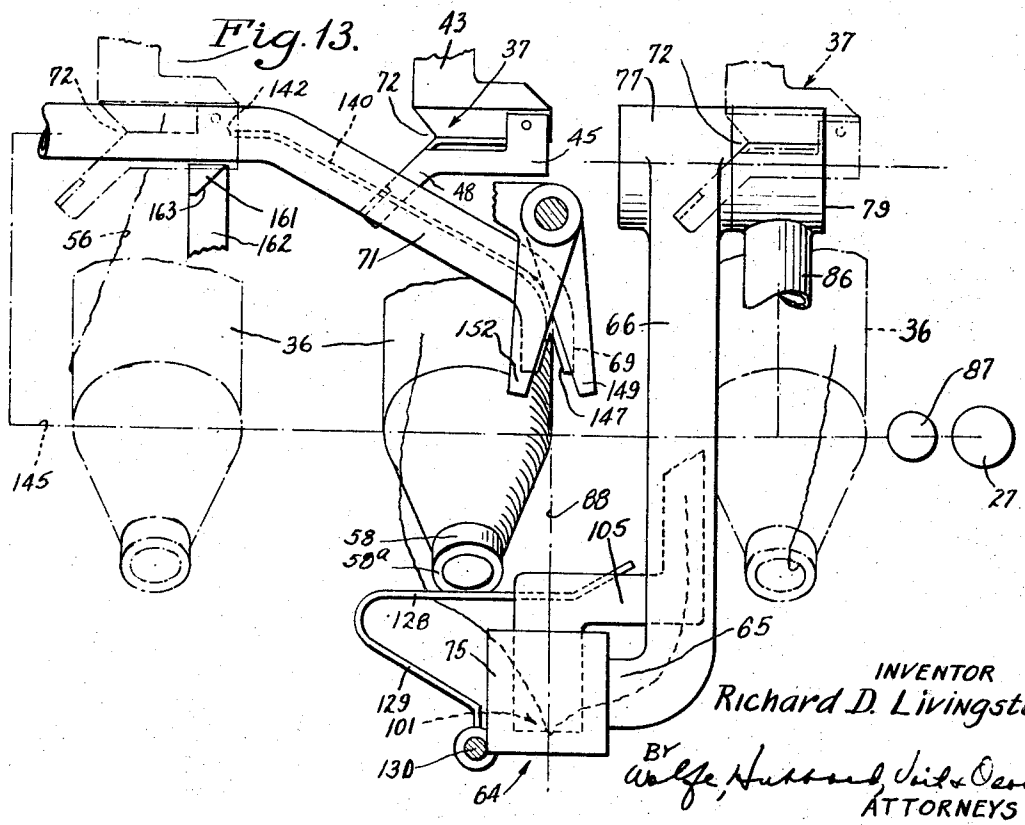


Fig. 13.



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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Fig. 14.

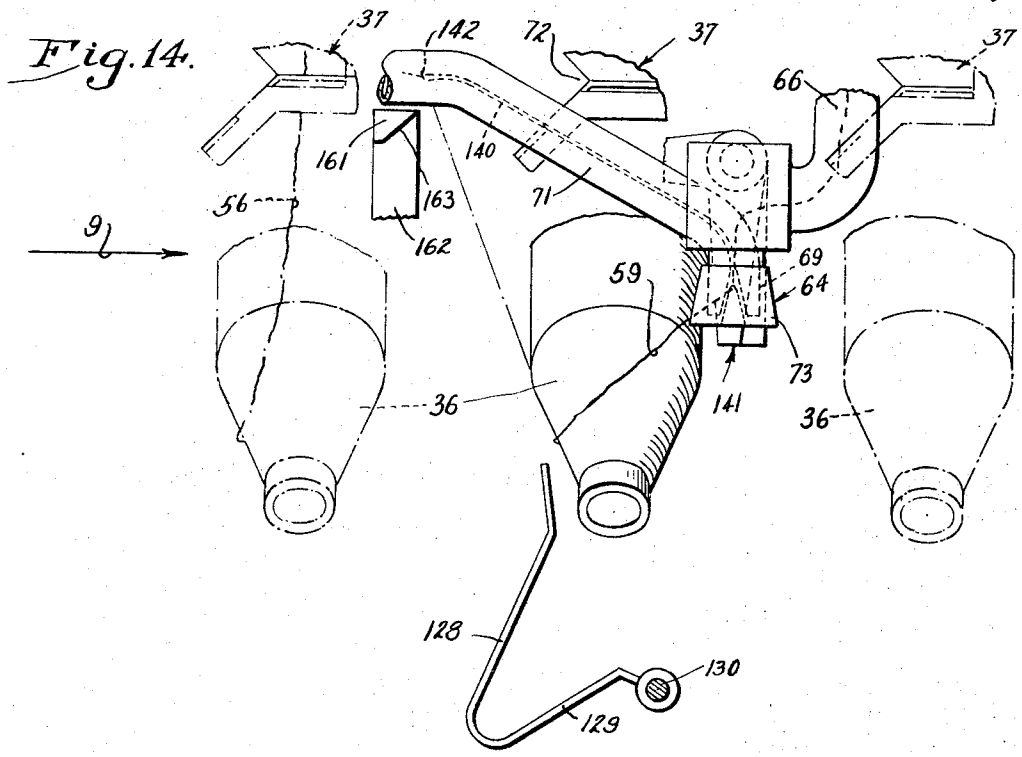
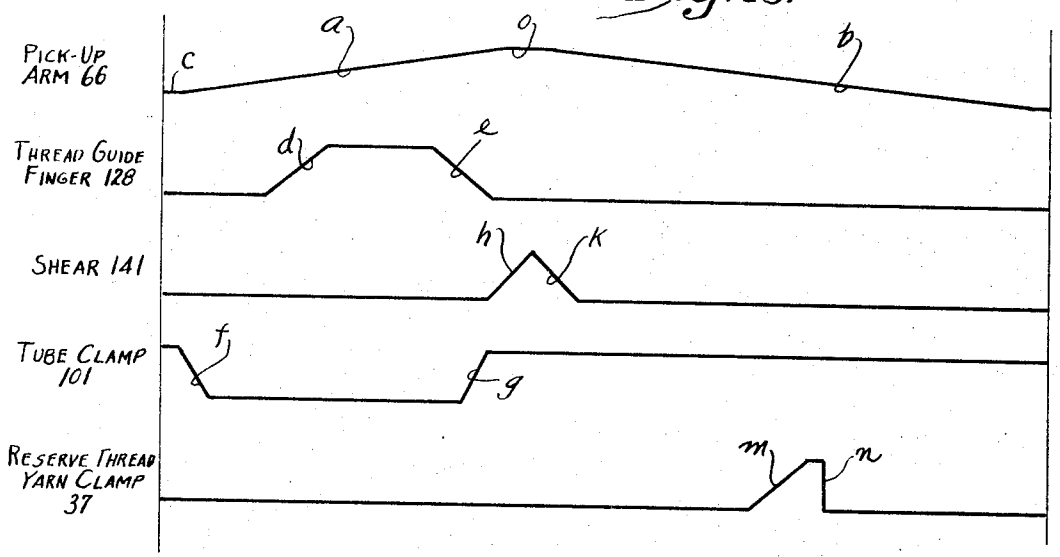


Fig. 15.



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MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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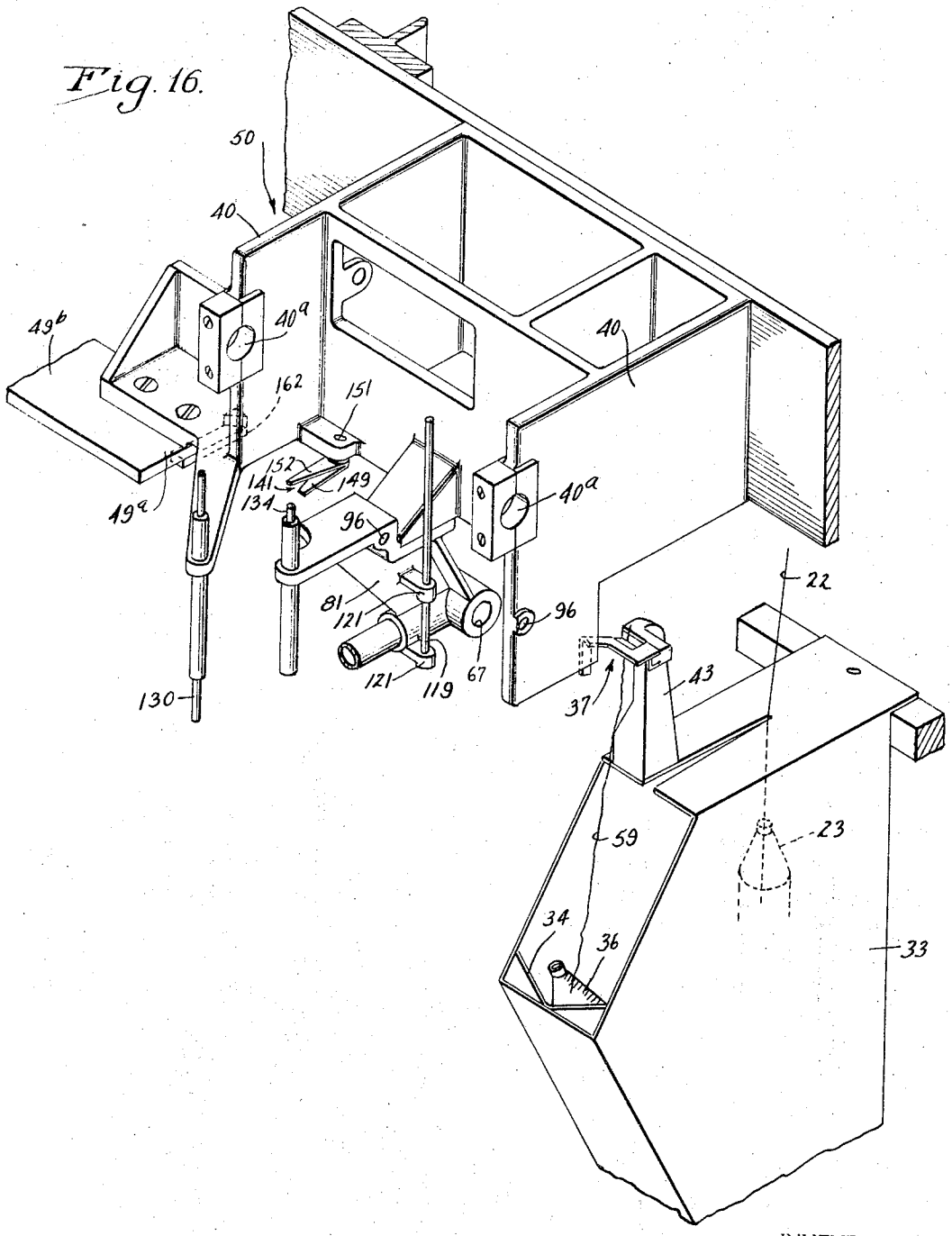
Fig. 16.



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United States Patent Office 3,345,004
Patented Oct. 3, 1967

3,345,004

MULTIPLE WINDER WITH AUTOMATIC THREAD POSITIONING

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Filed June 14, 1965, Ser. No. 463,575
30 Claims. (Cl. 242—35.5)

This invention relates to multiple thread winding machines of the types manufactured by Barber-Colman Company, examples being disclosed in Patents Nos. 1,267,977 and 3,017,129. In such winders, reserve bobbins are loaded into upwardly opening and equidistantly spaced pockets on one support with an unwound length of each bobbin thread lead upwardly to an associated gripper ready to be picked up by a tying unit including a knotter mounted on a second support and operable to pick up and tie each reserve thread to the broken thread of a package being wound and resume the winding. The two supports are movable relative to each other along a predetermined path to bring the successive hung-up threads into operative association with the tying unit. Heretofore, the hang-up of the bobbin threads in such multiple winders has been effected manually.

In certain of its aspects, the invention has more particular reference to a multiple winder in which the tying unit and knotter are mounted on a carriage or so-called traveler which moves continuously around an endless path successively past the winding units which are arranged side by side and above the respective bobbin pockets.

The primary object is to utilize the relative movement of the bobbin and tying unit supports along the aforesaid path in a novel manner to pick up the bobbin threads and hang each thread in its associated gripper in advance of the association of the thread with the tying unit.

Another object is to effect such automatic hang-up of bobbin threads in a spooler of the moving traveler type.

A further object is to adapt the thread hang-up mechanism for use with deposited reserve bobbins in which loose lengths of the threads thereof are tucked into the open upper end of the bobbin cores.

Still another object is to utilize the continuous motion of the traveler to effect both the opening and closing of the hang-up clamps in timed relation to movement of the picked-up threads to the hang-up positions.

A further object is to pick up each bobbin thread by means of a suction tube while positively unwinding the additional length of thread required for the hang-up.

The invention also resides in the novel construction of the suction tube nozzle, means for unwinding the bobbin threads, and the novel manner of positioning the thread for proper engagement in the hang-up clamp.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

FIGURE 1 is a fragmentary vertical cross-section of one winding unit of a Barber-Colman Type C spooler embodying the improved thread pick-up and positioning mechanism, the advancing traveler being shown in elevation.

FIG. 2 is an elevational view partially in diametrical section of a bobbin whose unwound thread is adapted to be handled by the improved pick-up mechanism.

FIG. 3 is a fragmentary perspective view of the reserve bobbin pockets and hang-up clamps of several winding units together with the moving parts of the improved thread pick-up mechanism.

FIG. 4 is a similar perspective view taken from a different angle.

FIG. 5 is a fragmentary section taken along the line 5—5 of FIG. 4.

FIG. 6 is a front elevational view of the cam arrangement on the traveler for actuating the thread pick-up arm and associated parts.

FIG. 7 is a fragmentary section taken along the plane 7—7 of FIG. 6.

FIG. 8 is a fragmentary section taken along the line 8—8 of FIG. 7.

FIG. 9 is a fragmentary section taken along the line 9—9 of FIG. 6.

FIG. 10 is a fragmentary view partially in section illustrating the manner of picking up a bobbin thread.

FIG. 11 is a fragmentary plan section taken from the plane 11—11 of FIG. 1 with moving parts on the traveler removed to show various mountings.

FIGS. 12, 13 and 14 are fragmentary plan views of the thread hang-up mechanism in different positions.

FIG. 15 is a time chart.

FIG. 16 is a fragmentary perspective view of the leading end portion of the traveler frame, most of the moving parts of the improved pick-up mechanism being omitted.

While the invention may be used in the different types of multiple winders shown in the above mentioned patents and is adapted for use with bobbins in which the unwound thread lengths take different forms and occupy different positions relative to the bobbin core, it is shown in the drawings and will be described herein as applied to a Barber-Colman Type C spooler and bobbins of the construction shown in FIG. 2. It is to be understood however that I do not intend to limit the invention by such illustrative disclosure but aim to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

BARBER-COLMAN SPOOLER

In the Type C spooler, a multiplicity of winding units **10** are arranged side by side along one side of an elongated support or frame **11** upstanding from a supporting floor with an endless path **9** (FIG. 11) around which a second support or so-called traveler or tender **12** moves and operates successively on idle ones of the units to resume winding thereby. Each winding unit is mounted on an upstanding bracket **13** on the frame and includes an elongated arm **15** fulcrumed at **16** on the upper end of the bracket. A spindle **17** projects laterally from the opposite or free end of the arm and rotatably supports the core of a cheese or cone **21** onto which the thread **22** of a supply bobbin **23** is wound to form a package of the desired size. Such winding occurs while the supply thread remains unbroken as shown in FIG. 1 with the cheese resting on the top of a continuously rotating traversing drum **24** carried by a shaft **25** paralleling the traveler path. The drum is grooved to traverse the thread back and forth across the cheese. In the winding position, the arm **15** projects generally horizontally and rearwardly from the pivot **16** as shown in full in FIG. 1. While being drawn upwardly, the thread passes through a break detector (not shown) and a thread cleaner or so-called snick plate **26**.

The traveler is moved continuously around the endless path **9** and the frame **11** successively past the winding units **10**. Power is supplied by a motor **27** (FIG. 1) which through suitable gearing drives a pinion **28** meshing with the teeth on an overhead rack bar **29** fixed to arms **31** upstanding from the frame **11**.

The supply bobbins **23** for the winding units **10** are supported on skewers **32** (FIG. 1) upstanding from the bottoms of upwardly opening pockets **33** mounted on and uniformly spaced along the frame **11** below the winding drums **24** and also below the path traversed by the traveler

12. The front wall 34 of each pocket is inclined upwardly and outwardly and coacts with a downwardly sloping bottom wall 35 to support a reserve bobbin 36 with the upper end 58 of the core thereof disposed somewhat below the path of the traveler 12. Normally, when the running thread 22 breaks or becomes exhausted, the skewer 32 is retracted downwardly by a plow on the traveler to doff the bobbin, and then is swung through a slot 35a into alinement with the reserve bobbin 36, raised into the bore of the latter and finally swung reversely to place the bobbin in the winding position.

In service operation of spoolers of the above character, new reserve bobbins 36 are manually dropped endwise by the operator into the pockets 33 after they have become empty. The operator finds the thread end, pulls the same upwardly to unwind enough to reach and be laid into a gripper in the form of a mechanically operable clamp 37 of the associated winding unit. The reserve thread thus hung up in the clamp is positioned for engagement at the proper time with the tying unit 38 on the advancing traveler, this unit including a knotter indicated generally at 30 (FIG. 7) and, when adapted to tie a weaver's knot, includes a hook 39 and a suction tube 41.

The clamps 37 each comprise an outwardly facing jaw 42 paralleling the path 9 of the traveler and fixed to the upper end of bracket 43 rigid with the frame 11 and upstanding from the top of the pocket 33 between the active and reserve bobbins 23 and 36 and in the plane of rotation of the thread package 21 (see FIG. 11). Coacting with the fixed jaw is a movable jaw 44 on the side of a lever 45 fulcrumed at 46 on the bracket and projecting in a direction opposite to the traveler motion. A spring 47 urges the lever toward and against the fixed jaw 42. The free end portion 48 of the lever is inclined relative to the fixed jaw and cooperates therewith to provide a throat for receiving and guiding the unwound and upwardly extending length of the reserve thread into the clamp. As shown in FIG. 1, the reserve bobbins are disposed below the path traversed by the bottom of the traveler frame 49 and the thread clamp 37 of each unit is spaced inwardly toward the winding drum 24.

When the thread 22 being wound breaks or becomes exhausted, a pull wire (not shown) is actuated to swing the cheese arm 15 upwardly from the winding position and overcenter past a vertical position from which the arm gravitates to the idle position shown in phantom in FIG. 1, the arm then projecting forwardly and generally horizontally from its pivot. The cheese of the winding unit thus idled is positioned for operative association with the tying unit 38 carried by the traveler 12. This unit includes the knotter 30 including the hook 39 which is operated from an upright shaft 55 and an end finding roll 51 which is operated from a horizontal cam shaft 53 extending along the traveler path 9 with its leading end portion journaled in bearings 40a in plates 40 (FIGS. 6 and 16) which are part of a casting 50 secured to the forward end 49a of the horizontal bottom plate 49b of the traveler frame 49. This shaft is coupled through bevel gearing 54 (FIG. 1) with the upright shaft 55 carrying a pinion in mesh with the traveler drive gear 28 and the drive ratio is such that the shaft is turned in synchronism with the traveler motion and through precisely one revolution while the traveler moves a distance equal to the pitch spacing of the winding units 10.

In passing each idle winding unit, the tying unit 38 operates through means including the roll 51 and a suction device and downtake arm 41 whose end 41a picks up the end portion of the broken thread on the cheese, brings it adjacent a thread 56 (FIG. 14) hung up in the clamp 37, and ties the two threads together. The cheese arm 15 is then cammed upwardly by a plow 57 (FIG. 1) on the traveler and then lowered onto the driving drum 24 to resume the winding. The structure for performing these functions and its automatic operation is fully disclosed in Patent No. 1,267,977 to which reference may be had for further details.

THE INVENTION IN GENERAL

In accordance with the present invention, the relative approaching motion between the supports 11 and 12 for the winding and tying units 10 and 38 is utilized through appropriate mechanism including a mechanical or suction type pick-up device to grasp the free end portion of the threads of bobbins in the pockets 33, draw the same upwardly to the clamps 37, and operate the latter to receive and grip each thread before the knotter and its associated parts of the tying unit come into engagement with the hung-up thread 56. By such automatic action, greater uniformity in hanging up the successive threads is achieved with a corresponding increase in spooler efficiency and all that is required of the spooler operator is to drop new bobbins into the reserve positions in the pockets 33 as they become empty.

To be picked up and positioned automatically by the improved mechanism, the leading end portion 59 of thread (see FIG. 2) which is to be further unwound from the mass 61 on each bobbin in the pockets 33 must occupy the same definite position relative to the upper end 58 of the core 62 of the bobbin. In certain multiple winders, this thread to be hung up in the clamp 37 of a winding unit may be that remaining between the thread cleaner 26 (FIG. 1) and a bobbin 23 is the winding position after breaking of the running thread 22 by the cleaner. In the present instance, this thread is on each bobbin 36 in the reserve position and, as shown in FIG. 2, extends from the wound thread mass 61 upwardly to the core end 58 and then reversely into the hole of the core so that the free end portion 63 of this thread extends into the bobbin core a distance, usually several inches and sufficient to maintain its position during transporting of the bobbin to the reserve pocket.

Generally stated and in the illustrated embodiment, the mechanism for automatically picking up the threads 59 out of the reserve bobbins 36 of the successive winding units and hanging the same up in the corresponding clamps 37 is mounted on the traveler frame 49 ahead of the tying unit 38 and is operated by and in synchronism with the traveler motion and through a suction nozzle 64 first to pick up the unwound thread 59 as the nozzle passes across the end 58a of the bobbin core (see FIGS. 1, 7, 10, 12), then clamp the thread to the nozzle, move the nozzle upwardly to unwind more thread (FIGS. 3, 4, 14), position the upper end of the thread above the level of the clamp 37 (FIGS. 3, 4, 5, 7 and 14) for entry into the throat of the clamp, and maintain this position while the thread is carried with the traveler into the clamp after opening thereof and until reclosure of the clamp.

To control the movements of the nozzle 64 accurately and in precise synchronism with the traveler movement, it is fixed to the laterally projecting free end portion 65 of an elongated suction tube or arm 66 fulcrumed in a bearing 67 (FIGS. 9 and 16) to swing about an axis 68 back and forth transversely of the traveler movement and between the pick-up and hang-up positions shown in full and in phantom in FIG. 7. The timing is such as to dispose the nozzle in its lowermost position (FIGS. 1, 7 and 10) as it passes across the bobbin end 58 and is alined with the core. In its upper position (FIGS. 4 and 5), the nozzle is disposed above the level of the hang-up clamp 37 and adjacent, but in this instance somewhat ahead of the throat of the clamp. The nozzle in this position is also disposed above the inlet end 69 of a second suction tube 71 (see FIG. 4) by which the unwound thread 59, now vertically suspended from the nozzle, is transferred backwardly relative to the traveler motion and transversely to a position opposite the throat 72 of the clamp for subsequent entry into the latter.

THREAD PICK-UP MECHANISM

In the present instance, the nozzle comprises a short frusto-conical tube **73** composed of relatively firm but flexible material such as rubber of somewhat greater diameter at its larger end than the end **58** of the bobbin cores **62**. The opposite end is telescoped on a short tube **74** projecting from a hollow head **75** which is fixed to the end portion **65** of the suction tube **66** and establishes communication between the latter and the nozzle. A notch **76** at the free end of the nozzle extends longitudinally thereof and is disposed in the plane of swinging the nozzle and on the side to receive the picked-up thread **59** and locate the same both axially and laterally relative to the nozzle as shown in FIGS. 4, 5 and 14 when the nozzle is in the upper or hang-up position, the thread then being located at the inner end of the notch which is disposed on the under side of the nozzle tube **73**. Adjacent the open end, the notch is flared to facilitate entry of the picked-up thread as the tube and nozzle are swung upwardly.

Formed on the fulcrumed end of the suction arm **66** is a hollow hub **77** (FIGS. 4 and 9) fixed to one end of a sleeve **78** journaled at the opposite end and axially fixed in the bearing **67** which is formed in a block **79** fixed to the end of a bracket **81** on the traveler frame casting **50** (FIG. 16). The sleeve **78** is closed by end walls **84** and **85** and communicates with the tube **65** through a passage **65^a** and through a passage **86^a** with the end of a pipe **86** telescoped in the gearing support **79** and communicating with a suitable vacuum source which may be a suitable pump **87** (FIG. 13) utilized in the Type C spooler as the vacuum source for the end finding and tying unit **38** on the traveler. The nozzle is thus supported on the traveler to swing in a vertical plane **88** (FIGS. 6 and 13) extending transversely of the traveler path **9** and spaced far enough ahead of the tying unit **38** to permit the pick-up and hang-up of the thread of each successive reserve bobbin between the time that the tying unit operates on one hung-up thread and the time when it approaches the hung-up reserve thread of the next winding unit.

Swinging of the suction arm back and forth is effected herein by cams **91** (FIGS. 1 and 6) on the traveler shaft **53** acting through a segmental gear **92** meshing with a pinion **93** (FIGS. 6 and 9) on the end of the sleeve **78** opposite the hub **77** of the suction arm. The segment is on the free end of an arm **94** fixed to one end of a rockshaft **95** journaled in parts **96** on the traveler frame. The other end of this shaft is fixed to a bell-crank **97** having arms which carry rollers **98** that bear against a pair of conjugate surfaces on the cams **91**.

The cam surfaces are shaped to swing the thread pick-up arm **66** up and down in each traveler cycle or revolution of the shaft at the times indicated at *a* and *b* in FIG. 15. As the nozzle is approaching each reserve bobbin along the traveler path, it is also being lowered and approaching the level of the core end as shown at **64^a** and **64^b** in FIG. 10. In the continuance of these motions, the leading side of the nozzle reaches the plane of the end surface **58^a** on the end just as it passes the far side of this core end. The downward motion continues a short distance so that when the nozzle is alined axially with the bobbin core as shown in full in FIG. 10, the end of the nozzle is disposed slightly below the plane and the nozzle is telescoped over the core end **59** sufficiently to insure efficient application of the vacuum in sucking the portion **63** of the unwound thread out of the core and upwardly through the nozzle and into the tube **66**. The surfaces of the cams **91** are shaped to dwell the nozzle momentarily in its lowermost position as indicated at *c* (FIG. 15). Raising of the nozzle starts immediately beyond this alined position so that the trailing side of the nozzle end is at or slightly above the end surface of the bobbin core by the time that it comes opposite the corresponding side of the

core end. As the nozzle passes the bobbin, it passes through the positions indicated at **64^c**, **64^d** (FIG. 9).

POSITIVE UNWINDING OF THREAD

Since the nozzle **64** in its upper or hang-up position is disposed above the reserve bobbin **36** a distance substantially greater than the length of the bobbin and of the thread **50** that may be tucked into the core thereof, it is necessary to unwind an additional length of thread off from the bobbin during the upward swinging of the pick-up arm. To accomplish this positively and without fail, provision is made for gripping the thread mechanically after the suction pick-up and for clamping the same to the arm and within the latter until the arm reaches its uppermost position, additional thread thus being pulled endwise and unwound from the bobbin as the arm is swung upwardly after the original unwound length has become taut. For this purpose, a clamp **101** (see FIGS. 3 to 6) is disposed within the end portion **75** of the suction tube and arranged to be opened and closed at proper times by a cam **100** on the shaft **53**. When the thread is sucked through the nozzle and into the tube **66** it passes between the jaws of the clamp which is then closed at *f* (FIG. 15) to grip and secure the thread to the tube as the latter is swung upwardly. As soon as the nozzle reaches the upper position, the clamp is opened as indicated at *g* thus releasing the thread unwound from the bobbin.

The clamp shown herein comprises a jaw **102** (FIG. 5) extending across the inner face of one side wall of the suction tube head **75** near the nozzle end, the coacting jaw being the end **103** of a bar **105** which projects through and is guided in a slot **106** in the opposite wall into and out of the groove to grip and release a thread sucked in through the nozzle. A hole **107** in the inner end of the bar establishes continuous communication between the tube and the nozzle.

The elongated outer end of the bar lies against the outer side of the tube **66** and is slidable endwise in spaced guides **108** thereon. It is urged inwardly or in the direction to close the clamp **101** by the force of a compression spring **109** acting between abutments **111** and **112** on the bar and tube. Retraction of the bar to open the clamp is produced by the cam **100** (FIG. 3) whose follower **113** is one arm of a bell-crank lever **114** journaled on a rockshaft **115** on the traveler frame. A depending arm **116** is joined by a link **117** to an arm **118** on the upper end of a rockshaft **119** journaled in bearings **121** (FIG. 16) on the traveler frame **50**. An arm **122** fast on the lower end of this shaft bears at its free end against the end of a rod **123** guided in the end walls **84**, **85** axially of the sleeve **78** (see FIG. 9). At the opposite ends, the rod bears against one end of a lever **124** fulcrumed at **125** on the tube and bearing at its other end against an abutment **126** on the clamp bar **105**. With the rod **123** extending along the axis of the arm **66** and having bearing engagement with the arm **124** on this axis, the motion of the cam **100** is transmitted to the clamp bar **105** in all positions of the pick-up arm.

THREAD GUIDING DURING UNWINDING

After picking up and clamping the tucked in thread end, the arm **55** is swung relative to the traveler frame first upwardly and then laterally along the arc **127** (FIG. 7) to the upright position shown in phantom in which the nozzle cup faces outwardly and the clamped thread hangs downwardly from the end of the notch **76** as shown in FIG. 5. In the initial part of the upward movement of the nozzle along the arc **127**, the thread is pulled upwardly substantially along the axis of the bobbin. But above the horizontal position of the arm, the nozzle moves laterally and away from the bobbin axis.

To maintain the unwinding pull along the bobbin axis during this final part of the nozzle movement, the invention provides a movable guide **128** which engages the thread between the bobbin and the partially raised nozzle

to hold a nearly axial line of unwinding during the final upward movement of the nozzle. Herein, the guide **128** is an elongated finger which projects transversely of the traveler path as shown in FIG. 12 at the start of unwinding and is on the free end of an arm **129** fixed to the lower end of an upright rockshaft **130** journaled in a tube **131** on the traveler frame and carrying at its upper end a crank **132** (FIGS. 7 and 8) a pin and slot coupled to the free end of an arm **133** on a rockshaft **134** carrying a follower arm **135** which, by a torsion spring **136** (FIG. 7) on the rockshaft **130**, is held against the periphery of a cam **137** on the shaft **53**.

The guide finger is normally disposed in the inactive position shown in FIG. 12 and in phantom in FIG. 8. It is swung into active position (FIGS. 8 and 13) as indicated at *d* (FIG. 15) after the nozzle has been raised to about a horizontal position so as to become effective in guiding the thread being pulled off from the bobbin and holding the portion adjacent the bobbin along an axial line as illustrated in phantom at **138** (FIG. 7). As the upward movement of the nozzle is continued, the thread is drawn around the guide and lies along a line **139** as the nozzle approaches the uppermost position. The guide is returned to inactive position as indicated at *e* (FIG. 15) before the nozzle reaches its uppermost position (FIG. 14).

TRANSFER OF PICKED-UP THREAD

By the time that the nozzle **64** reaches its uppermost position (FIG. 4), it will have advanced with the traveler to the position shown in FIG. 14 substantially ahead of the clamp **37** in which the thread **59** is to be hung up, the nozzle also being spaced transversely of the traveler path from the traveler side of the clamp. It is necessary, therefore, in the use of the automatic thread hang-up in the Type C spooler, to move the picked-up end of the thread backwardly along the traveler path and transversely and inwardly in order to bring the thread opposite the throat **72** of the clamp for entry therein when the clamp is subsequently opened.

Such transfer of the thread and positioning for hang-up in the associated clamp is achieved in the present instance by the coaction of the second suction tube **71** above referred to, a slot **140** along the bottom thereof and a shear **141** disposed between the end **69** of the tube and the nozzle **64** in the upper position of the latter. Beyond the closed end **142** of the slot, the tube is secured by a clamp **144** (FIGS. 1 and 7) to the under side of the traveler frame **50** and communicates through a pipe **145** (FIG. 13) with the vacuum source **87**. The tube is disposed substantially horizontally and bent at the inlet end **69** to face notches **146, 147** in this end outwardly and transversely of the traveler path in the plane **88**. Adjacent the closed end of the slot **140**, the tube is bent substantially into the plane of the clamps **37**, the end **142** terminating in this plane as shown in FIGS. 12 to 14. The length of the tube and therefore the backward transfer of the thread is such that the thread, which moves instantly to the end **142** upon operation of the shear, will be disposed opposite the throat **72** of the clamp **37** into which the thread is to be carried by the traveler and hung up.

The notches **146, 147** are alined vertically and are V-shaped so as to facilitate entry of the thread suspended from the nozzle **64** as the latter approaches its upper position following retraction of the guide finger **128** at *e* (FIG. 15) and opening of the clamp **101** at *g*. The thread thus freed is held taut by the suction applied through the nozzle.

The lower notch **146** communicates with the outer end of the slot **140**. In the upper position of the nozzle, the closed end of the notch **147** is vertically alined with the closed end of the notch **76** in the nozzle. The thread thus suspended from the nozzle extends across the tube so that, as soon as it is severed between the tube and the nozzle by closing of the shear, the thread will be drawn into the tube and then along the bottom slot **140** to the definite position determined by the slot end **142**. As a result of such transfer, the thread is held in upright position in the plane of and opposite the throat **72** of the clamp **37** of the winding unit associated with the thread and its bobbin.

The shear **141** comprises a stationary horizontal blade **149** fixed as through a depending pin **151** (FIGS. 4, 12 and 16) to the under side of the traveler frame casting **50** and coacting with a movable blade **152** formed by one arm of an L-shaped bell-crank lever **153** fulcrumed on the pin **151**. In the open condition of the shear (FIGS. 3 and 4), the cutting edges of the blades define between them a V-shaped notch vertically alined with the tube notches **146, 147** so as to receive the thread moved into these notches in the final upward movement of the pick-up nozzle.

The other arm of the lever **152** is pivotally connected through a link **154** with the free end of an arm **155** (FIG. 7) loose on the rockshaft **115** which is journaled on the traveler frame **50** and carries an arm **157** whose free end constitutes the follower of a cam **158** fast on the shaft **53**. A spring **159** urges the follower roller against the periphery of the cam which is shaped to close and and open the shear at the times indicated at *h* and *k* in FIG. 15. Closure of the shear with the thread positioned as shown in FIG. 4 severs the thread above the second tube **71** thus allowing the free end portion, then disposed in the notches **146** and **147**, to be drawn quickly into the tube along the bottom slot **140** to the closed end **142** and then along the tube beyond this end. Since as indicated at *g* (FIG. 15) the clamp **101** in the nozzle **64** is opened just before the shear is closed, any slack in the unwound length of the thread will be taken up and the thread will be held in upright position below the slot end.

At the time the shear is closer (see FIG. 14) to sever the thread, the nozzle **64** has already passed the clamp **37** in which the thread is to be hung. But owing to the inclination of the tube **71** and its slot **140**, the free length of the thread is carried backwardly relative to the traveler motion past this clamp and also laterally into the plane and opposite the throat **72** thereof. The thread is thus suspended in upright position in the slot end **142** and above the level of the clamp **37** and is located for entry into the throat of the clamp in the continued advance of the thread with the traveler.

As the suspended thread approaches the throat **72**, the clamp is opened to receive the thread as it advances with the traveler. Such opening is effected by a cam in the form of a plow **161** (FIGS. 12, 13, 14 and 16) on the end of a projection **162** rigid with the traveler frame **49**. The inclined leading face **163** of this plow is disposed just below the clamp and at the level of a lug **164** depending from the free end of the movable jaw of the clamp and engages the inclined inner side of this lug to cam the jaw outwardly and open the clamp as shown at the left in FIG. 12 and indicated at *m* in FIG. 15. At the time when the plow passes out of engagement with the lug, the thread will be disposed between the clamp and the jaw **44** will be swung by spring **47** against the fixed jaw **42**. The thread is thus gripped and held so that the trailing end will be drawn out of the tube **71** as the latter passes over the clamp in continued advance of the traveler. The thread is thus hung up in the clamp and separated from the pick-up mechanism and thus readied for operation of the tying unit **38** thereon.

The movements of the various parts of the pick-up and hang-up mechanism in synchronism with the movement of the traveler **12** as the tying unit **38** thereof approaches each successive winding unit **10** is illustrated in FIGS. 12 to 14 and the time charts, FIG. 15. Each pick-up and hang-up cycle for the reserve thread of each winding unit occurs in one complete revolution of the traveler

camshaft **53** while the tying unit **38** is servicing the previous winding unit **10** to tie the hung-up thread onto the package **21** and resume the winding by such unit.

Let it be assumed that the cycle starts as shown in FIGS. 12 and 15 with the nozzle **64** in its lowermost or pick-up position (FIGS. 1 and 10 and *c* in FIG. 15). The unwound length of the reserve thread **59** is sucked out of the bobbin core and into the tube and secured in the latter by closure of the clamp **101** at *f* as the arm **66** starts to swing upwardly to start the unwinding of additional thread from the reserve bobbin. After nearly an eighth of a revolution of the camshaft **53**, the finger **128** is swung in behind the thread at *d* thus holding the thread adjacent the bobbin in line with the bobbin axis through the first quarter revolution when the parts will be positioned as shown in FIG. 13, the nozzle **64** having moved somewhat past the clamp **37** in which the thread is to be hung up.

At *e*, the guide finger is retracted just before the arm reaches its uppermost position at *o* just after the clamp **101** is opened to release the thread from the arm. The released thread, then disposed in the notches **146**, **147** at the open end of the transfer tube and between the blades of the shear **141**, is severed by actuation of the shear at *h*, the parts then being positioned as shown in FIG. 14 after a half revolution of the camshaft **53**. The thread thus released is transferred instantaneously along the slot **140** of the tube **71** reversely of the traveler motion and thus brought into line with and opposite the throat **72** of the clamp **37** in which the thread is to be hung. In the final half revolution of the camshaft **53**, the nozzle **64** is swung downwardly toward the bobbin of the next adjacent winding unit **10** as the thread held in upright position by the suction tube **71** is advanced into the throat **72** of the clamp.

At three quarters of a revolution, the reserve thread clamp **37** is opened at *m* and then closed on the thread at *n*, the trailing end of the thread being drawn backwardly out of the tube **71**. The thread thus hung up in its clamp **37** is positioned accurately for association with the on-coming tying unit **38** the same as in the standard Barber-Colman spoolers.

The pick-up cycle thus described is repeated in successive revolutions of the camshaft **53**, thus automatically picking up and hanging in the proper clamps the threads of the reserve bobbins in the pockets of the successive winding units.

I claim as my invention:

1. In a thread winding machine, the combination of, a first support having thereon a plurality of upwardly opening bobbin pockets equidistantly spaced laterally along the support and each adapted to hold a bobbin with a short unwound length of the thread thereof exposed for ready pick-up, thread grippers on said first support spaced above the respective ones of said pockets for receiving and holding an unwound length of the thread of the bobbin therein, a second support carrying a tying unit including a knotter for engaging and operating automatically on the held-up lengths of said bobbin threads, means mounting said supports for relative movement along a predetermined path to associate said tying unit with said held-up threads one by one, means for relatively moving said supports along said path, and mechanism on said second support spaced along said path in advance of said knotter and operable automatically prior to association of the knotter with each successive bobbin pocket to engage and pick up the unwound length of thread of the bobbin in the pocket, draw the thread upwardly off from the bobbin to dispose the end portion of the thread in a predetermined position above the associated thread gripper for entry therein, each of said grippers being adapted to receive the corresponding thread raised to said position, said mechanism including means operated in timed relation to the relative movement of said supports to render said grippers active and inactive successively to receive and hold each thread in said predetermined position before such thread becomes associated with said knotter.

2. A thread winder as defined in claim **1** in which said knotter is brought into association with the successive hung-up threads in a continuous movement of said second support past the successive bobbin pockets, and said grippers each comprise coacting jaws which open in a direction reverse to such motion.

3. A thread winder as defined in claim **2** including means biasing each of said thread clamps to closed position and means on said second support operable in passing the successive clamps to open the same during entry of the positioned thread and then allow the clamp to close on and grip such thread.

4. In a thread winding machine, the combination of, a first support having an upwardly opening pocket thereon adapted to hold a bobbin with an unwound length of the thread thereof exposed at the upper end of the bobbin core, a second support carrying a knotter for operating on said unwound length of the thread of said bobbin, means mounting said supports for relative movement along a predetermined path and moving the same to bring said knotter and thread into operative association, a thread clamp on said first support spaced above said bobbin and having a throat facing along said path, an arm spaced along the path ahead of the knotter and fulcrumed on said second support to swing between a lower pick-up position below said clamp and an upper position above said clamp, means for swinging said arm to dispose the free end of said arm in said pick-up position wherein said free end is adjacent said bobbin in said pocket and in said upper position wherein said free end is spaced along said path from said clamp throat, a device on the free end of said arm operable while the arm is in said lower position to pick up and hold said unwound thread length whereby to draw the thread upwardly and unwind an additional length thereof as the arm is swung to said upper position, and mechanism operated in the subsequent relative movement of said supports to present the suspended thread to said clamp throat and open and close the clamp to allow the thread to enter and then grip the thread in the clamp before the latter becomes associated with said knotter.

5. A thread winder as defined in claim **4** including a cutter engageable with the picked-up thread when the latter is suspended from said device in the uppermost position thereof and operable when activated to sever the thread at a point spaced above the level of said clamp, and means engageable with the cut-off end of said thread and operable to guide the same into the associated clamp while the latter is open.

6. A thread winder as defined in claim **5** in which the suspended thread when cut off is spaced laterally from the throat of the associated clamp and said guide means operates to transfer the cut-off thread backward relative to said path and laterally thereof to a position opposite the throat of such clamp by the time the thread is presented to such throat in the relative movement of said supports.

7. A thread winder as defined in claim **5** in which said guide means includes a suction tube engageable at its end with the suspended thread and operating after cut-off thereof to draw the thread into the tube.

8. A thread winder as defined in claim **7** in which the end of said tube is formed with a notch to receive and position the thread when said device reaches said predetermined position, said tube having a bottom slot open at the tube end and guiding the thread along the tube after cutting of the thread.

9. A thread winder as defined in claim **8** in which the end of said tube slot extends backwardly from the throat of the associated clamp and terminates in a position to

present the thread to such throat in the continued relative movement between said supports.

10. A thread winder as defined in claim 4 in which said clamps are spaced along a line offset laterally from said path and the throats of the clamps open along the path toward said second support, said pick-up device, when in said upper predetermined position, being disposed above said clamp line and suspending the picked up thread in a position spaced from such line, said winder also including a suction device for gripping the suspended thread above the level of said clamps, means engageable with the suspended thread between said pick-up and suction devices and operable when activated to sever the thread, and means operable as an incident to such cutting of the thread to shift the upper end portion thereof backwardly along said path and laterally to a position opposite the associated clamp throat for entry therein.

11. A thread winder as defined in claim 4 in which said device, in swinging upwardly from said pick-up position, first moves away from the end of the bobbin core generally along the axis thereof and then laterally of such axis including a guide in the form of an arm disposed between the upper and lower positions of said pick-up device and swingable into and out of an active position disposed adjacent the axis of said bobbin core.

12. A thread winder as defined in claim 11 in which said guide arm is moved into and out of active engagement with each bobbin thread by the relative movement between said supports.

13. A thread winder as defined in claim 4 including means defining a suction passage on said arm terminating at an outwardly opening nozzle which, in each pick-up position of said arm, is exposed to the unwound length of thread on a bobbin so as to draw such thread into said passage.

14. A thread winder as defined in claim 4 in which said pick-up device includes a clamp opened and closed automatically in timed relation to the swinging of said arm and positively gripping and holding the thread during the upward swinging of the arm whereby to unwind an additional length of thread from said bobbin.

15. A thread winder as defined in claim 13 including a clamp device movably mounted on said arm and operable automatically during movement of the arm out of said pick-up position to grip the thread sucked into said nozzle and hold the thread positively during the further upward movement of the arm.

16. A thread winder as defined in claim 13 in which said clamp device includes fixed and movable jaws disposed within said passage and adapted when separated to receive the sucked in thread between them, and means operable during the upward movement of said arm from said pick-up position to actuate said movable jaw and grip the thread against said fixed jaw.

17. A thread winder as defined in claim 16 in which said movable jaw is connected to a member disposed externally of said arm and mounted to slide longitudinally of the latter.

18. A thread winder as defined in claim 16 in which said movable jaw is actuated through a member slidable axially along the axis of said arm.

19. A thread winder as defined in claim 16 in which said movable jaw is actuated through a member slidable axially along the axis of said arm and including means for utilizing the relative movements of said tying unit and bobbin pocket supports to actuate said movable jaw in timed relation to the movement of said arm.

20. A thread winder as defined in claim 13 including means carried by said nozzle and operating automatically in the upward movement to the nozzle to receive and position the picked-up thread accurately and laterally relative to the plane of swinging of the nozzle.

21. A thread winder as defined in claim 20 in which said nozzle is an outwardly opening cup and the thread positioning means is an outwardly opening notch disposed in the lower side of the cup in the upper position of the latter.

22. For use with bobbins in which the unwound lengths of the threads thereof are bent reversely and tucked into the upper end of the core of the bobbins as deposited in said pockets, a thread winder as defined in claim 13 in which said nozzle is an outwardly opening cup which is movably transaxially of the upper ends of the bobbin in the successive pockets and in each of said pick-up positions is alined axially and disposed close to the end of a bobbin cone so as to suck the tucked-in end of thread of the core through said nozzle and into said passage.

23. A thread winder as defined in claim 22 in which the open end of said nozzle is larger in diameter than the upper end of said bobbin cores and, in said pick-up position, is disposed slightly below the plane of the bobbin end and telescoped closely around such end.

24. A thread winder as defined in claim 22 in which the open end portion of said nozzle is composed of flexible material.

25. A thread winder as defined in claim 22 in which said nozzle cup is formed with a peripheral notch adapted to receive and locate the picked-up thread during upward swinging of said arm.

26. A spooler having, in combination, a row of winding units arranged side by side and each having a pocket for receiving a bobbin with a loose thread end and a clamp for suspending said thread above the pocket, a traveler including a tying unit movable along said row of winding units and operable in passing each idle winding unit to pick up the thread suspended from the clamp thereof, tie it onto the thread of the package being wound, and restart the winding operation, means carried by and movable with the traveler and operably automatically to open the successive clamps momentarily and close each clamp before the tying unit comes into operative association with the clamp, and mechanism carried by and movable with said traveler and operating automatically as the latter reaches each winding unit to find the thread of the bobbin in said pocket of such winding unit, draw the same upwardly and lay the thread into the clamp of such winding unit while the clamp is being held open by said last mentioned means.

27. A spooler as defined in claim 26 including a cutter carried by said traveler and operable in passing each of said winding units to cut off the suspended thread at a point adjacent and above the level of the clamp.

28. A spooler as defined in claim 26 in which the bobbins are disposed upright in the pockets of the respective winding units and the movement of the traveler past said winding units is continuous, said mechanism including a pick-up device disposed in a lower position and adapted to find and grasp the loose end of the thread of each of said bobbins as it passes such bobbin, and means on the traveler supporting said pick-up device and moving the same to an upper position in which the thread is positioned for transfer into the associated clamp in the traveler motion while such clamp is open.

29. A spooler as defined in claim 28 in which said pick-up device is on the free end of an arm mounted on the traveler to swing about an axis paralleling the motion of the traveler.

30. A spooler as defined in claim 28 in which the loose end of the thread on each reserve bobbin is tucked into the bore in the upper end of the bobbin core and said pick-up device includes a suction nozzle which, in said lower position passes across said upper core end through a position close to and in axial alinement with said bore.

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