Aug. 6, 1935. R. E. HAYNES ET AL 2,010,591

CIRCLET LOOPING MACHINE

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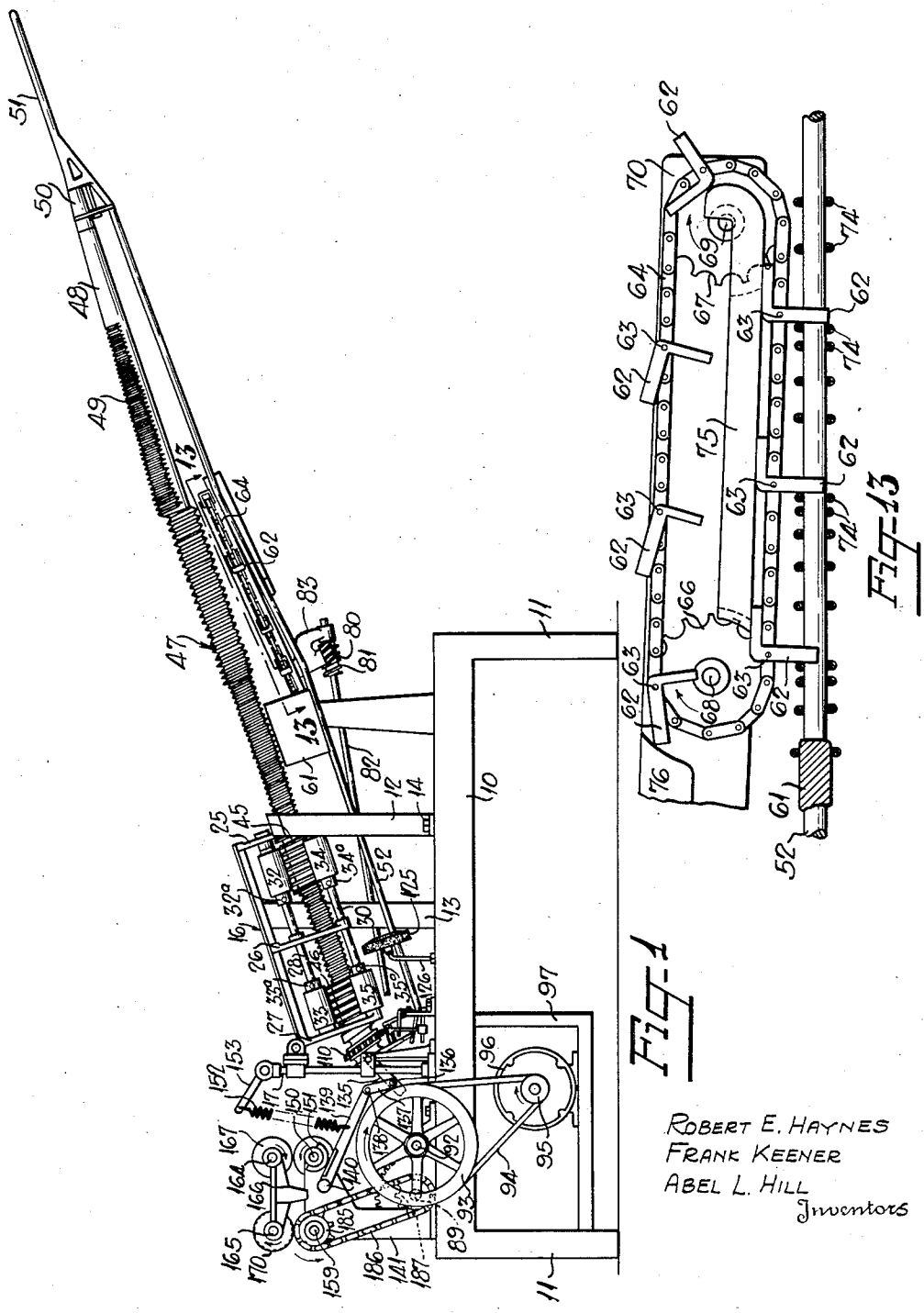


Fig-13

Fig-1

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CIRCLET LOOPING MACHINE

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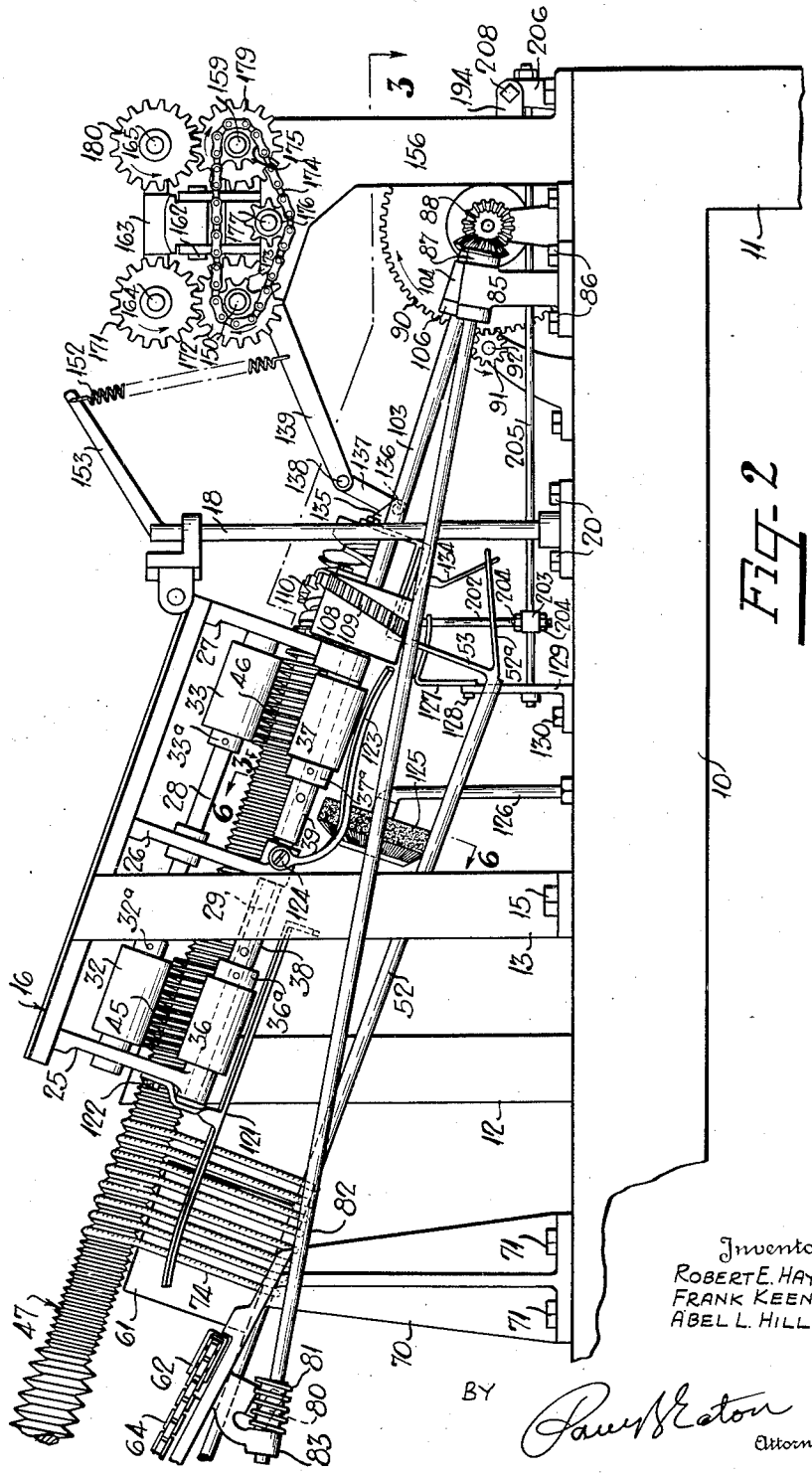


FIG. 2

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CIRCLET LOOPING MACHINE

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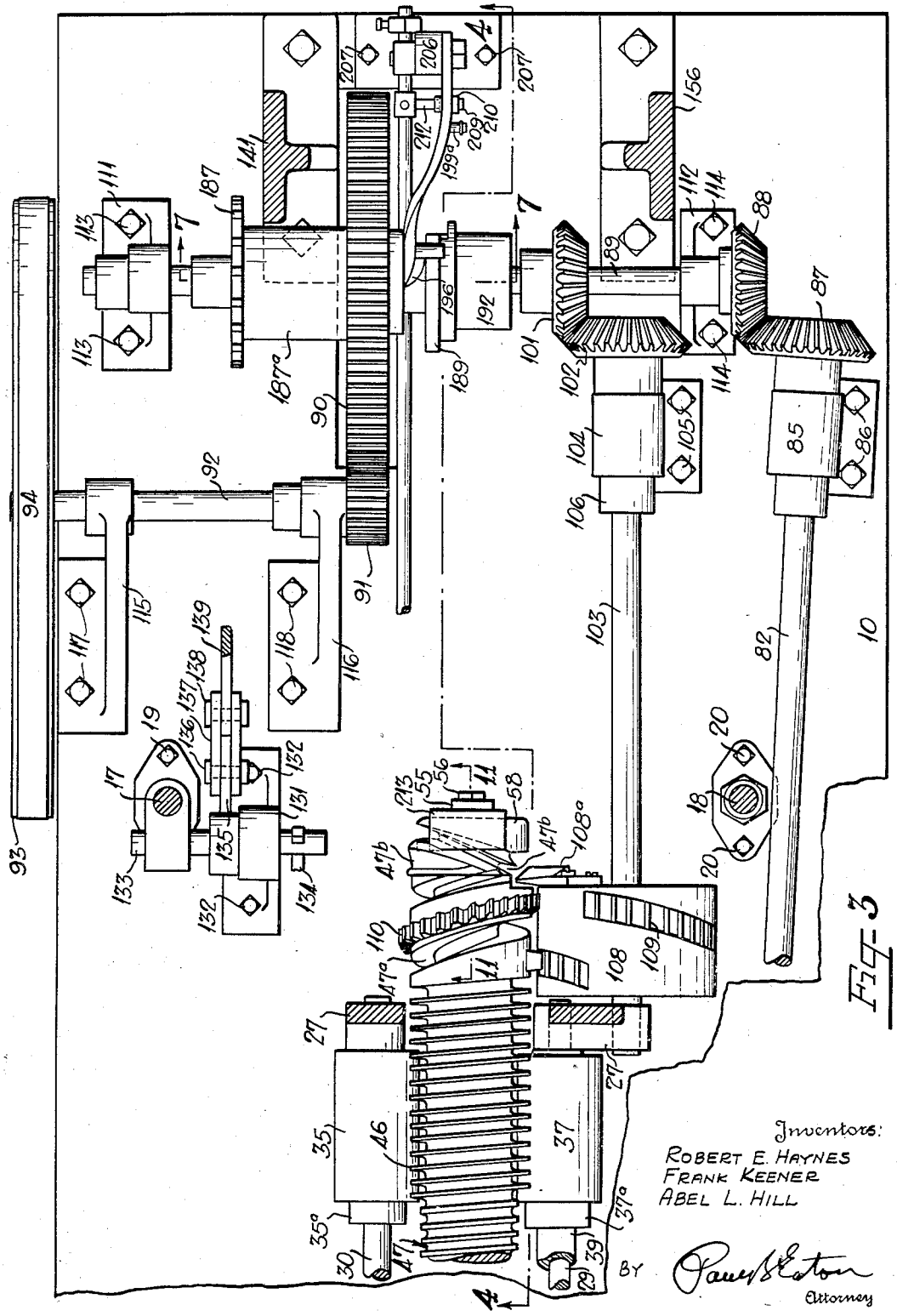


Fig. 3

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CIRCLET LOOPING MACHINE

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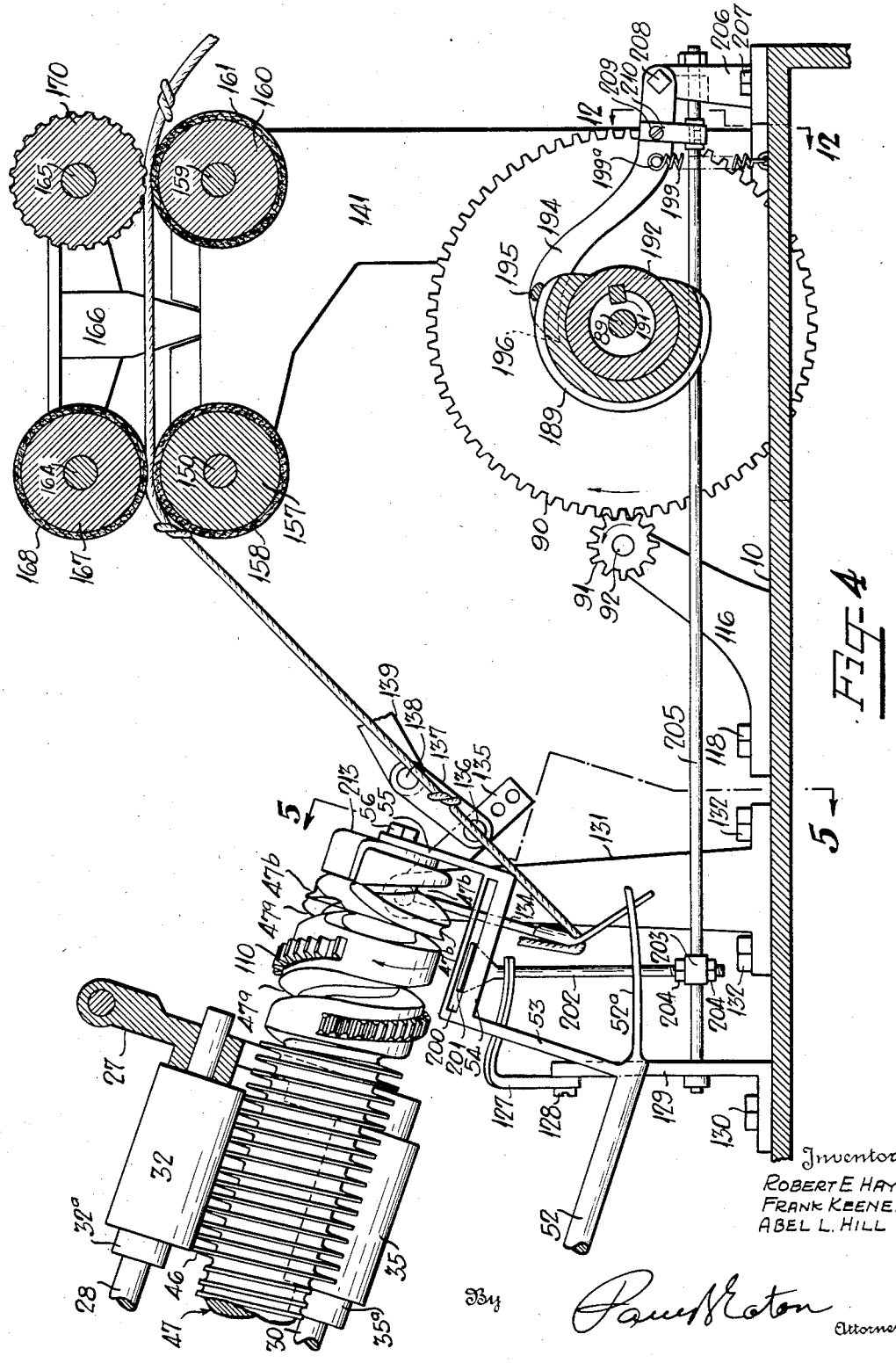


FIG. 4

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CIRCLET LOOPING MACHINE

Filed July 5, 1934 6 Sheets-Sheet 5

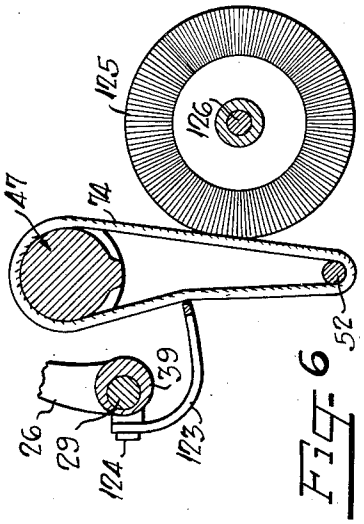


Fig. 6

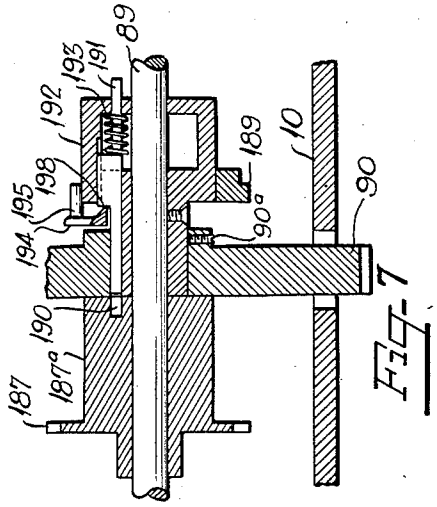


Fig. 7

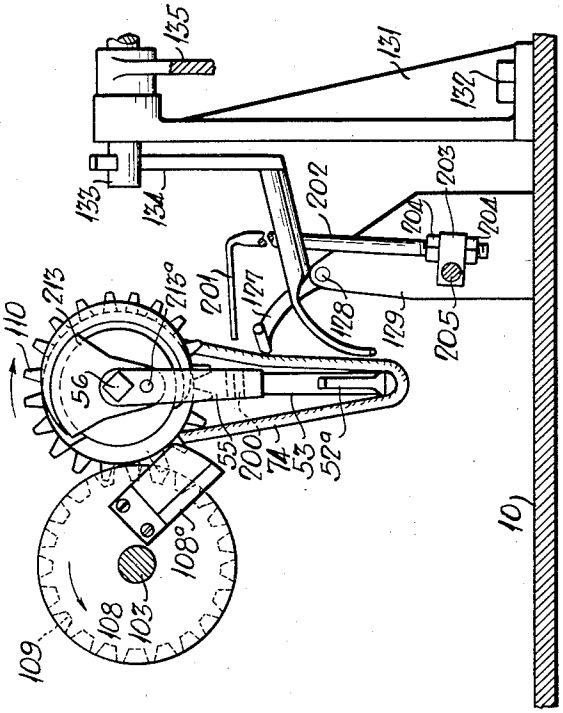


Fig. 5

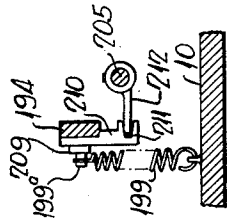


Fig. 12

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CIRCLET LOOPING MACHINE

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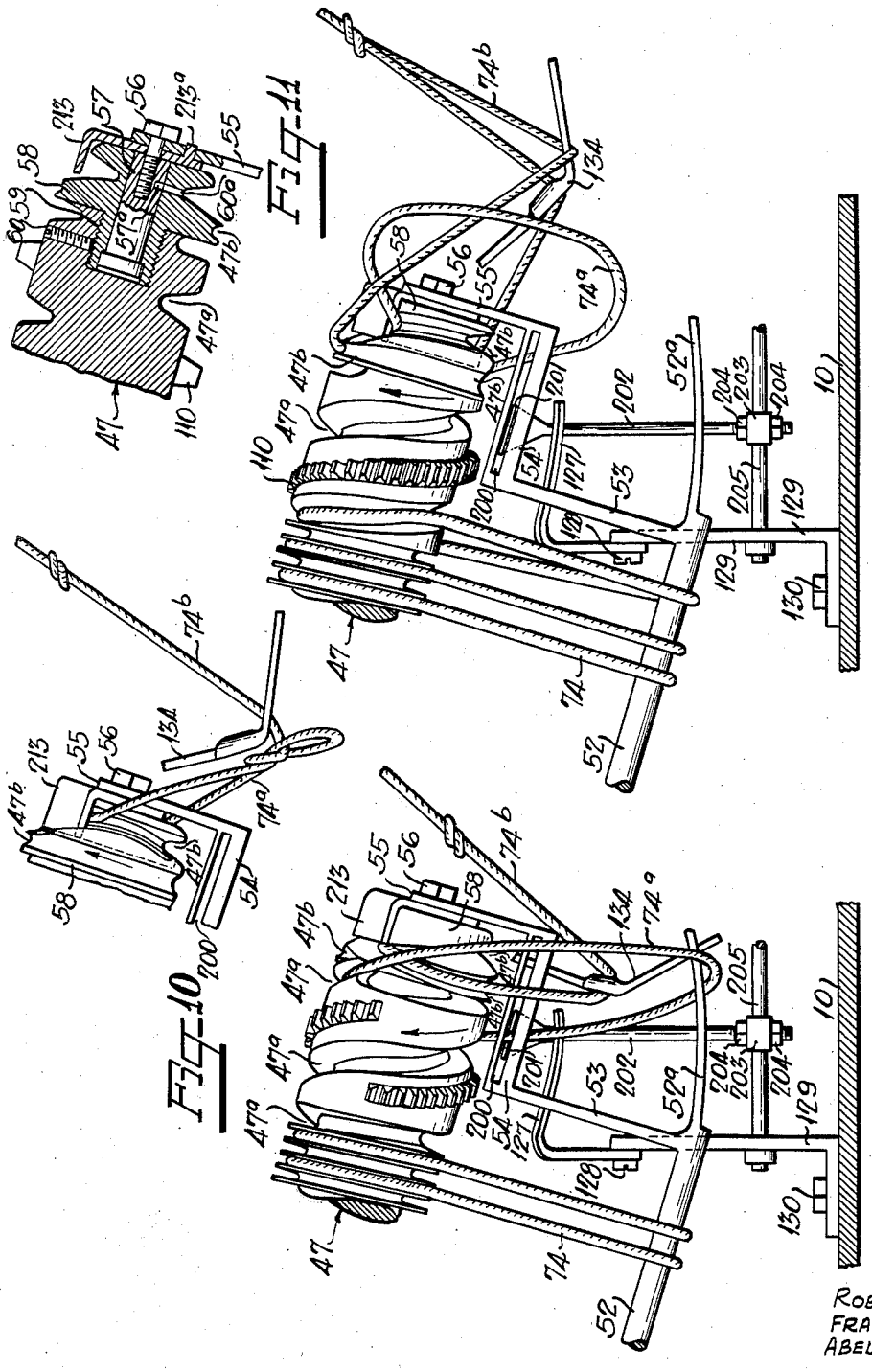


Fig-11

Fig-9

Fig-10

Fig-8

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Patented Aug. 6, 1935 2,010,591

UNITED STATES PATENT OFFICE

2,010,591

CIRCLET LOOPING MACHINE

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Application July 5, 1934, Serial No. 733,884

15 Claims. (Cl. 289—1)

This invention relates to a looping machine and more especially to a machine adapted to loop waste material such as circlets, and to place it in condition so that it can be used in the manufacture of rugs, carpets and the like.

Heretofore, the looping of these circlets has been done by hand which is very slow, inefficient and expensive, in fact, at the present time looping by hand is prohibitive since the labor costs are so high. It is, therefore, an object of this invention to produce a machine which will loop this waste material more rapidly than can be done by hand thereby making it possible to use this material which would otherwise be wasted.

This invention is an improvement on the machine shown in the co-pending patent application of Robert E. Haynes, Serial Number 667,131, Patent Number 1,972,520 of September 4, 1934, which shows another mechanism for looping the circlets.

It is another object of this invention to provide a looping machine with an inclined spiraled conveyor having a reverse spiral on the lower end thereof whereby the lowermost circlet is looped through and over the adjacent circlet to form a continuous strand.

It is a further object of this invention to provide a looping machine with means associated with the lower end of the spiraled groove which will prevent a circlet from shedding until another circlet has been fed to looping position. Means are also provided for applying the proper tension to the strand in order that the circlets will shed properly and be stretched taut, thereby, making a more workable material in the succeeding operations.

It is a further object of this invention to provide a machine for utilizing the looper rounds cut from hosiery during the knitting thereof. As it is well known, that as the toe is knitted onto the stocking, a portion of the stocking is cut-away which is usually about three-quarters of an inch in width. This circlet or continuous strand of knitted material rolls up at its edges to form an approximately round strand. This strand is resilient and this resiliency is employed to assist in the looping operation in the machine hereinafter described.

In the manufacturing of hosiery and especially half-hose, these are usually made on two machines. The upper portion of the stocking which is usually a ribbed top is made on a ribbing machine, and then cut to length and transferred to a plain circular knitting machine on which the remainder of the leg, and the heel, foot and toe are knit, as well as sufficient fabric to enable the looper or operator to place the loops of the opened ends on the point of a looping machine to loop or close the toe. The stocking before the toe is knitted thereon is placed on a transfer ring about three-quarters of an inch from the end of the knitting, and this portion of the stocking is cut-away and becomes waste. It is an object of this invention to provide a machine which will rapidly tie these endless circlets or bands together to form a continuous strand to be used in the weaving of rugs, carpets and other materials. If desired, of course, inferior stockings could be cut into circlets, but at present this is not necessary, as the great quantity of looper rounds which are at present discarded as waste form a sufficient supply for making continuous strands of these circlets without the necessity of cutting inferior hosiery into the circlets.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of the invention;

Figure 2 is an elevation of the opposite side of the left-hand portion of Figure 1;

Figure 3 is a sectional plan view taken along the line 3—3 in Figure 2;

Figure 4 is a vertical sectional view taken along the line 4—4 in Figure 3;

Figure 5 is a vertical sectional view taken along the line 5—5 in Figure 4;

Figure 6 is a sectional view taken along the line 6—6 in Figure 2;

Figure 7 is a sectional view taken along the line 7—7 in Figure 3 showing the clutch arrangement, and also showing the parts in a slightly different position from that shown in Figure 3;

Figure 8 is a view of the lower end of the spiraled conveyor similar to the central portion of Figure 4, but showing circlets thereon;

Figure 9 is another view similar to Figure 8 but showing the parts rotated in a slightly different position for shedding a circlet;

Figure 10 is a view showing the right-hand portion of Figures 8 and 9 after the parts have been rotated to shed a circlet;

Figure 11 is a sectional view taken along the line 11—11 in Figure 3;

Figure 12 is a sectional view taken along the line 12—12 in Figure 4;

Figure 13 is a sectional plan view taken along the line 13—13 in Figure 1.

Referring more particularly to the drawings, the numeral 10 denotes a suitable bed plate, which has integral therewith downwardly pro-

jecting legs 11, and mounted on plate 10 are supports 12 and 13 by any suitable means such as stud bolts 14 and 15 respectively. These supports project upwardly and support the upper end of a frame 16, in which the conveyor is mounted. The lower end of frame 16 is supported by posts 17 and 18, which in turn, are secured to member 10 at their lower ends by any suitable means, such as stud bolts 19 and 20 respectively. Frame 16 has projecting at right angles therefrom members 25, 26 and 27, in which are fixedly mounted shafts 28, 29 and 30. Shaft 28 has rollers 32 and 33 rotatably confined thereon by collars 32*a* and 33*a*. Shaft 30 has similar rollers 34 and 35 rotatably confined thereon by collars 34*a* and 35*a*, and shaft 29 has eccentric sleeves 38 and 39 adjustably mounted thereon, on which rollers 36 and 37 are rotatably confined by means of collars 36*a* and 37*a*. These rollers 32 to 37 inclusive serve as bearings for the spiraled circlet conveyor 47 which will be presently described. They also serve in conjunction with the enlarged portions of conveyor 47 as cutters for protruding strands on the circlets.

It is seen in Figures 1 and 2 that conveyor 47 has a spiraled groove therein, said spiraled groove being adapted to move a plurality of circlets downwardly as the conveyor rotates. It is further noted that the conveyor has enlarged spiraled portions 45 and 46 which are adapted to be contacted by the rollers 32 to 37 inclusive, but since the spiraled grooves are deep the strands of yarn are allowed to penetrate the groove and be conveyed downwardly without any interference with any of the bearing members, except any fringes on the circlets which are cut therefrom by portions 45 and 46 of the conveyor contacting the steel rollers 32 to 37 inclusive.

The right-hand portion of conveyor 47, as shown in Figure 1, has secured thereto a member 48 having a plurality of pitched grooves 49 therein, and the upper end of member 48 is rotatably mounted in bearing 50. Fixedly secured to bearing 50 is a projection 51 upon which the circlets are placed upon the conveyor. Secured to the lower end of member 51 is a guide rod 52 which projects downwardly substantially parallel to member 47, but diverges slightly from member 48, the purpose of which will be presently described.

The lower end of member 52 has integral therewith an upwardly projecting member 53 which has integral therewith another member 54 parallel to the conveyor 47, and the right-hand end of this member, as shown in Figure 4 has another upwardly projecting member 55 which is secured to the lower end of conveyor 47 by any suitable means such as stud bolt 56. This stud bolt 56 is threadably mounted in a member 57 which is rotatably mounted in a member 58 which is joined to the lower end of conveyor 47 by any suitable means such as having a threaded portion 59 threadably embedded in the lower end of conveyor 47. The member 58 is confined in position by means of a set screw 60 and member 57 is adapted to remain stationary while conveyor 47 and member 58 rotate. When it is desired to hold member 47 for purposes of assembling or disassembling, that is removing or installing stud bolt 56, it is noted that member 58 has a hole 60*a* radially disposed therein and that member 57 has a depression 57*a* so that as member 57 is rotated and a suitable pointed instrument is inserted into hole 60*a* it will enter hole 57*a* in member 57, so that member 57 can be locked against rotation while turning bolt 56. It is also to be noted that member 55 has a suitable hole therein penetrated by a pin 213*a* projecting from member 213*b*, so as to prevent rotation of member 213 which will be later described.

The circlets are placed over the member 51 and are pushed downwardly on top of rotating member 48. As the member 48 rotates the pitched grooves 49 tend to force the circlets downwardly onto the conveyor 47. It will be noted that the rod 52 which is substantially parallel to conveyor 47 and member 48 diverges causing the distance from the rod 52 to the conveyor 47 to be greater as the rod progresses downwardly. This is done in order that the circlets may be properly stretched when they reach the lower end of the conveyor 47. It also assists the loops to spread apart from each other since the upper end of the loop will be disposed on top of either member 48 or conveyor 47, and the lower end of the loop will be disposed around the rod 52. This arrangement insures one circlet in each round of the spiral groove. A suitable block 61 is secured to the upper surface of rod 52, and has its upper end abutting against the lower side of conveyor 47. This merely acts as a support in order to prevent the rod 52 from bending under the tension of the circlets as they progress downwardly on the conveyor 47.

In order to assist the conveyor 47 in carrying the circlets downwardly, a suitable conveyor is provided. It is also to be noted that this conveyor is disposed at the point where the rod 52 is diverging at an angle from the conveyor 47. Were it not for this conveyor there would be a tendency for the circlets to hang upon the rod 52 at this point, but by means of this conveyor the lower end of the circlets are carried downwardly upon rod 52 and thereby stretched to a proper position.

This conveyor comprises a plurality of angularly disposed lugs 62 pivoted as at 63 to a suitable sprocket chain 64. Sprocket chain 64 is mounted on sprockets 66 and 67 which, in turn, are fixedly mounted upon shafts 68 and 69 respectively. These shafts 68 and 69 are mounted in suitable bearings in a bracket 70, which bracket has its lower end mounted on the bed plate 10 by any suitable means such as bolts 71. It will be noted by referring to Figure 13, that the outstanding leg of each angle member 62 engages the lower end of the circlets 74 substantially at the top of rod 52 and forces them to the left toward the lower end of the conveyor 47. The other leg of the member 62 engages a projection 75 which is integral with the upper side of the bracket 70, and holds the angle member in the position shown on the side nearest the observer in Figure 13.

As the member 2 moves downwardly or to the left as shown in Figure 13, and around the sprocket 66 another projection 76 is engaged by the outstanding leg of the member 62. This causes the angle member 62 to assume the position as shown on the far side of Figure 13, and will occupy less space. It is further seen that when the angle member reaches the sprocket 67 that the right-hand end of projection 75 is again contacted and the angle member is caused to assume a position suitable for contacting the lower side of the circlets.

Shaft 68 has fixedly secured on the lower end thereof a suitable gear 80, which engages a worm 81, said worm being fixedly secured on shaft 82. The left-hand end of shaft 82, as seen in Fig-

ure 2 is rotatably mounted in a bearing 83, said bearing 83 projecting upwardly and being integral with the lower side of bracket 70. The right-hand end is also mounted for rotation in a bearing 85 which is secured to bed plate 10 by any suitable means such as stud bolts 86. A beveled gear 87 is fixedly secured on the lower end of shaft 82 which is adapted to engage another beveled gear 88, which is fixedly secured on the main drive shaft 89. Another gear 90 (see Figures 3 and 7) is fixedly secured on collar 192 by any suitable means such as screw 90a which in turn is secured to main drive shaft 89, said gear being adapted to mesh with a smaller gear 91 fixedly mounted upon shaft 92.

On the end of shaft 92 a pulley 93 is fixedly mounted, which pulley is driven by a belt 94, which is also mounted on a motor pulley 95 of motor 96. This motor may be disposed at any convenient location, but in the present instance it is shown as being supported by a bracket 97 secured to the lower side of the bed plate 10.

The main drive shaft 89 is rotatably mounted in bearings 111 and 112 which, in turn, are secured to the upper surface of bed plate 10 by any suitable means such as stud bolts 113 and 114 respectively. Likewise shaft 92 is rotatably mounted in bearings 115 and 116 which are secured to bed plate 10 by any suitable means such as stud bolts 117 and 118 respectively.

Since the motor pulley 95 is adapted to rotate in a clock-wise manner in Figure 1, the pulley 93 will be rotated in a like manner thereby rotating the shaft 92 and the pinion 91 (see Figure 3). This rotation will produce a clock-wise movement of shaft 89 as seen in Figure 4, which will cause the upper side of shaft 82 and pinion 87 to rotate toward the observer in Figures 2 and 3. It is evident that this movement of the shaft 82 will cause the sprockets 66 and 67 and also the chain 64 to rotate in a clock-wise manner as viewed in Figure 13.

Another beveled gear 101 is fixedly secured to main drive shaft 89, which is adapted to mesh with beveled gear 102, said beveled gear 102 being fixedly mounted on shaft 103. This shaft has one end rotatably mounted in a suitable bearing 104 which is secured to the upper portion of bed plate 10 by any suitable means such as stud bolts 105. A suitable collar 106 is fixed on shaft 103 immediately to the left of bearing 104 (see Figure 3) to limit the downward movement of the shaft and its associated parts. The left-hand end of shaft 103 is rotatably mounted in member 27 and disposed immediately to the right of member 27 on this shaft (Figures 2 and 3) is a cylindrical member 108 having spirally disposed gear 109 cut therein. These gear teeth are adapted to mesh with another spirally disposed gear 110, which is integral with the lower end of conveyor shaft 47.

In order to guide the circlets 74 in their proper path of travel as they are conducted down the spiralled shaft, a suitable guide 121 (Figure 2) is secured to the member 25 by any suitable means such as stud bolt 122. Another guide member 123 is secured to member 26 by any suitable means such as a screw 124, and this guide member serves the same purpose, namely to keep the circlets in their proper path of travel, so that they will not hang or interfere with the other parts of the apparatus.

A brush 125 is rotatably mounted in the upper end of a support 126, said support 126 being secured to the upper side of member 10. By referring to Figure 6 it will be seen that brush 125 contacts the circlets of yarn 74 on one side, and the guide 123 contacts the yarn on the other side, as it is conveyed down the spiralled shaft. This brush contacts the circlets and prevents them from overlapping each other on rod 52. As the circlets are conveyed downwardly the brush tends to press them apart in their proper position, so that they will be looped at the lower end of the conveyor in a proper manner.

Another guide 127 is pivoted as at 128 to the upper portion of bracket 129, said bracket 129 being secured to member 10 by any suitable means, such as stud bolts 130. A bracket 131 (see Figure 5) is secured to bed plate 10 by any suitable means such as stud bolts 132, the upper end of this bracket having rotatably mounted therein a stud 133, in which is fixedly mounted an L-shaped member 134. The L-shaped member 134 projects downwardly and to the left in Figure 5. Member 134 serves as a guide for the circlets and also assumes the positions as shown in Figures 8, 9 and 10 when the circlets are being looped. Member 134 while in the position shown in Figure 8 prevents shedding of circlet 74b and also causes 74b to follow reversed groove 47b. When it assumes the position shown in Figure 9 it allows shedding of circlet 74b.

Fixedly secured on stud 133 is also an arm 135, which projects downwardly (Figures 2 and 5), and has pivotally secured as at 136 an upwardly projecting link 137 said link 137 being pivoted as at 138 to another link 139. This link 139 is pivoted as at 140 to roll stand 141, which is mounted on bed plate 10. It will be noted by referring to Figure 1 that link 139 is adapted to be contacted by a cam 151 mounted on shaft 150. This link is held in contact with the cam at all times by means of a suitable spring 152, which has its lower end connected to link 139 and its upper end connected to arm 153, said arm being integral with the upper end of support 18. This cam 151 and the associated parts are adapted to co-operate with the action of the L-shaped member 134 and its function in connection with this apparatus will be later described.

Another support 156 is secured to the upper portion of member 10 and is similar to support 141. In the upper end of support 156 is adapted to be rotatably mounted, the other end of shaft 150, and fixedly secured on this shaft and disposed between the supports 141 and 156 is a suitable roller 157 having a covering 158 thereon. Another shaft 159 is rotatably mounted in the upper end of supports 141 and 156 and fixedly mounted on this shaft 159 is another roller 160 which has a covering 161 secured thereon. Hingedly secured as at 162 to the upper end of support 156 is a bracket 163, said bracket 163 being adapted to have rotatably mounted therein shafts 164 and 165. The other end of shaft 164 is rotatably mounted in bearing 166, and upon this shaft is mounted a roller 167 having a cover 168 thereon. This roller 167 is disposed directly above the roller 157 and is adapted to draw out the looped circlets and supply the necessary tension at the proper time.

Likewise, the other end of shaft 165 is rotatably mounted in bearing 166, and mounted on this shaft intermediate the bearings 163 and 166 is a corrugated roller 170. Roller 170 is disposed directly above roller 160 and also serves as a tension means for the looped circlets of yarn. It is seen that shaft 164 has a sprocket 171 fixedly mounted thereon (Figure 2) which is adapted

to mesh with another sprocket 172, said sprocket 172 being fixedly mounted on shaft 150. A smaller sprocket 173 is also fixedly mounted on shaft 150 and upon this sprocket is mounted a suitable chain belt 174 which extends to the right, and is also mounted upon sprocket 175, said sprocket 175 being fixedly secured on shaft 159. A suitable idler sprocket 176 is secured on stud 177, said stud 177 being secured to support 156, and this idler is adapted to take up the slack in the chain belt 174. A pinion 179 is fixedly secured on shaft 159 which is adapted to mesh with pinion 180 fixedly mounted on shaft 165.

The other end of shaft 159 (Figure 1) has a sprocket 185 thereon, upon which is mounted a chain belt 186. This chain 186 is mounted at the lower end upon sprocket 187, said sprocket 187 being loosely mounted on main drive shaft 89. When the main drive shaft 89 rotates in a counter clock-wise manner as shown in Figure 1, it is evident that the shaft 159 and its associated parts will also rotate in the same direction since this shaft 159 has the gear 179 on the other end thereof meshing with gear 180, the shaft 165, the shaft 165 to rotate in a counter clock-wise direction in Figure 2. The rotation of the shaft 159 will also be transmitted to shaft 159 through the medium of chain belt 174, and sprocket 173; therefore, pinion 172 will cause the pinion 171, and the shaft 164 to rotate.

When the high side of cam 151 engages the link 139 (see Figure 1) the parts 139, 135 and 134 assume the positions shown in Figures 1, 5, and 8, whereas, when the low side of the cam 151 engages the link 139 the spring 152 will pull the link 139 and its associated parts upwardly to cause member 134 to assume the position shown in Figure 9. When a circlet is shedding from the spiraled conveyor 47, and the parts are assuming a position shown in Figure 9, it is thus seen that the rollers 157, 160, 167 and 170 must rotate a slight amount in order that the proper tension shall be applied to the looped strand after the rollers have advanced the looped strands a sufficient amount it is then necessary for them to stop with the proper tension on the yarn if another circlet has not advanced to the proper position on the spiraled shaft to be looped onto the end of the strand, otherwise the continued rotation would break the strand since a circlet will not shed until another circlet has been looped thereto. The means for starting and stopping these rollers at the proper time will be presently described.

By referring to Figure 7 it will be seen that the hub 187*a* of sprocket 187 has a cavity 190 cut therein. A plunger 191 is slidably mounted in the hub portion 192, and has a spring 193 disposed on the right-hand end thereof which is confined on the plunger by means of the hub portion 192. This spring normally forces the plunger 191 to the left and causes the left-hand end to enter the cavity 190, unless it is otherwise obstructed. In the position shown in Figure 7 the gear 90 will rotate, since it is fixedly secured to hub 192 which, in turn is secured to shaft 89, but the sprocket 187 will not rotate because it is loosely mounted on this shaft. When the left-hand end of plunger 191 is allowed to enter the cavity 190 the sprocket 187 and the gear wheel 90 are connected and will turn together which will cause the rollers 157, 167, 160, and 170 to rotate.

It is evident that it is necessary for the plunger 191 to engage the hub 187*a* of the sprocket 187 continuously when the circlets are properly positioned on conveyor 47 but when there is a missing circlet the plunger 191 must disengage hub 187*a* to stop rotation of the rollers 157, 160, 167, and 170. Therefore, means must be provided for engaging and disengaging the plunger 191 at the desired time. Hub 192 has a suitable cam 189 fixedly mounted thereon, which is adapted to be contacted by cam lever 194. Cam lever 194 has a projection 195 integral therewith, which causes the left-hand end of lever 194 (Figure 4) to raise or lower as the cam 193 rotates with shaft 89. It should be further noted that the plunger 191 is disposed at a point on the low side of the cam 193, and unless otherwise prevented the projection 195 will allow the pointed end 196 of cam lever 194 to fall downwardly, and cause this pointed end to engage the shoulder 198 of plunger 191 and cause it to move to the right in Figure 7, thereby moving the left-hand end of the plunger 191 out of the cavity 190. If there are no circlets near the lower end of the conveyor 47, with the machine threaded and the looped strands in the position shown in Figures 4 and 8, it is evident that if the plunger 191 were allowed to engage the hub 187*a* of sprocket 187 the rollers 157, 160, 167 and 170 would turn and the strand would be broken because the strand cannot shed off the end of conveyor 47 until another circlet 74 is looped thereto. Since the left-hand portion 196 of cam lever 194 is allowed to drop downwardly and to engage the shoulder 198 of plunger 191, to cause the plunger to move to the right, it is evident that the sprocket 187 and its associated parts will not rotate. However, in normal operation when the circlets are being fed consecutively to the end of conveyor 47 it is not desired that the point 196 of cam lever 194 engage the shoulder 198, because a loop is formed at every revolution of the drive shaft 89 or spiraled conveyor 47.

The rollers should rotate continuously in order to take up the slack in the strand and to produce the proper tension.

Therefore, means must be provided for holding this point 196 out of engagement with the shoulder 198 when the apparatus is operating under normal conditions.

It is seen that the member 54 has a slot 200 therein, which is adapted to be penetrated by feeler 201 when there are no circlets being fed over the lower end of the conveyor 47. It is evident by referring to Figure 5 that when a circlet is being carried down the conveyor that a portion of the circlet will be disposed between the feeler 201 and the slot 200 for a short time and will not allow the feeler 201 to move into the slot.

Feeler 201 has a downwardly projecting arm 202 which is secured to block 203 by any suitable means such as nuts 204 disposed on each side of the block. Block 203 is fixedly secured to the shaft 205, said shaft 205 having one end mounted for oscillation in bracket 129, and the other end being mounted for oscillation in a bracket 206. Bracket 206 is secured to the upper portion of bed plate 10 by any suitable means such as stud bolts 207. Cam lever 194 is pivoted as at 208 to the upper portion of bracket 206. A suitable spring 199 has its upper end secured to lever 194 as at 199*a* and its lower end secured to bed plate 10. This spring pulls the free end of lever 194 downwardly at all times.

Secured as at 209 to cam lever 194 is a bracket 210 (Figure 12). This bracket has a fork 211 in the lower end thereof, which is adapted to loosely hold the end of arm 212, said arm 212 be-

ing fixedly mounted on oscillating shaft 205. It is evident when the feeler 201 (see Figure 5) engages a circlet 74 that the shaft 205 will not be allowed to oscillate enough to move the lever 212 downwardly, and allow the bracket 210 and the cam lever 194 to be moved downwardly. When a circlet is not present the feeler 201 will move inwardly and the oscillating shaft 205 will be allowed to rotate in a counter clock-wise direction, (Figures 5 and 12), thereby, moving the bracket 211 and the cam lever 194 downwardly. This will allow the point 196 to engage the shoulder 198 of plunger 191, thus preventing the left-hand portion of the plunger from entering the cavity 190 (Figure 7), therefore the sprocket 187 and the rollers 157, 160, 167, and 170 will not turn.

It is seen in Figure 8 that a circle 74*a* has been conveyed to the end of the conveyor through the spiraled groove 47*a*, and that the preceding circlet 74*b* has already been looped and is disposed in the reverse groove 47*b*. In Figure 9 the end of the conveyor 47 is shown rotated slightly from the position shown in Figure 8 and at this time the circlet 74*a* which is disposed in the groove 47*b* has been moved upwardly and is now engaging the shed plate 213, said plate 213 being secured to the end of the conveyor shaft by means of the stud bolt 56. This plate stops the rotative movement of the loop 74*a* and allows the circlet 74*b* which is disposed in the reversed groove 47*b* to shed and assume a position as shown in Figure 10. It will be noted, especially in Figure 3, that reversed groove 47*b* at its beginning is not reversed but as it advances becomes a reversed groove. Member 108 has a projection 108*a* secured thereto to close the reversed portion of groove 47*b* and to cause circlet 74*a* to enter the unpitched or beginning portion of reversed groove 47*b* and prevents circlet 74*a* from entering the rearward pitched portion of groove 47*b* which has circlet 74*b* therein. It is noted that circlet 74*b* has the oncoming circlet 74*a* fed around it and as the upper portion of 74*b* is fed over the upper end of circlet 74*a*, this makes the loop.

In the position of the circlet 74*b* in Figure 9 the low side of the cam 151 is contacting the link 139, which allows the spring 152 to pull the L-shaped member 134 to the position shown in Figure 9. Since the plunger 191 is engaging (Figure 7) the cavity 190 disposed in the face of hub 187*a* of sprocket 187 the sprocket is rotating, thereby causing the rollers 157, 160, 167 and 170 to move the looped circlet and cause the proper amount of tension to be applied thereto. When there is no circlet opposite feeler 201 (Figure 5), point 196 of cam lever 194 engages the shoulder 198 and disengages the sprocket 187 from gear 90.

It should be noted that a suitable extension 52*a* is provided on the end of rod 52 to hold the lower end of the circlets in their proper position until they are looped and shedded.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being set forth in the appended claims.

We claim:

1. Means for looping circlets together to form a strand comprising a spiral conveyor for conveying a plurality of circlets in parallel relation to each other, means for holding the circlets in taut condition on the conveyor, means for feeding one end of a circlet through the next circlet and over the end of the next circlet and means for applying tension to the first circlet to move it off the conveyor and to secure it in position on the second circlet.

2. Means for looping endless pieces of fabric together comprising a spiraled conveyor, means for feeding the pieces to the conveyor, means for applying tension to the pieces while they are on the conveyor, means for directing the last piece on the conveyor through and over one end of the next piece to loop the same together.

3. Means for tying circlets together comprising a rotatable shaft having a spiraled groove throughout its length, and having a reversely pitched groove at its discharge end, means for supplying circlets to the rotatable shaft, means for guiding the last circlet on the shaft to cause it to traverse said reversely pitched groove and extend through and over one end of the next circlet on the shaft, and means for guarding the next circlet while the first circlet is shed from the shaft over the shielded portion of the next circlet.

4. A machine for tying circlets together comprising a spiraled conveyor for feeding a plurality of circlets continuously through the machine parallel to each other, a rod disposed in parallel relation to the spiraled conveyor for applying tension to the circlets, means for directing one end of the last circlet in the machine through the next circlet and over one end of the next circlet to loop the said circlets together.

5. A machine for tying looper rounds cut from hosiery during the manufacture thereof, comprising a spiraled conveyor and a spaced parallel rod for positioning a plurality of the rounds parallel to each other and moving the same laterally, means for moving one end of the first looper round through the adjacent oncoming looper round and over the end of the oncoming looper round, and means for applying tension to the first looper round to remove it from the positioning and moving means and to cause it to be looped around and through the other end of the adjacent looper round.

6. A circlet tying machine comprising means for arranging the circlets in parallel spaced relation and feeding them continuously in one direction and means for reversing the direction of travel of one end of the last circlet to pass it through and over one end of the next circlet to loop the two circlets together.

7. A machine for tying circlets together comprising means for feeding a plurality of parallel circlets through the machine and means for reversing the direction of travel of the last circlet to cause one end thereof to be fed through and over one end of the next circlet.

8. A machine for tying circlets together comprising a shaft having a spiral groove throughout its length, means contacting the periphery of the shaft intermediate its ends for supporting the same for rotation, said shaft having a reversely pitched groove on its discharge end traversing the said spiral groove, means for feeding circlets onto the shaft, means for positioning a circlet in each round of the spiral groove, a spirally disposed gear on said shaft, a driving member having a spirally disposed gear thereon meshing with the first-named spirally disposed gear for imparting rotation to the shaft and allowing the oncoming circlets to pass the spirally disposed gears in the groove therebetween, means for guid-

ing the last circlet on the shaft through and over one end of the next circlet, means for applying tension to the last circlet to remove it from the shaft, and means for engaging the circlets on the shaft one at time to control the tension applying means.

9. A machine for tying circlets together comprising means for feeding a plurality of parallel circlets through the machine, means for reversing the direction of travel of one end of the last circlet to cause said one end thereof to be fed through and over one end of the next oncoming circlet, and means for guarding the end of the next circlet while the first circlet passes thereover.

10. A machine for tying circlets together comprising means for feeding a plurality of parallel circlets through the machine, means for reversing the direction of travel of one end of the last circlet to cause said one end thereof to be fed through and over one end of the next oncoming circlet, means for intermittently engaging the next circlet and means controlled by said engaging means for removing the last circlet from the feeding means.

11. A machine for tying circlets together comprising means for feeding a plurality of parallel circlets through the machine, means for reversing the direction of travel of one end of the last circlet on the feeding means to cause said one end to be fed through and over one end of the next circlet, a feeler for engaging the next circlet on the feeding means, means for withdrawing the last circlet from the feeding means after it has been looped over the next circlet, and means controlled by said feeler for rendering inoperative the withdrawing means in the absence of a next circlet.

12. A circlet tying machine comprising a shaft having a spiral groove throughout its length, a plurality of rollers engaging the outer portions of the shaft for supporting the same for rotation and to permit circlets to pass along the groove out of contact with the rollers, a spiral gear on one round of said shaft, a driving wheel having a spiral gear thereon engaging the first-named spiral gear for driving the shaft and at the same time allowing the circlets to follow the spiral groove as the shaft is rotated, means spaced from the shaft for applying tension to the circlets and preventing their rotation with the shaft to thus advance the circlets along the shaft, means for causing a circlet to be disposed in each round of the groove on said shaft, a reversely pitched groove on the discharge end of the shaft for guiding one end of the last circlet on the shaft backwardly through the next oncoming circlet and over the end of the next oncoming circlet to loop the last and the next oncoming circlets together.

13. A circlet tying machine comprising a constantly rotating shaft having a spiral groove throughout its length and having a reversely pitched spiral groove on its discharge end traversing the first groove, means for supplying circlets to each round of the said first spiral groove, a fixed member disposed in spaced relation to said shaft and loosely secured to each end of the shaft to impart tautness to the circlets as they are moved along the shaft, means for guiding the last circlet on the shaft into said reversely pitched spiral groove to cause it to pass through the next oncoming circlet and over the end of the same, means for removing the last circlet from the shaft, and means for shielding the next circlet which is entering the reversely pitched groove while the last circlet is shedded from the shaft.

14. A circlet tying machine comprising a threaded shaft whose threads for at least a portion of the shaft are deeper than the cross-sectional width of the circlets, a plurality of means disposed intermediate the ends of the shaft and engaging the peripheries of the threads for supporting the shaft for rotation, means for imparting rotation to the shaft, said shaft also having on its discharge end a reversely pitched thread traversing the first thread, means for feeding circlets onto said shaft to be moved therealong by rotation of the shaft, means for placing a circlet in each round of the thread, means for guiding one end of the last circlet through the next oncoming circlet and over the end of said next circlet to discharge the last circlet from the shaft in looped relation to the next circlet, said operation being repeated at each revolution of the shaft.

15. A machine for looping circlets together to form a strand comprising a spiraled conveyor for disposing a plurality of circlets in parallel relation and feeding them continuously through the machine, means for reversing the direction of travel of the last circlet on the discharge end of the conveyor to cause it to pass through the next circlet and over one end of the next circlet, means for guarding the next circlet while the first circlet passes thereover, and means for applying tension to the last circlet to remove it from the feeding means and pull it over the next circlet and form a looped knot at the other end of said next circlet, the said next circlet, then becoming the last circlet for repeating the above described operation on another oncoming circlet.

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