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Crandall et al.

[11] **3,867,745**

[45] **Feb. 25, 1975**

[54] **METHOD FOR DRAWING IN WARP THREADS**

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[73] Assignee: **Barber-Colman Company,** Rockford, Ill.

[22] Filed: **Sept. 20, 1973**

[21] Appl. No.: **398,970**

Related U.S. Application Data

[62] Division of Ser. No. 262,105, June 12, 1972, Pat. No. 3,787,938.

[52] **U.S. Cl.** **28/72.5**

[51] **Int. Cl.** **D03j 1/16**

[58] **Field of Search** 28/45, 49, 72.5, 43, 44, 28/72.6

[56] **References Cited**

UNITED STATES PATENTS

3,423,808 1/1969 Altenweger 28/49

Primary Examiner—Louis K. Rimrodt

Attorney, Agent, or Firm—Wolfe, Hubbard, Leydig, Voit & Osann Ltd.

[57] **ABSTRACT**

A method for drawing short lengths of thread of yarn through the weaving elements of a loom in a preselected manner while leaving an end portion of each thread exposed for subsequent tying to the thread of yarn on a warp beam.

4 Claims, 8 Drawing Figures

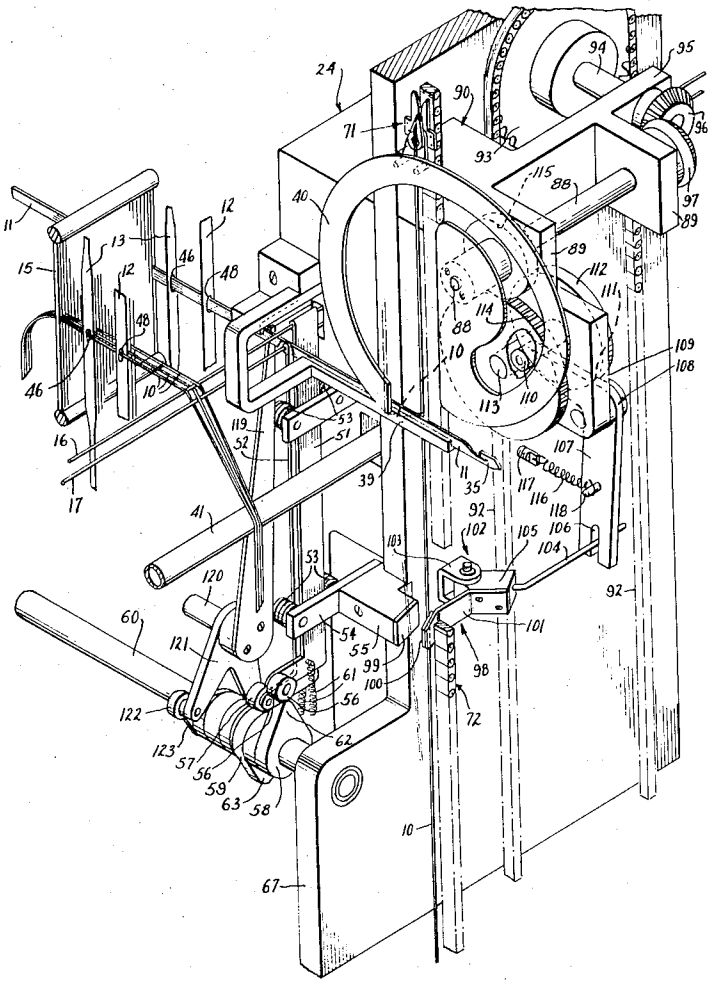


Fig. 1.

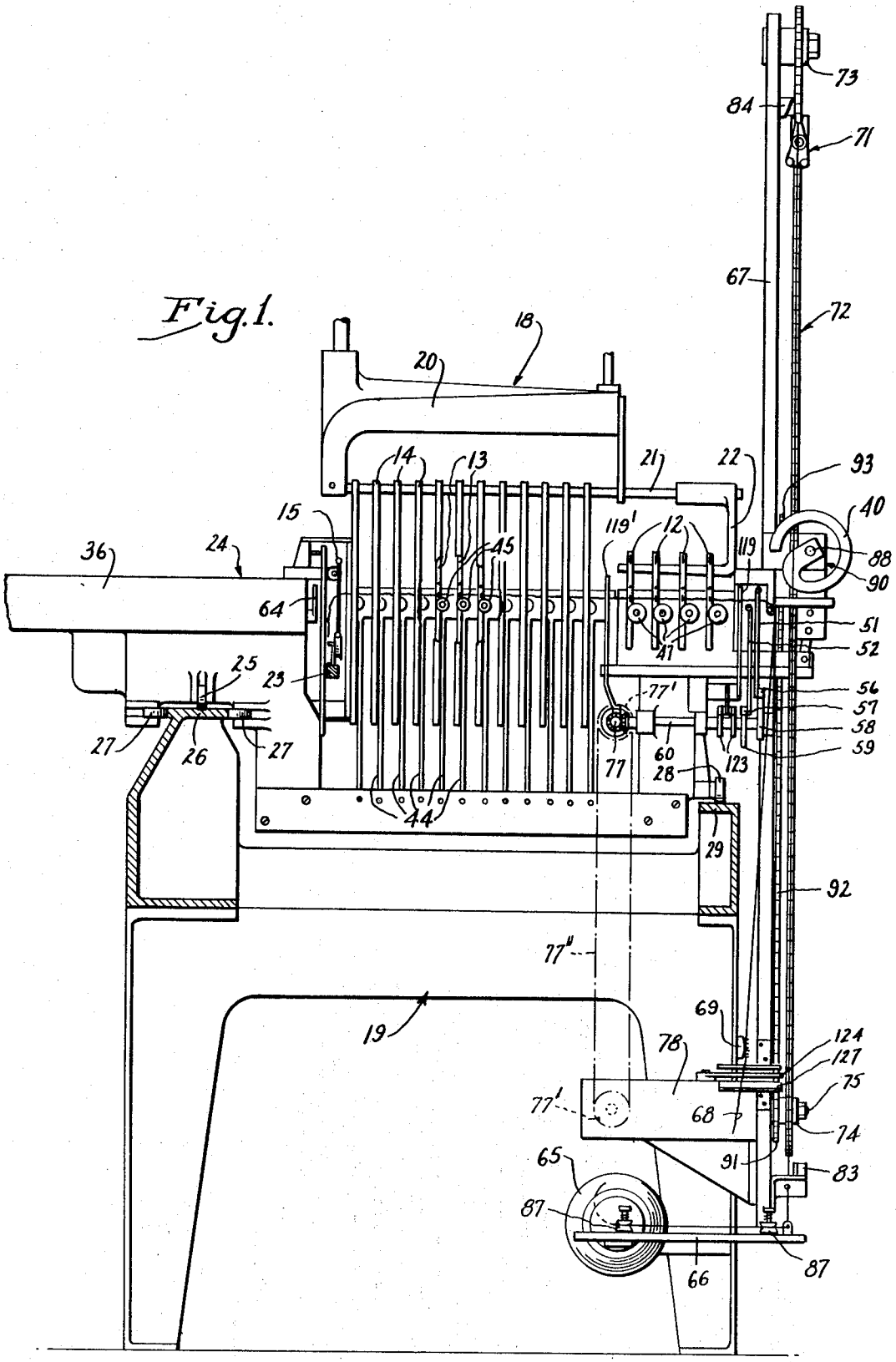

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22
93
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15
119'
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45
64
51
52
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23
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56
57
58
59
77'
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26
27
77
60
28
123
44
29
92
77"
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124
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77'
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Fig. 3.

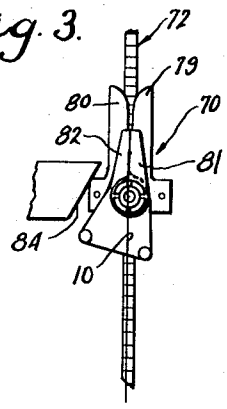


Fig. 2.

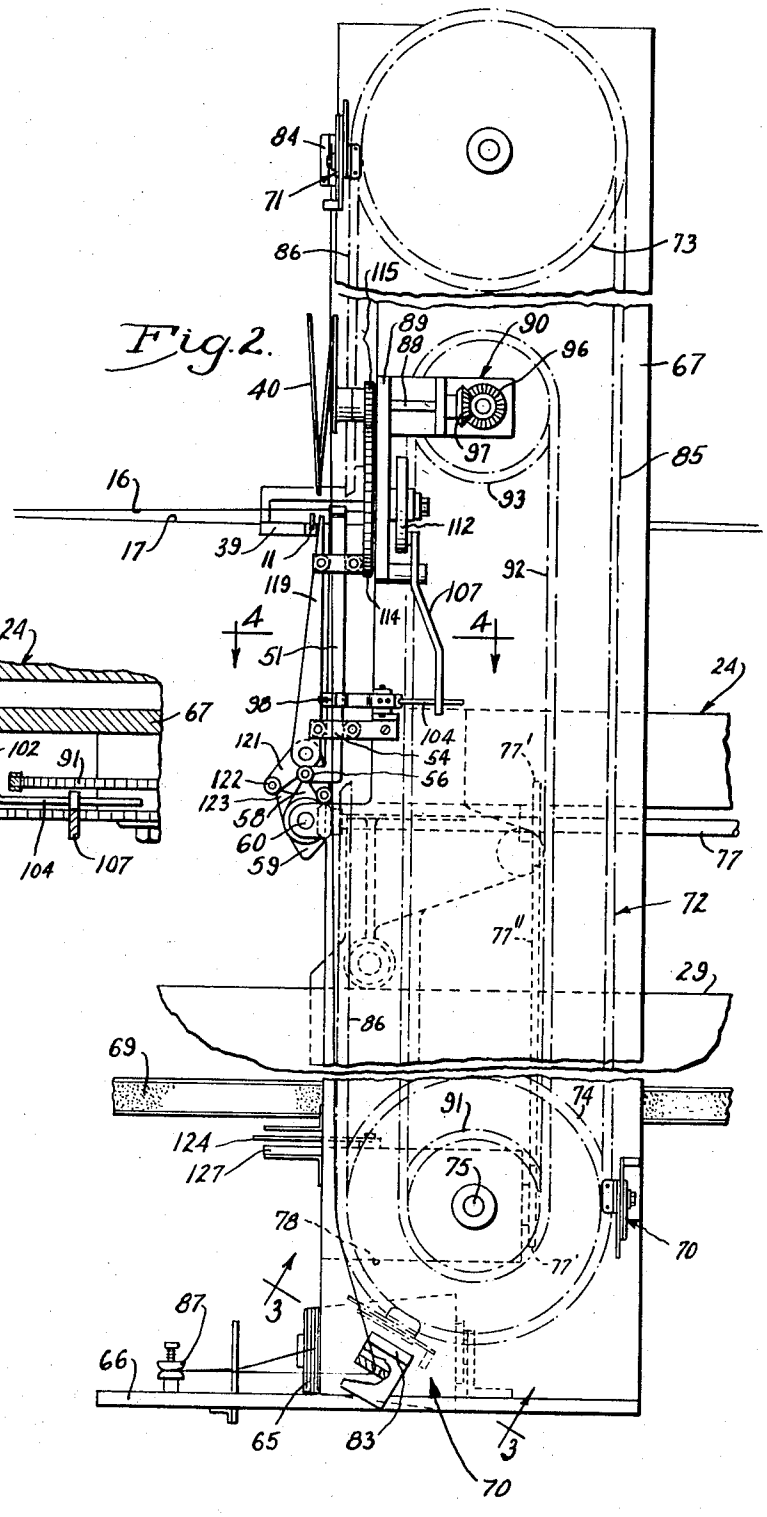


Fig. 4.

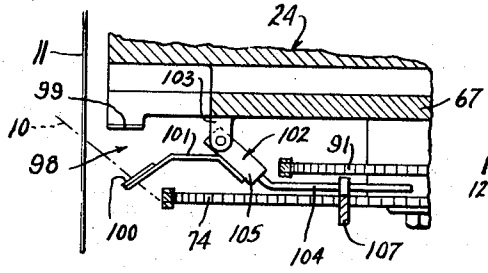


Fig. 5.

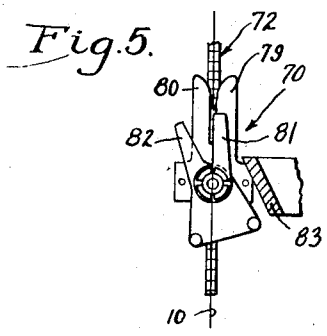
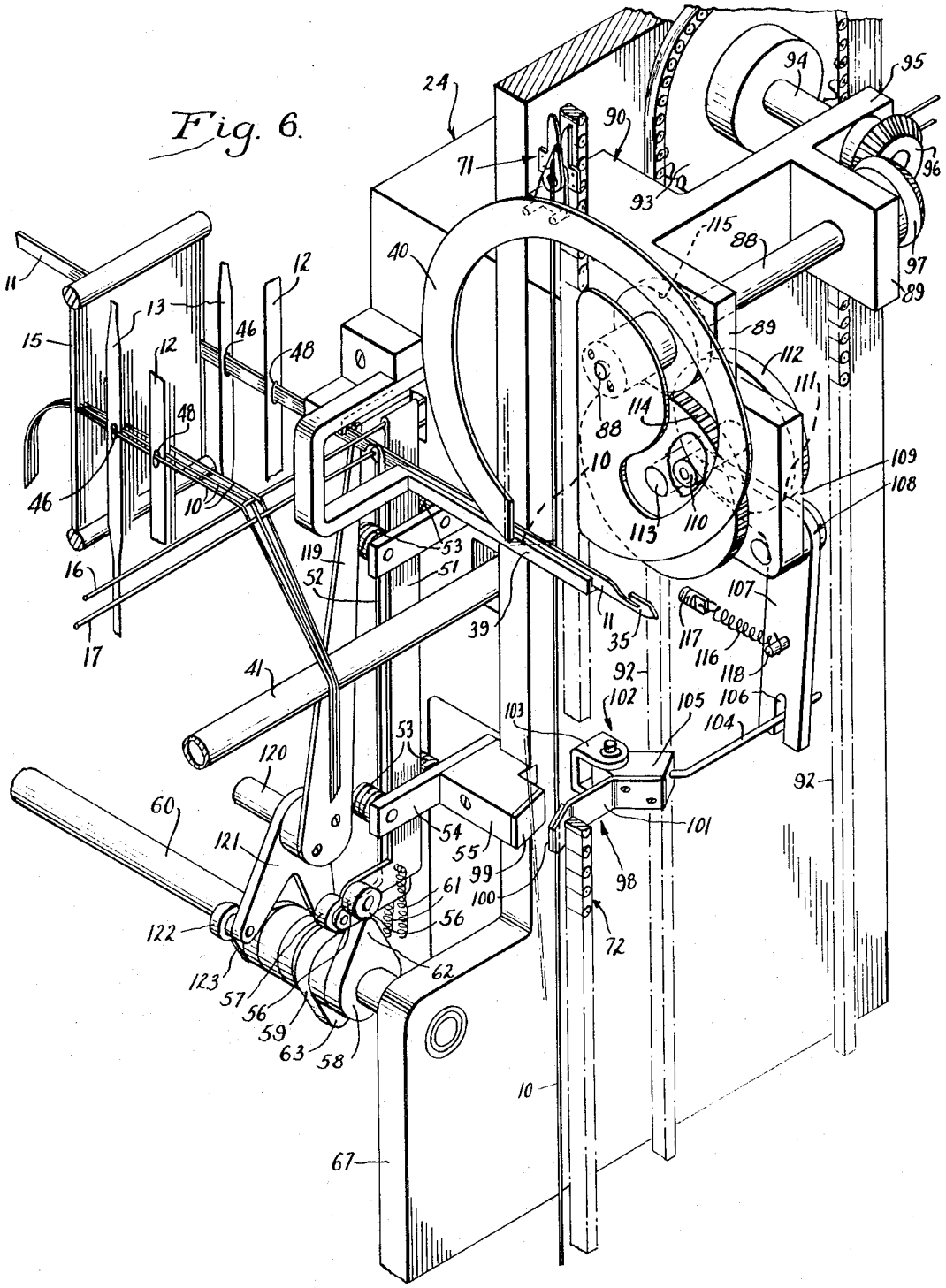


Fig. 6.


24
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90
93
94
95
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97
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88
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40
11
12
13
15
46
48
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119
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122
123
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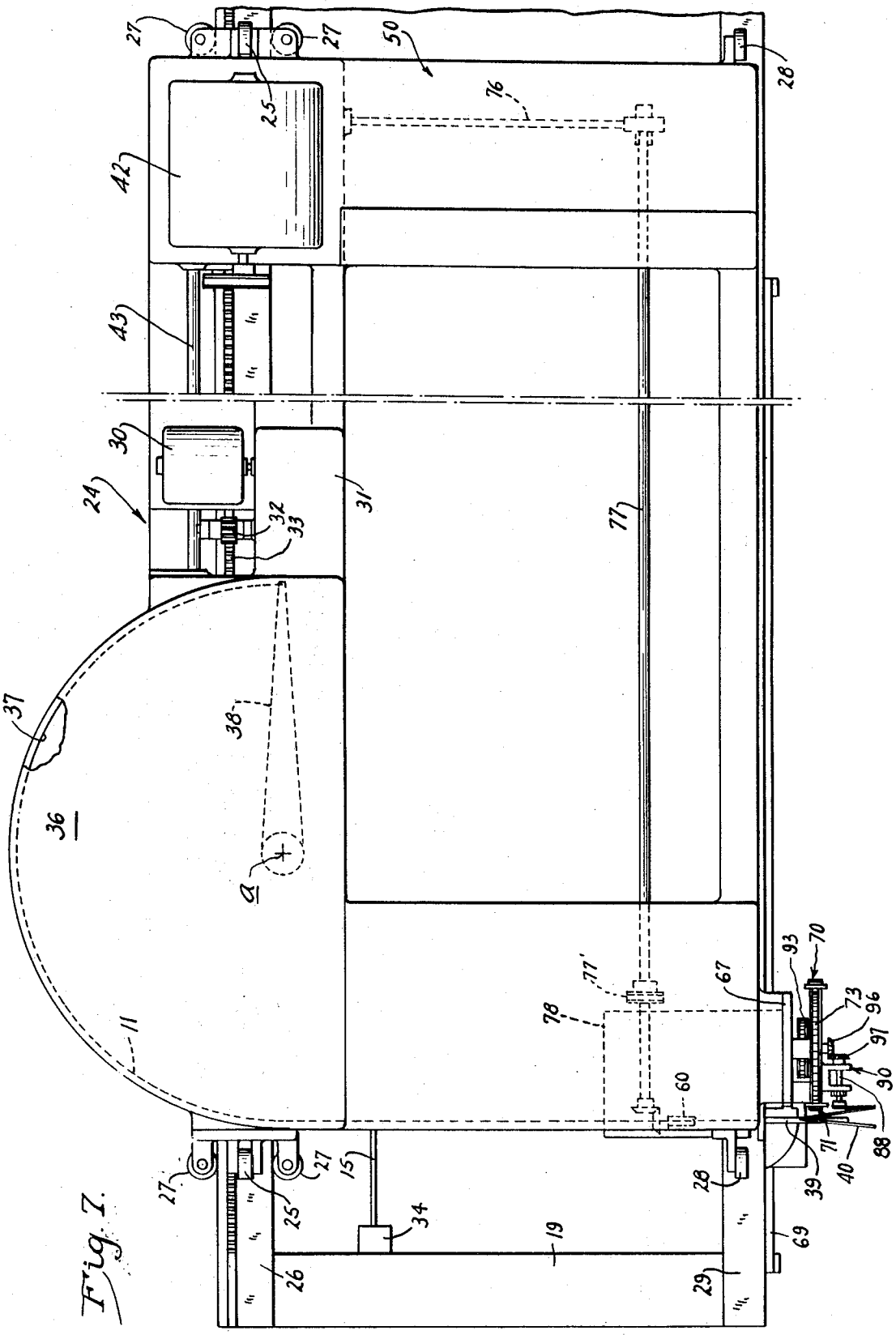

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77'
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Fig. 7.

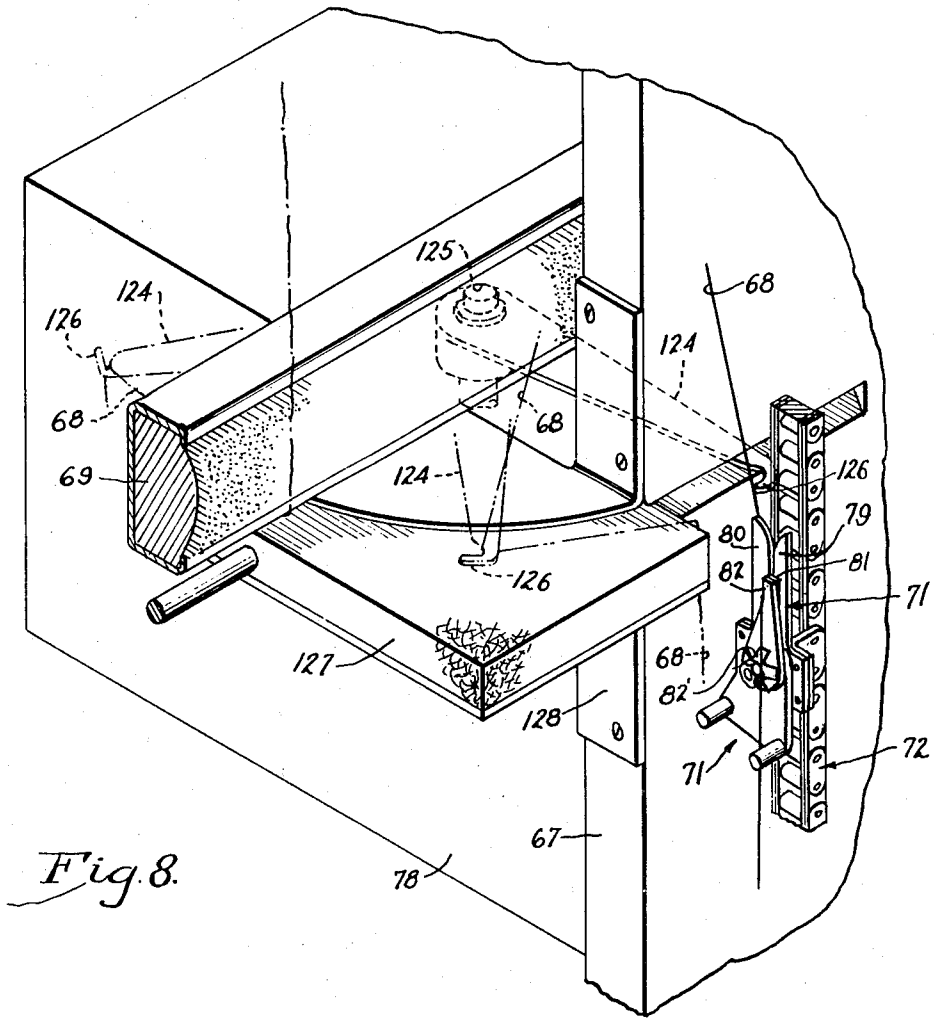

125
124
126
68
69
68
124
68
124
126
79
80
81
82
71
68
82'
71
72
127
128
67
78

Fig. 8.

METHOD FOR DRAWING IN WARP THREADS

This is a division of application Ser. No. 262,105, filed June 12, 1972, now U.S. Pat. No. 3,787,938, granted June 29, 1974.

BACKGROUND OF THE INVENTION

This invention relates to a method for drawing warp threads of yarn through the weaving elements of a loom, namely, the drop wires, the heddles and the reed, in a preselected manner so that, when the weaving elements are associated with the loom and operated in a preset manner, the loom weaves the desired pattern. It has been the usual practice to draw the threads directly from a warp beam and through the weaving elements and then to transport the weaving elements and the warp beam together to the loom. This practice presents a number of problems one of the more important of which is transportation. Thus, with large warp beams, it is difficult and cumbersome to transport the weaving elements and the beam together through narrow aisles, doors and the like and it is virtually impractical to transport such an assembly from one plant to another. Moreover, this method of drawing in requires practically the full-time attention of an operator.

SUMMARY OF THE INVENTION

The general object of the invention is to provide a new and improved method of drawing in warp threads which method permits the drawing in to be performed and, thereafter, the weaving elements may be transported to the loom separately from the warp beam and, also, which is essentially automatic and requires little operator attention.

The principal object is to achieve the foregoing by drawing a short length of thread through each set of weaving elements while leaving an exposed end portion so that these end portions may be tied at the loom to corresponding threads on a warp beam and the short lengths act as pilot threads for drawing the threads on the beam through the weaving elements.

Another object is to draw the short lengths of thread through a leasing apparatus associated with the weaving elements so that the tying of the short threads to the warp threads may also be accomplished automatically.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side view of a warp drawing-in machine for performing the present invention.

FIG. 2 is a fragmentary side view as seen from the right in FIG. 1.

FIG. 3 is an enlarged fragmentary sectional view taken along the line 3—3 in FIG. 2.

FIG. 4 is an enlarged fragmentary sectional view taken along the line 4—4 in FIG. 2.

FIG. 5 is a view similar to FIG. 3 but showing the parts in a moved position.

FIG. 6 is an enlarged fragmentary perspective view of the principal mechanisms used in the drawing-in operation.

FIG. 7 is a fragmentary top view of the machine.

FIG. 8 is an enlarged fragmentary perspective view of one of the mechanisms used in the drawing-in operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings for purposes of illustration,

the invention may be performed by a warp drawing-in machine in which threads **10** of yarn are drawn through the weaving elements of a loom (not shown) by a reciprocating needle **11** (FIG. **6**). As is customary inn the art, the weaving elements include a plurality of drop wires **12**, heddles **13** in a frame **14**, and a reed **15**. The threads may also be drawn through lease strings **16** and **17** (FIG. **6**). The weaving elements, together with the lease strings, constitute a unit which is held in the warp drawing-in machine while the warp threads are drawn in and, thereafter, this unit is transported to and mounted on a loom.

More specifically, the weaving elements are mounted on a truck **18** which, as is well known in the art, is movable on tracks (not shown) to be moved toward the frame **19** and is locked in a fixed position relative to the frame of the machine during the drawing-in operation. Thereafter, the truck is separated from the machine and the weaving elements are transferred to a transport truck (not shown) to carry the elements to a loom. Adjacent each end of the truck **18** is an arm **20** which carries a horizontal bar **21** extending generally from the front of the machine toward the back and the heddle frames **14** are suspended from these bars and locked in position in the customary manner. On the front portions of the bars are U-shaped supports **22** for the drop wires **12** and the reed **15** is mounted on a support **23** on the frame. During the drawing-in, the lease strings **16** and **17** are supported by tying the ends to any suitable part of the frame **19** and, after the drawing-in is completed, they are untied from the frame and the adjacent ends of the strings are tied together for transporting.

A carriage **24** is mounted on the frame **19** to move from one end of the latter to the other and carry the reciprocating needle **11** along the weaving elements whereby the needle draws successive threads of yarn through these elements. At the rear of the carriage at each end of the latter are wheels **25** (FIGS. **1** and **7**) which ride on a track **26** on the frame **19** and spaced rollers **27** journaled on the carriage to turn about vertical axes engage the side of the track so that the carriage moves in a straight line. A second set of wheels **28** are journaled on the front of the carriage and ride on a second track **29** on the frame. The carriage **24** is advanced along the frame by a feed motor **30** (FIG. **7**) which, through a speed reducer **31**, drives a pinion **32** engaging a rack **33** on the track **26**. The motor is energized and deenergized to step the carriage along the frame under the control of a mechanism **34** which is responsive to the opening of successive dents in the reed **15**, this control being disclosed in Wieneke U.S. Pat. No. 2,807,861, issued Oct. 1, 1957.

The needle **11** is an elongated flexible metal strip with a hook **35** (FIG. **6**) formed on its projecting or outer end. In its withdrawn position, the needle is disposed within semi-circular housing **36** (FIGS. **1** and **7**) with the needle against the arcuate track **37** of the housing and the hook **35** behind the reed **15**. The inner end of the needle is attached to the outer end of a horizontal arm **38** which turns about an axis *a* which is the center of the arcuate track **37**. When the arm **38** is turned counterclockwise as viewed in FIG. **7**, the needle is projected through a dent in the reed **15**, a selected heddle **13**, one of the drop wires **12** and between the lease strings **16** and **17**. In the projected position of the needle, the latter is supported by a channel-shaped

guide 39 (FIG. 6) and the hook 35 engages a thread of yarn which, as will be described more in detail later, is positioned for engagement by the needle by a spiral cam 40 rotatably mounted on the carriage. As the arm 38 is turned in the opposite direction, the thread is drawn over a horizontal guide 41 on the truck 18, through the lease strings and weaving elements. The arm is turned back and forth by a main drive motor 42 (FIG. 7) mounted on the carriage 24 through a shaft 43 and mechanism (not shown) well known in the art.

Journaled in a horizontal row on arms 44 (FIG. 1) of the carriage 24 are worms 45, there being one worm for each heddle frame 14. Before the needle 11 is projected each time, a selected one of the worms is turned depending upon the pattern to be woven by the loom to twist the next free heddle in the associated frame through 90° to present the hole 46 in the heddle (FIG. 6) to the needle. Similarly, worms 47 are carried by the carriage with one associated with each rank of drop wires 12, there being four ranks in the illustrated embodiment. Again, before the needle is projected, one of the worms 47 twists an associated drop wire to present the hole 48 (FIG. 6) in the latter to the needle, it being customary to present drop wires from successive ranks in repeating order upon successive projections of the needle. As is well known in the art, the main drive motor 42 turns selected ones of the worms 45 and 47 for each reciprocation of the needle through a pattern control mechanism 50 (FIG. 7).

At the beginning of the drawing-in, one of the lease strings 16 and 17 is above the other so that the needle 11 passes between the strings and draws the thread of yarn under one string and over the other. With the parts in the position shown in FIG. 6, the needle will draw the next thread of yarn under the string 16 and over the string 17. Before the next thread is drawn in, the string 16 is lowered and the string 17 is raised so that this thread passes under the string 17 and over the string 16. The positions of the strings are reversed between each reciprocation of the needle and thus the lease strings keep the warp threads separated and in proper sequential order.

To move the lease strings 16 and 17 up and down, the latter are threaded through holes in the upper ends of upright arms 51 and 52 (FIG. 6) respectively and the arms reciprocate vertically between rollers 53 journaled on an arm 54 of a block 55 which is mounted on the carriage 24. Followers 56 and 57 carried on the lower ends of the arms ride respectively on cams 58 and 59 fast on a shaft 60 which, through suitable mechanism (not shown) is turned by the main drive motor 42, the followers being held down against the cams by contractile springs 61 acting between the carriage and the arms 51 and 52. The rises 62 and 63 on the cams 58 and 59 are angularly spaced apart 180° to raise one lease string while the other is lowered.

With the foregoing arrangement, the carriage 24 initially is positioned at the left end of the frame 19 as viewed in FIG. 7 with the needle 11 in its retracted position within the housing 36. The first dent in the reed 15 is opened, the motor 42 through the pattern control mechanism 50 turns a selected one of the worms 45 and a selected one of the worms 47 to twist the proper heddle and drop wire, the cams 58 and 59 space the lease strings 16 and 17 vertically, and the spiral cam 40 positions a thread of yarn for engagement by the needle. The motor 42 then turns the arm 38 to project the needle through the opened reed dent and the twisted heddle and drop wire, between the lease strings and into engagement with the thread with the latter in the hook 35. The arm 38 then is swung in the opposite direction to retract the needle and draw the thread between the lease strings and through the selected drop wire and heddle and the open reed dent. A stripper 64 (FIG. 1) then swings in a manner well known in the art to remove the end of the thread from the needle hook 35. Next, the feed motor 30 steps the carriage 24 to the right to aline the hook of the needle with the next reed dent which is opened while the positions of the lease strings are reversed and a second heddle and the next drop wire are positioned and twisted. The needle then is projected and retracted to draw in a second thread and the cycle is repeated until all the threads have been drawn in. It should be understood that the functions described occur at high speed and movement of the carriage across the frame is virtually continuous.

It has been the practice to mount not only the weaving elements on the truck 18 but also the warp beam (not shown) and, after the drawing-in is completed, to transfer the beam as well as the weaving elements to the transport truck, and transport all to the loom. With large warp beams, this presents problems such as transporting the elements and the warp beam along narrow aisles and through doors and it is impractical to transport the assembly from one plant to another. To overcome these disadvantages, the present invention contemplates a novel method by which short pilot threads are drawn through the weaving elements which then, with these threads, are transported to the loom independently of the warp beam. At the loom, each thread of yarn on the warp beam is tied to the end of the corresponding pilot thread and the pilot threads are then used to pull the threads on the warp beam through the weaving elements. If the pilot threads are leased as described above, this tying may be performed automatically by a warp tying machine even in cases such as when a color pattern is to be woven.

Because color has no significance as regards the pilot threads, the latter may be cut from a single package 65 (FIG. 1) of undyed yarn, the package conveniently being mounted on a horizontal arm 66 on a vertical support plate 67 suitably secured to the carriage 24 to move with the latter. According to the novel method, yarn is pulled off the package 65 and up through the spiral cam 40 where it is engaged by the needle 11 and drawn between the lease strings 16 and 17 and the weaving elements 12, 13 and 15. The thread of yarn is cut leaving a short free end 68 which is held temporarily in a conventional card bar 69 (FIG. 1) on the frame 19. As the thread is cut, the new end of the yarn on the package is gripped and the process is repeated.

To carry out this method, two shear-clamp assemblies 70 and 71 are carried by an endless chain 72 which is disposed in front of the machine and in a plane parallel to the path of movement of the carriage. The chain is trained over an idler sprocket wheel 73, which is journaled on the plate 67 adjacent the upper end thereof, and around a driven sprocket wheel 74 disposed near the bottom of the plate. The latter is fast on a shaft 75 (FIG. 2) which is driven by the motor 42 (FIG. 7) through shafts 76 and 77, sprockets 77', a chain 77'' (FIG. 1) and a gear box 78. The shear-clamp assemblies 70 and 71 are equally spaced along the

chain **72**, that is, they are spaced apart the same distance in both directions along the chain.

The shear-clamp assemblies **70** and **71** are identical in construction and, as shown in FIGS. **3** and **5**, each includes stationary first fingers **79** and **80** which guide the yarn from the package **65** between second fingers **81** and **82** mounted respectively in front of the fingers **79** and **80**, the finger **81** being stationary and the finger **82** being swingable toward and away from the fingers **79** and **81**. As is customary in assemblies of this type, an axial compression spring **82'** (FIG. **8**) holds the finger **82** either in the closed position shown in FIG. **3** or in the open position illustrated in FIG. **5**. As the finger **82** swings toward the finger **81**, it first clamps the yarn against this finger and then cooperates with the finger **79** to shear the yarn leaving the short thread drawn through the weaving elements while the fingers **82** and **81** still grip the new free end of the yarn on the package **65**. Thus, the fingers **81** and **82** constitute the clamp of the assembly and the fingers **79** and **82** coact as shears. Mounted on the plate **67** beneath the sprocket wheel **74** is a stationary cam **83** which engages and swings the finger **82** of each shear-clamp assembly toward the fingers **79** and **81** and also on the plate adjacent the sprocket wheel **73** is a stationary cam **84** which engages and swings the finger **82** back to the open position. Thus, the shear-clamp assemblies are open as each moves down the inactive run **85** (FIG. **2**) of the chain **72** and are closed as they move up the active run **86**. As an assembly moves up the active run, it draws yarn from the package **65**, the yarn extending from the package around a tension roller **87** on the arm **66** to the shear clamp.

To support the spiral cam **40** in the carriage **24**, the cam is fast on one projecting end of a shaft **88** (FIG. **6**) which is journaled in spaced bearing members **89** integral with a mounting block **90** fastened to the plate **67**. The cam **40** is turned in timed relation to the operations of the other mechanisms by the motor **42** through a sprocket wheel **91** (FIG. **2**) which is secured to the same shaft **75** as is the sprocket wheel **74**. An endless chain **92** is trained around the sprocket wheel **91** and a sprocket wheel **93** journaled on the plate **67** adjacent the spiral cam (See FIG. **6**). A shaft **94** keyed to the sprocket wheel **93** and journaled in an arm **95** on the block **90** carries a conical gear **96** meshing with a conical gear **97** on the other end of the shaft **88** thus completing the drive of spiral cam **40**.

In order to hold each pilot thread as the upper end portion of the thread is being drawn in by the needle **11**, the thread is gripped below the needle by a stationary clamp **98** (FIGS. **4** and **6**). Herein, the clamp includes a horizontal fixed jaw **99** which is on one end of the block **55**, the latter being fastened to the edge of the plate **67**. The movable jaw **100** of the clamp **98** is carried on the end of one arm **101** of a bell crank lever **102** which is journaled in a bracket **103** to turn about a vertical axis, the bracket being mounted on the plate **67**. A rod **104** projects horizontally from the other arm **105** of the lever **102** and into a slot **106** in the lower arm **107** of a second bell crank lever **108** which is fulcrumed between its ends on portion **109** of the block **90** to swing about a horizontal axis. A follower roller **110** on the other arm **111** of the lever **108** rides on a cam **112** which is fast on a shaft **113** journaled in the block portion **109**. Also fast on the shaft **113** is a spur gear **114** which meshes with a pinion **115** keyed to the shaft **88**. A contractile spring **116** connected at one end to an anchor **117** on the plate **67** and at the other end to a pin **118** on the lever arm **107** biases the clamp **98** toward its open position and holds the follower **110** against the cam **112**. By turning the cam through the same drive used for the other mechanisms, the clamp **98** is opened and closed in the proper timed relation to the operations of these other mechanisms.

As is customary in warp drawing-in machines, a stripper **119** (FIG. **6**) operates after a thread has been drawn in to move that thread and its associated heddles **13** and drop wire **12** to the left as viewed in FIG. **6** to make room for the next thread to be drawn in. The stripper is an upright arm secured to a shaft **120** conveniently mounted on the carriage **24** with its upper end portion normally to the right of the path of the needle **11**. Legs **121** project downwardly from the shaft **120** at an angle to each other and carry follower rollers **122** which straddle a cam **123** on the camshaft **60**. The rotation of the camshaft is timed so that, together with the shape of the cam, the stripper arm **119** is momentarily swung to the left and then back as the needle reaches its retracted position. The stripper **119** operates in conjunction with the usual strippers **119'** (FIG. **1**).

Another stripper **124** (FIGS. **1** and **8**) is operable after each pilot thread is cut from the package **65** to place the lower end of that thread in the card bar **69**. In the form illustrated, this stripper is a horizontal arm with its inner end fixed to a vertical shaft **125** driven from the gear box **78** so that this stripper also functions in the proper timed relation to operations of the other mechanisms. The stripper **124** is disposed in a plane just below the card bar and normally projects forwardly as illustrated in solid lines in FIG. **8** with a hook **126** on its outer end behind the thread **10** being drawn in. As this thread is cut from the supply package, the stripper swings to the left toward and then under the card bar as shown by the broken line positions, the hook **126** carrying the thread into the card bar. Preferably, a horizontal felt pad **127** is disposed slightly beneath the stripper so that the latter retains control of the thread as it swings. The pad may be mounted on the plate **67** by means of a bracket **128**. When the stripper has placed the thread in the card bar, it continues to swing in the same direction until it is back to its starting position, it being understood that the stripper turns continuously during the drawing-in.

Although the operation is described below as a sequence of steps, it will be apparent that some steps occur concurrently and some overlap. A cycle begins with one of the shear-clamp assemblies such as the assembly **70** being closed by the cam **83** when the assembly is in the broken line position shown in FIG. **2**. As a result, this assembly grips the end of the yarn on the package **65** and draws the yarn up along the active run **86** of the chain **72**. The yarn passes between the jaws **99** and **100** of the stationary clamp **98** and through the spiral cam **40**. During this time, the first dent of the reed **15** has been opened, the selected heddle **13** and drop wire **12** have been positioned and twisted and the needle **11** is advancing through these elements and between the lease strings **16** and **17**. By the time the needle is fully projected, the spiral cam **40** has turned sufficiently to lay the yarn over the needle as illustrated in broken lines in FIG. **6** so that the yarn will be engaged by the hook **35**. As the needle begins to retract, the shear-clamp assembly **70** approaches the cam **84** which

opens the finger **82** of this assembly thereby releasing the yarn end. At about the same time, the cam **112** closes the stationary clamp **98** which grips and holds the yarn until the free portion of the yarn above the clamp **98** has been drawn over the guide **41,** between the lease strings **16** and **17,** through the selected drop wire **12** and heddle **13,** through the reed **15** and is stripped from the needle by the stripper **64** after which the cam **112** reopens the clamp **98.** When this has been completed, the cam **123** swings the stripper arm **119** to the left to clear the yarn just drawn in and the associated drop wire and heddles for the next drawing-in.

In the meantime, the other shear-clamp assembly **71** has been traveling down the inactive run **85** of the chain **72** in the open position. Shortly after the shear-clamp assembly **70** has been opened, the shear-clamp assembly **71** moves to the position originally occupied by the assembly **70** (broken line position in FIG. **2**). At this point, the cam **83** swings the finger **82** of this assembly toward the fingers **79** and **81.** This results in the portion of yarn which has just been drawn in being cut from the supply package **65** leaving a short thread drawn through the lease strings **16** and **17** and the weaving elements. At the same time, the assembly **71** grips the new free end of the yarn on the package **65.** After being severed, the end of the short thread is swept into the card bar **69** by the stripper **124.**

As the shear-clamp assembly **71** begins to carry the new free end of the yarn on the package **65** up the run **86,** the cams **58** and **59** reverse the positions of the lease strings **16** and **17,** a newly selected heddle **13** and the next drop wire **12** are positioned and twisted, the second dent in the reed **15** is opened, and a second short thread is drawn in in the same manner as the first. The process is repeated, using the shear-clamp assemblies **70** and **71** alternately, until the required number of short threads have been drawn in. When this has been completed, the lease strings **16** and **17** are untied from the frame **19** and the strings are tied together at both ends. Then, the truck **18** is disconnected from the frame and the weaving elements with the short threads are transferred to the transport truck and are transported to a loom where the loose ends of the short threads **10** are tied to corresponding threads of a warp beam. If the short threads have been leased, as has been described, this tying may be performed automatically by a tying machine and the warp threads will be tied in the proper order. The lease strings then are untied and removed and the short pilot threads **10** are used to pull the threads on the warp beam through the weaving elements.

It will be observed that, with the novel method of the present invention, the transport truck can be comparatively small because it does not carry a warp beam or other simple transport means may be used. Thus, the transport truck is easily transported along aisles, through doors and even to distant locations. Moreover, the method may be performed with little attention of an operator.

We claim as our invention:

1. In a method of initially drawing threads of yarn from a warp beam through the successive sets of the weaving elements of a loom, the steps of, drawing a short pilot length of yarn through the first set of weaving elements separated from the loom and warp beam while leaving an end portion of the yarn exposed in front of said elements, and similarly threading a short pilot length of yarn through each of the other sets of weaving elements.

2. The method as defined in claim **1** including the step of tying the threads on a warp beam to said short pilot lengths of yarn.

3. The method as defined in claim **1** in which the short pilot threads of yarn are leased as they are drawn through the weaving elements.

4. A method as defined in claim **1** in which each of said short pilot lengths of yarn is drawn from a single package and severed from the package after being drawn through its respective set of weaving elements.

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