Nov. 10, 1964 C. BUSTAMANTE 3,156,265

NOVELTY FABRIC LOOM

Filed May 23, 1961 7 Sheets-Sheet 1

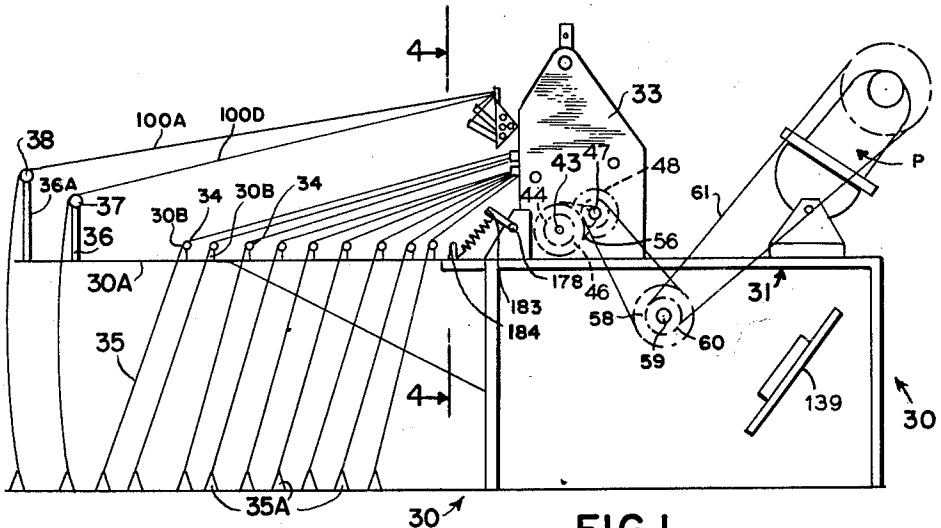

FIG. 1

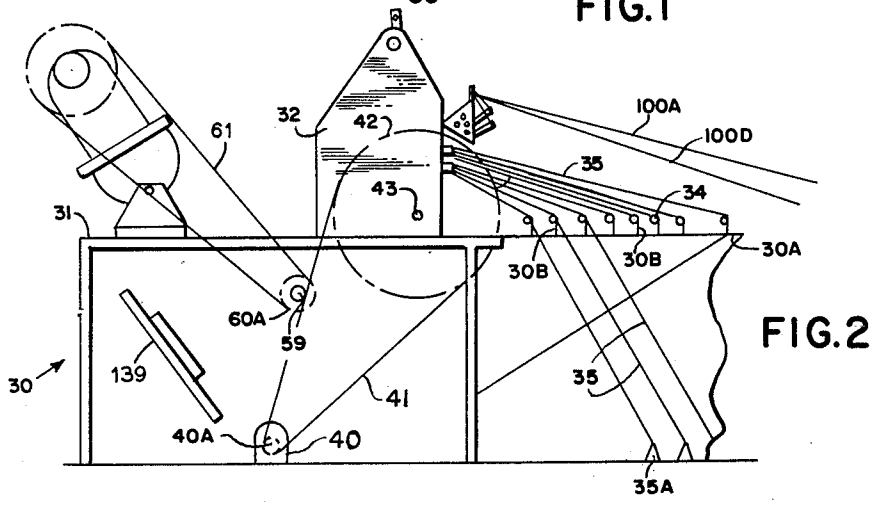

FIG. 2

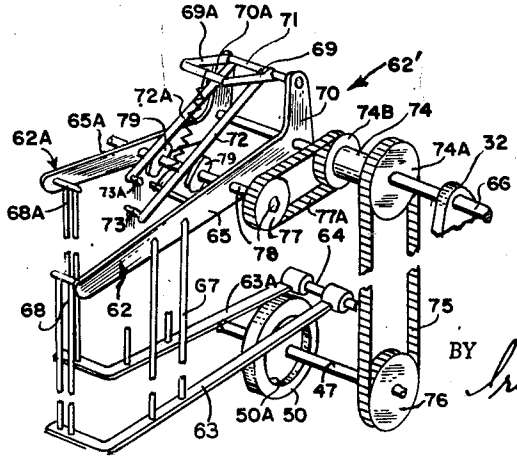

FIG. 5

INVENTOR.
Cesar Bustamante
BY Irving Heidman
ATTORNEY

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NOVELTY FABRIC LOOM

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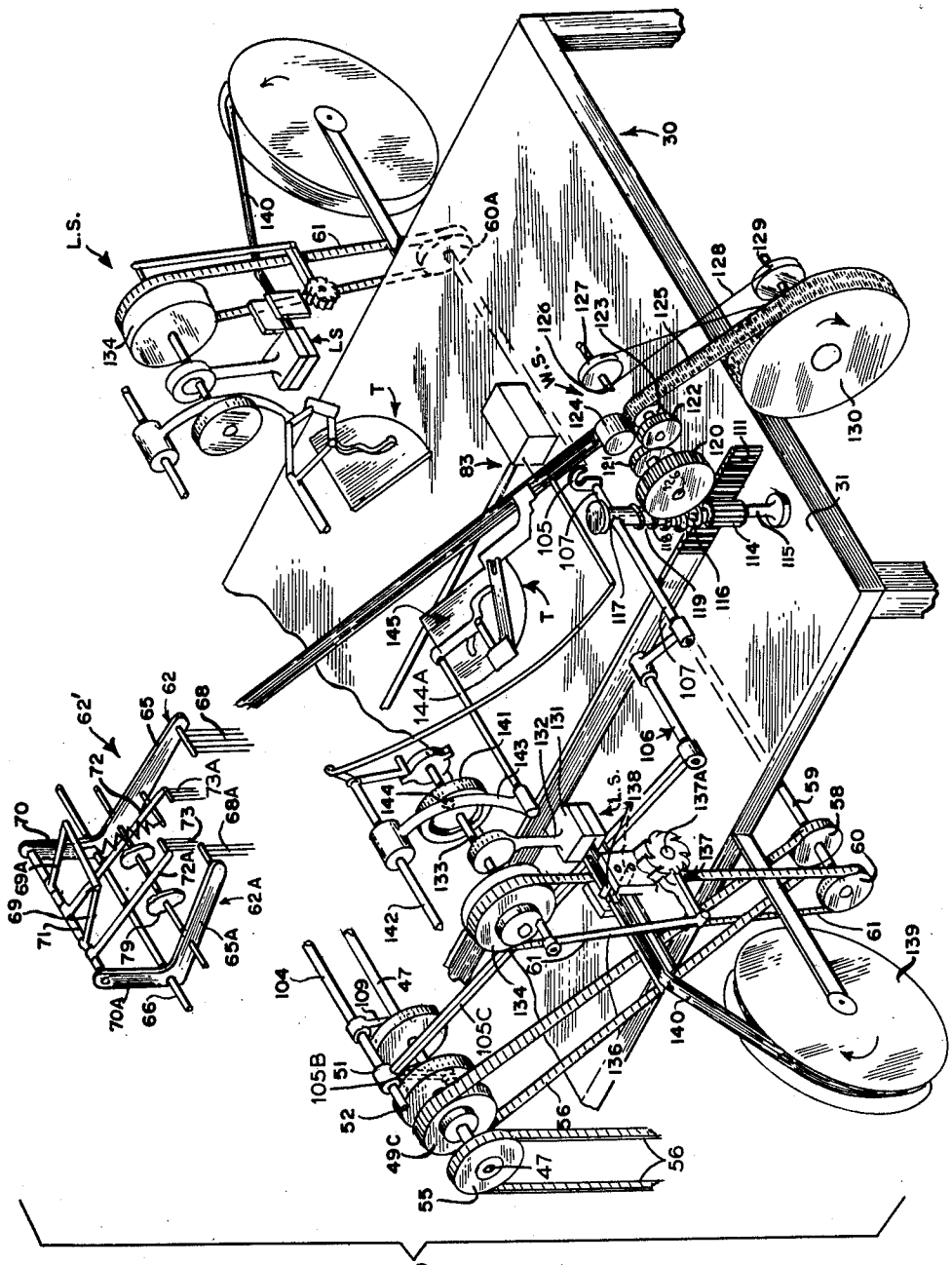

FIG. 3

INVENTOR.
Cesar Bustamante

BY Irving Seidman

ATTORNEY.

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NOVELTY FABRIC LOOM

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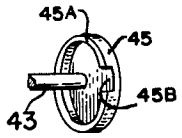
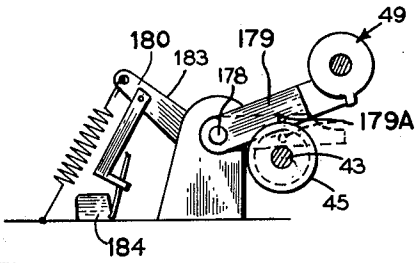


FIG.24



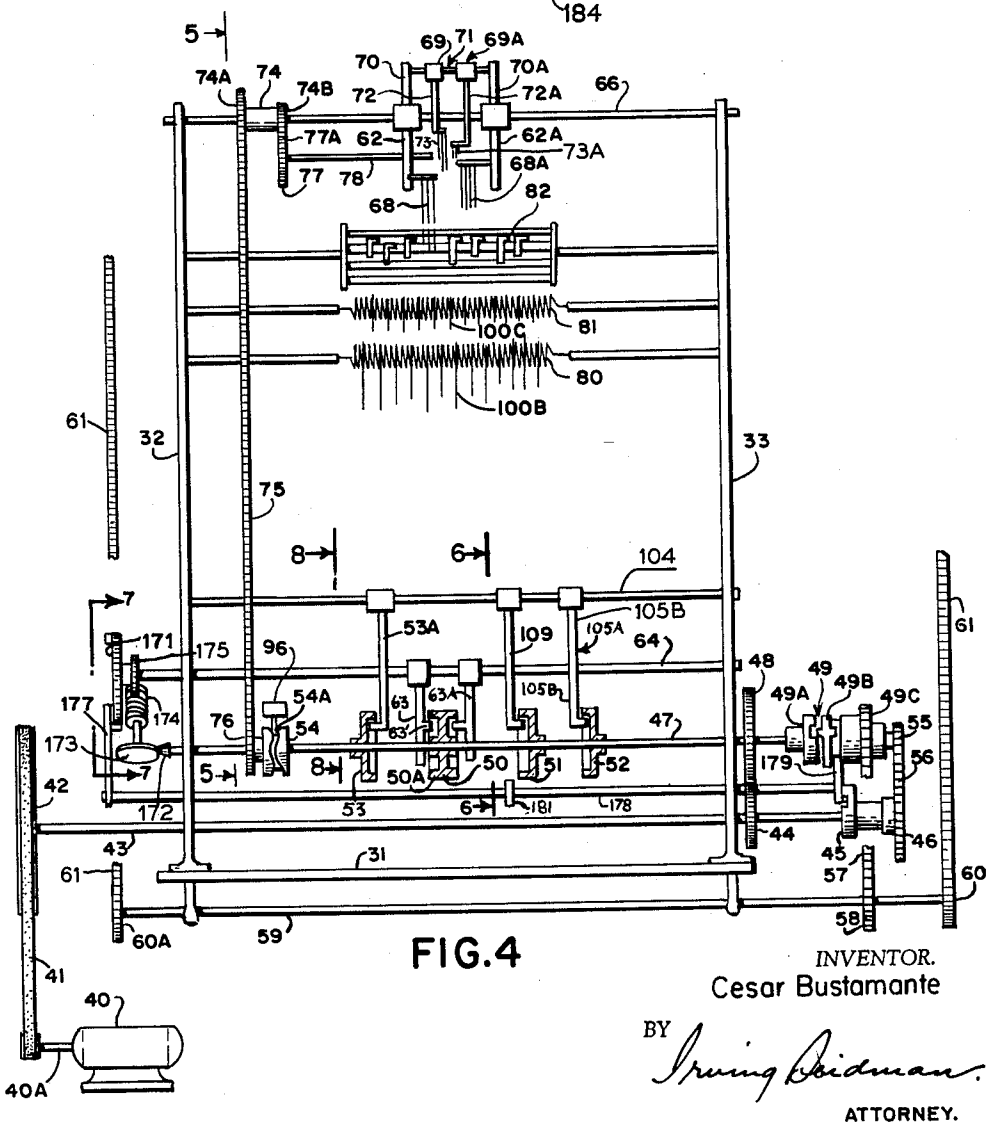


FIG.4

INVENTOR.
Cesar Bustamante

BY Irving Baidman

ATTORNEY.

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NOVELTY FABRIC LOOM

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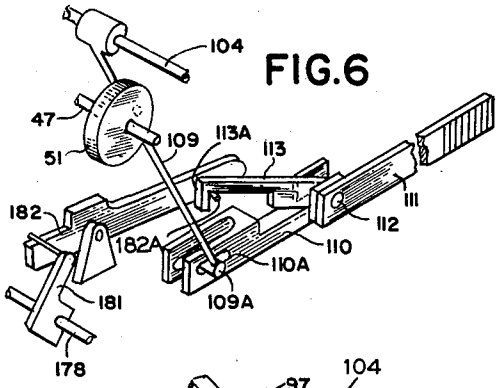

FIG.6

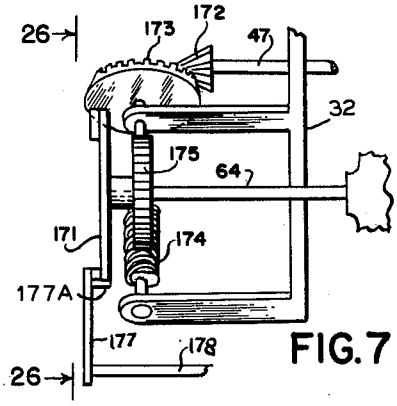

FIG.7

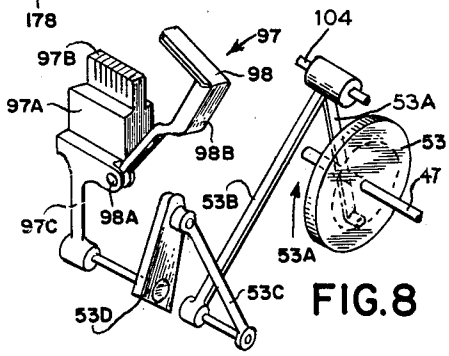

FIG.8

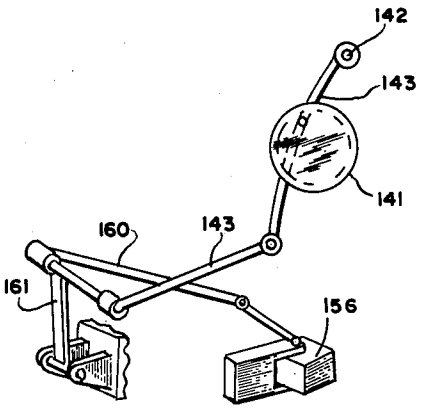

FIG.10

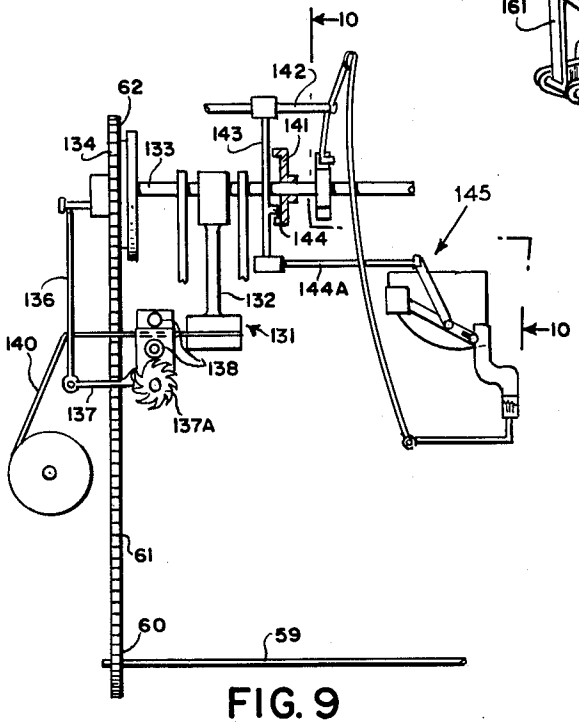

FIG. 9

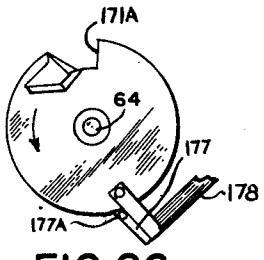

FIG.26

INVENTOR.
Cesar Bustamante

BY Irving Feldman.

ATTORNEY

Nov. 10, 1964 C. BUSTAMANTE 3,156,265

NOVELTY FABRIC LOOM

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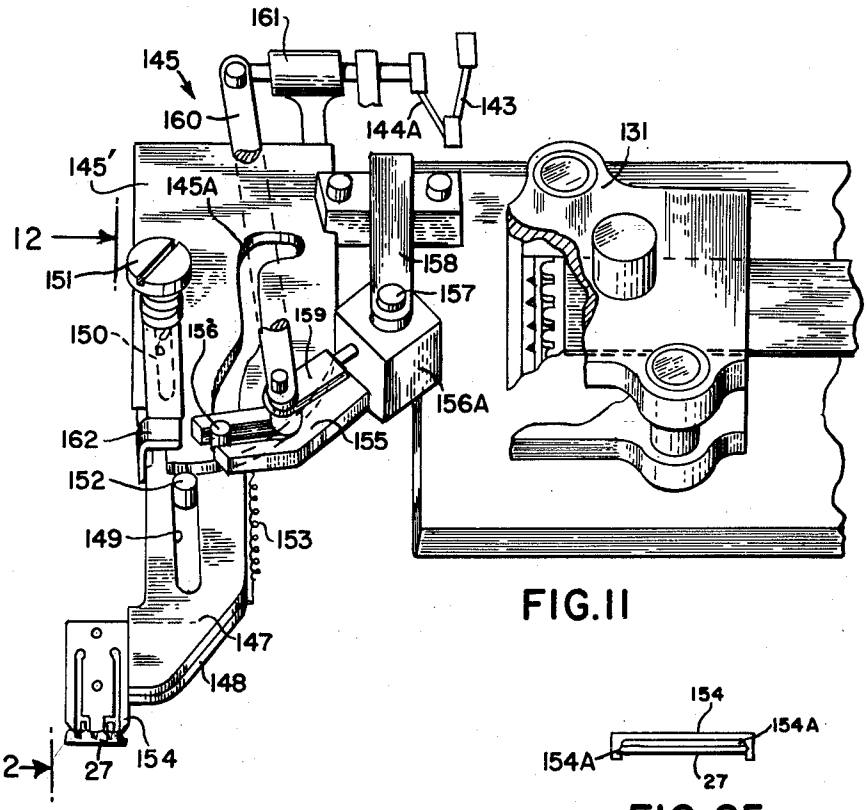

FIG. 11

FIG. 25

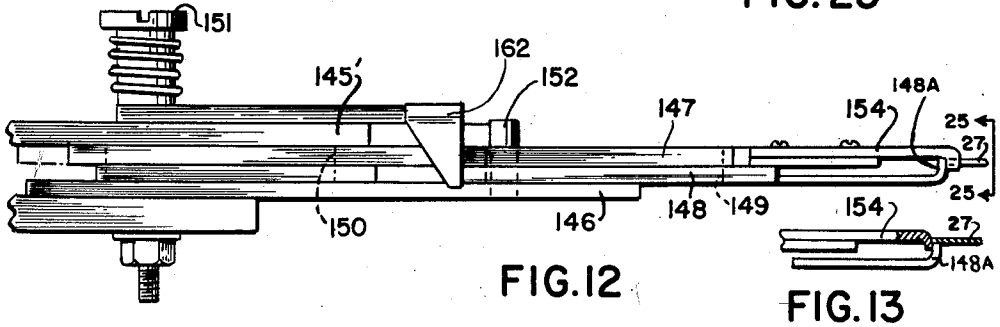

FIG. 12

FIG. 13

INVENTOR.
Cesar Bustamante

BY Irving Seidman

ATTORNEY.

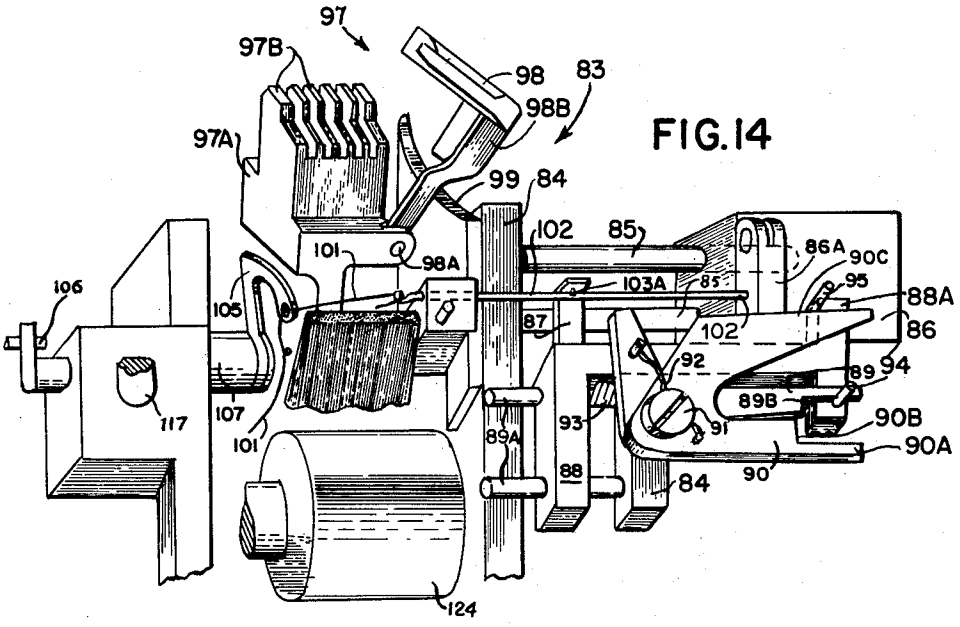

FIG.14

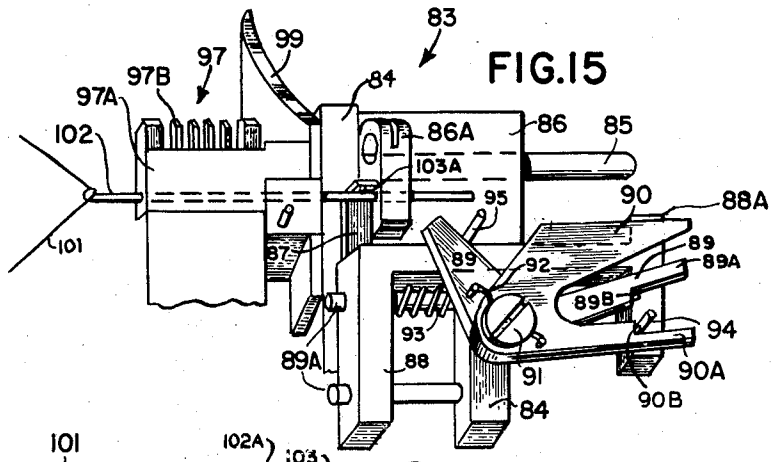

FIG.15

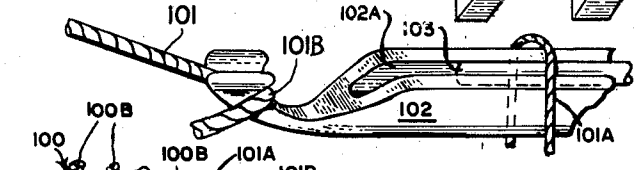

FIG.16

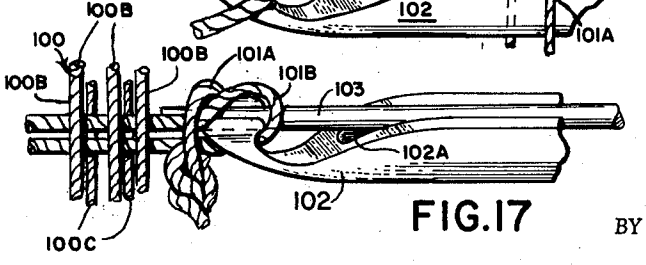

FIG.17

INVENTOR.
Cesar Bustamante
BY Irving Heidman
ATTORNEY.

Nov. 10, 1964 C. BUSTAMANTE 3,156,265

NOVELTY FABRIC LOOM

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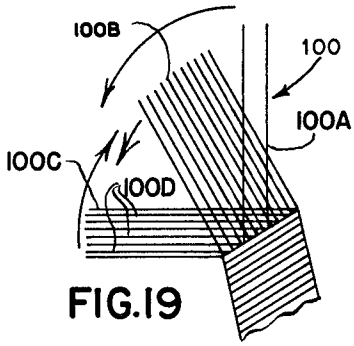

FIG.19

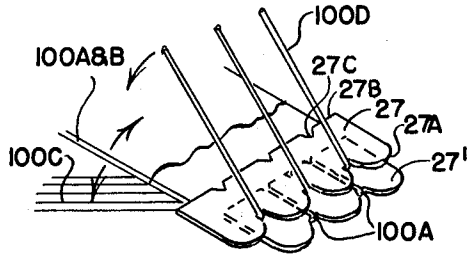

FIG.21

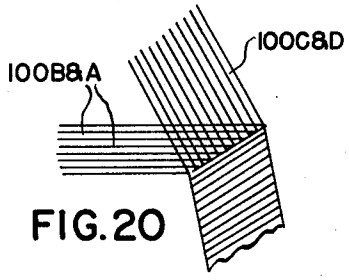

FIG.20

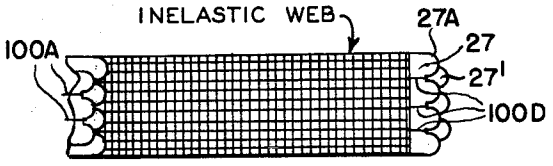

FIG.18

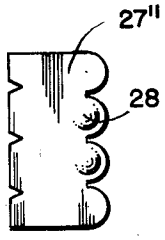

FIG.22

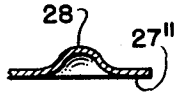

FIG.23

INVENTOR.
Cesar Bustamante

BY Irving Seidman

ATTORNEY.

United States Patent Office 3,156,265 Patented Nov. 10, 1964

3,156,265

NOVELTY FABRIC LOOM

Cesar Bustamante, 150 W. 21st St., New York, N.Y.

Filed May 23, 1961, Ser. No. 111,948
9 Claims. (Cl. 139—11)

This invention is related in general to the art of wearing, and more particularly to an improved fabric weave and machine for automatically making the same.

An object of this invention is to provide an improved fabric weave having a selvedge edge along the length of a woven fabric formed with a chain or looped stitch.

Another object is to automatically interweave onto a fabric woven in accordance with this invention, a metallic, plastic, leather link or the like so as to give the woven fabric a pleasing and ornamental appearance.

Another object is to provide a machine for automatically weaving threads into a fabric having a selvedge edge formed with a chain or looped stitch.

Another object is to provide a machine for automatically weaving a fabric from numerous threads and interweaving thereinto ornamental links or the like.

Another object is to provide for a machine which will successively blank the ornamental links from a suitable stock material and successively place the blanked link into position for interweaving the same onto the woven fabric.

Another object is to provide a machine for automatically and continuously weaving fabric with ornamental links interwoven thereinto in predetermined lengths, and automatically spacing the predetermined lengths by woven web portions in which the links have been omitted.

Still another object of this invention is to provide a machine for automatically and continuously weaving rubberized or stretchable thread into predetermined lengths of elastic fabric with inelastic intervals of woven fabric disposed between successive predetermined lengths of elastic fabrics.

A feature of this invention resides in the provision that the machine and fabric produced thereby is particularly suitable for automatically making elastic belts and the like of woven thread with and/or without ornamental links interwoven thereinto.

Another feature of the invention resides in the provision that the machine is reliable in operation, exceedingly fast and capable of operating with a minimum of attention on the part of an operator.

Still another feature resides in the arrangement and operation of the weft thread hook and latching needles for attaining the chain or looped stitch selvedge edge in a fabric woven in accordance with this invention.

Other features and advantages will become readily apparent when considered in view of the drawings and description pertaining thereto in which

FIG. 1 is a left side elevation view of the weaving machine of this invention with parts thereof shown schematically.

FIG. 2 is a right side elevation view of the machine schematically illustrated in part.

FIG. 3 is a front view pictorial illustration of the machine schematically shown in part.

FIG. 4 is a rear section view taken substantially along line 4—4 of FIG. 1.

FIG. 5 is a detail side view of the weaving bars taken along line 5—5 of FIG. 4.

FIG. 6 is a detail view of the stroke mechanism taken along line 6—6 of FIG. 4.

FIG. 7 is an enlarged detail of the sizing cam assembly which controls the length of fabric interwoven with ornamental links, and is taken along line 7—7 of FIG. 4.

FIG. 8 is a section view taken along line 8—8 of FIG. 4.

FIG. 9 is a detail front view of the stamping station.

FIG. 10 is a view taken along line 10—10 of FIG. 9.

FIG. 11 is an enlarged pictorial view illustrating the means for transporting the blanked link from the stamping station to the weaving station.

FIG. 12 is an end view taken along line 12—12 of FIG. 11.

FIG. 13 is a fragmentary detail view of FIG. 12 illustrating the relative position of the parts in blank extracting position.

FIG. 14 is a fragmentary pictorial plan view of the weaving station with the hook needle fully retracted.

FIG. 15 is a fragmentary pictorial plan view of the weaving station with the hook needle protracted to pick up the weft thread.

FIG. 16 is an enlarged detail of the improved needle construction for weaving the weft thread illustrating the position of the weft thread in preparation for forming the chain or looped stitch.

FIG. 17 illustrates the arrangement of the needle parts in chain stitch forming position.

FIG. 18 illustrates a fragmentary portion of an ornamental fabric woven in accordance with this invention illustrating an inelastic woven web segment formed between successive predetermined lengths of ornamental elastic belt segments.

FIGS. 19, 20 and 21 illustrate the various positions of the warp threads during a weaving operation in accordance with this invention.

FIG. 22 illustrates a detail of a modified link.

FIG. 23 is a section view taken along line 23—23 of FIG. 22.

FIG. 24 is a detail view of clutch synchronizer.

FIG. 25 is a detail front view taken along line 25—25 of FIG. 12.

FIG. 26 is a side view taken along line 26—26 of FIG. 7.

It will be understood that the invention, to be herein described in detail, is applicable to the art of weaving in general. However, the invention will be described with particular reference to the weaving of fabrics having ornamental links interwoven thereinto. More particularly the invention will be described with reference to the making of elastic or stretchable fabric or belts formed of woven elastic and/or inelastic threads, and which has interwoven thereinto links formed of any suitable material such as metal, plastic, leather and the like. While the links may assume any desired shape, the links **27**, as illustrated in FIGS. 18 and 21, are formed with a scalloped leading edge **27A** and a trailing edge **27B** having formed therein corresponding V-shaped notches **27C**. It will be noted that links **27** having an even number of scallops and links **27'** having odd number of scallops are alternately interwoven onto the face of the belt or fabric in overlying relationship as to give a scale-like appearance. Further, the arrangement and shape of the links **27** and **27'** are such that they do not interfere with either the flexibility of the finished goods or the elasticity thereof when the fabric is formed of woven elastic threads. For added effect the links **27''** may be formed with scallops having a slightly raised outer contour **28** to give a further rounded or bead-like appearance thereto.

In accordance with this invention the improved fabric weave comprises the division of the warp threads **100** into at least two sets **100B** and **100C**. See FIGS. 16, 17, and 19 to 21. With the two sets of warp threads **100B**, **100C** held apart, a pick-up of the weft thread **101** is made; and the weft thread **101** inserted transversely between the two parted sets **100B**, **100C** of warp threads **100**. The pick-up of the weft thread **101** in accordance with this invention is made with a hook needle **102** in a manner to form a weft thread loop **101A** on the shank of the needle **102**. With the weft thread **101** positioned

between the two warp sets 100B, 100C, the positions of the warp sets 100B, 100C are interchanged. Upon changing position of the warp threads 100B, 100C the hook needle 102 is again advanced to pick up the weft thread and forms the next weft thread loop 101B. In doing so the previously formed weft loop 101A slides onto the rear end of the needle and over a latch needle 103 which is slidably mounted within a recess 102A of hook needle 102 as needle 102 advances to the left to hook the next weft thread to form the next weft loop. Upon return or retraction of hook needle 102, with the next weft loop 101B, the latch needle 103 is timed to close the hook needle 102 so that the retained loop 101A is cast off needle 102 and over the held loop 101B as shown in FIG. 17. Thus a chain stitch or looped selvedge edge is formed along the longitudinal edge of the woven fabric. In the fully retracted position of the hook needle 102, the latch needle 103 is moved to open the hook so that the operation can be repeated. With a weave constructed in the manner described the necessity of the heretofore use of a flying shuttle is eliminated together with its inherent disadvantages.

To interweave links 27, 27′ onto the face of a fabric woven as above described, the warp threads are further divided into two additional sets 100A and 100D. As shown in FIGS. 19 to 21 the warp thread sets 100A, 100D also interchange relative position with the changing of position of warp thread sets 100B, 100C, but warp sets 100A, 100D are timed so that each set 100A and 100D is respectively angled with respect to either sets 100B, 100C to provide spacing therebetween for receiving links 27 or 27′. Thus upon the warp sets 100A, 100D changing position, the respective links 27, 27′ are alternately secured to the face of the fabric by either warp threads 100A or 100D. Note that the warp thread sets 100A, 100D have an even and odd number of threads, respectively corresponding to the number of even or odd scalloped links 27, 27′.

In accordance with this invention the weave of the above described fabric is automatically formed by a machine comprising a frame 30 that includes a table top 31 and a frame extension 30A for the warp. Frame extension 30A consists of a pair of angle members extending rearwardly from table top 31 and they are interconnected by a plurality of spaced transversely, extending structural members 30B. Connected to each of the transverse members 30B are a plurality of conventional thread tension discs 34 over which the warp forming threads 35 are threaded. The spools 35A supplying the respective warp threads are suitably mounted below the frame extension 30A.

Since the machine for purposes of description is herein described with reference to weaving an elastic fabric for use as a woven belt, it will be understood that several of threads 35 are formed of an elastic type thread in order to render the finished fabric elastic.

Connected to the rear end of the frame 30 are opposed uprights 36, 36A for supporting therebetween the thread tension members 37, 38 respectively and over which the warp threads of sets 100A, 100D are threaded. These warp threads are the ones which interweave the links 27, 27′ onto the face of the fabric embodying the warp threads 35. All of the threads are threaded over suitable tension members in going to the weaving station as will hereinafter be described.

As shown in FIG. 3, means are supported on the table top 31 forming a weaving station W.S. and a link stamping station L.S. In the illustrated embodiment two link stamping stations L.S. are provided, one disposed on either side of the weaving station. One link forming station blanks an even scalloped link 27 and the other blanks an odd scalloped link 27′ from a respective supply of a suitable stock material 140. Operatively associated with each of said link stamping stations are transfer means T for alternately transporting the blank links 27, 27′ from their respective blanking station L.S. to the weaving station W.S., as will be hereinafter described.

Means for powering the machine 30 includes an electric motor 40 having the spindle 40A of its armature connected by a belt 41 in driving relationship with a pulley 42 journalled on the end of the main drive shaft 43. The drive shaft 43 is journalled in suitable bearings supported in spaced uprights 32, 33 mounted on table top 31.

Connected intermediate the ends of the drive shaft 43 and adjacent upright 33 is a spur gear 44. Rotatably mounted on the end of the drive shaft 43 is a clutch synchronizer 45 and connected sprocket 46, the purpose of which is to correlate the engaging and disengaging of the clutch 49 to coordinate the link stamping operation of the machine with its weaving operation.

Journalled between uprights 32, 33 slightly above the main drive shaft 43 is a cam shaft 47. Connected to the cam shaft 47 intermediate the ends thereof is a gear 48 which is arranged to mesh with gear 44 on the main drive shaft 43. Thus the cam shaft 47 is connected in driving relationship with the drive shaft 43. Mounted on the cam shaft 47 is a clutch mechanism 49 as well as camming wheels 50, 51, 52, 53, 54.

The clutch mechanism includes a clutch plate 49A fixed to the cam shaft 47 to rotate therewith and a cooperating clutch plate 49B with connected clutch sprocket 49C mounted so as to idle relative to the cam shaft when disengaged from plate 49A. Connected to the very end of the cam shaft 47 is a fixed sprocket 55 which in turn is connected by a chain drive 56 with sprocket 46 of the clutch synchronizer 45. Thus the rotation of the cam shaft 47 controls the rotation of the clutch synchronizer 45.

The clutch synchronizer consists of a disc having a laterally extending flange 45A provided with a notch 45B formed in the flange 45A, the purpose of which will be hereinafter described.

The clutch sprocket 49C in turn is connected by a chain drive 57 to a sprocket 58 journalled on a shaft 59. As shown, sprockets 60, 60A are connected to each end of the shaft 59, and each of these sprockets 60, 60A are in turn connected by respective chain drives 61 to a driven sprocket 134 which controls the action of press 131 of the respective stamping stations L.S. for stamping the links 27 or 27′, respectively.

The shedding of the respective warp threads 35 is controlled by the shedding means generally identified as 62′. The drive for the shedding mechanism consist of the cam wheel 50 which is fixed to cam shaft 47. As shown, the cam is provided with a flanged periphery 50A which extends to either side of the wheel. It will be understood that each flange is provided with a cam surface 180° out of phase with respect to each other to control the respective alternate action of shedding mechanism 62, 62A. Each shedding mechanism 62, 62A is identical, but opposite in hand; therefore only one need be described. As shown in FIGS. 3, 4 and 5, an actuating link 63 is pivotally mounted on shaft 64. Intermediate the length of link 63 there is provided a roller 63′ which is adapted to engage one of the cam surfaces of the cam wheel 50. A driven link 65 of the shedding mechanism 62 is pivotally journalled to shaft 66, and it is connected in driving relationship with link 63 by a cross tie rod 67. Each link 63, 65 extends from its pivoted ends to the shedding station and supports therebetween the separating bars or heddles 69 in which the warp threads are threaded. Thus it will be noted that as the cam wheel 50 is rotated, a reciprocating movement is imparted to the shedding mechanism 62′. The shedding mechanism 62A is similarly constructed but is timed to reciprocate in a direction opposite to that of 62. The separating bars 68, 68A of the respective shedding stations 62, 62A control the warp threads of sets 100B and 100C respectively. Thus upon actuation of the cam wheel 50, the respective sets 100B, 100C of warp

threads interchange position during the weaving operation of the machine.

In order to provide for the interweaving of links 27, 27' onto the face of the fabric woven from warp threads 100B, 100C, an auxiliary pair of shedding mechanisms 69, 69A are provided. These auxiliary mechanisms are likewise similarly constructed but opposite in hand. Accordingly, the pivot of links 65, 65A of the primary shedding mechanisms 62, 62A are provided with uprights 70, 70A for supporting therebetween the shaft 71 about which the shedding links 72, 72A of the auxiliary shedding mechanism are connected. Depending from links 72, 72A are the separating bars or heddles 73, 73A which control the alternate positioning of warp threads 100A or 100D respectively, in the manner herein described for securing links 27, 27' onto the woven fabric. The action of the auxiliary separating bars 73, 73A are timed relative to the action of the main weaving bars 68, 68A by a camming mechanism. This mechanism consists of a sleeve 74 having sprockets 74A and 74B connected at the ends thereof and the sleeve 74 is mounted on shaft 66. Sprocket 74A is connected in driving relationship by a chain drive 75 riding over sprocket 76 journalled to cam shaft 47. Sprockets 74B in turn is connected in driving relationship to a sprocket 77 by a chain drive 77A. Sprocket 77 in turn rotates a shaft 78 journaled in links 65, 65A of the main shedding mechanism. A two lobe cam 79 connected on shaft 78 operates on the links 72, 72A of the auxiliary weaving mechanism to alternately reciprocate the auxiliary weaving links accordingly.

Threads 35 are threaded to their respective separating bars 68, 68A. As shown threads 35 which make up warp set 100B are threaded over a coil spring 80 connected between uprights 32, 32, the convolutions of which separate the respective threads. Thread 35 forming warp threads set 100C are passed over convolutions of a spring 81. Above spring 80, 81 there are mounted tension lever arms 82 through which warp threads of sets 100A and 100D are threaded prior to passing to their respective separating bars 73, 73A of the auxiliary shedding mechanism.

Means for weaving the weft thread 101 between the separated warp threads 100, include a novel hook and latching needle assembly 83. According to this invention the needle assembly 83 cooperates with the warp thread shedding mechanism 62'. As shown in drawings FIGS. 14 to 17, the needle assembly includes a needle housing or frame 84. Extending laterally of frame 84 are a pair of ways 85 on which the needle carrier 86 is reciprocally mounted. Fixed in block 86A on carrier 86 is a hook needle 102. As seen in FIGS. 16 and 17 the hook needle 102 is formed with a longitudinal slot 102A in which there is slidably mounted a needle closure element 103.

Referring to FIGS. 14 and 15, it will be seen that the tail 103A of the closure element 103 is bent laterally and is fixed to an arm 87 connected on a needle closure element carrier 88, the latter being slidably mounted on ways 89A connected on the needle housing 84. Thus the closure element 103 mounted on carrier 88 is rendered readily movable relative to the hook needle 102.

Mounted on the frame 84 of the needle assembly 83 are a pair of cooperating levers 89 and 90 to control the movement of the needle closure element 103 relative to the movement of the hook needle 102 to form the chain stitch. Lever 89 is substantially L shaped and lever 90 is substantially U shaped. Each is commonly fulcrumed at its respective bend by pin 91, the U-shaped lever being disposed in top of lever 89. A spring 92 places a spring tension on the two levers 89–90 relative to each other. Leg 89A and leg 90A of each lever 89, 90 are provided with a shoulder 89B, 90B respectively. These shoulders provide means for retaining the needle closure element carrier 88 against the bias of spring 93 which tends to normally urge the carrier 88 and needle closure element 103 carried thereby to the left end into hook closing position as seen in FIG. 17. An upright pin 94 connected to the carrier 88 is arranged to alternately engage shoulders 89B and 90B to hold the carrier 88 in retracted position until released.

In the normal retracted position of the hook needle carrier pin 95 is arranged to ride on edge 90C of lever 90. Also in fully retracted position the pin 95 is in engagement with a projection 88A of the carrier to hold it against the action of spring 93 and in retracted closure element open position.

Means for activating the needle assembly during weaving includes a needle cam wheel 54 connected on cam shaft 47. As seen in FIG. 4, the periphery of the cam wheel 54 is provided with a camming groove 54A. Cooperatively engaged with the groove 54A of the cam wheel 54 is the needle actuating lever 96. This lever 96 is pivoted intermediate the end thereof to the frame 30 and has a roller connected thereto arranged to ride in groove 54A so that upon rotation of the camming wheel 54, a lateral movement is imparted to the lever 96. By connecting the end of the lever 96 to the bottom of the hook needle carrier 86, the lateral movement of the lever 96 transmits a reciprocating movement to the needle carrier 86 on ways 85. Thus the action of the needle assembly is timed to the action of the main shedding bars 68, 68A and the auxiliary shedding bars 73, 73A.

As the needle carrier 86 is moved to the left, as viewed in FIGS. 14 and 15, pin 95 riding on surface 90C of lever 90 advances the hook needle toward the weft thread holder 105. In doing so the pin 94 of the closure element carrier 88 engages shoulder 89B of lever 89 to prevent movement of the closure element carrier 88 to the left, as viewed in FIGS. 14 and 15. As the pin 95 of the hook carrier 86 slides off edge 90C of lever 90, it trips lever 89 (FIG. 15). In doing so the shoulder 89B releases pin 94 only to permit shoulder 90B to engage pin 94 to prevent the operation of the needle closure element 103. In this position the hook of needle 102 picks up the weft thread 101. Continued rotation of the needle cam wheel 54 effects movement of needle arm lever 96 to retract or move the carrier 86 to the right as seen in FIGS. 14 and 15. In doing so pin 95 on carrier 86 trips lever 90 as it engages its cam edge 90C, and thus causes the shoulder 90B to release pin 94 permitting spring 93 to bias the closure element carrier 88 toward the left to latching position of the hook needle 102, the pin 94 riding in the V between legs 89A, 90A of levers 89, 90. At the end of the stroke of lever 96, the pin 95 will engage projection 88A of the closure element carrier 88 whereby it is retracted together with carrier 86 to the extreme right or closure element open position. With this hook needle and cooperating closure element operation a chain stitch is formed in the selvedge as herein described.

To insure positive separation of the warp threads 100 a comb and guard assembly 97 is provided. As illustrated the comb 97A of the assembly includes a member having a plurality of spaced fingers 97B to separate the warp threads 100 in weaving. On one end of comb 97A a needle guard 98 is provided. As shown the needle guard 98 is rendered laterally pivotable relative to the comb 97A. A spring (not shown) embracing pin 98A pivoting the guard relative to the comb normally urges guard 98 laterally of the comb 97A. A cam 99 fixed to the needle housing 84 engages the arm 98B of the guard to pivot the guard toward the comb 97A as the comb is pivoted toward the weaving station.

Means for actuating the comb and guard assembly 97 includes a cam wheel 53 (FIGS. 4 and 8) connected to cam shaft 47. Operatively engaged with the cam of wheel 53 is a bell crank 53A fulcrumed about shaft 104. Leg 53B of bell crank 53A is connected by a suitable linkage 53C and D to the rocker arm 97C of the comb block 97A. Thus upon actuation of the cam shaft 47 the movement of the comb and guard assembly is timed with the operation of the shedding mechanisms 62, 62A

and the cooperating action of the needle assembly 83. Accordingly it will be noted that the comb and guard functions to insure positive separation of the warp threads of sets 100B, 100C. Also the guard serves to pack the weft thread 101 tightly between the warp threads 100 to insure a tight weave.

During the weaving operation it is also essential that the left thread holder 105 (see FIG. 3) be pivoted toward and away from the weaving station. Timing of the weft thread holder 105 relative to the action of the hook needle 102 is effected by cam wheel 52 also connected on cam shaft 47. Bell crank 105A is fulcrumed on shaft 104, and has one leg 105B thereof engaging the cam surface of wheel 52. The other leg 105C of bell crank 105A is pivotally connected to a suitable link train 106 which in turn connects to the rocker shaft 107. Thus actuation of the cam wheel 52 effects the appropriate bobbing movement of the weft thread holder 105 during a weaving operation.

The rate at which the threads are advanced through the weaving station W.S. is controlled by a takeup mechanism 108, shown in FIG. 6. This takeup mechanism includes a cam wheel 51 connected to shaft 47. Operatively engaged with cam wheel 51 is a lever 109 pivoted to shaft 104. Intermediate the length of lever 109 is a roller engaging the cam surface of wheel 51. The free end of the lever 109 is provided with a laterally extending pin 109A which is adapted to engage in slots 110A in the bifurcated extension 110 connected to the end of a rack 111. Pivoted about a pin 112 securing extension 110 to a rack 11 is an "L" member 13. As shown, the leg 113A of angle 113 is adapted to extend between the bifurcates of extension 110 at a position intermediate the ends of slot 110A. The position of leg 113A intermediate the ends of slot 110A enables the takeup mechanism to operate so as to have a long and short feed of thread depending on whether the leg of 113A is up or down, as will be hereinafter described.

The teeth of rack 111 are arranged to engage a gear 114 fixed to a shaft 115 rotatably mounted on the table top 31. At the top of shaft 115 is a ratchet boss 116. A shaft 117 is disposed in alignment with shaft 115 and has fixed to the lower end thereof a mating ratchet member 118 cooperating with ratchet 116. A spring may be provided to urge the ratchet member together. Connected to shaft 117 is a worm 119 which meshes with a gear 120. Fixed to gear 120 is a second gear 121. Gear 121 in turn meshes with gear 122 for driving a takeup roller 123 and cooperating driven rubber roller 124 between which woven fabric or belt 125 is received.

Connected to the end of a shaft 126 driven by gear 120 is a pulley 127. This pulley 127 is connected by a belt 128 in driving relationship to a pulley 129 connected to a shaft on which the spool 130, upon which the woven fabric is wound, is positioned.

Thus it will be apparent that upon rotation of the cam wheel 51 the rack 111 is reciprocated with a given amount. In doing so the described gear train effects rotation of the takeup roller 123, 124 and spool 130 for collecting the woven fabric 125 at a given rate.

With the mechanism so far described it will be noted that the threads 35 when threaded through to the weaving station can be readily woven into a fabric upon the actuation of the motor 40.

In order to provide for the interweaving of ornamental links into the woven fabric 125, means are provided for stamping the links from a given stock material, such as plastic, metal, leather or the like. In accordance with this invention a link stamping station L.S. is mounted on the table top 31 on either side of the weaving station W.S. Accordingly the stamping of the links and the movement of the links from the stamping station to the weaving station are coordinated with the weaving operation. As shown in FIGS. 18 and 21 the links are formed with a scalloped edge and the links in the finished goods are disposed in overlying relationship to give a scale appearance. Thus the stamping means of each station is timed to alternately stamp their respective links.

Since the stamping stations are similarly constructed with the exception of the die for blanking the links, only one need be described.

Each station consists of a punch press 131 having suitable dies for forming the respective links 27, 27'. The punch 132 of each press is operated by the rotation of shaft 133. Means rotating the crank shaft 133 includes sprocket 134 which is connected by a chain drive 61 to a sprocket 60 fixed on the press drive shaft 59. As hereinbefore described the press shaft 59 in turn is connected in driving relationship with the cam shaft 47 through clutch mechanism 49. Thus, with clutch engaged the press drive shaft is connected in driving relationship with cam shaft 47 to effect rotation of the respective punch presses 131. It will be noted that the crank shaft connections to the respective punch presses 131 are disposed 180° out of phase so that the presses 131 are alternately actuated.

Means for advancing the stock 140 material from which the respective links are blanked includes a link 136 eccentrically connected at one end to the hub of the sprocket 134. The other end of link 136 is connected to a pawl 137 for actuating a ratchet 137A to control the stock feed rollers 138. The stock 140 in turn is fed from a spool 139 mounted on the frame of the machine to the feed rollers 138. Thus upon each revolution of the sprocket 134 controlling the crank shaft of the press 131, the operation of the eccentric link 136 effects an advance of the stock material 140 to insure continuous operation.

Operatively associated with the press 131 of each stamping station is a means T (FIG. 3) for alternately transporting the formed link from its respective press 131 to position on the fabric at the weaving station. The means T operatively associated with each press 131 for moving the formed link from the respective press includes a cam wheel 141 fixed to shaft 133. Pivoted to shaft 142 on the frame of the press is a link 143 which has connected thereto a roller 144 for engaging the cam 141. Connected to the free end of link 143 is a suitable linkage 144A for operating the gripping means 145 by which the links are moved to the weaving station.

Referring to FIGS. 11 and 12, the gripping means 145 include a cam plate 145' having an irregular slot 145A. Pivotally mounted between fixed plate 145' and movable plate 146 are a pair of plate members 147, 148. Each plate member 147, 148 is provided with a pair of aligned slotted openings 149, 150. The respective plates 145', 146, 147, 148 are operatively secured together by a fastener 151 extended therethrough and a pin 152 connected to the bottom plate 146 and projecting upwardly through aligned slots 149 of plates 147, 148. It will be noted that plate 147 is rendered movable relative to plate 148 and a spring 153 is connected therebetween to bias the same relative to each other. Connected to the end of plate 147 is a gripper 154 which is provided with a slot 154A in the depending flanges thereof for frictionally retaining therebetween the blanked link 27. Plate 148 is provided with up-turned fingers 148A adapted to engage the rear of the link to force the link from gripper 154 for ejecting the link at the weaving station.

Means for actuating the plates 147, 148, 146 relative to cam plate 145' includes a bifurcated lever 155 engaging a pin 156 connected to plate 147. The other end of lever 155 is connected to a block 156A pivoted about a pivot 157 on a frame bracket 158 which is connected to the frame. Also connected to block 156A is a link 159 pivotally connected to another link 160, the latter being connected to rocker arm 161 actuated by cam wheel 141 and connected lever 143 and associated linkage. Thus it will be observed that rotation of cam wheel 141, as the press operates, effects movement of the rocker

arm 161 and connected linkage 160, 159, 156A, and 155 to guide the plates 147, 148 according to the cam slot 145A. The arrangement is such that the link 27 secured by gripper 154 at the press 131 and the gripper 154 at the end of plates 147, 148 is rotated through an arc of 90° for positioning the link at the weaving station between warp threads 100B, 100C and threads 100A, 110D.

The releasing of the link at the weaving station is accomplished by relative movement between plates 147, 148. To assure such movement a latching lever 162 is provided to engage a shoulder on plate 148. Thus immediately upon the return of plates 147, 148 from the weaving station, the upper plate is permitted to move relative to the lower plate held fast momentarily by the latch lever 162. The relative movement of the two plates 147, 148 permits the fingers of the lower plate to discharge the link from the upper plate 148.

With the machine arrangement described a continuous weaving operation may be performed with links being interwoven into the fabric if desired. To facilitate the ultimate assembly of the belt it is desirable that the end portion of the link studded belt lengths be free of links so that the necessary buckle and clasp may be secured thereto. Since the machine so far described will weave a continuous link studded fabric, a feature of this invention resides in means whereby the continuous weaving operation may be carried on so that at predetermined intervals a portion of the fabric can be woven without the interweaving of links at these intervals. See FIG. 18. Thus after a spool 13 has been wound to capacity with a continuous length of woven fabric, the respective predetermined link studded lengths can be subsequently cut to individual belt lengths so as to have their respective ends free of links. In order to provide for this a sizing cam plate 171 is provided. As seen in FIGS. 4 and 7, the cam sizing plate is journaled on the end of shaft 64. Accordingly the cam sizing plate by varying the diameter of the plate can be sized to accommodate a particular belt length. Thus by interchanging appropriate cam plates 171, the predetermined link ornamental belt lengths can be made in various belt lengths, e.g. small, medium or large.

As shown in FIGS. 4 and 7 the cam plate 171 consists of a disc having a notched out portion 171A as shown. A drive for rotating the cam plate 171 includes a beveled gear 172 fixed to the end of cam shaft 47. Bevel gear 172 meshes with a gear 173 which in turn rotates a worm 174. The worm 174 in turn meshes with a gear 175 journaled to shaft 64 which is fixed to the cam plate 171 to effect rotation thereof.

Thus it is to be observed that rotation of the cam shaft 47 will rotate cam sizing plate 171 accordingly through connected gear train 172, 173, 174 and 175.

Positioned to cooperate with sizing cam 171 is a lever 177 which is fixed to a shaft 178. Lever 177 is provided with a cam follower 177A which is adapted to ride on the outer periphery of the cam plate.

Fixed to the other end of the shaft 178 is a lever 179 which has connected thereto a pin 179A which is adapted to ride beneath the flange 45*a* of the clutch synchronizer 45. The free end of the lever 179 is positioned adjacent to the clutch 49. The arrangement of levers 177 and 179 is such that when the cam follower 177A of lever 177 riding on the periphery of the sizing plate 171 drops into notch 171A, it will rotate shaft 178 to cause lever 179 to pivot also, as notch 45B of the clutch synchronizer is brought into alignment with pin 179A of clutch lever 179. When this occurs, pin 179A will ride above flange 45A and lever 179 will effect a disengagement of clutch plates 49A, 49B and the stamping operation is ceased, but the weaving operation continues. Thus for the interval of notch 171A, a length of fabric corresponding thereto is woven without links. As soon as the cam follower 177A of lever 177 rides out of the notch 171A, lever 179 is pivoted away from clutch as the notch 45A comes into alignment with latch pin 179A of latch 179. When this occurs the stamping operation again commences, and interweaving of the links in the fabric resumes. It is to be noted that the clutch synchronizer insures that the interweaving of the links will be resumed at the proper timing with that of the weaving operation. To insure positive action of the clutch lever, a suitable positive acting spring means (not shown) may be provided.

If desired a counting lever 183, FIG. 24, may be fixed to shaft 178 so that each time the linking stamping operation is ceased the lever 180 will trip a suitable counter 184. Thus the number of individual belt lengths wound on a given spool is readily made known at any instant.

In order to shorten the stroke or feed of the warp threads at the weaving station when the stamping operation is ceased to eliminate the elasticity of the linkless web portions formed between linked belt lengths, a lever 181 for controlling the stroke of the feed rack 111 is also fixed to shaft 178. See FIG. 6. Thus it will be noted that when shaft 178 is pivoted by cam follower 177A dropping in notch 171A of sizing plate 171, lever 181 will effect tripping of a lever 182 which in turn will raise leg 113A of L-shaped member 113 above the slots 110A. It will be observed that with leg 113A raised above slots 110A, pin 109A of lever 109 will result in some lost motion, and thereby reduce the linear stroke or travel of rack 111, which in turn reduces the angular rotation of the feed rollers 123, 124 of the weaving station. Thus the warp threads, and particularly the elastic warp threads, are woven in their relatively unstretched position, the result of which is to render the length of fabric thus woven inelastic. Upon the resumption of the link stamping operation, lever 181 is raised, and thereby causes lever 182 to reposition leg 113A of member 113 in position between bifurcates of member 110. Thus the rack resumes the long stroke and in doing so causes the elastic warp threads to be woven in their extended or stretched position so that the link studded section of the woven fabric will have an elastic characteristic.

The operation of the weaving machine is as follows:

The warp threads 35 are threaded over their respective tension members 34 and thread separating springs 80 and 81, through appropriate eyelets in their respective warp separating bars 68, 68A, and between rollers 123, 124 which maintain the elastic threads distended. The link holding warp threads are threaded over their respective tension members 37, 38, tension lever 82, through appropriate eyelets in their respective auxiliary separating bars 73, 73A, and thence through rollers 123, 124. The weft thread 101 is threaded through eyelet of its holder 105. With the strip of stock material fed to the feed rollers of the respective stamping stations L.S., the machine is readied for operation.

Upon actuation of the motor 40, the main drive shaft 43 affects the rotation of the cam shaft 47 on which the camming wheels 50, 51, 52, 53 and 54 are fixed, and they control the timing and operation of the main separating bar sets 62, 62A and cooperating auxiliary separating links 72, 72A; with respect to the needle assembly 82, the weft thread holder 105, and the comb and guard action. With the clutch 49 engaged the presses P are rendered operative to alternately stamp the links 27, 27'. The arrangement described insures that the elastic threads are woven in their distended position when the links are interwoven thereto.

The sequence of the weaving operation with the ornamental links interwoven in the fabric is as follows:

Referring to FIG. 19: With the layer of warp threads 100C, 100B separated and the odd links holding warp threads 100A separated from layer 100B, a link is moved into position between layer 100A and 100B. In this position the comb 97B is in position as shown in FIG.

15 and the guard 98 is firm against the weft thread of the preceding weaving step. With the parts so arranged the needle cam wheel 54 and connected linkage causes the hook needle carrier 86 to advance the hook needle 102 through the slot in guard 98 toward the holder 105 of the weft thread 101. Upon hooking and picking up the weft thread, the hook needle 102 is retracted to the right as shown in FIG. 14. In moving to the right, pin 95 on carrier 86 trips lever 90 to release the needle closure element 103 and it moves to close the hook of needle 102 to retain the loop of weft thread on the hook while casting off the loop of the preceding weft thread, as hereinbefore described to form the chain stitch. With the hook needle 102 fully retracted the latch needle is urged to unlatched position and the comb 97B and guard 98 is rocked away from the weaving station. As the comb 97 and guard 98 is moved out of the way by the timing of camming wheel 53, the camming wheel 50 effects actuation of the shedding bars. The action of the shedding mechanism is such that the position of warp thread layer 100A and B are interchanged with layers 100C and D, as shown in FIG. 20. With the warp threads in this position the comb 97 and guard are again moved toward the weaving station. The hook needle is again moved to the left to pick up the weft thread 101. In doing so, the loop of the preceding weft thread slides out of the opened hook needle and onto the shanks of the hook needle and closure element 103 as the hook needle 102 moves to the left, FIG. 16. During retraction, the hook needle 102, and closure element 103 cooperate to again effect the chain stitch as described. The comb 97 and guard again move away from the weaving station and the separated warp layers 100A, B and 100C, D interchange to assume a position as shown in FIG. 21. In this position the warp threads layer 100D is spaced from layers 100A and B. In this position the press stamps the even scalloped edge link 27 and its cooperating transfer means T is timed to position the blanked even scalloped links between warp layer 100A and 100D. Thus the comb and guard 98 is again timed to move toward the weaving station. As the guard moves into position between layers 100C and 100A to pack the weft thread between the warp threads of layers 100C and A, the hook needle is again advanced toward the weft holder to again pick up the weft thread 101. The hook needle 102 with the weft thread is again retracted with the next chain stitch being formed as described, and the comb and guard subsequently moved away from the weaving station so that the weaving camming wheel 50 may again effectively interchange the layers or warp threads to a position illustrated in FIG. 20. This completes the weaving sequence, which is continuously repeated to form a fabric belt of a given length having interwoven ornamental links.

A feature of this weaving operation to be noted is that the weft thread on each pass is formed of a double strand, in accordance with this invention, with the looped end of the double strand forming the chain stitch.

The operation of the sizing cam 171 controls the length of fabric interwoven with links. By controlling the size of the cam plate the length of fabric with interwoven links can be varied. Thus belt or fabric sizes, small, medium or large, and the like, can be formed merely by changing the cam plate circumference. As the notch in cam plate 171 engages lever 177, the clutch connecting the drive shaft 59 of the presses in driving relationship with the cam shaft 47 is disengaged. Thus weaving of the threads is continued without the links being formed or positioned between warp threads. Thus for an interval corresponding to the size of notch 171A of the sizing cam 171 the fabric is woven free of links.

During the weaving of the linkless portion of the fabric the action of lever 177 also effects the operation of the takeup mechanism 108 to reduce or shorten the stroke of rack 111 which in turn controls the angular rotation of takeup rollers 123, 124. Thus the portion of the fabric without links is rendered inelastic in that the elastic warp threads, if any, are given a shorter stroke which tends to reduce the distention of the weave or woven fabric when free of links.

As the cam lever 177 rides out of notch 171A to again ride on the outer periphery of cam plate 171 the clutch becomes engaged to again commence the operation of the stamping operation and the takeup mechanism 108 is again rendered operative to distend the elastic warp thread for imparting the necessary elasticity thereto to make the link woven portion of the fabric.

From the foregoing description of the machine and its operation it will be seen that the following improved method of weaving thread in fabric can be readily and automatically performed with a minimum of human attention.

The improved method for weaving thread into fabric in accordance with this invention includes the steps of separating of warp threads into a plurality of layers, holding the two layers apart, picking up a weft thread and inserting the same between the separated layers so as to form a loop on one end thereof, interchanging the position of the warp thread layers, then picking up the next weft thread while retaining the looped end of the preceding weft thread, and inserting the next weft thread between the interchanged warp thread layers, and forming a chain stitch by pulling the loop of the next weft thread through the loop of the preceding retained weft thread along a selvedge edge portion of the fabric; and repeating the above sequence to weave a fabric to a given length.

In securing an ornamental link onto the weave of the fabric, the warp threads are additionally divided into a plurality of auxiliary warp threads which are adapted separate from the other or main layers of warp threads, stamping a link from suitable blank material and thereafter positioning the link between one of the auxiliary layers of warp thread and a main layer of warp thread so that when the layers of warp threads are interchanged during the weaving operation, the auxiliary warp threads will secure the links in place on the weave of the main layers of warp thread, and the operation repeated as often as desired.

From the foregoing method and apparatus an improved weave is attained. It will be noted that the fabric resulting therefrom has its warp threads interchanged about a double strand of weft threads, i.e. a weft thread folded on itself to form a loop along one of the selvedge edges of the fabric. The arrangement is such that the looped end of the next formed weft loop is extended through the loop of the preceding weft loop and thereby terminate a selvedge edge of the fabric with a chain stitch. The normal weaving operation heretofore known did not produce such a weave.

While the instant invention has been disclosed with reference to a particular embodiment thereof, it is to be appreciated that the invention is not to be taken as limited to all of the details thereof as modifications and variations thereof may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. A machine for automatically interweaving ornamental links into a fabric comprising a frame having a weaving station in which warp and weft threads are woven into fabric, a stamping station for blanking said links positioned adjacent said weaving stations, means for moving said links from said stamping station to said weaving station, and means for interweaving said links into said fabric as the fabric is being woven.

2. The invention as defined in claim 1 wherein said means for interweaving said links into said fabric includes an auxiliary separating bar set for separating a portion of the warp threads from the other warp threads so that the links may be positioned between said separated warp threads.

3. A machine for automatically interweaving scalloped edged links in a fabric comprising a frame having a weaving station in which threads are woven into fabric, a pair of stamping stations for blanking said links, means for successively feeding blank material to each of said stamping stations, each of said stamping stations including means for alternately blanking said links from said material and cooperating means for alternately moving said links blanked of each of said stamping stations to said weaving station, and means for successively interweaving said links into said fabric as it is being woven.

4. A machine for interweaving ornamental links into fabric during a weaving operation comprising a frame having a weaving station including a plurality of separating bar sets for separating the warp threads into a plurality of layers, and a hook needle and needle closure element assembly for inserting a weft thread between the separated warp bars, a holder for the weft thread positioned adjacent said assembly, said assembly including a hook needle and cooperating needle closure element mounted on said hook needle for movement toward and away from said holder for receiving and pulling the weft thread through the layers of warp threads, means for stamping links from a suitable blank material disposed adjacent the weaving station, means for moving the blanked link from the stamping means to a position between a pair of said warp thread layers, means for operating the separating bar sets and cooperating hook needle and needle closure element to weave said link into said fabric, and means for controlling the operation of said needle and needle closure element to effect a chain stitch along a selvedge edge of the woven fabric.

5. A weaving machine for interweaving ornamental links into a fabric during a weaving operation comprising a frame having a weaving station and a cooperating stamping station disposed on either side of the weaving station, said weaving station including a plurality of main separating bar sets for separating the warp threads into a plurality of main layers of warp threads, an auxiliary separating bar set operatively associated with each of said main separating sets for separating the link holding warp thread layers from the respective main layers of warp threads, a hook needle and a cooperating needle closure element; a holder for a weft thread positioned adjacent said hook needle, means for moving the hook needle toward said holder to pick up a weft thread and away from said weft thread holder for inserting the weft thread between separated layers of warp threads, means for alternately stamping links from a blank material at said stamping stations, means for alternately moving the links stamped at each of said stations to the weaving station for positioning the respective links between one of the main layers of warp threads and an auxiliary layer of warp threads, means for interchanging the relative positions of the main warp layers and auxiliary warp layers relative to each other upon the insertion of the weft thread between the separated warp layers, and means for controlling the operations of said hook needle and needle closure element to effect a chain stitching of successive weft threads along one selvedge edge of the fabric so woven.

6. The invention as defined in claim 5 including means for ceasing the stamping operation without interrupting the weaving operation so that weaving of the fabric continues free of links.

7. The invention as defined in claim 6 including means operative upon the cessation of the stamping means to shorten the feed of the warp threads during the weaving operation.

8. A machine for weaving elastic thread into elastic and/or inelastic fabric and interweaving thereinto ornamental links comprising a frame having a weaving station for interweaving warp and weft threads into fabric, said weaving station including separating bars separating elastic warp threads into a plurality of layers, a needle assembly having a hook needle and cooperating relatively movable needle closure element, a weft thread holder positioned opposite said needle assembly, means for reciprocating said hook needle toward and away from said weft thread holder to pick up and insert the weft thread between the separated layers of warp threads, means controlling the latching and unlatching of said needle closure element relative to said hook needle, a stamping station including means for stamping links from suitable blank material, means for moving the blanked link from the stamping station and for inserting said links between a pair of said warp thread layers, means for interchanging the position of the respective warp thread layers relative to the weft thread inserted therebetween, means for maintaining a tension on said elastic warp threads as the threads are drawn through the weaving station during a weaving operation, means operative for ceasing the operation of the stamping means upon the weaving of a predetermined length of fabric with links woven therein, and means rendered operative upon the cessation of said stamping means to reduce the tension on said elastic warp threads and rate of feed thereof through the weaving station so that continuation of the weaving operation results in inelastic web portion being formed as a continuation of the elastic, linked woven, length of fabric.

9. The invention as defined in claim 8 and including a comb and guard means operative to separate said warp layers, and said guard having a slot therein for receiving the hook needle to insure the insertion of the weft thread between the separated layers of warp threads.

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