July 22, 1958 A. J. COBERT 2,844,016

THREAD PULLER, HOLDER AND CUTTER

Filed June 23, 1953 4 Sheets-Sheet 1

Fig. 1.

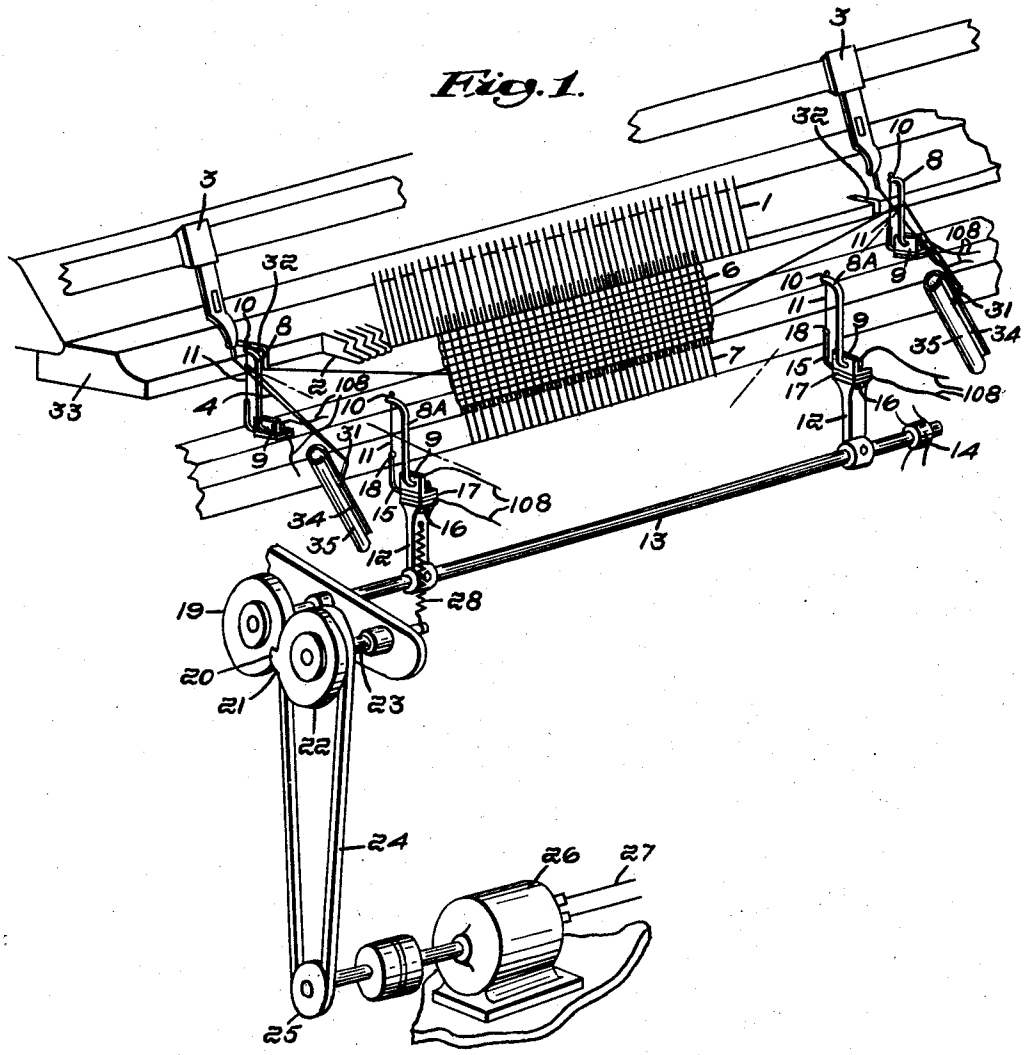


Fig. 2.

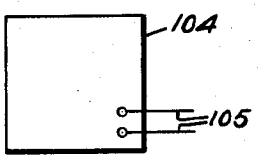
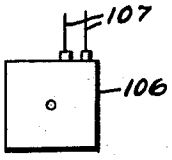


Fig. 3.



Inventor:
Arthur J. Cobert,
By Maxwell Fish
Attorney

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THREAD PULLER, HOLDER AND CUTTER

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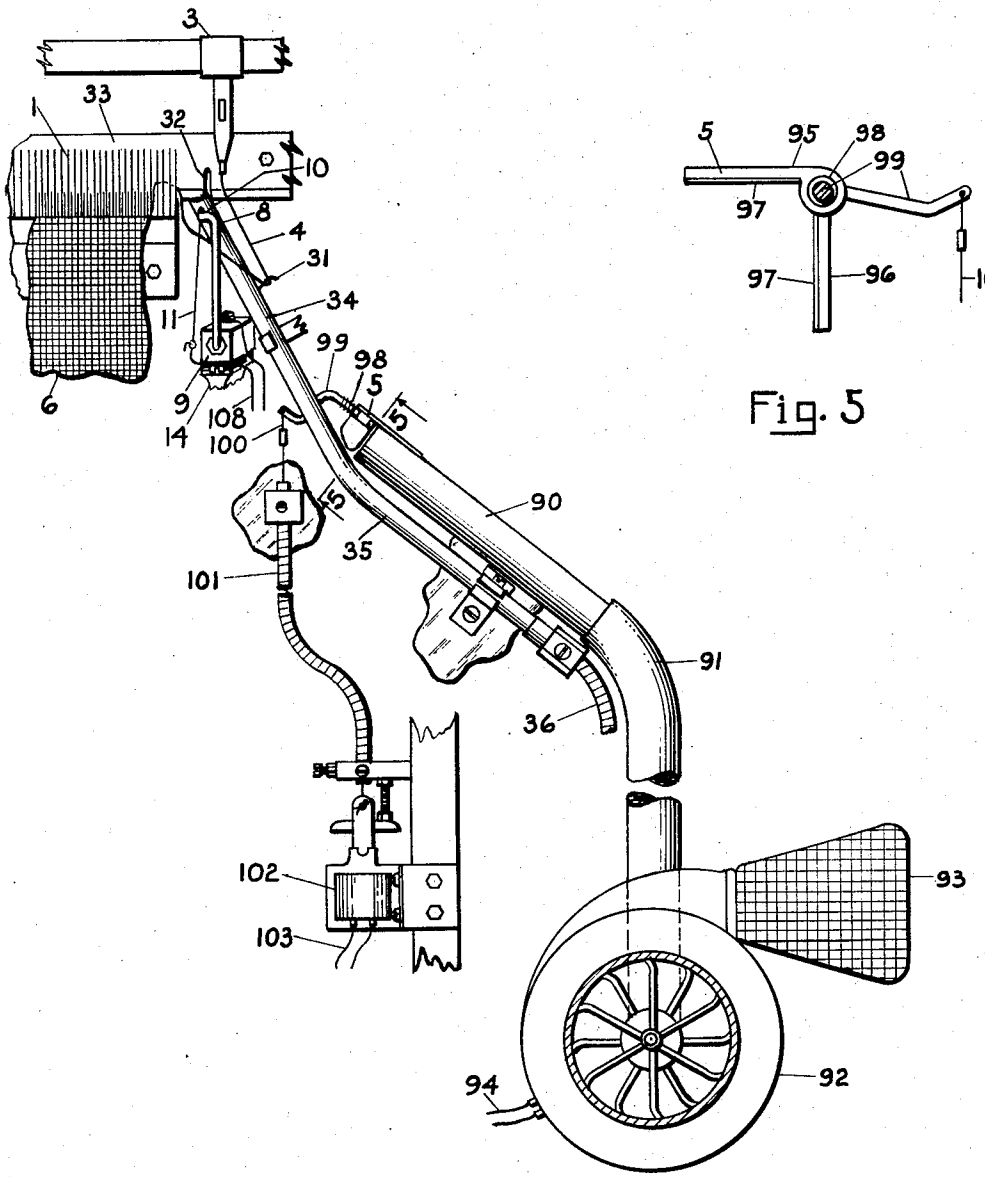


Fig. 4

Fig. 5

Arthur J. Cobert.
INVENTOR.
BY Lamont Johnston
ATTORNEY

July 22, 1958 A. J. COBERT 2,844,016

THREAD PULLER, HOLDER AND CUTTER

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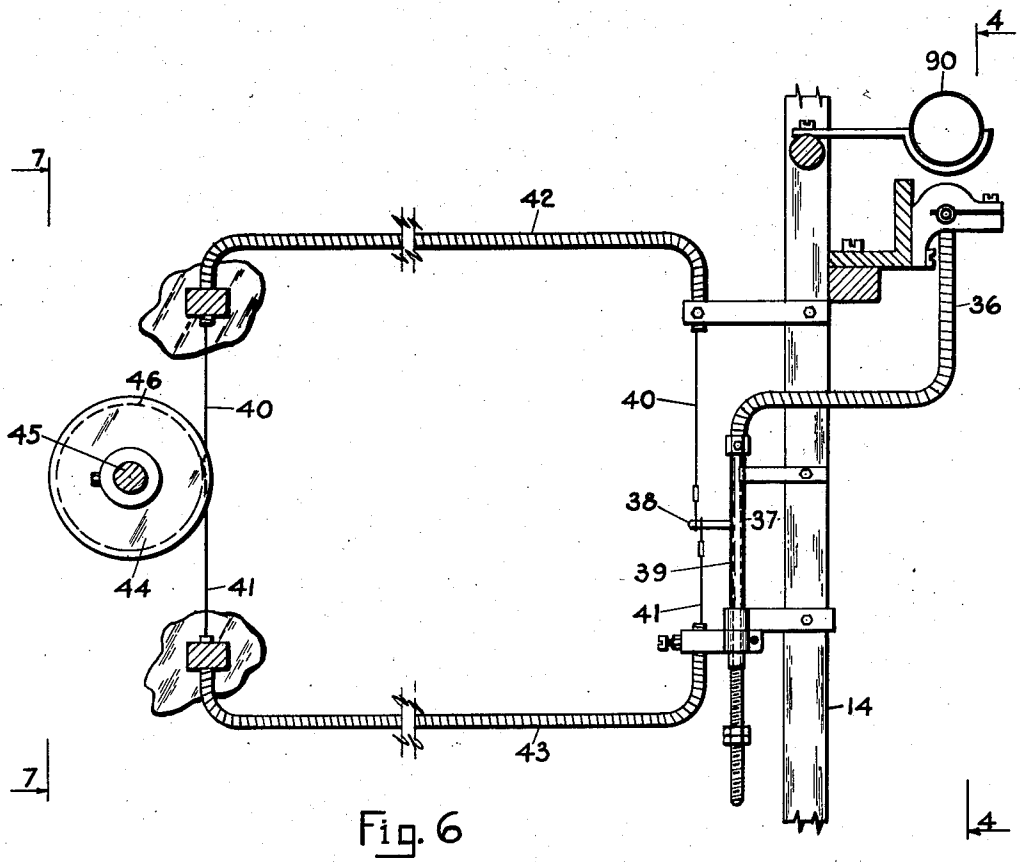


Fig. 6

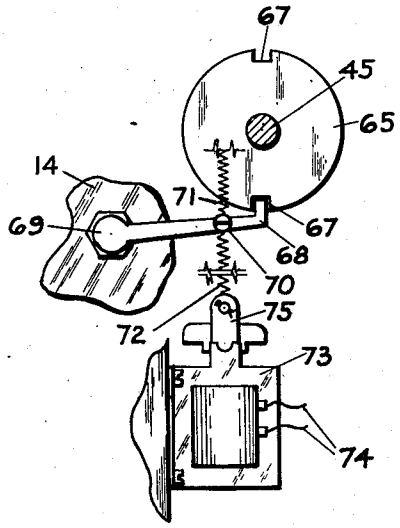


Fig. 8

Arthur J. Cobert
INVENTOR.

BY Lamont Johnston
ATTORNEY

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THREAD PULLER, HOLDER AND CUTTER

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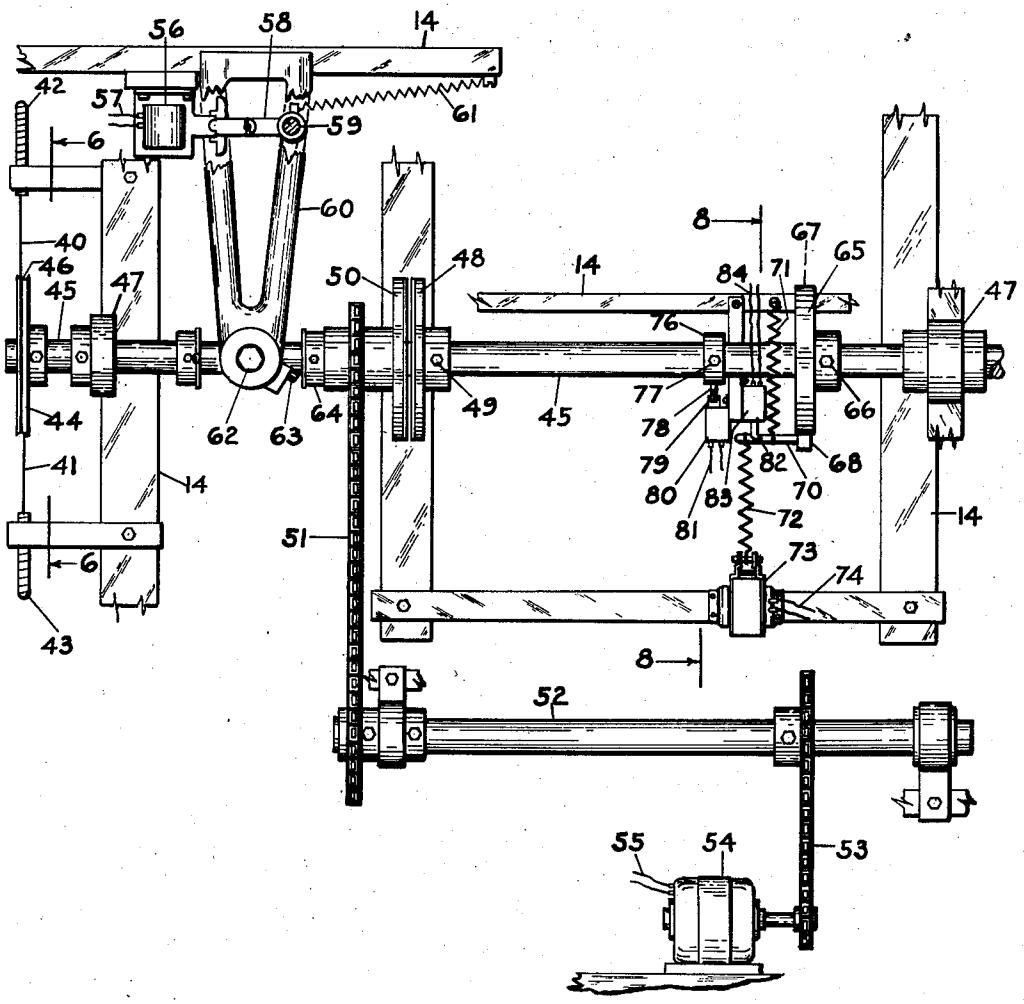


Fig. 7

Arthur J. Cobert
INVENTOR.

BY Lamont Johnston
ATTORNEY

United States Patent Office 2,844,016 Patented July 22, 1958

2,844,016

THREAD PULLER, HOLDER AND CUTTER

Arthur J. Cobert, Cleveland, Ohio, assignor of fifty per-cent to Beautiful Bryans, Incorporated, Chattanooga, Tenn., a corporation of Tennessee

Application June 23, 1953, Serial No. 363,591

46 Claims. (Cl. 66—82)

This invention relates to straight-bar or full-fashioned knitting machines, and more particularly to a method and means for pulling thread extending between the fabric and the thread laying means to a point offset from the needle row, holding the thread at that point and severing the thread while it is being held.

This application is a continuation in part of my U. S. Patent No. 2,746,275 dated May 22, 1956, for Yarn Severing Device for Straight-Bar Knitting Machines.

As set forth in the above mentioned application, in starting the operation of a knitting machine, the end of the thread or yarn protruding from the thread carrier tube must be held in some manner while the thread carrier traverses across the needles. Heretofore, it has been the practice to hold the thread by wrapping its end around a cleat or a clip manually. Thus, the thread is fed from the carrier into the needles and the operation of knitting is commenced. As the fabric is formed in the knitting operation, it is gradually drawn away from the needles by a suitable fabric draw off mechanism as successive courses of the fabric are being knitted. As the fabric is drawn away, it is necessary to sever the thread between the point at which its end is held and the first course of the fabric. Heretofore, the operation of severing the thread from its point of initial attachment has been done manually by the operator of the machine.

At the end of the operation of knitting each part of a fabric blank, it has heretofore been necessary for the operator to sever manually the thread extending from the carrier tube to the fabric near the edge of the fabric, to pull the thread out of the thread carrier tube a sufficient distance and then to wrap it around a clip. This procedure of securing the end of the thread is essential because, otherwise, during the operation of other thread carriers or of the other parts of the machine, the vibration imparted to the idle thread carrier would cause the thread to be retracted through the carrier tube and it would be necessary to pass the thread again through the carrier tube, which would mean wasted time on the part of the operator.

While such manual operations may be practical on small machines having only one or a very few knitting sections, they are not practical with machines now used in knitting mills having a large number of sections operating simultaneously under the control of one operator. It is readily apparent that the manual operations of severing the thread between its point of initial attachment and the fabric at the commencement of knitting with thread from any carrier, severing the thread from the fabric at the end of knitting with thread from that carrier, and attaching the end of the thread to a clip require a considerable amount of time on the part of the operator. This is especially so because the operator must tend a number of knitting sections and, where all of these manual operations are required for each section, a large amount of the operator's time will be required. In so far as such operations can be carried out automatically, the time of the operator is conserved and he is thereby enabled to operate a larger number of knitting sections. Since the cost of labor is a large part of the cost of operating a textile mill, it will be readily apparent that automatic devices which reduce labor costs are highly desirable. Automatic devices for severing the thread which have heretofore been proposed have not been practical and devices for holding the thread or yarn which have been devised previously have not been automatic.

One object of my invention is to provide a device for automatically pulling to a point offset from the needle row the portion of thread extending between the thread carrier and the fabric being knitted on a straight-bar knitting machine at the end of the operation of knitting with thread from that carrier.

Another object is to provide in a full-fashioned knitting machine a device for automatically holding at a point offset from the needle row an end of the thread which extends from the fabric.

A further object of my invention is to provide an automatic device for pulling the thread out of the thread carrier tube to a point offset from the needles on the completion of knitting with thread from one carrier a part of a fabric blank, holding the thread at that offset point and severing the thread from the fabric while it is being held.

Still another object is to provide an automatic device for pulling the thread out of the thread carrier tube to a point offset from the needle row on the completion of knitting with thread from one carrier a part of a fabric blank, holding the thread at that offset point, severing the thread from the fabric and then clamping the thread at that offset point during successive operations of the knitting machine.

A still further object of this invention is to provide an automatic device for disposing of waste pieces of thread which are produced as a result of severing the thread between the point of initial attachment or clamping and the first course of the fabric made with that thread.

The foregoing and other objects, features and advantages of this invention will be apparent from the following description and from the accompanying drawings of a preferred embodiment, it being understood that the detailed description and drawings are merely illustrative of the invention, which is defined in the claims.

In the drawings,

Figure 1 is a partial perspective view, partly diagrammatic and partly broken away, of one section of a straight-bar knitting machine, showing only those parts of the machine which are essential to a proper understanding of this invention.

Figure 2 is a symbolic representation of an electrical control panel used to control the operation of my machine.

Figure 3 is a symbolic representation of a variable resistor used in controlling the operation of my machine.

Figure 4 is a fragmentary elevational view, taken on the line 4—4 of Figure 6, showing the thread puller, the thread holder, and one of the thread cutters as they are assembled in relation to each other and in relation to the knitting elements.

Figure 5 is a partial sectional view of the clamp, taken on the line 5—5 of Figure 4.

Figure 6 is a fragmentary side view of the cable mechanism used in connection with the thread puller, taken on the line 6—6 of Figure 7.

Figure 7 is a rear elevation, partly broken away, showing only the driving connections for the thread puller, taken on the line 7—7 of Figure 6.

Figure 8 is a detailed sectional view, on the line 8—8 of Figure 7, of a pawl and ratchet wheel stop mechanism

for automatically stopping the thread pulling mechanism at the end of travel of the thread puller.

Like reference numerals refer to like parts throughout the several figures of the drawings.

According to my invention, one section of a straight-bar knitting machine is illustrated. This section has a plurality of knitting needles 1, a plurality of sinkers and dividers 2, and a plurality of thread carriers 3. A suitable thread 4 extends from the thread carriers 3 and is drawn from one or more of these carriers during the operation of knitting. The thread is supplied to the thread carriers from thread cones, not shown.

The thread 4 is initially drawn by hand from the thread carriers 3 and its end is fastened between the jaws of a clamp member 5, to be described in detail hereinafter. The clamp 5 holds the end of the thread firmly as the thread carrier 3 commences its traverse across the needles 1 in the operation of knitting. As the fabric 6 is formed by the knitting action of the needles 1 and of the sinkers and dividers 2, the fabric is drawn away from the knitting elements by a draw off mechanism, such as a series of welt hooks 7. Such a draw off mechanism is fully described in my application, Serial No. 294,804, filed June 21, 1952, and entitled "Welt Turner."

As the welt hooks 7 draw the fabric 6 away from the knitting elements, the beginning end of the thread extending between the clamp 5 and the first course of the fabric is drawn into contact with a fixed thread severing device or cutter 8. This thread cutter is located on the right side of the machine, directly below the sinker head. The thread severing device, when the fabric has been knitted sufficiently that its end will not tend to unravel, severs the end of the thread near the edge of the fabric between the fabric and the point of attachment of the thread in the clamp 5. The thread severing device is fully described in my patent referred to heretofore, No. 2,746,275. It comprises a support arm or bracket 8, secured in an upright position in a clamping member 9. The upper end of the support arm 8 is bent at a right angle and is slotted at 10 to receive a heating element 11. The clamping member 9 is fixed to the frame 14 of the knitting machine.

In addition to the fixed or stationary cutter 8, there are two retractible cutters 8A, one located on each side of the knitting section. These retractible cutters are ordinarily used in connection with the knitting of the heel and toe of the fabric blank and hence they are customarily spaced about ½" to ¾" outside of the width of the heel fabric, which is approximately 8". The distance apart at which these cutters are set is adjustable, depending upon the requirements for a given style of the hosiery mill in which the machine is located.

Each retractible cutter 8A is secured upright in a clamping member 9 and is slotted at its upper end 10 to receive a heating element 11. The clamping member 9 is fixed to a bracket 12, which, in turn, is fixed on a support rod 13 extending transversely across the knitting section and supported in suitable bearings in the frame 14 of the machine.

A hook-shaped spring wire 15 is secured in a suitable manner to the clamp 9, as by means of a bolt 16, suitable insulation 17 being provided to insulate the spring wire 15 from the clamp member 9, and also from the bolt 16 and the bracket 12. The electrical resistance element 11 has a knot in one end and the element is passed into the slot 10 in the upper end of the support arm or bracket 8A, the knot in the end of the element preventing its end from being drawn through the slot. The lower end of the electrical resistance element 11 is formed in the shape of a loop 18 adapted to be hooked over the end of the hook-shaped spring wire 15. Thus, the spring wire holds the electrical resistance element taut and also provides an electrical conduit for the heating current.

Fixed to one outer end of the transverse rod 13 is a cam wheel 19. This cam wheel has a notch 20 cut in its periphery for coaction with a lug 21 on a wheel 22 supported on a spindle 23 from the frame 14 of the machine. The wheel 22 is adapted to be rotated, at a suitable time, as by means of a belt 24 running around a pulley 25 at its other end. The pulley 25 is mounted on the axle of a suitable electric motor 26, energized from a suitable source of power, not shown, through lead-in wires 27, the connections of which are to be described more fully hereinafter. A tension spring 28 is connected between the support bracket 12 and the spindle 23 to draw the support bracket 12, the transverse rod 13, clamping member 9, bracket 8A, and the heating element 11 back into a retracted position after the thread has been severed.

It is a simple matter to cut the thread when feeding it into the needles. On the other hand, when the thread is being removed from the fabric, the conditions are different, because there is only a short piece of thread extending from the edge of the fabric to the thread carrier, a length of about one inch. There is no way for that short piece of thread to get into the path of the cutter. If it did, that would be undesirable for reasons now to be explained. If the cutter were made to get into the path of the thread and to cut the thread, there would be left only a short end of the thread extending from the carrier to the place where the thread was cut off. Then, during subsequent knitting courses, the vibration of the machine would tend to remove the thread from the tube up into the body of the carrier, making it impossible to re-use that carrier on the next cycle, without re-threading it. Even if the thread did not go up into the tube, it would be too short to start feeding. In order to avert these difficulties, a thread puller mechanism is provided, which pulls out the thread at the end of the traverse.

On completion of the knitting of a portion of a fabric blank, the thread puller is actuated. There is one thread puller on each side of each knitting section. This puller comprises a hook 31 which, when not in use, is located in a slot 32 in the sinker head 33. The hook 31 is so positioned that, when one of the thread carriers 3 is at rest at the extreme end of its travel, the hook is located between the thread carrier and the needles 1. Thus, when the hook is drawn downwardly, it catches onto the portion of thread extending between the needles and the thread carrier and pulls a bight of the thread down from the carrier tube to a point offset from the needle row.

The thread puller hook 31 projects upwardly and out through a longitudinal slot 34 in a thread puller tube 35. In its position in the slot 32 in the sinker head 33, the thread puller 31 is behind the thread carrier when the thread carrier is at the end of its travel. The thread puller tube 35 extends forwardly and downwardly from the slot 32 to a position below the thread holder, to be described hereinafter. The thread puller hook 31 is soldered to the upper end of a push-pull type of spring wire cable, which is essentially a tightly wound helical spring. This cable extends downwardly past the lower end of the thread puller tube 35 through a flexible sheath 36 and into a vertical puller rod tube 37, which is fastened by means of suitable brackets to the frame 14 of the machine, as may be seen in Figure 6. The flexible sheath 36 is used primarily because it may be easily installed, but it would be equally effective to extend the thread puller tube 35, itself, down to the puller rod tube 37.

The lower end of the spring wire cable is attached in some suitable manner, as by soldering, to a puller rod housed within the puller rod tube 37. From the puller rod, a stud, or pin, 38 projects horizontically out through a slot 39 in the puller rod tube 37. To this stud are attached two flexible cables 40 and 41, which may suitably be braided, stranded wire. The cable 40 extends upwardly from the stud 38 and the cable 41 extends downwardly, the cable 40 passing through a suitable cable housing 42, such as one formed by a tightly wound wire or helical spring, and the cable 41 passes through a

similar cable housing 43. Both cables 40 and 41 lead to a pulley 44 mounted on a shaft 45, each cable leading into a groove 46 in the pulley in a direction opposite to that of the other cable. Thus, as the pulley 44 is rotated, one cable is wound onto the pulley while the other is being unwound. Of course, it will be understood that it would also be suitable to use a single cable leading over the pulley having its ends attached to the stud 38 on the thread puller rod.

The manner of causing selective rotation of the pulley shaft 45 will now be described, reference being had particularly to Figure 7. The shaft is supported from the frame 14 of the machine by means of suitable bearings 47. One side 48 of a clutch is fixed to the shaft, as by means of a setscrew 49. The other part 50 of the clutch is free to rotate and to be moved axially on the shaft 45. The movable part 50 of the clutch is drivingly connected, as by means of a sprocket and chain drive 51, an intermediate shaft 52 and a sprocket and chain drive 53, to an auxiliary ratio motor 54 having power leads 55 from a suitable source of power, not shown.

The clutch 48, 50 is actuated by a solenoid 56, having suitable leads 57. To the solenoid 56 is connected a link 58 which is pivoted freely on a link shaft 59, journaled between the tops of two levers 60, one lever being in back of the other as shown in Figure 7. Opposing the action of the solenoid 56 on the link 58 is a tension spring 61 suitably fastened at its other end to a portion of the frame 14 of the machine. The levers 60 are pivoted on stub shafts 62 suitably mounted in the frame of the machine on each side of the main shaft 45, but not in contact therewith, so that the main shaft 45 is free to rotate with respect to these stub shafts. Two hardened screws 63 project from the lower ends of the levers 60 in contact with a hardened thrust collar 64, which is fixed to the movable clutch member 50. As will be apparent from an inspection of Figure 7, when the solenoid 56 is actuated, it draws the link 58 and the levers 60 toward itself, against the action of the tension spring 61, thereby causing the levers 60 to rotate in a counterclockwise direction on the stub shafts 62. The radius along the levers 60 to the link shaft 59 from the stub shafts 62 being much greater than the distance from the stub shafts to the outer ends of the hardened screws 63, the mechanism incorporates a large mechanical advantage. The hardened screws 63 force the hardened thrust collar 64 to the right, as seen in Figure 7, and thus force the free part 50 of the clutch into solid driving contact with the fixed part 48 of the clutch. This accomplishes a driving connection from the motor 54, through its chains 51 and 53, its auxiliary shaft 52 and through the clutch halves 50 and 48, with the main pulley drive shaft 45. At this time, if the motor 54 is energized, it causes rotation of the pulley drive shaft 45, and thus of the pulley 44, and linear motion of the flexible cables 40 and 41. These cables, in turn, cause motion of the stud 38 and of the puller rod to which the stud is attached, either upwardly or downwardly. This, in turn, causes a corresponding motion of the spring wire cable and of the thread puller hook 31.

In order to lock the thread puller hook at the end of its travel, either in the slot 32 in the sinker head 33 or at the bottom of the slot 34 in the thread puller tube 35, a locking detent or pawl and ratchet wheel stop mechanism is provided. This mechanism is illustrated in Figures 7 and 8. A locking disc or wheel 65 is fixed to the pulley shaft 45, as by means of a setscrew 66. This wheel has a pair of oppositely disposed, square-sided slots 67 in its periphery, adapted for coaction with a locking pawl or detent 68. The pawl is pivotally mounted in the frame 14 of the machine for free rotation about an axis 69 and has a pin 70 projecting from its side intermediate its ends. To the pin 70 is attached one end of a tension spring 71, the other end of which is fastened to a suitable portion of the frame 14 of the machine. Another tension spring 72 is also connected at one end to the pin 70, extending from that pin in a direction opposite to that of the spring 71 to a link 75 of a solenoid 73 having suitable leads 74. The relative tensions of the springs 71 and 72 are such that the spring 71 normally prevails and forces the locking detent or pawl 68 into one of the slots or notches 67.

When the solenoid 73 is energized, it pulls the link 75 and the spring 72, which is attached to the link, downwardly, overcoming the greater tension of the upper spring 71. When this happens, the pawl 68 is pulled out of the slot 67 and the disc 65 is free to rotate, thus permitting the pulley shaft 45 to be rotated. As the shaft 45 is rotated by the motor 54, it pulls the thread puller hook 31 downwardly through the various cable connections. When the shaft has rotated enough to bring the pawl 68 and the notch 67 out of register, so that the pawl is not able to fall back into the notch, a collar 76, fixed to the shaft 45, as by means of a setscrew 77, is rotated sufficiently to bring a switch actuating button 78 projecting from the collar into contact with a switch lever 79, causing the switch lever to open the circuit in a switch 80. This switch is connected by leads 81 in series with the leads 74 of the solenoid 73, so that when the circuit is opened in the switch 80 by contact of the switch actuating button 78 with the switch lever 79, the circuit to the solenoid 73 is broken. This permits the pawl 68 to be pulled by the upper spring 71 against the periphery of the disc 65, in a position ready to be pulled into the next notch 67, when that notch comes under the pawl. When the pawl falls into the next notch, it stops rotation of the shaft 45 and it stops at the same time movement of the thread puller hook 31 at one or the other end of its travel.

At the instant when the pawl 68 falls into the notch 67, the stud 70 projecting from the pawl is forced against a leaf or blade 82 of a switch 83. This causes the blade 82 to open the circuit in the switch 83, which is connected by means of leads 84 in series with the leads 55 and 57 of the motor 54 and the clutch solenoid 56. In other words, when the pawl 68 falls into one of the slots 67, it opens the circuit to the solenoid 56 and the motor 54, thereby stopping the motor and allowing the clutch to be pulled to a released position by the spring 61, breaking the driving connection between the clutch members 48 and 50.

The sequence of operation of the parts described above for operating the thread puller is followed in either direction of travel of the thread puller hook 31. To reverse the direction of travel, it is only necessary to reverse the direction of rotation of the motor 54.

The thread holder illustrated in Figure 4 comprises a tube 90 located directly above the lower end of the thread puller tube 35 and connected by a hose 91 to a suction manifold, not shown. As in the case of the thread puller, there is a thread holder on each side of each knitting section. A centrifugal blower 92, driven by a suitable motor, not shown, or other means for creating a partial vacuum in the manifold, has its suction opening connected with the manifold. The blower 92 preferably has a screen or cage 93 over its exhaust opening to catch waste threads. When the centrifugal blower 92 or vacuum motor is operated, it creates a partial vacuum in the manifold, in the hose 91 and in the thread holder tube 90. This causes a flow of air into the open end of the tube 90, and the flow of air draws the loose end of the thread 4 into the tube and holds it there as long as the vacuum blower 92 is operating. The motor for the centrifugal blower 92 is connected by means of leads 94 to a relay, not shown, in series with a pattern bar on a pattern control panel, to be described hereinafter.

The clamp 5 illustrated in Figures 4 and 5, as has already been mentioned, is provided for holding the loose end of the thread when desired, there being one

clamp on each side of each knitting section. This clamp is located slightly to one side of the open, upper end of the thread holder tube **90**. It comprises two small plates **95** and **96**, faced on their inner sides with sponge rubber or any other suitable rubbery, plastic material **97**. The plates **95** and **96** are normally biased by a spring **98** to a closed position. One plate **96** of the clamp is fixed in approximately a vertical position and the other plate **95** is hinged to it by means of a pivot pin **99**. The pivot pin extends beyond the sides of the plate and is bent upwardly and then outwardly again to form a substantially S-shaped piece. The spiral spring **98** is wound around this pivot pin **99** in such a manner as normally to keep the clamp closed and to hold the outer end of the pivot pin **99** up.

To that outer end of the pivot pin **99** there is connected a wire **100** which passes downwardly through a flexible sheath **101** to a solenoid **102** to which it is attached. The solenoid is connected by leads **103** to the control panel, to be described later. When the solenoid **102** is energized, it pulls down on the wire **100** and on the pivot pin **99**, so that the movable plate **95** of the clamp is opened. When the solenoid is de-energized, the spiral spring **98** snaps the clamp shut. In the open position, the pivoted plate **95** of the clamp is lifted over the thread holder tube **90**. The solenoid **102** is connected by its leads **103** in series with the leads **94** for the motor for the vacuum blower **92**. Thus, when the motor for the blower **92** is energized, the solenoid **102** is also energized to lift up the pivoted side **95** of the clamp. At the instant when the motor of the vacuum blower **92** is de-energized, the solenoid **102** is also de-energized, and the spring **98** instantly closes the clamp.

A control panel **104** is provided for automatically controlling all the steps of operation of the thread puller, the thread holder, and the thread cutter. This control panel is illustrated symbolically in Figure 2 and representative leads **105** from the control panel to the various parts controlled are illustrated. This control panel is fully described in my application, Serial No. 294,804, filed June 21, 1952, and entitled "Welt Turner." In addition, there is illustrated in Figure 3 a variable resistor **106** having leads **107**, by means of which it is connected in series with leads **105** from the control panel **104**, and also in series with the heating elements **11** of the thread cutters **8** and **8A** through their leads **108**. By a suitable adjustment of the variable resistor **106**, the voltage applied across the heating elements **11** can be adjusted to the desired amount, approximately 1½ volts, in order to cause the heating elements **11** to be heated quickly to the proper temperature for quickly severing the yarn.

The complete operation of this invention will now be described.

At the start of the knitting operation, the end of a thread **4** used in forming the welt extends from a thread carrier **3** and is clamped between the faces of a clamp **5**. The knitting operation is commenced, the carrier **3** drawing the welt thread **4** around and in contact with the element **11** of the fixed cutter **8** to the needles **1**. After a few courses of knitting have been completed, the element **11** of the stationary thread cutter **8** is heated electrically and cuts the thread. The knitting operation continues while the end of the thread is being severed, since it is not essential that the cutting take place on any particular row or course. It is satisfactory to cut the thread within thirty or forty courses of a given point, although it is a simple matter to time the cutting much more accurately than that. The exhaust blower **92** and the solenoid **102** are then energized simultaneously. Thus, the clamp **5** is opened and the waste end of the thread is drawn out of the machine through the tube **90** and the hose **91** into the screen **93**.

When the knitting of the welt has been completed and the welt thread carrier is brought to rest at the right side of the knitting head, a main body thread carrier **3** is introduced from the right side into the field of knitting. At this time, it is necessary to sever both the inoperative thread of the welt thread carrier and the thread of the main body carrier.

The severing of a thread being newly introduced into the field of knitting, such as the welt thread at the beginning of formation of the welt, or the main body thread at the start of knitting of the main body, is a simple matter, since such threads pass from the clamp **5** around the heating element **11** of the stationary cutter **8**, and there is no need to hold that end. On the other hand, to sever and hold a thread which is being removed from the field of knitting is more difficult. In that case, the thread must be pulled out of the carrier and must be held in a suitable manner, as by the clamp **5**.

The first step taken in holding and severing a thread being removed from the field of knitting is for a suitable contact on the pattern control panel **104** to cause, through one pair of leads **105** and the leads **94** and **103**, the motor for the vacuum blower **92** and the solenoid **102** to be energized. The blower **92** creates a partial vacuum in the manifold, in the hose **91** and in the thread holder tube **90**, causing a flow of air into the upper end of the tube. The solenoid **102** causes the pivoted side **95** of the clamp to be lifted over the thread holder tube **90**. This clamp must be opened before the thread puller **31** can pull down the thread being removed, such as the welt thread, because otherwise the thread would pass on the wrong side of the clamp. In other words, if the thread were pulled down before the clamp is opened, the thread would pass outside of the top side **95** of the clamp, rather than between the clamp faces **97**, and the clamp would simply push the thread upwardly.

With the clamps **5** open and the exhaust blower **92** drawing air into the tubes **90**, both thread pullers **31** are next started downwardly toward the clamps. The auxiliary ratio motor **54** and the solenoids **56** and **73** are energized simultaneously from a suitable source of power, not shown, through the control panel **104**. The leads **55** and **57** for the motor **54** and the solenoid **56** are in series and are also in series with one pair of leads **105** from the control panel **104**.

The following things are caused to happen at the same instant: The motor **54** starts to rotate and to drive the chain drives **51** and **53**, the intermediate shaft **52** and the freely mounted half **50** of the clutch. The solenoid **73** lifts the locking pawl **68** out of the slot **67** in the locking disc **65** and thus permits the shaft **45** to rotate. At the same instant, the solenoid **56** rotates the clutch levers **60** in a counterclockwise direction to force the movable clutch member **50** against the fixed clutch member **48** and thus to cause rotation to be transmitted through the clutch members ultimately from the motor **54** to the shaft **45**. This causes the pulley **44** to rotate and to move linearly the cables **40** and **41**. These cables, in turn, acting through the stud **38**, the thread puller rod and the thread puller cable, cause the thread puller hook **31** to start downwardly and to emerge from its slot **32** in the sinker head **33**. The thread puller hook catches onto the thread **4** extending between the thread carrier **3** and the needles **1** and pulls down a bight of the thread, causing that side of the bight which is adjacent to the needles to come into contact with the heating element **11** on the stationary thread cutter **8**.

When the shaft **45** has been rotated a sufficient amount that the pawl **68** is out of register with the slot **67** in the disc **65**, the switch **80**, in series with the solenoid **73** through their respective leads **81** and **74**, deenergizes the solenoid **73**. This permits the upper spring **71** to draw the pawl **68** against the periphery of the locking disc **65**. When the next slot **67** comes into registry with the pawl **68**, the pawl is forced by the spring **71** into that slot. The motion of the pawl into the slot **67** causes its stud **70** to open the circuit in the switch **83**, which is in series

with the motor 54 and the solenoid 56 through their respective leads 84, 55 and 57. This causes the solenoid 56 to be deenergized, so that the clutch member 50 is released from engagement with the clutch member 48 by the action of the tension spring 61. At the same time, the motor 54 is deenergized. During this time, the thread puller hook 31 has reached the lower end of its travel.

In traveling downwardly, the right thread puller contacts the welt thread 4 extending between the welt thread carrier 3 and the needles 1, but there is no thread for the left thread puller to pull down at this time. The puller draws a bight of the welt thread downwardly, with that part of the bight between the puller and the needles coming into contact with the heating element 11 of the stationary cutter 8. Since the end of the main body thread is being held in the clamp 5, it also extends in contact with the element 11 of the stationary cutter 8, because its carrier 3 has been moved into the field of knitting, in the same manner as when the welt thread was first brought into the field of knitting at the beginning of the cycle. Thus, there are two threads lying across or in contact with the element 11 of the stationary cutter 8.

After the thread puller reaches the lower end of its travel, a contact is then made on the pattern control panel 104 to cause a voltage to be applied across the heating element 11. If desired, all of the heating elements 11 on the fixed cutter 8 and on both retractible cutters 8A may be energized at the same time, since only the thread or threads to be cut are in contact with one of the elements. The element quickly becomes hot and almost immediately severs both threads 4 in contact with it. Since the exhaust blower 92 is now operating, it will draw the free end of the welt thread extending from the welt thread carrier 3 which has just been severed into the thread holder tube 90, as well as the waste piece of the main body thread, the end of which was originally held in the clamp 5. The waste piece will be disposed of by being caught in the screen 93.

The heating elements 11, the blower 92 and the solenoid 102 are then de-energized, causing the clamp 5 to be closed by its spring 98 over the end of the welt thread and also over any other threads which may have been originally under the clamp, such as the heel threads, holding those threads between its rubbery faces 97. The clamp will then hold the ends of the welt and heel threads until it is necessary to use thread from one of those carriers again. The heating element 11 is also de-energized as soon as the threads are severed.

The thread pullers 31 are returned to their upper positions in the slots 32 of the sinker head 33 at any time after the completion of the cutting and clamping cycle, but before they are needed again for pulling down the left heel thread.

After the cutting of the threads at the beginning of the main body of the fabric blank, the next time when the cutters are used is at the start of knitting the heel reinforcements, after the heel carriers have been introduced into the field of knitting. At this time, the retractible cutters 8A are brought into use, since they are adjusted for this width, which is approximately eight inches from one edge of the fabric to the other, compared with a width of fifteen inches at the beginning of the welt. Since, in this instance, we are concerned with the cutting of the heel carrier threads extending from the clamps 5 to the edge of the fabric, the thread pullers are not needed. After several courses of the heel knitting have been completed, the retractible cutters 8A are moved into position, at which time they will be in the path of the heel threads. The cutters 8A are put into position by action of the motor 26, controlled through its leads 27 from the control panel 104, and acting through the belt 24, the cam wheels 19 and 22, and the transverse rod 13 to cause the heating element assembly to be rotated toward the thread. The elements 11 of both retractible cutters 8A are heated simultaneously and cut the heel threads on both the left and right sides of the knitting section. After the threads are severed, the exhaust blower 92 is energized to remove the waste ends of the heel threads. After operating for a short period, the exhaust blower is de-energized and the cutters 8A are retracted and cooled.

At the start of knitting of the toe, the left heel carrier is removed from the field of knitting, since only the main body thread carrier and the right heel thread carrier remain operative. After the left heel carrier is removed, the right heel carrier is fed across the entire width of the blank, which at that time is the width of the sole, this forming the beginning of the toe.

The retractible cutters 8A are moved into position. The exhaust blower 92 and the solenoids 102 for the clamps 5 on both sides are then energized. The thread pullers 31 on both sides are moved downwardly, the left thread puller drawing down a bight of the thread from the left heel carrier. Although the right thread puller is being drawn down at the same time, at this time there is no thread for it to pull down, but that does not matter. The elements 11 of the cutters 8A are then energized to sever the thread, the severed end extending from the left heel carrier 4 being drawn into the air tube 90 between the faces of the clamp 5. The exhaust blower 92 and the solenoid of the clamp 5 are then de-energized and the left clamp 5 holds the end of the thread extending from the left heel carrier. The cutters 8A are then retracted and the thread pullers 31 are returned to their upper positions in the sinker head slots 32. The width setting of the retractible cutters is fairly accurate for the cutting of the left heel thread, since the width of the fabric at the start of the toe is almost identical to the width at the start of the heel, for which width the retractible cutters are set.

The next point at which the cutters are used is at the end of the knitting of the fabric blank. At this time, the two remaining operative thread carriers, the right heel carrier which formed the toe and the main body carrier, are removed from the field of knitting. They are moved out to the right side of the knitting head and their threads must be cut and clamped on that side. The sequence of operation then is exactly the same as at the start of the toe, except that the thread puller on the right side will carry two threads down to the clamping area and the left thread puller will not be carrying any thread.

The fabric at the end of the knitting blank is much narrower than it is at the start of the toe. At the end of the blank, the fabric is only about one-fourth of an inch from side to side. Although the positions of the retractible cutters 8A are not correct for this narrow width, they are used in preference to installing a separate cutter for the end of the blank, even though the ends of the threads that are left are considerably longer than the one-half inch or three-fourths inch length of thread end which is desirable in other parts of the stocking. This end is usually trimmed off by an inspector in a later operation. If desired, a separate cutter mounted for cutting the threads extending from the end of the fabric blank at the correct length can be easily installed. Another possible arrangement is to have the right end retractible cutter 8A movable along the transverse rod 13, synchronizing the adjustment of the cutter 8A with the width of the fabric blank. In the latter case, the cutter would always cut the thread at the proper length, regardless of the width of the fabric.

By my invention, there is provided a mechanism which saves considerable time on the part of the operator of a straight-bar knitting machine. Since it eliminates many manual operations, the operator is enabled to run more machines and, thus, the cost of the labor for operating each machine is considerably reduced. The pulling, holding and cutting of the threads mechanically not only are labor saving, but they are also more exact because the threads are always cut at the same length. The thread-cutting elements are, in most cases, so positioned that

they cut the thread off about one-half inch from the edge of the fabric. This results in a product of uniformly higher quality, since the threads are always cut at the same length. In contrast, when the threads are cut manually, they are cut at varying lengths from the edge of the fabric, resulting in a product of varying quality. In addition, there is provided a quick and efficient method of disposing of the waste thread resulting from the operation of the machine. A still further consideration is that the machines can be operated continuously over a greater proportion of time, because it is not necessary to stop the machines for cutting the threads at certain times as is the case where the threads must be cut manually.

I claim:

1. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, and means for pulling said portion of the thread to a point offset from the needle row comprising a guideway, a hook slidable in the guideway to engage said thread portion extending from the fabric to the thread laying means, and means including a cable for moving the hook.

2. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, means including a device for creating air suction to hold said end of the thread at a point offset from the needle row and means for severing the thread while its end is being held.

3. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, means including a device for creating a draft of air to hold said end of the thread at a point offset from the needle row and means for severing the thread while its end is being held.

4. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, means for holding an end of the thread at a point offset from the needle row while the thread is being knitted into the fabric, means for severing the portion of thread extending from the fabric to said end and means for removing the severed portion from the machine.

5. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, and means including a clamp spring-biased to a closed position for holding said end of the thread at a point offset from the needle row and a deviec for creating a draft of air to hold said portion of the thread in position to be engaged by the clamp.

6. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, means for severing an end of the thread extending from the fabric, means including a clamp spring-biased to a closed position for holding said end of the thread at a point offset from the needle row while the thread is being knitted into the fabric and subsequently when the portion of thread adjacent said end is severed from the fabric and means for removing the severed portion of the thread from the machine.

7. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, and means including a pair of jaws faced with a rubbery material and spring-biased to a closed position for holding said end of the thread at a point offset from the needle row.

8. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, means for severing an end of the thread extending from the fabric, means including a pair of jaws faced with a rubbery material and spring-biased to a closed position for holding said end of the thread at a point offset from the needle row while the thread is being knitted into the fabric and subsequently when the portion of thread adjacent said end is severed from the fabric and means for removing the severed portion of the thread from the machine.

9. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, and means including a solenoid-opened, spring-closed clamp for holding said end of the thread at a point offset from the fabric.

10. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, means for severing an end of the thread extending from the fabric means including a solenoid-opened, spring closed clamp for holding an end of the thread at a point offset from the needle row while the thread is being knitted into the fabric and subsequently when the portion of thread adjacent said end is severed from the fabric and means for removing the severed portion of the thread from the machine.

11. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means for severing the thread while it is being held, means to clamp said portion of thread offset from the needle row, and means to create a draft of air to hold said portion of the thread in position to be engaged by the clamp.

12. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row and means for severing the thread while it is being held.

13. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row and means including a device for creating an air suction to hold said portion of the thread at said offset point.

14. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row and means including a device for creating a draft of air to hold said portion of the thread at said offset point.

15. In a full fashioned knitting machine the combi-

nation of a needle row, means movable from storage position into the field of knitting to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric and thereafter to return said thread laying means to storage position, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means movable from said storage position into the field of knitting for laying a second thread, means for holding said portion of thread at the offset point and for holding the end of the second thread while the thread is being knitted into the fabric, means for severing both of said threads between said point and the fabric, and means for removing the severed portion of the second thread from the machine.

16. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row and means including a pair of jaws faced with a rubbery material and spring-biased to a closed position for holding said portion of the thread at said offset point.

17. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row and means including a solenoid-opened, spring-closed clamp for holding said portion of the thread at said offset point.

18. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row and means for holding said portion of the thread at said offset point.

19. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row and means including a device for creating air suction to hold said portion of the thread at said offset point.

20. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row and means including a device for creating a draft of air to hold said portion of thread at said offset point.

21. In a full fashioned knitting machine the combination of a needle row, means movable from a storage position into the field of knitting to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric and thereafter to return said thread laying means to the storage position, means comprising a hook extending from a cable to pull said portion of said thread to a point offset from the needle row, means movable from said storage position into the field of knitting for laying a second thread, means for holding said portion of thread at the offset point and for holding the end of the second thread while the thread is being knitted into the fabric, means for severing both of said threads between said point and the fabric, and means for removing the severed portion of the second thread from the machine.

22. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row, and means including a clamp spring-biased to a closed position for holding said portion of the thread at said offset point.

23. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row, and means including a pair of jaws faced with a rubbery material and spring-biased to a closed position for holding said portion of the thread at said offset point.

24. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row and means including a solenoid-opened, spring-closed clamp for holding said portion of the thread at said offset point.

25. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, means for severing an end of the thread extending from the fabric and means for removing the severed end from the machine.

26. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, means including a clamp spring-biased to a closed position for holding said portion of the thread at a point offset from the needle row, a device for creating a draft of air to hold said portion of the thread in position to be engaged by the clamp, and means for severing the thread to form said thread end.

27. A full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, an end of said thread extending from the fabric, means including a pair of jaws faced with a rubbery material and spring-biased to a closed position for holding said end at said offset point and means for severing said end while it is being held.

28. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread and means to draw off the fabric, an end of said thread extending from the fabric, means including a solenoid-opened, spring-closed clamp for holding said end at a point offset from the fabric and means for severing said end while it is being held.

29. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of

said thread extending from the fabric to the thread laying means, means comprising a hook extending from a cable for pulling said portion of the thread to a point offset from the needle row, means for holding said portion at said offset point, and means for severing said portion of the thread while it is being held.

30. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means including a device for creating an air suction to hold said portion at said offset point, and means for severing the thread while it is being held.

31. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means including a device for creating a draft of air to hold said portion at said offset point and means for severing the thread while it is being held.

32. In a full-fashioned knitting machine, the combination of a needle row, means movable from storage position to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means for holding said portion at said offset point while the thread is being knitted into the fabric including clamping means, means for yieldably drawing said thread portion to said offset point, means for severing said portion of thread extending from the fabric to said holding means, and means for clamping and unclamping said held thread portion while yieldably drawn to said offset point.

33. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means including a pair of jaws faced with a rubbery material and spring-biased to a closed position for holding said portion at said offset point, and means for severing the thread while it is being held.

34. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said row to knit fabric from said thread, and means to draw off the fabric, a portion of said thread extending from the fabric to the thread laying means, means for pulling said portion of the thread to a point offset from the needle row, means including a solenoid-opened, spring-closed clamp for holding said portion at said offset point, and means for severing the thread while it is being held.

35. The method of operating a full-fashioned knitting machine having a needle row, means to lay thread to said row, means cooperating with the row to knit fabric from said thread, and means to draw off the fabric, comprising pulling a portion of the thread extending between the fabric and the thread laying means to a point offset from the needle row severing said portion of the thread, creating a draft of air to position one of the ends of said severed thread portion and clamping and unclamping said held end portion while supported by said draft of air.

36. The method of operating a full fashioned knitting machine having a needle row, means movable into the field of knitting to lay thread to said row, means cooperating with the row to knit fabric from said thread, and means to draw off the fabric, the steps comprising pulling a portion of the thread extending between the fabric and the thread laying means when returned to its storage position to a point offset from the needle row yieldably holding said thread at said offset point severing said thread portion between the fabric and said point, and clamping and unclamping said offset portion while yieldably held at said offset point.

37. In a full fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a thread severing and holding device for said knitting threads comprising, a device for creating a draft of air to hold a portion of the thread at a point offset from the needle row, a thread clamp operable to clamp a thread portion held in said air draft, and a thread severing means disposed to sever a portion of said thread between the yarn holding device and the fabric.

38. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a thread severing and holding device for said knitting thread comprising, a device for creating a draft of air to hold a portion of the thread at a point offset from the needle row, a thread clamp having open and closed positions to receive and to clamp a thread portion supported in said air draft, a thread severing means disposed to sever a portion of said yarn between the yarn holding device and the fabric, and means acting when rendered operative to establish said air draft, and to open the clamp, and thereafter to close the clamp and to discontinue the air draft.

39. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a thread severing and holding device for said knitting thread comprising, a device for creating a draft of air to hold a portion of the thread at a point offset from the needle row, a thread clamp having open and closed positions to receive and to clamp a thread portion supported in said air draft, a thread severing means disposed to sever a portion of said yarn between the yarn holding device and the fabric, and means acting when rendered operative to establish said air draft and to open the clamp, and thereafter to close the clamp and to discontinue the air draft, and means for rendering said thread severing means operative to sever said thread portion extending to fabric.

40. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a thread severing and holding device for said knitting threads comprising, a device for creating a draft of air to hold a portion of the thread at a point offset from the needle row, a thread clamp having open and closed positions to receive and to clamp a thread portion supported in said air draft, a thread severing means disposed to engage with, and actuable to sever a portion of the thread between the thread holding device and the fabric, and pattern means controlling said air draft and thread clamp to establish said air draft and to open the clamp and thereafter to close the clamp and to discontinue the air draft, and controlling said thread severing means to sever said thread portion extending to the fabric.

41. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a holding means for thread ends comprising a device for creating a draft of air to hold a portion of the thread

from a point offset from the needle row, a thread clamp disposed to engage with and hold said portions of thread extending into said air draft, and means acting when rendered operative to open and close said clamp to admit thereto and to release therefrom threads held under the influence of said air draft.

42. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a holding means for thread ends comprising a device from a point offset from the needle row, a thread from a point offset from the needle row, to a thread clamp having open and closed positions to receive and to clamp a thread portion supported in said air draft, and means acting when rendered operative to establish said air draft and to open the clamp, and thereafter to close the clamp and to discontinue the air draft.

43. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a holding means for the thread ends comprising means for drawing a portion of the yarn extending between the fabric and said thread laying means to a point offset from the needle row, a device creating a draft of air to hold an offset portion of said thread, and a thread clamp having open and closed positions to receive and to clamp said offset thread portion supported in said air draft.

44. A claim according to claim 43 in which there is provided a thread severing device mounted on the machine operable to sever a portion of said thread between the thread holding device and the fabric.

45. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread to clear the fabric from the needles, and a holding means for the thread ends comprising means for drawing a portion of the thread extending between the fabric and said thread laying means to a point offset from the needle row, a device creating a draft of air to hold an offset portion of said thread, and a thread clamp having open and closed positions to receive and to clamp said offset thread portion supported in said air draft, a thread severing device supported from the machine operable to sever a portion of said thread between the thread holding device and the fabric, and means for operating said thread drawing, draft forming, thread clamping, and thread severing devices in sequence, to draw a portion of said thread to the offset position, to hold and to clamp said held thread portion, and to sever said offset thread portion from the fabric.

46. In a full-fashioned knitting machine, the combination of a needle row, means to lay thread to said row, means cooperating with said needle row to knit fabric from said thread and to clear the fabric from the needles, and a holding means for the thread ends comprising means to draw a portion of the thread extending between the fabric and said thread laying means to a point offset from the needle row, a device for holding the thread in said offset position, a cutting device supported movably from the machine for movement from an inoperative withdrawn position to a thread engaging position adjacent the point of attachment of the thread to the fabric, and means acting when rendered operative for activating said cutting device in said thread engaging position to sever the thread.

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