Dec. 24, 1940. E. NADEAU 2,226,069

SHUTTLELESS LOOM

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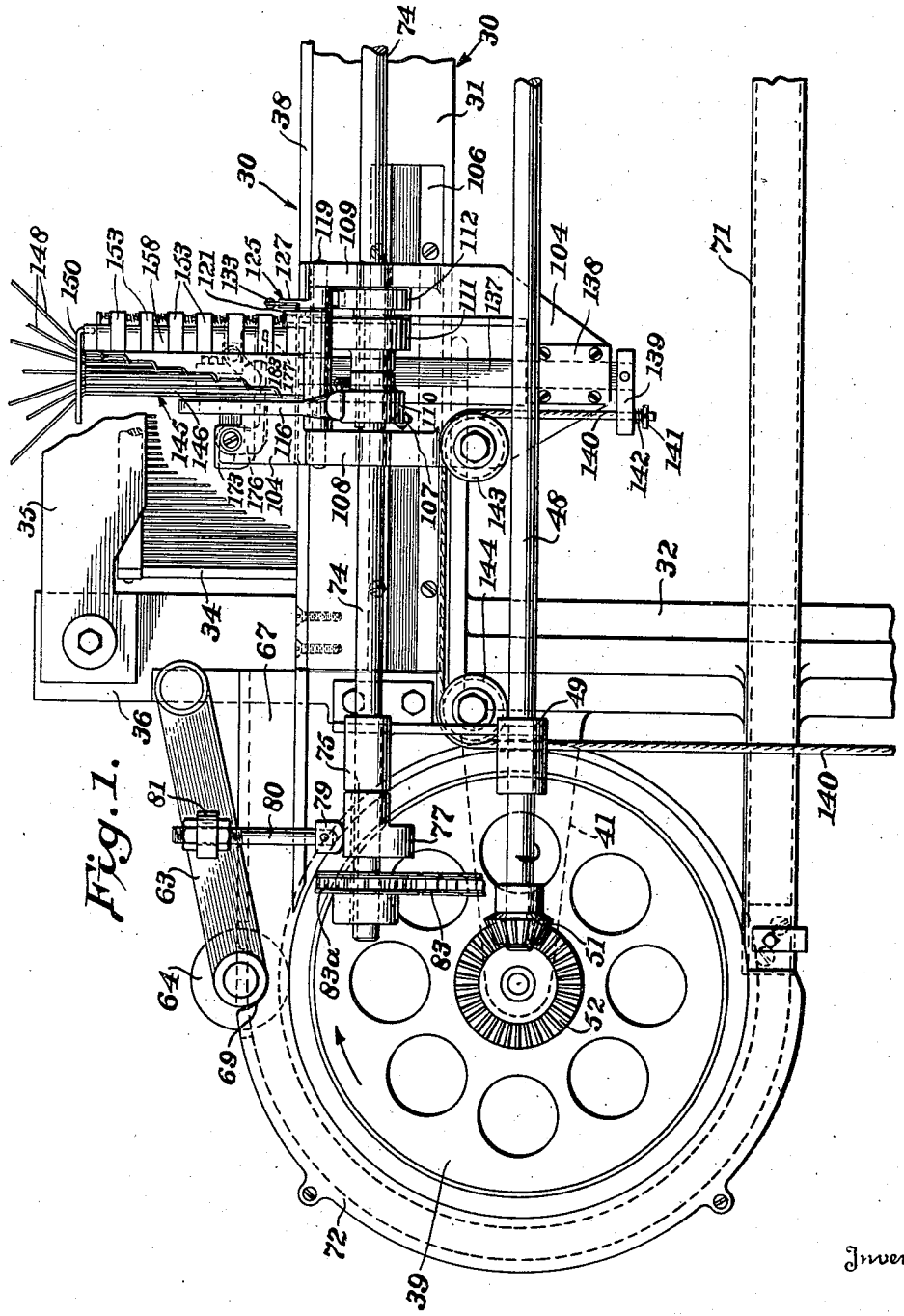


Fig. 1.

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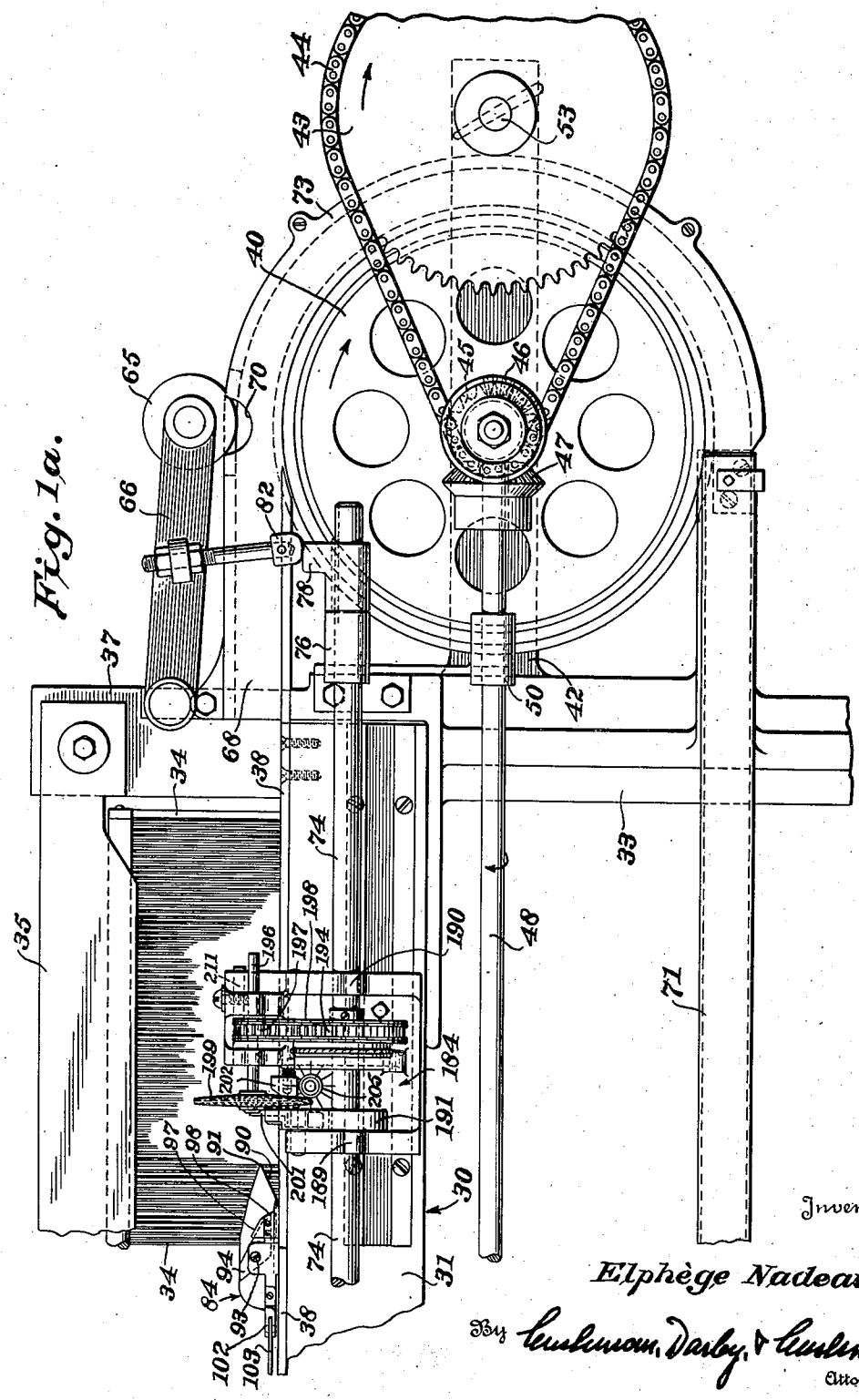
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SHUTTLELESS LOOM

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Fig. 1a.



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SHUTTLELESS LOOM

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Fig. 2.

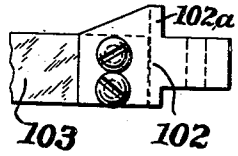


Fig. 3.

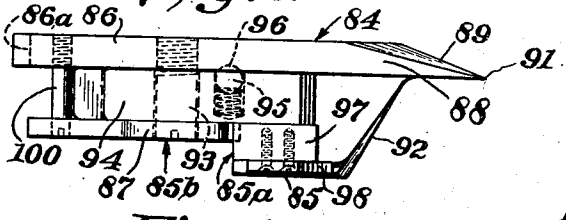


Fig. 4.

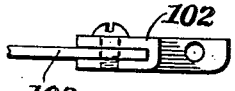


Fig. 5.

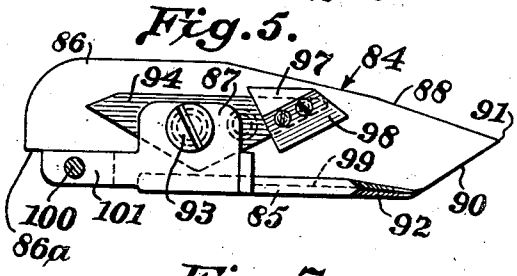


Fig. 6.

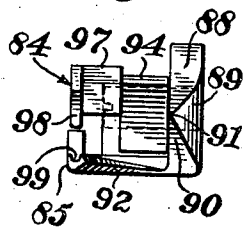


Fig. 7.

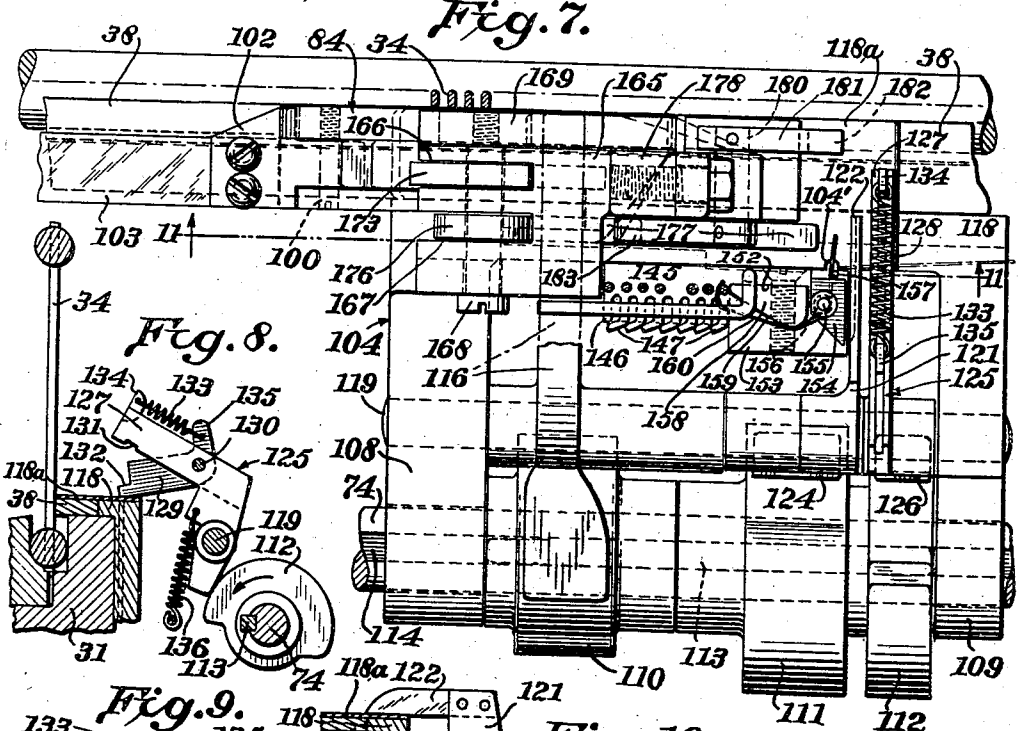


Fig. 8.

Fig. 9.

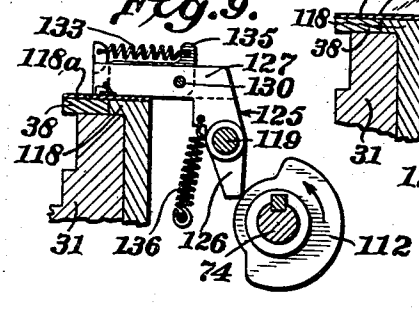
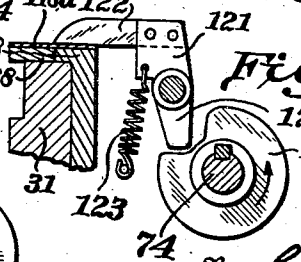


Fig. 10.



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SHUTTLELESS LOOM

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Fig. 11.

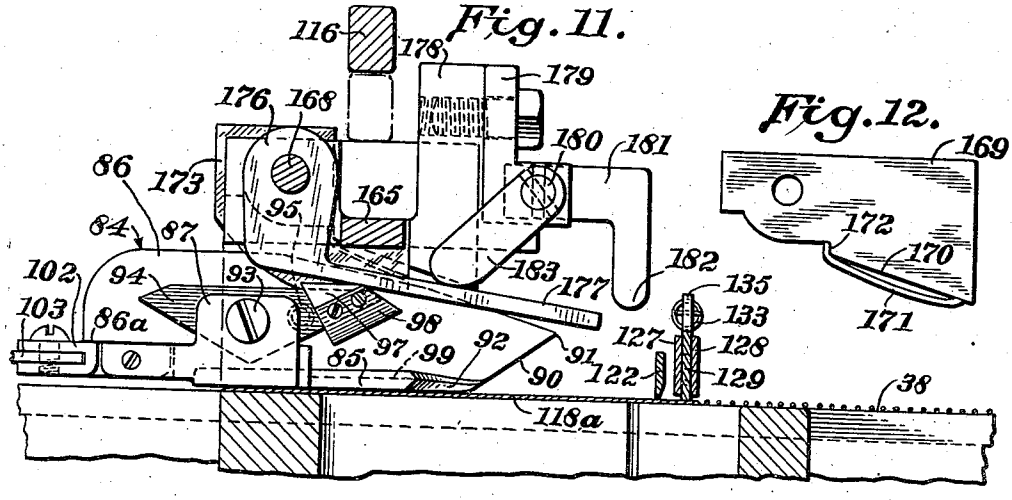


Fig. 12.

Fig. 13.

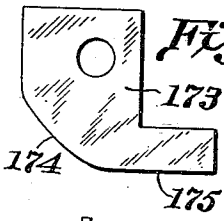


Fig. 15.

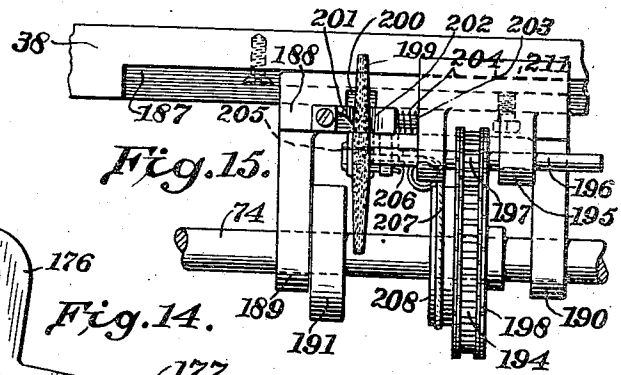


Fig. 16.

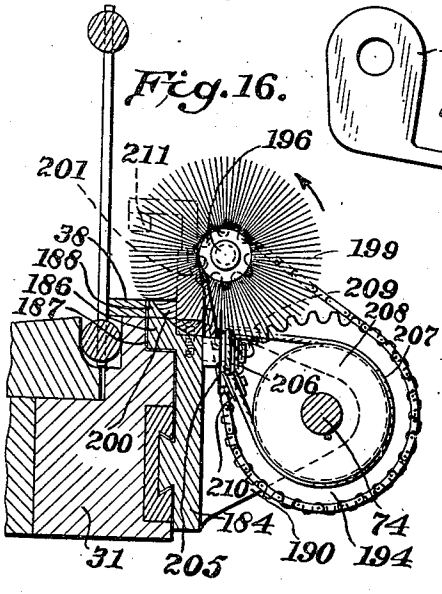
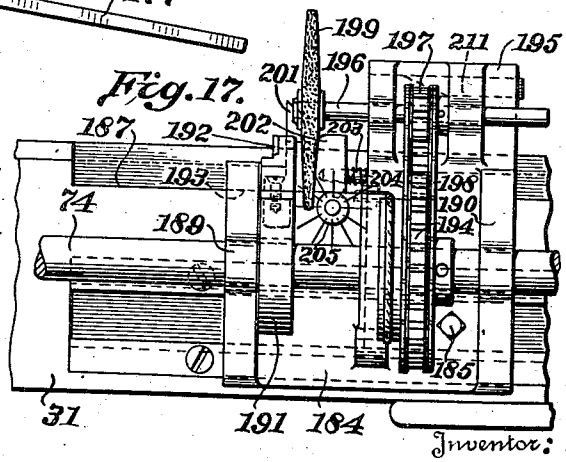


Fig. 14.

Fig. 17.



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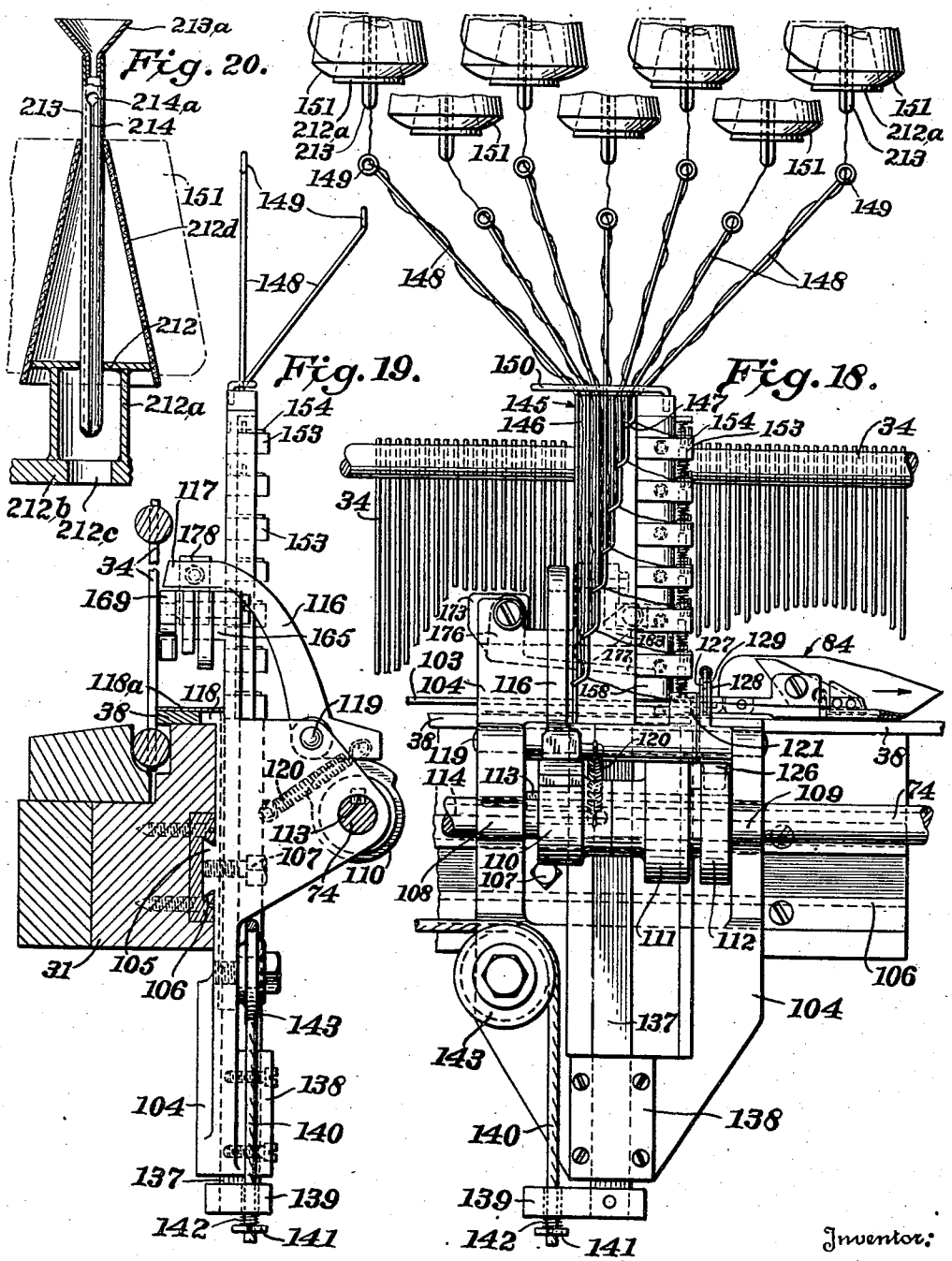
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Dec. 24, 1940. E. NADEAU 2,226,069

SHUTTLELESS LOOM

Filed Dec. 14, 1939 8 Sheets-Sheet 5



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SHUTTLELESS LOOM

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Fig. 22.

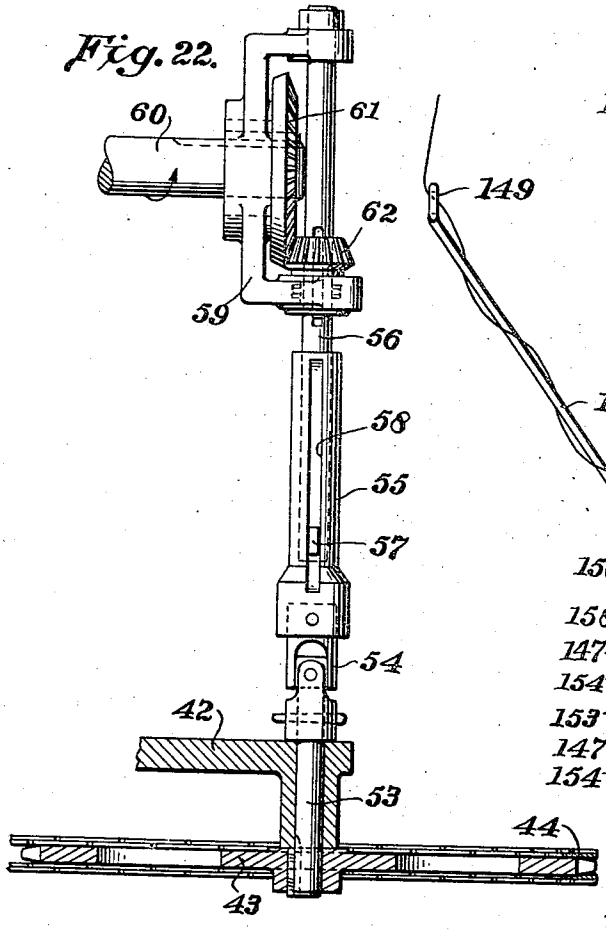


Fig. 21.

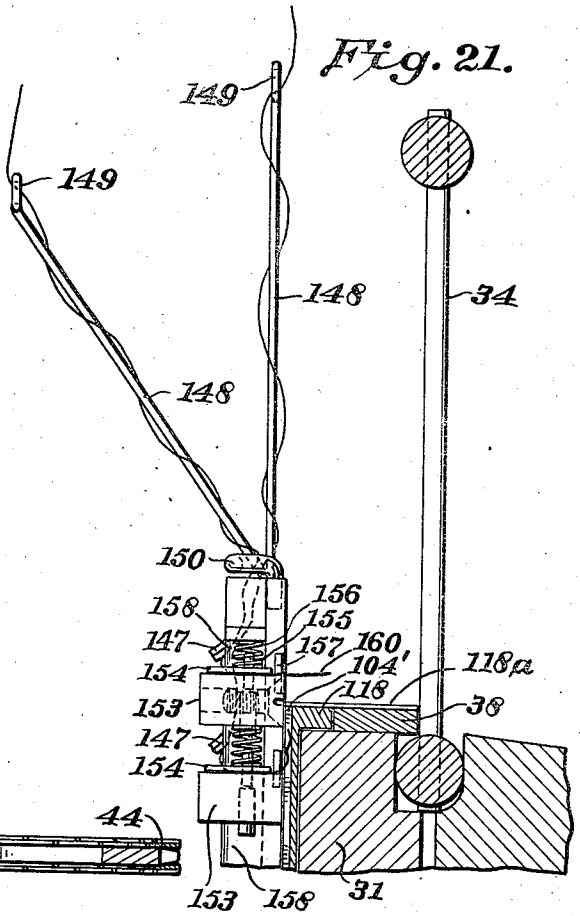
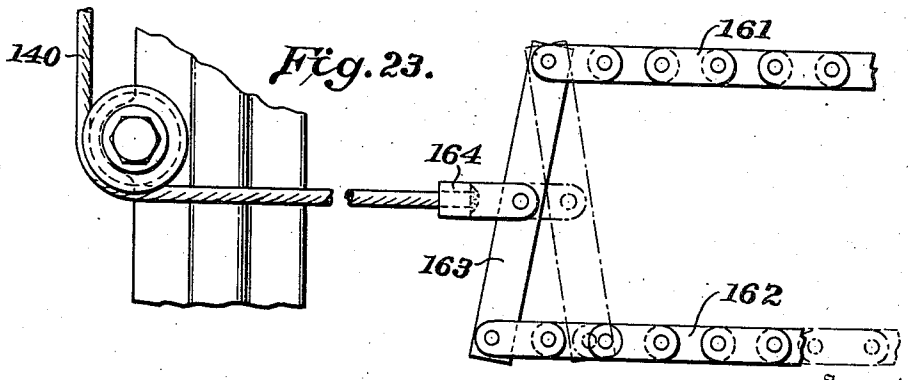


Fig. 23.



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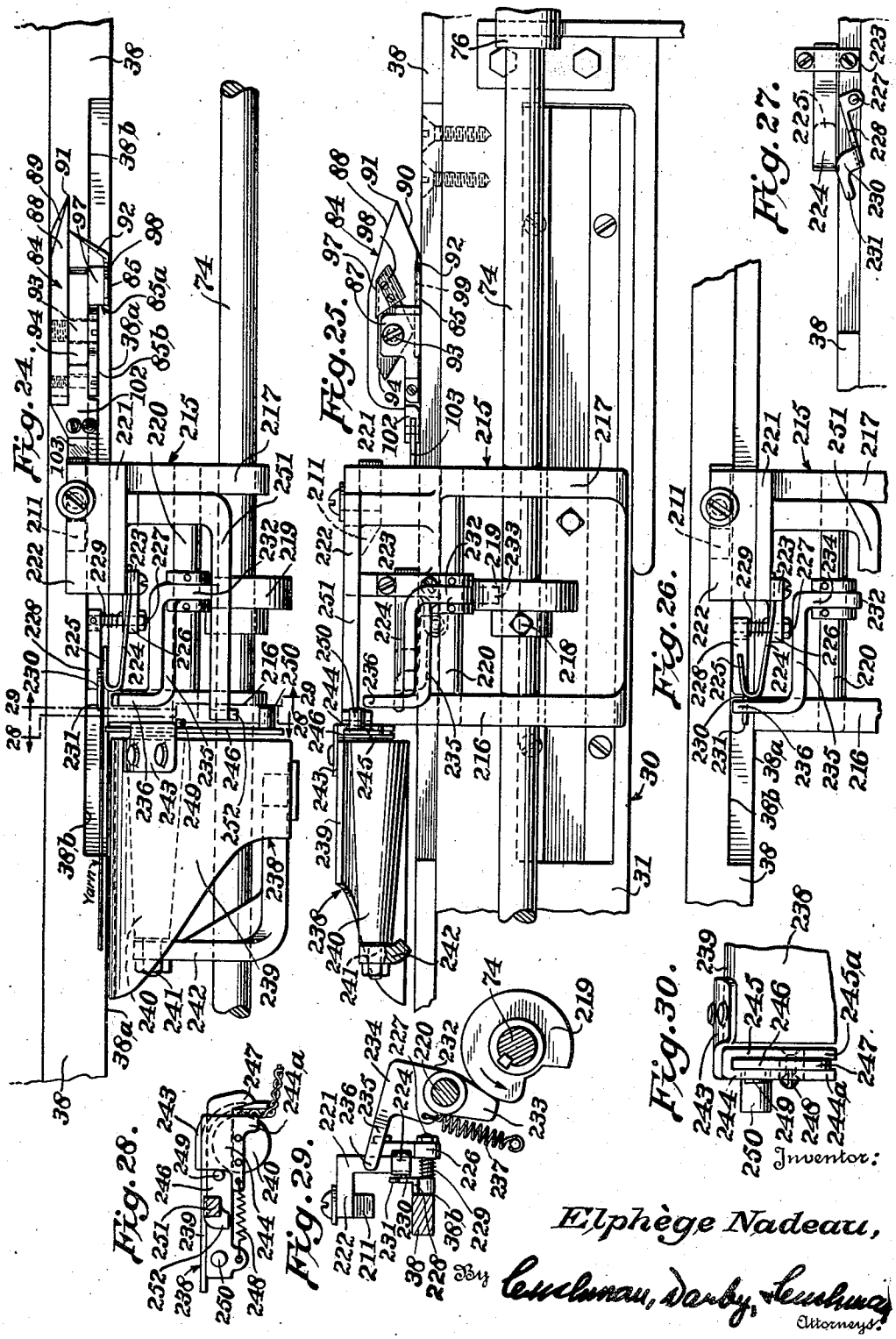
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Dec. 24, 1940. E. NADEAU 2,226,069

SHUTTLELESS LOOM

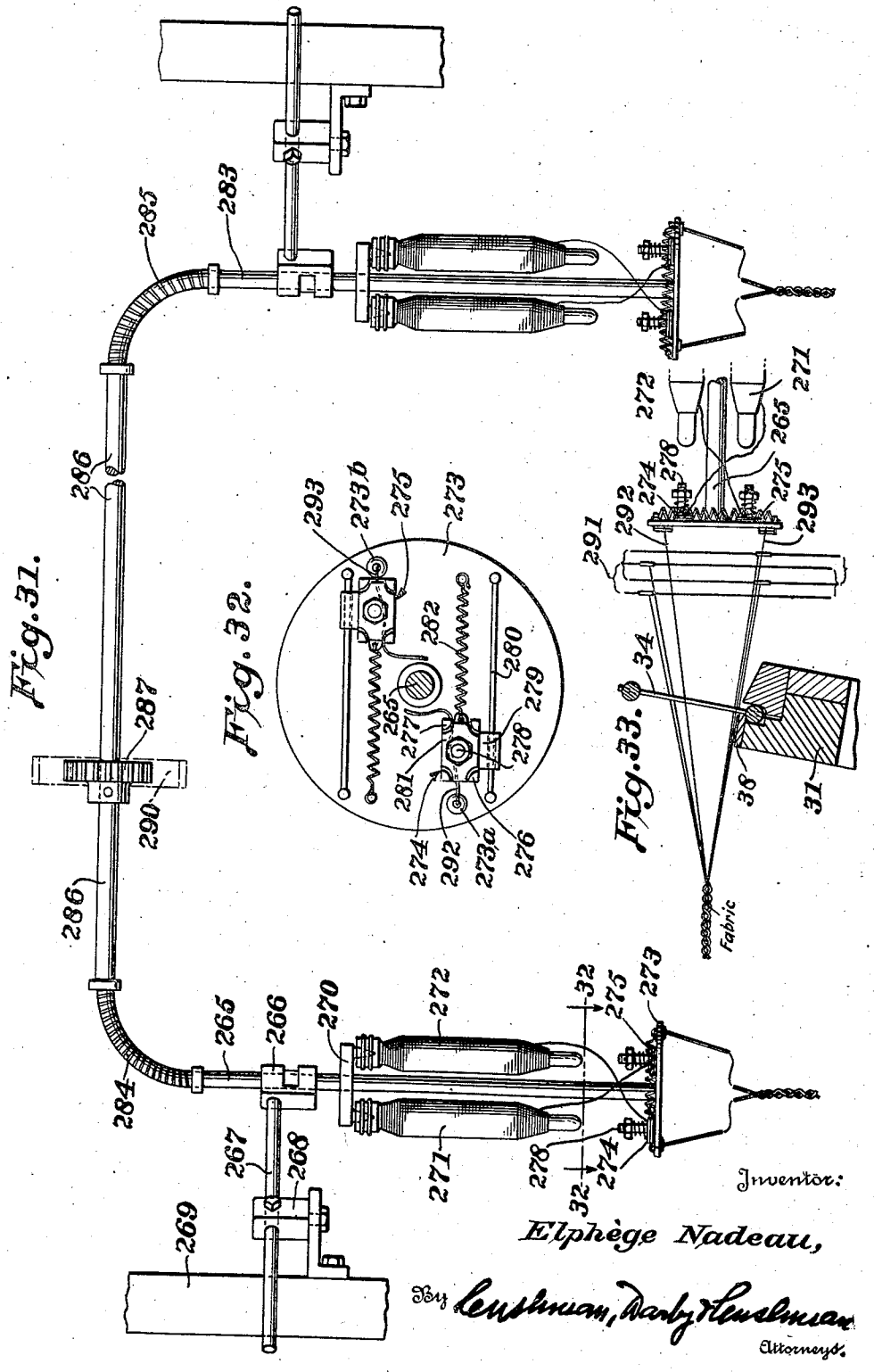
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SHUTTLELESS LOOM

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Patented Dec. 24, 1940 2,226,069

UNITED STATES PATENT OFFICE

2,226,069

SHUTTLELESS LOOM

Elphège Nadeau, Woonsocket, R. I., assignor of one-half to Dunn Worsted Mills, Woonsocket, R. I., a corporation of Rhode Island

Application December 14, 1939, Serial No. 309,288

23 Claims. (Cl. 139—127)

This invention relates particularly to looms of the shutterless type and has as an object to provide such a loom wherein the insertion of the weft yarn is effected with smoothness and rapidity with the picks evenly tensioned, and wherein attendant operations are carried out with precision by simple mechanisms. Another object, and an important one, is to provide a shutterless lay unit which may be readily substituted for the lay unit of the conventional loom. As illustrating the manner of achievement of the various objects of the invention I have shown in the accompanying drawings a practical embodiment of the invention to which I shall refer in order that the various novel features involved may be well understood.

In the drawings:

Figure 1 is a front elevation of the left hand portion of the new apparatus.

Figure 1*a* is a front elevation of the right hand portion of the same.

Figure 2 is a plan view of the leading portion of a propelling element for a yarn carrier or conveyor.

Figure 3 is a plan view of the carrier.

Figure 4 is a side elevation of the leading portion of the propelling element.

Figure 5 is a side elevation of the carrier.

Figure 6 is a front elevation of the carrier.

Figure 7 is a plan view of carrier controlling mechanism and yarn feeding, holding and cutting mechanism.

Figure 8 is a partial section through the lay showing the yarn holding mechanism of Figure 7 in open position.

Figure 9 shows the said yarn holding mechanism in closed position.

Figure 10 is a partial section through the lay showing the cutter of Figure 7 in elevation.

Figure 11 is a section substantially on line 11—11 of Figure 7.

Figures 12, 13 and 14 show details of the carrier control elements in elevation.

Figure 15 is a plan view of yarn arresting and tensioning mechanism which appears also in Figure 1*a*.

Figure 16 is a partial section through the lay showing the yarn arresting and tensioning mechanism in elevation.

Figure 17 is an elevation of the yarn arresting and tensioning mechanism as seen from the front of the lay.

Figure 18 is an elevation of the yarn feeding mechanism as seen from the front of the lay.

Figure 19 is a section through the lay showing the yarn feeding mechanism as seen from the left of Figure 18.

Figure 20 shows a means for drawing yarn from a package.

Figure 21 is a partial section through the lay showing a portion of the yarn feeding mechanism as seen from the right of Figure 18.

Figure 22 shows transmission means for driving some of the lay mechanisms from the loom crank shaft.

Figure 23 is an elevation showing, in part, means for controlling the yarn feeding mechanism.

Figure 24 is a plan view of another form of yarn arresting and severing mechanism.

Figure 25 is an elevation of the mechanism of Figure 24.

Figure 26 is a partial plan view similar to Figure 24 but showing parts in different relation.

Figure 27 is a partial elevation similar to Figure 25 but showing parts in different relation.

Figure 28 is a section substantially on line 28—28 of Figure 24.

Figure 29 is a section substantially on line 29—29 of Figure 24.

Figure 30 is a fragmentary view of severing mechanism shown in Figures 24 and 25.

Figure 31 is a plan view of listing mechanism.

Figure 32 is a section substantially on line 32—32 of Figure 31, and

Figure 33 is an elevation, with parts in section and other parts diagrammatically shown, indicating the relation of the listing mechanism to the lay and harness.

Referring to the drawings, reference numeral 30 generally designates the lay which includes essentially a cross portion 31 and swords 32 and 33, Figures 1 and 1*a*. The swords are conventionally spaced and have fittings (not shown) at their lower ends by means of which they may be mounted in a conventional loom frame so that the lay of the present invention is readily substitutable for the conventional lay. The reed 34 is supported between the cross portion 31 and an upper transverse member 35 whose ends are secured to upward frame extensions 36 and 37.

Secured on top of cross member 31 is a race plate 38 whose extremities are close and substantially tangential to the upper portions of wheels 39 and 40 suitably journaled on lateral frame extensions 41 and 42. Wheels 39 and 40 are peripherally surfaced with material such as semi-hard rubber. The extension 42 rotatably supports a sprocket 43 which is connected by a chain 44 with a sprocket 45 secured coaxially to wheel

40. Coaxial with sprocket 45 and fixed thereto, is a bevel gear 46 which engages a bevel gear 47 fixed on one end of a shaft 48 which is supported in bearings 49 and 50. At its other end shaft 48 has fixed thereto a bevel pinion 51 which engages a bevel gear 52 coaxial with and secured to wheel 39.

Sprocket 43, Figure 22, is fixed on one end of a shaft 53 to whose other end is secured one part of a universal joint 54, the other part of the joint being secured to a sleeve 55 in which is telescopically received one end of a shaft 56. The shaft 56 has fixed thereon a lug 57 which is slidable in a longitudinal slot 58 in sleeve 55. The other end of shaft 56 is journaled in a bracket 59 which is carried freely on one end of the loom crank shaft 60. A bevel gear 61 fixed on the crank shaft engages a bevel pinion 62 fixed on shaft 56.

In view of the above described connections, sprocket 43 is enabled to be driven from the loom crank shaft which is positionally fixed, whereas sprocket 43 oscillates with the lay. The extensible driving connection 55, 56 provides for the movement of the lay toward and away from crank shaft 60, this in conjunction with the universal joint which takes care of the arcuate phase of the lay movement. Rotation of sprocket 43 causes wheel 40 to be driven in the direction of the arrow, Figure 1a, and likewise through the above mentioned intermediate connections, causes wheel 39 to be driven in the direction of the arrow, Figure 1. Bevel gears 46 and 47, as here shown, are of equal size, whereas bevel pinion 51 is considerably smaller in diameter than bevel gear 52. It therefore follows that wheel 39 is rotated at a substantially slower speed than wheel 40.

Pivoted on extension 36, Figure 1, is an arm 63 which carries a roller 64, of substantial weight, adapted to roll on the top of wheel 39. A similar roller 65, Figure 1*a*, carried by a pivoted arm 66, is adapted to roll on the top of wheel 40. Inverted channel members 67 and 68, Figures 1 and 1*a*, rest on the ends of race plate 38 and their top walls are apertured to permit movement of rollers 64 and 65 toward and away from wheels 39 and 40. Cut-outs 69 and 70 in the channel side walls provide clearance for bearing boxes at the extremity of arms 63 and 66. A tunnel member 71, ordinarily in the form of a square tube, is secured to the swords below and in parallel relation to the cross portion 31 with its upper wall substantially tangential to the bottoms of the wheels 39 and 40. The left hand end of member 71 is joined with the left end of channel 67 by means of a substantially semi-circular guard 72 of channel section open toward wheel 39 and, the right hand end of member 71 is joined with the right hand end of channel 68 by means of a similar substantially semi-circular guard 73.

A timing shaft 74 is journaled at its ends in bearings 75 and 76 above shaft 48 and has fixed thereon cams 77 and 78. Cam 77 cooperates with a follower 79 on the end of a rod 80 which is fixed in an ear 81 on arm 63 and is longitudinally adjustable relative to the latter by means of the clamp nuts shown. A follower 82 similarly associated with arm 66 cooperates with cam 78. The loom crank shaft is sprocketed to a double sprocket (not shown) rotatable on the rocking axis of the lay, the second sprocket of the double sprocket being connected by a chain 83 with a sprocket 83*a* on the left hand end of shaft 74. Shaft 74 is rotated at the same speed as the crank shaft.

The yarn carrier, generally designated by reference numeral 84, is shown in Figures 1*a*, 3, 5, 6, 11 and 18. It is in the form of a metal block having a bottom wall 85, a side wall 86 and an opposite side portion 87. At its forward end the side wall 86 has a forwardly and downwardly inclined surface 88 laterally beveled at 89 and forwardly and upwardly inclined at 90 to a point 91. The forward edge of the bottom surface 85 is rearwardly and laterally inclined and beveled top and bottom to provide an oblique edge 92. The bottom surface projects outwardly beyond wall portion 87 so that a shoulder 85*a* is provided behind which is a recess 85*b*. Pivoted between wall portions 86 and 87 by means of a screw 93 is a substantially triangular lever 94 which carries a spring pressed ball detent 95 engageable in top and bottom indentations, as at 96, in the inner face of side wall 86 to hold the lever 94 in its upper and lower limits of swing. In Figure 5 the lever is shown in its upper limit and in Figure 18 in its lower limit. Secured to the forward end of lever 94 through spacer block 97 is a piece of stiff leather or other similar material 98 which, in the position of parts shown in Figure 18, is closed laterally engaged in a longitudinally extending groove 99 formed in the leading portion of the bottom wall 85. The lower straight edged portion of member 98 constitutes a tongue which has contact substantially throughout its length with at least the sides of groove 99 when the parts are in the position of Figure 18. By mechanism to be hereinafter described, the tongue is caused to depress a suitably disposed yarn end into the groove 99 so that the end is securely gripped between the thus constituted jaws to enable it to be drawn through the shed by the carrier.

Pivoted on a pin 100 which extends horizontally between the rear portion of wall 86 and a rear and lower extension 101 of wall portion 87, is a fitting 102 which has a transverse slot in which is received one end of a thin flexible strip of metal 103 by means of screws as shown. Fitting 102 has a portion 102*a* which underlies a shoulder 86*a* at the end of wall 86 so that a one-way hinge joint is provided. This strip of metal is in the form of a flat parallel-edged spring steel blade of, for example, .040 of an inch in thickness by .5 of an inch in width and somewhat longer than the reed. It is offset to the opposite side of fitting 102 from portion 102*a* and its edges are in planes perpendicular to pin 100, the latter being perpendicular to wall 86 and spaced substantially above the bottom surface of the carrier. By means of this flexible tail piece, which, however, is adapted to push the body portion 84 of the carrier without undue buckling, the carrier is enabled to be driven through an endless path in the following manner:

Assuming the carrier to be in a position somewhat to the left of that shown in Figure 18, and shafts 48 and 74 to be driven in the manner heretofore described, follower 79 rides down on the low portion of cam 77 and permits the weight of roller or wheel 64 to rest on the tail 103 of the carrier. The tail piece being thus held against the rubber periphery of wheel 39 is engaged by the latter so that the carrier is propelled across the race plate 38 at what may be ordinary shuttle speed. The propelling impulse preferably continues until the end of the tail piece leaves the bight of the wheels. The carrier is laterally steadied in its travel by the thus engaged tail piece. As the carrier traverses the shed, follower 82 rides on the high portion of cam 78, as shown

in Figure 1a, so that roller 65 is elevated in time enough to permit the carrier to pass between it and wheel 40. When the carrier has passed this point, follower 82 rides down on cam 78 so that roller 65 drops on tail piece 103 and a driving impulse, which is preferably continued until the tail piece has passed from beneath the roller, is again imparted to the carrier and the latter, following around guard 73, through tunnel member 71, and upward through guard 72, completes its circuits, roller 64 having been timely raised by cam 77 to provide clearance. In this way driving impulses are imparted to the carrier at each end of the raceway and it is driven in an endless path which is supported by the lay. The useful travel of the carrier, as herein contemplated, is confined to that along the top of the track, and, as has been above stated, this may be at the usual shuttle speed. The remainder of the travel may be much faster and it is for this reason that wheel 40 is arranged to be driven at a higher speed than wheel 39.

As has been above stated, the edge of tail piece 103 which is adjacent the reed is set away from the latter, and in this way wear of the tail piece on the reed is prevented. Due to the one-way hinge joint between fitting 102 and the carrier body, bucking of the carrier body, i. e., flying up of its forward end, upon impulse imparted by the tail piece, is prevented while at the same time free flexing is permitted as the carrier traverses the curved end portions of its endless track. Bucking tendency is minimized by the substantial spacing of pivot pin 100 above the bottom surface of the carrier body.

I shall now describe the means whereby the carrier is brought to rest at the entering side of the shed, is caused to pick up a yarn end, and whereby the yarn is held and cut at the entering side of the shed.

Referring particularly to Figures 1, 7, 18 and 19, reference character 104 designates a carriage in the form of a vertical plate having a horizontal dove-tail rib 105 on its rear face, this rib being engaged in a complementary guideway in a strip 106 set in the front face of the lay cross portion 31. The strip 106 is disposed adjacent the left hand end of said cross portion 31 and the carriage 104 may be slid relative thereto and locked in adjusted position by means of set screws as at 107. The carriage has at its lateral edges outstanding flanges which provide bearings 108 and 109 in which shaft 74 is journaled. Between the bearings cams 110, 111 and 112 are mounted on shaft 74 and have a common key 113 which is slidable in an elongated keyway 114 in shaft 74, Figure 18. The cams 110 to 112 have elongated bearing portions so as to fill the space between bearings 108, 109 whereby to maintain the cams in fixed rotational planes. As indicated in Figure 19, the key 113 is held in position by contact with the inner faces of the bearings. The cam 110 cooperates with the tail portion of a bell crank lever 116 whose other end 117 extends above race plate 38. Adjacent the sword 32 the race plate, it may be mentioned, is provided with a longitudinally extending recess in its forward edge and slidable along this recess and complementing the narrowed portion of the race plate is a rib 118 on carriage 104. Screwed on top of rib 118 and extending across the adjacent portion of the race plate is a thin (for example, $\frac{1}{16}$") plate 118a which extends from the left hand end of the carriage to near the right hand end and forms part of the carrier track. Plate 118a is beveled at its left hand end so that the carriage can readily ride up onto it. Its right hand end is adjacent the warp threads so that jumping of the carrier on encountering the latter is prevented. In its arrested position the carrier is on plate 118a. Bell crank lever 116 is pivoted on a shaft 119 whose ends are supported in the side flanges of carriage 104 above and somewhat to the rear of shaft 74 as most clearly seen in Figure 19. The tail portion of bell crank lever 116 is held against the face of cam 115 by means of a tension spring 120.

Adjacent the bell crank lever 116 a cutter 121 is pivoted on shaft 119, this cutter including a blade 122 as most clearly shown in Figure 10. A tension spring 123 pulls the cutter blade toward the position shown in Figure 10 wherein the blade bears against the top of rib 118 or against a hardened block set in the top of the latter. The cutter 121 has a tail portion 124 for cooperation with cam 111. When the cutter is cocked by the cam the free end of the blade is disposed so as not to obstruct travel of the carrier 84.

To the right of the cutter a holder 125 is pivoted on shaft 119 and includes a tail portion 126 which cooperates with cam 112. On the opposite side of shaft 119 from the tail portion 126, the holder has a pair of spaced apart fingers 127 and 128, in angular relation to the said tail portion, between which is pivoted a third finger 129 on a pin 130. The fingers 127 and 128 have notches as at 131, Figures 8 and 9, and the finger 129 has its free extremity cut away to provide a shoulder 132. A tension spring 133 has its ends connected respectively to an ear 134 secured between the extremities of fingers 127 and 128 and a nose 135 on finger 129 so as to hold the parts normally in the relation shown in Figure 8 wherein the extremity of finger 129 is out of the path of travel of the carrier. A tension spring 136 tends to swing the holder 125 in a counterclockwise direction so that when the tail 126 is released by cam 112 the fingers will be snapped to the closed position shown in Figure 9 so that a yarn end can be securely gripped between the notches as at 131 and the shoulder 132.

Vertically reciprocable on the outside of carriage 104 is a bar 137 which is guided in a groove at the lower end of the carriage and retained therein by means of a cover plate 138, Figures 1, 18 and 19. The bar has secured to its lower extremity a laterally projecting foot 139 which is pierced to receive one end of a cable 140 whose extremity has an abutment 141 secured thereto, there being a compression spring 142 interposed between the abutment and the foot. Cable 140 is led upwardly over a pulley 143 then laterally to and downwardly from a pulley 144 at the upper end of sword 32, Figure 1.

At its upper end bar 137 has secured thereto an elongated vertically extending block 145 whose forward face, as here shown, is grooved to provide seven grooves as at 146 of different lengths, the grooves becoming shorter toward the right, Figures 1 and 18, and each rib having a lower extremity as at 147 bent over the adjacent rib to provide a guide from beneath which the yarn may be laterally withdrawn at the lower ends of the grooves. Mounted on top of block 145 are seven wires as at 148 having end eyes as at 149, Figure 18, and at the lower ends of these wires a guard 150 is secured across the top of block 145 for the purpose of defining yarn guides in conjunction with the upper ends of the grooves.

Yarn is led from seven packages as at 151 through the eyes as at 149, twisted two or three times about the wires as at 148, to prevent tangling with each other, and then led behind the guard 150 into the upper ends of the grooves as at 146, and then laterally from the grooves beneath the bent feet as at 147.

Block 145 is rabbeted along its right hand edge, Figure 7, to provide a surface 152 against which are secured superposed blocks as at 153, Figures 1, 18 and 21, which carry thread tensioning and guide means. The tensioning and guiding means comprise plates as particularly shown at 154, Figure 7, vertically slidable on pins as at 155 and pressed downwardly by springs as at 156. Adjacent the inner edge of each plate as at 154 is a vertical pin as at 157. Between the blocks as at 153 are spacer blocks as at 158 which have forward faces contoured as at 159, Figure 7. As will be seen from the latter figure, the yarn 160, drawn from beneath the foot 147, is guided across surface 159, beneath presser plate 154 and against pin 155, and then against pin 157. The yarn end is shown as projecting at substantially right angles above and across plate 118a in Figures 7 and 21, in which position it is adapted to be gripped by the carrier jaw.

In the use of the described yarn feeding mechanism a selected one of seven different yarns from the seven packages is adapted to be positioned for engagement by the carrier, the yarn presented depending upon the elevation of block 145. Yarn ends below the top of rib 118 are received in a vertical groove 104' in the front face of the carriage, Figures 7 and 21. The position of block 145 is controlled through cable 140 from the head motion of the loom, as here contemplated, although other suitable control means may be utilized. In looms of known type there are in the head motion four vibrators and jacks that actuate the shuttle boxes. From two jaws there is one chain which operates the right hand shuttle boxes into four different positions, while the other jaws operate the left hand boxes through a chain in the same manner. For the control of my yarn feeding mechanism I utilize these two chains designated at 161 and 162, Figure 23, by pivoting a bar 163 to their ends and connecting cable 140 to the middle of this bar by means of a clevis 164. The controlled tensioning of cable 140 elevates block 145 to bring a selected yarn feeding station into proper relation to the raceway while the controlled slackening of the cable permits the block to drop by gravity to the selected position. By the described arrangement I am enabled to weave a fancy pattern as readily as solid cloth.

In advance of the yarn feeding device I provide means for arresting the carrier and for insuring that jaw 98 is open. Further, means are provided for closing the jaw when, as the carrier begins to travel, the jaw comes over the projecting yarn end.

On its rear surface and above raceway 38, carriage 104 is provided with a block 165 which has two parallel vertical slots 166 and 167 extending longitudinally of the race plate, reference now being had particularly to Figures 7, 11 to 14 and 19. A shoulder screw 168, carried by block 165 extends through a bore crossing the slots and its threaded end is engaged in a threaded bore in a brake member 169 which is swingable alongside the outer face of block 165. Brake member 169, which is most clearly shown in Figure 12, has a downwardly and forwardly inclined lower surface 170 along which extends a leaf spring 171 which is fixed at the point 172 and free at its forward end. The plane of swing of the block member coincides with the path of travel of wall 86 of carrier 84.

Received in slot 166 is a dog 173 having a rear cam surface 174 and a forwardly extending tongue 175, this dog being supported by screw 168. The vertical plane of dog 173 coincides with the path of travel of lever 94 of carrier 84.

Pivoted on screw 168 in slot 167 is a member 176 which has a forwardly extending elongated tongue 177 in the vertical plane of travel of spacer block 97 of carrier 84.

Secured to an upright portion 178 of block 165 is a bracket 179 which provides a bearing for a pin 180 extending parallel to screw 168. On one end of pin 180 is an angular arm 181 whose lower extremity 182 is in the vertical plane of travel of wall 86 of carrier 84. Fixed on the other end of pin 180 is a finger 183 which is adapted to engage the top surface of finger 177.

As the carrier emerges from guide channel 67, the brake member 169 is in a position wherein its spring 171 will be engaged by the inclined surface 88 of the carrier wall 86 and the brake member cannot swing upwardly out of the way in view of the fact that the upper end 117 of lever 116 overlies the forward portion of the brake member, the tail portion of lever 116 riding on the high portion of cam 115 as shown in Figure 19. Hence the carrier is stopped, the shock being minimized by spring 171. When the high portion of cam 115 passes from beneath the tail portion of lever 116, the lever is swung in a clockwise direction by means of spring 120 and the brake 169 will now release the carrier, swinging freely upwardly, when propelling force is imparted to the latter. When this occurs, by reason of roll 64 being lowered onto the tail piece 103, the carrier moves forward, dog 173 insuring that the left hand portion of lever 94 is depressed so that the jaw 98 is fully open. When the jaw has reached, or has nearly reached, the projecting yarn end 160, the inclined surface 88 of carrier wall 86 engages the extremity 182 of lever 181 thereby causing finger 183 to bear downwardly on the elongated finger 177. The finger 177 is thus borne against spacer block 97 and quickly swings lever 94 in a clock-wise direction to force jaw 98 in groove 99 and thus securely engage the yarn end. At this time the holder 125 is in the position shown in Figure 8, while cutter 121 is in the open position so as not to obstruct the path of the carrier.

The carrier now traverses the shed with the yarn and at the departing end of the shed encounters mechanism for releasing the yarn, holding and tensioning the released yarn, and then cutting off the yarn end adjacent the warp.

A carriage 184, Figures 1a, 15, 16 and 17, is adjustably mounted on cross portion 31 in the same manner as carriage 104, heretofore described, and may be locked in adjusted position by means of set screws as at 185. As here shown the upper portion of the carriage has a rearwardly projecting rib 186 which is received in a longer recess 187 in the top of cross portion 31. Rib 186 has secured to the top thereof a strip 188 which is complementary to a narrow portion of race plate 38 where it is recessed for the length of recess 187.

Carriage 184 includes outwardly projecting webs which provide bearing portions 189 and 190 for shaft 74. Adjacent bearing 189 shaft 74 has fixed thereon, as by means of a set screw, a cam 191

which is similar to cam 111 of Figure 10 and cooperates with a cutter 192, similar to cutter 121, which is pivoted on a pin 193 projecting from the adjacent web. Adjacent bearing 190 a sprocket wheel 194 is fixed on shaft 74 by a set screw. An upper extension 195 of the bracket provides bearings for a shaft 196 on which is fixed a sprocket 197 connected by a chain 198 with sprocket 194. On the left hand end of shaft 196 is a rotary brush 199 of such diameter as to project a substantial distance across the carrier path and which is adapted to sweep through an arcuate groove 200, which has shaft 196 as a center, extending transversely in the top edge of carriage 184. Fixed at the left hand side of brush 199 in contact with the lower portion thereof is a finger 201 whose face adjacent the brush is substantially coplanar with the adjacent side wall of groove 200. On the opposite side of the brush, and also directly opposite finger 201, is a block 202 slidable on a horizontally extending stud 203 and pressed against the brush by a compression spring 204. A stud on the outer face of the carriage carries a pin wheel 205 whose plane of rotation is perpendicular to the plane of rotation of brush 199 and the pins of wheel 205 are arranged to have an outward combing action on the brush when the pin wheel is rotated in counter-clockwise direction. For the purpose of driving the pin wheel it has fixed thereto a grooved pulley 206 driven by a belt 207 from a grooved pulley 208 on sprocket 194, the portions of the belt between pulleys 206 and 208 being engaged by direction pulleys 209 and 210.

Supported by and behind the upward carriage extension 195 is a cam block 211 which is adapted to engage the rear portion of lever 94 of the carrier, as the carrier travels past, so as to swing the lever in counter-clockwise direction.

As the carrier passes brush 199 the yarn is engaged by the bristles of the latter, which is rotating in the direction of the arrow, Figure 16, to be swept against the edges of groove 200 and between finger 201 and block 202 which are adjacent the brush. Almost immediately the cam block 211 engages the rear portion of lever 94 of carrier 84 and swings the lever in a counter-clockwise direction so that jaw 98 is moved out of groove 99 to release the yarn. At this point the tail 126 of holder 125 leaves the high part of cam 112 so that the holder fingers snap to the position shown in Figure 9 engaging the yarn between the notches as at 131 and the shoulder 132. Immediately cutter 121 severs the yarn between holder 125 and feeding device 145. The severed portion of the yarn at the feeding device now springs to a transverse disposition above rib 118, as particularly shown in Figures 7 and 21, so as to be in position to be engaged by the carrier jaw during the next cycle. If in the next cycle the feeding device should be elevated, the ends which were within groove 184' will spring out into substantially horizontal position so that the selected end will be properly disposed. Brush 199, acting on the severed end of the yarn applies a yielding tension to the pick. After the pick is beaten in, cutter 192 operates to sever the yarn adjacent the warp. The severed yarn end at the departing side of the shed will be swept downwardly by brush 199 and combed out of the brush by the pin wheel 205.

It will be evident that various warp widths may be accommodated by suitably adjusting carriages 184 and 184 since all the feeding, holding, and severing devices, and devices for controlling the carrier jaw are supported by these carriages. Upon loosening the set screws as at 107 and 185, the carriages may be moved longitudinally of the lay. In case of carriage 184, it is additionally necessary to loosen cam 191 and sprocket 194 so that they may be slid on shaft 74 to their new positions.

The described mechanism affords many advantages over the conventional shuttle loom. The yarn carrier is small and light and hence requires small propulsive force, and economy of operation is enhanced by reason of its endless path in which it is arrested but once. In view of the small size of the carrier, a smaller shed opening is required than in the case of a shuttle loom, thereby reducing the tension on the warp yarns during shedding. Due to the definite tension applied on each and every filling yarn inserted, the product is more uniform than in the case of the shuttle loom. Also, the elimination of the operation of winding bobbins for a shuttle saves time and expense and leaves the filling yarn in a stronger condition, due to less handling.

In order that the yarn packages may be arranged in a small group I preferably employ the means for drawing the yarn from the packages shown in Figure 20 and fragmentarily in Figure 18. Referring particularly to Figure 20, reference numeral 212 designates a disc supported on a tubular pedestal 212*a* from a base 212*b*, the latter having a perforation 212*c* surrounded by the pedestal. Disc 212 is received in the base of the conical cop 212*d* to support the cop. A metal tube 213 has an expanded porcelain mouth 213*a* at one end and is provided with longitudinally extending parallel slots or slits as at 214 which extend from its other end to adjacency with the mouth where a relatively large opening 214*a* is provided. As shown in Figure 20 the tube 213 is frictionally supported in the opening at the small end of the cop and extends directly downwardly through an opening in disc 212. In threading, tube 213 being free of the cop, a hook is inserted through opening 214*a* and out of the mouth and engaged with the yarn end of the package. The yarn end is then pulled out of opening 214*a* and slid down to the open end of slot 214. The tube is inserted to the position shown in Figure 20 and the yarn end led to the feeding device as shown in Figure 18. With the slotted tube other threading methods may be used although the one just described is preferred. As an alternative, for example, the yarn end may be slid up to the ends of the slots and a loop pulled out through the mouth by means of a hook. The yarn may then be broken outside the tube and the new end tied to the loop so that it can be pulled through the tube.

In Figures 24 to 30, I have shown alternative, and in many respects preferable, mechanism for arresting the yarn at the departing end of the shed and severing the protruding filling ends. To refer to these figures, reference numeral 215 designates a carriage mounted on cross portion 31 of the lay at the departing side of the shed and adjustable longitudinally of the lay in the manner above described with reference to carriage 184. Carriage 215 includes outstanding vertical webs 216 and 217 apertured to pass timing shaft 74 and between these webs the shaft has fixed thereon by means of a set screw 218, a cam 219. Above shaft 74, and parallel thereto, webs 216 and 217 fixedly support a shaft 220.

The carriage includes a vertical extension 221 immediately adjacent to the line of edge 38*a* of the race plate, the extension having a top horizontal flange portion 222 extending over the race plate 38

and supporting cam 211, heretofore described. Mounted on the left hand margin of extension 221 by means of a bracket 223 is a flat spring finger 224 which extends horizontally and has at its free end a bent back portion 225, which projects just above the level of the race plate and across the line of edge 38a in the normal position shown in Figure 26.

The left hand edge of extension 221 has a projecting ear 226 pierced on a horizontal axis transversely of the race plate and fixedly supporting a pin 227 which projects into a longitudinally extending recess 38b of the race plate and pivotally supports a generally horizontally extending finger 228 within the said recess. Between ear 226 and finger 228 a torsion spring 229 surrounds pin 227 and tends to swing finger 228 in a clockwise direction.

At its free end, finger 228 has an upwardly projecting flange 230 at its outer edge, this flange extending longitudinally of the finger and terminating at the free end of the finger in a nose 231.

In the normal position of fingers 224 and 228, portion 225 of the former overlies portion 230 of the latter so that the top of portion 230 is substantially flush with the top of the race plate, this relation being most clearly shown in Figures 26 and 27. The top of portion 230 is inclined toward the extremity of the nose 231 so that even though projecting somewhat above the level of the race plate the travel of the carrier will not be interfered with. Portion 225 of finger 224 is in the path of travel of the outer extremity of edge 92 of the carrier bottom. With this arrangement, the carrier leaving the shed strikes portion 225 of finger 224, forcing it outwardly and releasing finger 228 so that the latter snaps upwardly behind the portion of the carrier which passes over recess 38b, into the recess 85b of the carrier bottom, bringing flange 230 directly opposite portion 225 of finger 224. As the latter is released, as the carrier passes on, portion 225 springs toward flange 230 so that the yarn is gripped between the two. Immediately thereafter, the carrier gripper is released due to the action of cam 211, so that the yarn is held solely by the fingers. The grip of the fingers, while adequate to hold the inserted yarn, is not of such extreme force but that the yarn will be drawn between the fingers by the carrier without breaking until the carrier gripper is released.

Pivoted on shaft 220 and positioned thereon by fixed collars, is a lever 232 having a lower portion 233 associated as a follower with cam 219, and an upper portion 234 which has an L-shaped extension 235 with an extremity 236 extending transversely of the race plate but out of the path of the carrier, Figure 29. Nose 231 is below and in the path of swing of extremity 236. After the pick has been beaten in, the low part of cam 219 reaches follower portion 233, permitting lever 232 to be snapped in a counter-clockwise direction by a tension spring 237. Portion 236 of lever 232 thus strikes the nose 231 of finger 228 and returns the finger to the position of Figures 26 and 27, so that portion 225 of finger 224 is permitted to spring again over flange portion 230 to retain finger 228 in its normal depressed position.

A temple 238 is secured on the breast beam in the usual manner and comprises a cover 239 and a roll 240 having a spindle 241 supported at its inner end by a temple bracket 242. Fixed on the outer forward edge of the cover 239 is a bracket 243, which supports mechanism for severing the protruding weft ends.

Bracket 243 has parallel vertical flanges 244 and 245 which depend closely adjacent the outer edge of the temple cover. The lower portions of flanges 244 and 245 are connected by rivets through a filler piece to provide a slideway for a slide 246 which includes a shearing head 247 projecting downwardly and outwardly of lower extensions 244a and 245a of flanges 244 and 245 whose edges are faced toward the lay. The shearing head is normally held in spaced relation from the edges of extensions 244a and 245a by a tension spring 248 which is connected between the rear end of slide 246 and flange 244 in the manner particularly shown in Figure 28. The action of the spring is limited by a stop 249 on the slide which engages the edge of flange 244. At its rear end slide 246 carries a pin 250 which projects away from the temple.

The extension 221 of carriage 215 has integral with its upper portion an L-shaped arm 251 whose extremity 252 oscillates with the lay in a path intersecting pin 250 of slide 246.

As the cloth travels up roll 240, the protruding weft ends are successively lifted into the space between flange portion 244a and 245a on the one hand, and shearing head 247 on the other hand. As the lay approaches the end of its beating-in movement the extremity 252 of arm 251 strikes pin 250 so that slide 246 is moved and shearing action of head 247 is effected to sever the protruding end or ends within its range of action. As extremity 252 of arm 251 now moves away from pin 250, the shearing head 247 is returned to open position by spring 248.

The yarn holding mechanisms at both ends of the shed are effective, preferably, to hold the yarn ends with little or no slippage until the pick is beaten in. In such case, additional tensioning of the pick is effected as the lay approaches the end of its beating-in stroke.

In Figures 31 to 33, I have shown listing mechanism which may be utilized in conjunction with the loom heretofore described. Referring to these figures, reference numeral 265 designates a spindle rotatable on a horizontal axis behind the loom harness in a bearing 266 carried by an arm 267 which is longitudinally adjustable in a block 268 supported by a frame member 269. Spindle 265 has fixed thereto a cross member 270 which carries two bobbins 271 and 272. At the extremity of spindle 265 adjacent the free end of the bobbins, there is secured a circular disc 273 provided with diametrically spaced porcelain eyes 273a and 273b. Slidable on the surface of the disc 273 adjacent the bobbins is a pair of tension members generally designated by the reference numerals 274 and 275 which are identical in construction so that description of one will suffice.

Tension member 274 comprises a rectangular bottom plate 276 provided with upstanding lugs 277 at its four corners and with an upstanding stud 278 at its center, the upper end of the stud being threaded. At one side the plate 276 has an ear 279 which is bent around a guide wire or light bar 280 supported sufficiently away from the disc surface by end posts to permit free sliding of plate 276 toward and away from eye 273a on a cord intersecting the latter.

A plate 281, centrally apertured to receive stud 278, rests on top of plate 276, having cut-out corners receiving the lugs 277. A compression spring interposed between plate 281 and an abutment nut on stud 278 yieldingly urges the former against plate 276. A tension spring 282 has its ends respectively connected to plate 281 and to an anchorage on disc 273 and is arranged to pull ten-

sion member 274 away from eye 273a. Tension member 275 has the same provisions, as may be readily seen from Figure 32. Yarn from one of the bobbins is led between plates 276 and 281 of member 274 and through eye 273a, the yarn being securely retained in the tension devices by the lugs 277. Yarn from the other bobbin is similarly led through tension member 275 and eye 273b.

A second spindle 283, parallel to the first, is similarly supported and equipped, and the ends of the two spindles remote from the discs as at 273 are connected by flexible shaft portions 284 and 285 with a suitably supported shaft 286 on which is fixed a gear 287 suitably driven, as for example, from a gear 290 on the loom drive shaft. The spindles are thus rotated constantly in the same direction at the rate of one-half turn per pick.

In the use of the apparatus the spindles are set apart in accordance with the width of the wall through suitable adjustment of the supporting arms as at 217, this being permitted by the flexible shaft portions, and the yarns from the two sets of bobbins are passed through the reed at each side immediately adjacent the outside warped yarns. As each pick is beaten in, the listing yarns are twisted on the pick in the manner shown in Figures 33 so that the weft ends are securely tied together. In Figure 33 the heddles are generally indicated at 291, and the listing yarns from bobbins 271 and 272 at 292 and 293.

In Figure 32 disc 273 is assumed to be at the right-hand side of the warp looking toward the reed. Eye 273a consequently is nearly straight behind the reed slot through which both of the listing yarns 292 and 293 are passed. However, there will be a substantial angle between eye 273b and the said reed slot so that the length of yarn between eye 273b and the reed will be greater than the length of yarn between eye 273a and the reed. This situation is taken care of by the yielding of the spring associated with member 275. On the other hand, it will be seen that member 274 has been drawn somewhat away from eye 273a by its spring 282 so that the slack, which would have otherwise developed in yarn 292 upon movement of eye 273a to the inside position shown, is taken up. Effective listing action is thus assured.

It is to be understood that the invention is susceptible of varied embodiment, and consequently I do not limit myself to the specific disclosure herein. The invention includes changes in form and arrangement of parts comprehended in the following claims.

I claim:

1. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, and means at each end of the shed for propelling said carrier in its endless path with the same end of the carrier always leading, the propelling means at the departing end of the shed being arranged to receive the carrier and return it to the entering end of the shed at a speed greater than that imparted to the carrier by the propelling means at said entering end.

2. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed; said carrier comprising a body portion, means on said body portion for gripping a yarn end, and a flexible tail portion connected with said body portion and through which the carrier is propellable; a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier and rotary means at each end of the shed which successively engage said tail portion to propel said carrier in its endless path with the same end of the carrier always leading.

3. Structure according to claim 2 wherein each of said rotary means comprises a pair of wheels between the peripheries of which said tail portion is engageable, and wherein means is provided for displacing one of said pair of wheels away from the other to permit free passage of said body portion between the wheels.

4. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed; said carrier comprising a body portion, means on said body portion for gripping a yarn end, and a flexible tail portion connected with said body portion and through which the carrier is propellable; a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, pairs of wheels at the ends of the shed and in said guideway, said tail portion being engageable for propulsion between the peripheries of the wheels of each of said pairs of wheels, means for driving one wheel of each of said pairs and imparting a greater peripheral speed to the driven wheel at the departing end of the shed than to the driven wheel at the entering end of the shed, and means for displacing one of the wheels of each of said pairs of wheels away from its associated wheel to permit free passage of said body portion between the wheels.

5. Structure according to claim 4 wherein a drive shaft for the driven wheels is journaled on the lay, and wherein said drive shaft is rotated from a driven shaft external of the lay through an extensible universally jointed connection.

6. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, said carrier including a yarn gripper, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier means for propelling the carrier along its path, a multiple yarn feeding device vertically reciprocable adjacent said race plate and adapted to position a selected yarn end above and in transversely extending relation to said plate, and means for causing said gripper to grip the selected yarn end.

7. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, said carrier including a yarn gripper, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for propelling the carrier along its path, a multiple yarn feeding device vertically reciprocable adjacent said race plate and adapted to position a selected yarn end above and in transversely extending relation to said plate, and means for causing said gripper to grip the selected yarn end, said last-named means including a presser member actuated by said carrier during travel of the latter.

8. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, said carrier including a yarn gripper pivoted on a horizontal axis extending transversely of the carrier, a horizontal race plate for said carrier on

said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for propelling the carrier along its path, a yarn feeding mechanism adapted to position a yarn end above and in transversely extending relation to said plate at the entering end of the shed, a presser member mounted on said lay above said plate at the entering end of the shed, and means engaged by said carrier in its travel and moved to actuate said presser member to cause the latter to swing said gripper into gripping relation with the yarn end.

9. In a loom, means for carrying a weft yarn end through the warp shed and releasing the said end, means at the entering end of the shed for holding the inserted yarn, means at the departing end of the shed providing a wall extending transversely of the path of movement of said carrying means and beyond which the released end of the yarn projects, and a rotary brush cooperating with said wall to brush said released end thereover and thereby tension the inserted yarn.

10. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier means for driving said carrier in said endless path, yarn feeding means at the entering end of the shed, said carrier having means effective to grip a yarn end at said feeding means whereby to carry the yarn through the shed, yarn arresting means at the departing end of the shed, said arresting means comprising cooperating spring-biased gripping fingers which are opened by the carrier during its travel and then close to grip the yarn as the carrier passes, and means effective to release the yarn from the carrier.

11. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for driving said carrier in said endless path, yarn feeding means at the entering end of the shed, said carrier having means effective to grip a yarn end at said feeding means whereby to carry the yarn through the shed, yarn arresting means at the departing end of the shed, said arresting means comprising an upwardly spring-biased finger disposed in a recess in the race plate, a second finger spring-biased horizontally transversely of the base plate and normally overlying a portion of the first finger to hold the latter depressed so as not to interfere with the travel of the carrier, the second finger having a portion engageable by the carrier to move the second finger whereby to release the first finger so that the latter springs up behind a portion of the carrier which passes over said recess, the carrier in its continued travel releasing the second finger so that the same springs toward the first finger to cause the yarn to be gripped between the two fingers, means effective to release the yarn from the carrier, and means for returning the first finger to render it reengageable in depressed position by the second finger.

12. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for driving said carrier in said endless path, yarn feeding means at the entering end of the shed, said carrier having means effective to grip a yarn end at said feeding means whereby to carry the yarn through the shed, yarn arresting means at the departing end of the shed, said arresting means comprising a spring finger biased transversely horizontally of said race plate thereabove, a horizontally pivoted finger normally held inoperative by said spring finger below the latter and spring biased upwardly, said spring finger having a portion engageable by said carrier so that said spring finger is swung to release said pivotal finger whereupon the latter springs upwardly into such position that when said spring finger is released during continued travel of the carrier the yarn will be gripped between the two fingers, means effective to release the yarn from the carrier, and means for returning the pivoted finger to render it reengageable in depressed position by said spring finger.

13. A weft carrier for a shuttleless loom, said carrier comprising a body portion, means on said body portion for gripping a yarn end, and a flexible tail portion through which the carrier is propellable pivoted to said body portion on an axis extending transversely of the latter.

14. A carrier according to claim 13 wherein the tail portion is pivoted to the body portion on an axis spaced substantially above the bottom of the body portion.

15. A carrier according to claim 13 wherein the tail portion is pivoted to the body portion through a one-way hinge joint so arranged as to oppose lifting of the front end of the body portion when a driving impulse is imparted to the latter through the tail portion.

16. In a shuttleless loom, a weft carrier comprising a body portion having a bottom wall adapted to pass under a traversely extending yarn end to be gripped, an upwardly faced longitudinally extending groove in the leading portion of said bottom wall, a lever pivoted on said body portion on a traverse axis and having at one end a tongue adapted to enter said groove to grip the yarn end, means for depressing said one end of said lever to engage said tongue in said groove, and means for depressing a portion of said lever on the opposite side of the pivoting axis from said one end to disengage said tongue from said groove whereby to release the yarn end.

17. In a shuttleless loom comprising a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, and means for propelling the carrier along said plate, the combination of a multiple yarn feeding device comprising a slide vertically reciprocable adjacent said plate at the entering end of the shed, said slide carrying superposed yarn feeding stations whereby as the slide is displaced a predetermined station will present a selected yarn end above and transversely of said plate so as to be engageable by said carrier, and means adjacent said slide provided with a vertical groove for the reception of the yarn ends which are below the selected yarn end.

18. In a shuttleless loom comprising a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means for propelling the carrier along said plate, the combination of a multiple yarn feeding device comprising a slide vertically reciprocable adjacent said plate at the entering end of the shed, super-

posed yarn feeding stations on said slide, and means on said slide for guiding yarns from a supply downwardly in a group and laterally to respective feeding stations, whereby as the slide is moved a predetermined station will present a selected yarn end above and transversely of said plate so as to be engageable by said carrier.

19. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for propelling said carrier through said path, yarn feeding means at the entering end of the shed adapted to position a yarn end above and transversely of said plate in position to be gripped by said carrier, means for releasing the gripped yarn at the departing end of the shed, means disposed at both ends of the shed for holding protruding portions of the inserted yarn, the holding means at the departing end of the shed being constituted by a rotary brush which acts to tension the inserted yarn, and means adjacent said holding means for cutting said protruding portions.

20. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for propelling said carrier through said path, yarn feeding means at the entering end of the shed adapted to position a yarn end above and transversely of said plate in position to be gripped by said carrier, means for releasing the gripped yarn at the departing end of the shed, means disposed at both ends of the shed for holding protruding portions of the inserted yarn, means adjacent said holding means for cutting said protruding portions, a horizontal shaft journaled on the lay, the holding and cutting means at each end of the shed constituting units, and means controlled from said shaft for operating said units, at least one of said units being adjustable longitudinally of said shaft in accordance with the width of the warp.

21. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for propelling said carrier through said path, yarn feeding means at the entering end of the shed adapted to position a yarn end above and transversely of said plate in position to be gripped by said carrier, means for releasing the gripped yarn at the departing end of the shed, means disposed at both ends of the shed for holding protruding portions of the inserted yarn, means adjacent said holding means for cutting said protruding portions, the cutting means at one end of the shed being mounted externally of the lay and including a horizontally movable shearing member, and a temple mounted adjacent said shearing member, the relation being such that the temple raises the weft ends into the path of movement of said shearing member.

22. In a shuttleless loom, a lay, a weft carrier for carrying the weft yarn through the warp shed, a horizontal race plate for said carrier on said lay beneath the shed, means connecting the ends of said race plate and defining with said plate an endless path for said carrier, means for propelling said carrier through said path, yarn feeding means at the entering end of the shed adapted to position a yarn end above and transversely of said plate in position to be gripped by said carrier, means for releasing the gripped yarn at the departing end of the shed, means disposed at both ends of the shed for holding protruding portions of the inserted yarn, means adjacent said holding means for cutting said protruding portions, the cutting means at one end of the shed being mounted externally of the lay and including a horizontally movable shearing member, a temple mounted adjacent said shearing member, the relation being such that the temple raises the weft ends into the path of movement of said shearing member, and means on the lay for operatively moving said shearing member as the lay approaches the end of its beating-in movement.

23. In a shuttleless loom, a weft carrier, a race plate for said carrier on which the shed yarns are laid, a carriage adjustable longitudinally of said race plate at the entering end of the shed, and a plate mounted on said carriage and closely overlying the top of the race plate, said plate being of such thickness as to guide the carrier smoothly onto the shed yarns.

ELPHÈGE NADEAU.

CERTIFICATE OF CORRECTION.

Patent No. 2,226,069. December 24, 1940.

ELPHÈGE NADEAU.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, lines 2 and 8, for "shutterless" read --shuttleless--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of December, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.