United States Patent

Scott

[15] **3,682,205**

[45] **Aug. 8, 1972**

[54] NEEDLE LOOM

[72] Inventor: **George W. Scott**, Conneaut Lake, Pa.

[73] Assignee: **Textron, Inc.**

[22] Filed: **July 28, 1970**

[21] Appl. No.: **58,894**

[52] **U.S. Cl.** ..... **139/124 A**
[51] **Int. Cl.** **D03d 47/42**
[58] **Field of Search** .139/11, 116, 123, 124 R, 124 A

[56] **References Cited**

UNITED STATES PATENTS

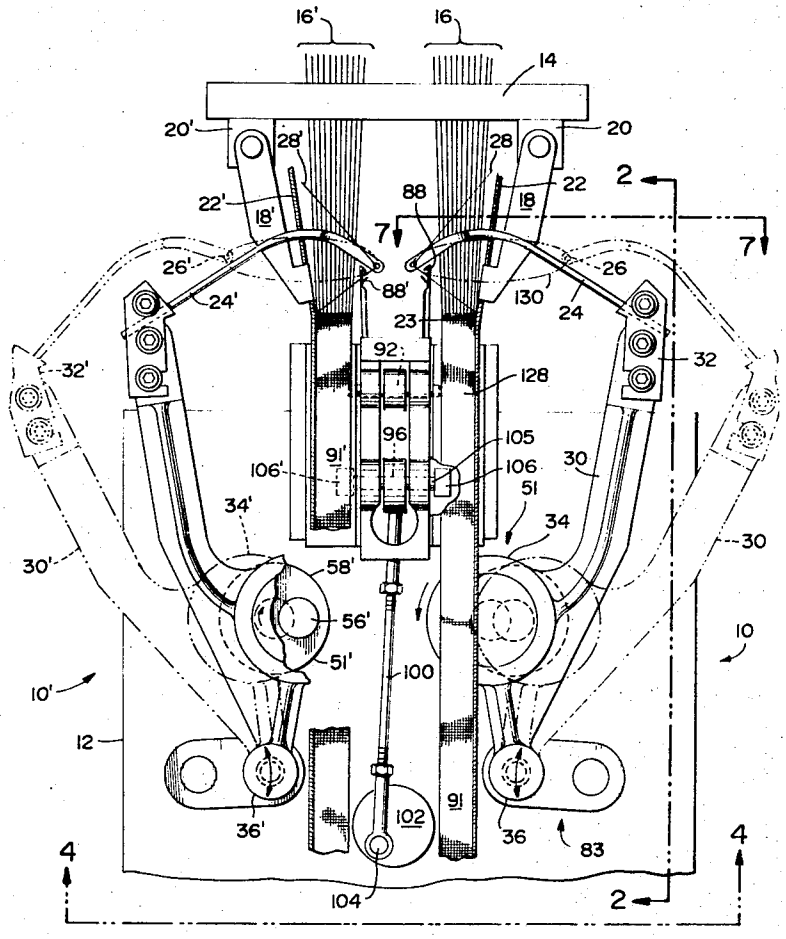
3,457,964	7/1969	Burbank	139/124 A
3,136,343	6/1964	Firing	139/124 A
3,056,431	10/1962	Bonas et al.	139/123

Primary Examiner—Henry S. Jaudon
Attorney—Meech & Field

[57] **ABSTRACT**

A needle loom for weaving a slide fastener element strip along the edge of a tape including a harness for providing shedding movement to a plurality of warp threads at a weaving area, a guide for supplying the slide fastener element strip to the weaving area in a substantially constant plane, a weft laying needle for carrying a weft thread through each shed formed at the weaving area, a control mechanism for alternately moving the weft laying needle through the sheds in a first plane above the guide and in a second plane below the guide and in spaced parallel relation to the first plane, a knitting needle for catching loops of the weft thread to form a selvedge edge for the tape and a displacement mechanism for moving the knitting needle to first and second positions coinciding with the first and second planes.

2 Claims, 7 Drawing Figures



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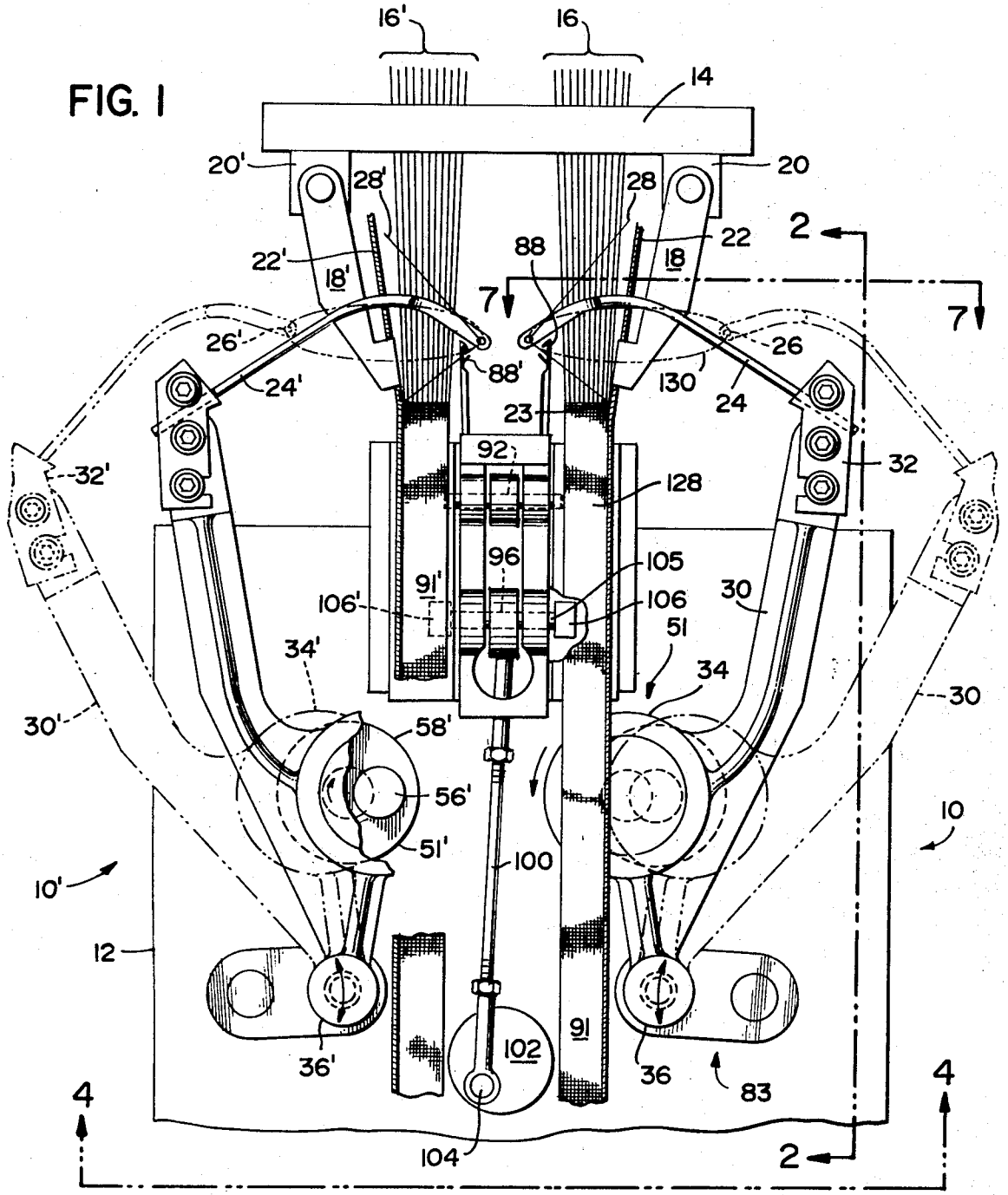
3 Sheets-Sheet 1

FIG. 1



INVENTOR
GEORGE W. SCOTT
BY
Meech & Field
ATTORNEYS

FIG. 2

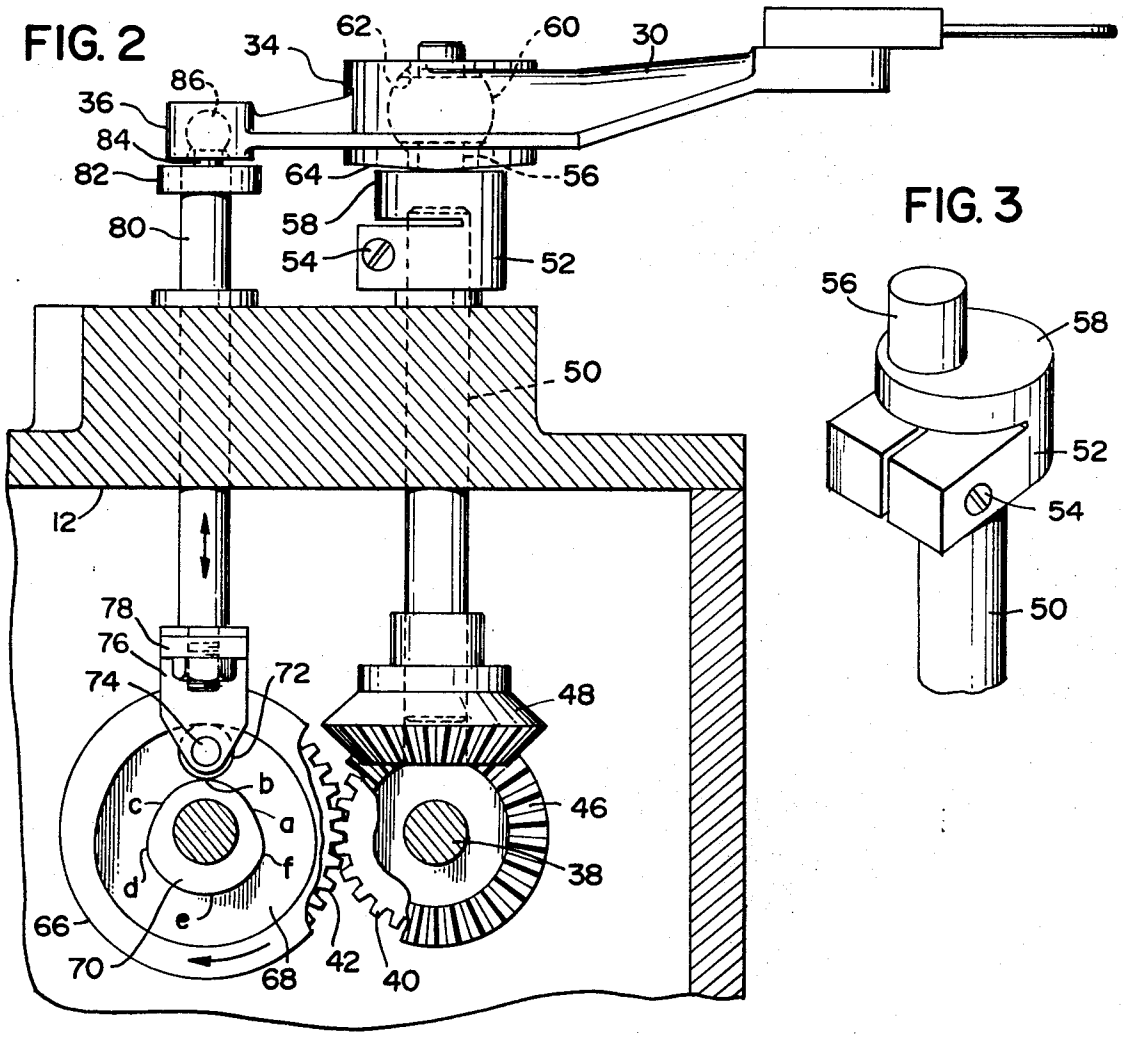


FIG. 3

FIG. 7

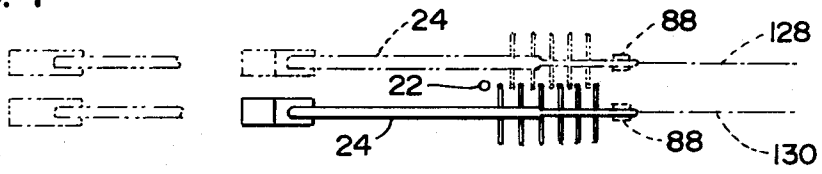
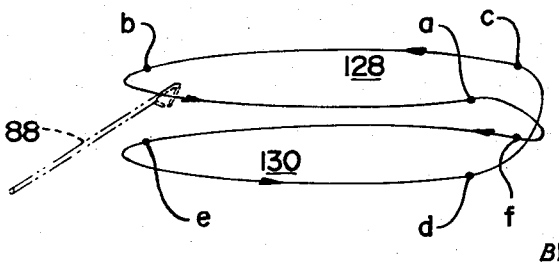


FIG. 6



INVENTOR.
GEORGE W. SCOTT

BY

Meech & Field
ATTORNEYS

FIG. 4

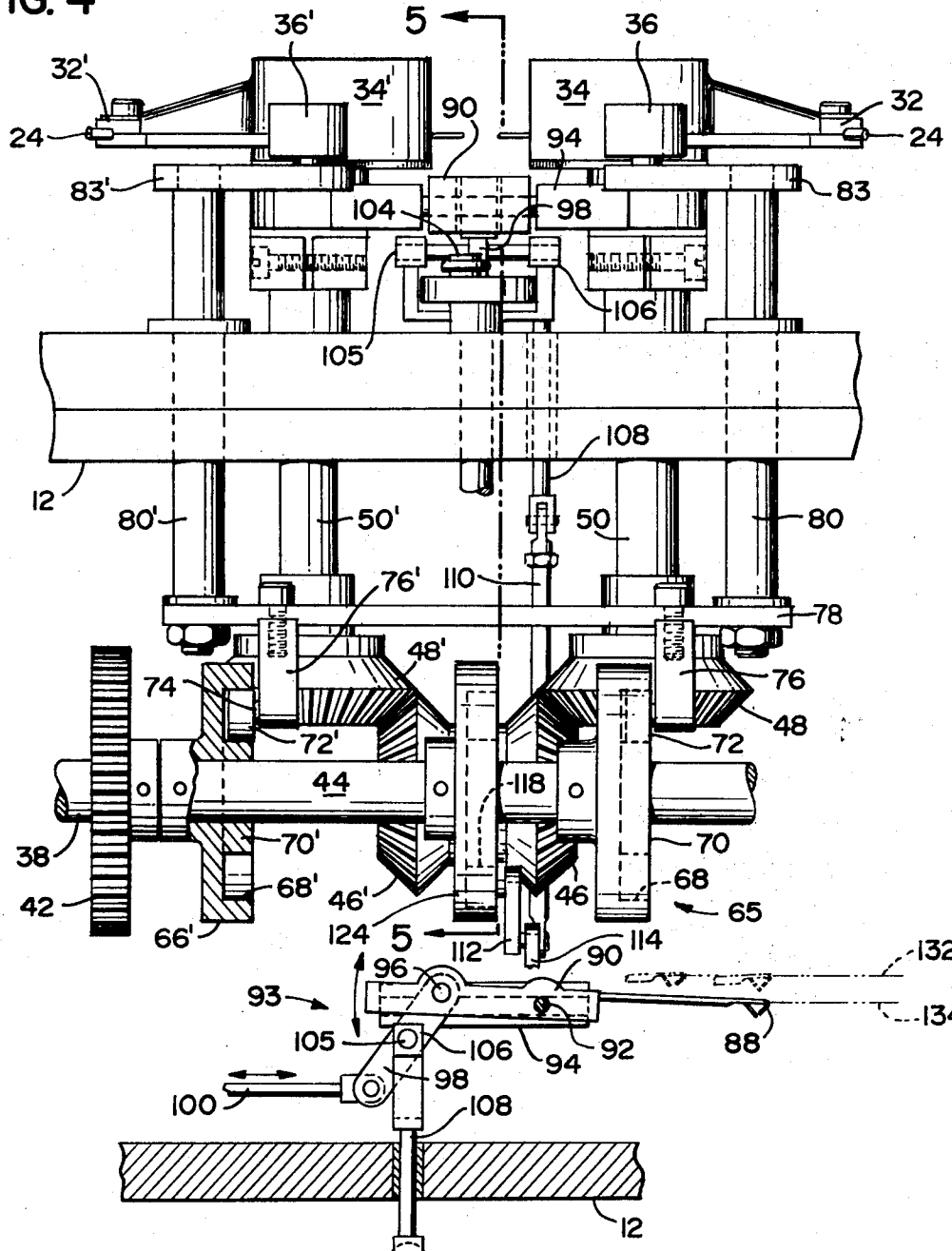
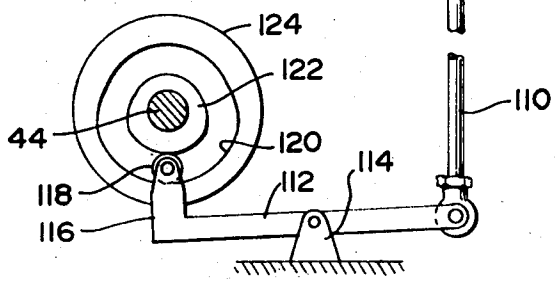


FIG. 5



INVENTOR.
GEORGE W. SCOTT

BY

Meech & Field
ATTORNEYS

NEEDLE LOOM

BACKGROUND OF THE INVENTION

The present invention pertains to needle looms and more particularly to such needle looms for weaving a slide fastener element strip along the edge of a narrow tape.

Needle or shuttleless looms are conventionally utilized to weave narrow fabrics. Such looms normally use a weft laying needle to carry a weft thread into and out of a shed of warp threads with loops of the weft thread being caught by a knitting needle at the innermost position of the weft laying needle. Once the weft laying needle moves out of the shed, a new shed is formed and the weft laying needle is moved into and out of the new shed with the knitting needle operating to draw the succeeding loop of weft thread through the preceding loop of weft thread to form a selvedge edge for the fabric. The weft laying needle is normally moved in an elliptical path to facilitate formation of the selvedge edge. The prior art as above described is exemplified by U. S. Pats. No. 2,902,057, No. 3,224,467 and No. 3,320,908.

Needle looms have been found to be especially useful in the slide fastener industry to weave tapes which carry the interlocking elements of slide fasteners; and, with the advent of slide fastener element strips made of continuous filaments of plastic material, needle looms have been utilized to weave the slide fastener element strip along an edge of the tape as the tape is being woven. While weaving the slide fastener element strip into an edge of the tape as the tape is being woven, provides great time and money savings and serves to more fully automate the production of slide fasteners, the slide fastener element strip is treated as a warp thread during the weaving thereby requiring the slide fastener element strip to be bent rapidly to provide it with shedding movement, and the rapid bending of the slide fastener element strip may result in slightly deforming the strip.

U.S. Pats. No. 3,457,964 and No. 3,457,965 disclose needle looms for weaving slide fastener element strips to shedding movement. U.S. Pat. No. 3,457,964 accomplishes the above result by alternately moving the weft laying needle above and below the slide fastener element strip which is supported in a constant plane. In order to cooperate with the knitting needle, the weft laying needle is given a vertical movement toward the knitting needle as it approaches its innermost position such that the path of travel of the weft laying needle has a vertical component both in and out of the shed. U.S. Pat. No. 3,457,965 accomplishes the above result by imparting a vertical movement to the slide fastener element strip before and after the fell and to a portion of the tape to move the strip above and below the plane of the laying needle without requiring severe bending thereof.

While the loom of U.S. Pat. No. 3,457,964 does not provide a shedding movement of the slide fastener element strip, it does utilize a vertical movement of the weft laying needle while in each shed, and this requires greater and more precise shedding movement of the warp threads and limits the width of tape which can be woven. In the loom of U.S. Pat. No. 3,457,964, the movement of the weft laying needle necessitates a complex driving mechanism with little error tolerance in order to assure that the weft laying needle does not

become entangled in the warp threads and properly cooperates with the knitting needle. Furthermore, the loom of U.S. Pat. No. 3,457,964 does require some vertical movement and bending of the slide fastener strip.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to construct a loom for weaving a slide fastener element strip along an edge of a tape without imparting shedding movement to the slide fastener element strip.

The present invention is generally summarized in a loom for weaving a slide fastener element strip along an edge of a tape including a harness providing shedding movement to warp threads at a weaving area, a guide supplying the slide fastener element strip to the weaving area in a substantially constant plane, a weft laying needle for carrying a weft thread through the warp threads at the weaving area, a knitting mechanism for catching the weft thread after it has been carried through the warp threads to form a selvedge edge for the tape, and a driving mechanism for alternately projecting and withdrawing the weft laying needle through the warp threads in a first plane on a first side of the guide and in a second plane on a second side of the guide and in spaced parallel relation to the first plane.

Another object of the present invention is to weave a vertically stationary slide fastener element strip along an edge of a tape without restricting the width of the tape.

A further object of the present invention is to move a weft laying needle through consecutive sheds in spaced parallel planes.

The present invention has another object in that a knitting needle is moved to be aligned with each of a pair of spaced parallel planes of movement of a weft laying needle.

Some of the advantages of the present invention over known looms for weaving a slide fastener element strip along an edge of a tape include increased slide fastener configuration integrity, decreased apparatus complexity and increased adaptability of the loom to produce various width fabrics.

Further objects and advantages of the present invention will become apparent from the following description of a preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial top plan view of a loom according to the present invention.

FIG. 2 is a section taken along line 2—2 of FIG. 1.

FIG. 3 is a broken perspective view of an eccentric driving mechanism for use with the loom of FIG. 1.

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

FIG. 5 is a schematic view taken along line 5—5 of FIG. 4.

FIG. 6 is a schematic representation of the excursion path of the weft laying needle relative to the warp threads and the slide fastener element strip.

FIG. 7 is a view taken along line 7—7 of FIG. 1 illustrating the relation between the weft laying needle and the warp threads.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A pair of needle looms **10** and **10'** according to the present invention are illustrated in FIG. **1** and are supported on a frame **12**. Looms **10** and **10'** are mirror images of each other and only loom **10** will be described with similar parts associated with loom **10'** being given the same reference numbers with primes and not described again for the sake of brevity.

A harness frame **14** receives a plurality of warp threads **16** and **16'** from a supply such as a plurality of spools with suitable tensioning mechanisms for the threads. As is conventional, harness frame **14** contains a plurality of heddles for imparting shedding movement to the warp threads in predetermined sequence in accordance with a control assembly. A guide arm **18** has one end bolted to a support **20** for the harness mechanism, and arm **18** is held stationary to supply a slide fastener element strip **22** to a weaving area **23** to be woven with the warp threads.

Slide fastener element strips **22** and **22'** may be made of any material capable of providing mating elements which may be controllably interlocked by means of a slider. Such slide fastener element strips are normally made of a continuous plastic filament given a specific configuration, such as the common ladder-type or coiled configurations; and, such slide fastener element strips may include a cord or thickened thread running through the interlocking elements for added support. The slide fastener element strips may be conveniently configured at a location sufficiently near the looms to be directly supplied thereto through suitable conduits or they may be stored under frame **12** after being configured and supplied to arms **18** and **18'** from storage bins.

A weft laying needle **24** has an eye **26** in one end thereof receiving a weft thread **28** from a suitable supply, and needle **24** is secured to a carrier **30** at its other end by means of a clamp **32** which is bolted to the carrier and has a bore therethrough for receiving and clamping needle **24**. Carrier **30** is driven at an intermediate portion **34** and at an end portion **36** to impart an elliptical movement to needle **24**.

Drive power for the looms is derived from a shaft **38** which is rotated at a predetermined speed by a suitable motor, not shown. A gear **40** (FIG. **2**) is secured to shaft **38** and engages a gear **42** which is secured to a shaft **44** (FIG. **4**). Shaft **38** drives a pair of bevel gears **46** and **46'** which engage bevel gears **48** and **48'** attached to shafts **50** and **50'**, respectively. The speed ration of the drive gearing causes shafts **50** and **50'** to be driven at twice the speed of shaft **44**.

Shaft **50** extends up through frame **12** to an eccentric drive mechanism **51** including a block **52** secured to an end of shaft **50** by means of a screw **54**, and block **52** has a stud **56** attached thereto at a position eccentric to the axis of shaft **50** and extending upward from a fulcrum plate **58** carried on the top of block **52**. Stud **56** carries a spherical pivot member **60** which is received in a spherical recess **62** in intermediate portion **34** of carrier **30**, and an arcuate bottom surface **64** of portion **34** rocks on fulcrum plate **58**. A control mechanism **65** for end portion **36** of carrier **30** includes a pair of cam members **66** and **66'** secured to shaft **44** and having cam grooves **68** and **68'** therein following the contour of plate cams **70** and **70'**, respectively. A pair of rollers **72** and **72'** ride on the outer surfaces of plate cams **70** and **70'** in grooves **68** and **68'**, respectively; and the rollers are rotatably disposed on journals **74** and **74'** which are secured to brackets **76** and **76'**, respectively. A bar **78** is bolted to the brackets, and a pair of risers **80** and **80'** are bolted to either end of bar **78**. Shaft **80** is journaled through a suitable bearing in frame **12** and rotatably supports one end of a link **82** of a link mechanism **83**. The other end of link **82** has a stud **84** extending therefrom carrying a spherical pivot **86** which is disposed in a spherical recess in end portion **36** of carrier **30**.

A pair of knitting needles **88** and **88'** are supported on a carrier **90** disposed between the two woven tapes **91** and **91'** at a position to permit the knitting needles to catch the weft threads as they are carried through each shed by weft laying needles **24** and **24'**. A displacement mechanism **93** for the knitting needles includes a pivot pin **92** extending through carrier **90** and received in longitudinal slots in a stationary guide block **94** to permit movement of the knitting needles in a plane parallel to the plane of movement of the woven tapes. A second pivot pin **96** extends through carrier **90** at a rear position on the other side from the knitting needles such that carrier **90** is pivotable about pins **92** and **96**. A rocker lever **98** has one end connected with pin **96** in a slot in carrier **90** and another end connected with one end of an arm **100** of a reciprocating mechanism which includes a rotating plate **102** carrying an eccentric stud **104** connected with the other end of arm **100**. The drive for plate **102** is derived from shaft **38** in the same manner as the drive for block **52** such that plate **102** and block **52** rotate at the same speed. A pivot pin **105** extends through lever **98** and is supported at its ends in pillow-blocks **106** and **106'** which are secured to a riser **108**. Riser **108** is journaled through a bearing in frame **12** and has its lower end connected with one end of a link **110** which has its other end connected with one end of a rocker lever **112**. Lever **112** is supported at a fulcrum **114** and has a transverse leg **116** at the other end which rotatably supports a roller **118** riding in a cam groove **120** having a configuration defined by a plate cam **122** of a cam member **124** centrally secured to shaft **44**.

In operation, warp threads **16** are supplied to weaving area **23** with shedding movement by harness frame **14** to provide consecutive sheds of different warp threads to provide any desired tape weave configuration. The slide fastener element strip **22** is supplied to weaving area **23** in a substantially constant plane coinciding with the plane of the woven tape **91** as it moves away from weaving area **23**. For this purpose, arm **18** is stationary and guides slide fastener strip **22** to converge with warp threads **16** on one side of weaving area **23**.

Carrier **30** is provided with an elliptical movement, as indicated by dashed line **130** in FIG. **1**, by means of eccentric mechanism **51** at intermediate portion **34** and link mechanism **83** at end portion **36**. That is, as shaft **50** is rotated, stud **56** provides intermediate portion **34** of carrier **30** with a circular movement while end portion **36** is constrained to arcuate movement due to the tethering action of link **82** to move the needle carrying end of carrier **30** in an elliptical path and accordingly

an elliptical excursion path for eye **26** of needle **24**. Thus, the weft thread **28** is carried through each consecutive shed, and loops thereof are caught by knitting needle **88** which is then withdrawn by means of arm **100** operating on lever **98** as reciprocatingly driven by stud **104** on plate **102** to loop the previous double pick of weft thread thereover to provide a selvedge edge.

The operation thus far described is conventional and has been found highly desirable for speedy and accurate operation. In order to permit slide fastener element strip **22** to be moved in a substantially constant plane without shedding movement, weft laying needle **24** is moved vertically each time it is withdrawn from a shed such that on alternate weft laying cycles needle **24** is moved above and below guide arm **18** supplying slide fastener element strip **22** to weaving area **23**. The vertical movement is provided by means of the camming of riser **80** by cam member **66**. That is, as shaft **44** rotates, roller **72** will contact a large portion of plate cam **70** for substantially half a rotation and a smaller portion for substantially half a rotation. The large and small halves of plate cam **70** are interconnected by smoothly tapering surfaces such that needle **24** is not moved abruptly. As riser **80** is moved up and down in accordance with rotation of cam member **66**, carrier **30** is rocked about fulcrum plate **58** which engages arcuate bottom surface **64** of intermediate portion **34**. Vertical movement of carrier **30** is facilitated by the spherical pivot members **62** and **86** engaging spherical recesses in the carrier.

Since shaft **44** only rotates once for two rotations of shaft **50**, it can be seen that weft laying needle **24** travels a substantially complete elliptical excursion path while roller **74** engages either half of plate cam **70**. The path of movement is illustrated schematically in FIG. **6** wherein letters *a*, *b*, *c*, *d*, *e*, and *f* indicate positions of weft laying needle **24** relative to the position of plate cam **70** and rotation of eccentric mechanism **51** with the same letters used in FIG. **2** to denote corresponding cam surfaces. Thus, as shaft **44** rotates weft laying needle **24** moves as depicted by the arrows in FIG. **6** such that eye **26** of the needle is maintained in substantially constant, spaced, parallel planes **128** and **130** except for movement between *c* and *d*, *f* and *a*, which movement takes place when laying needle **24** is in an endmost withdrawn position. As previously mentioned, the cam surfaces between *c* and *d*, and f and a smoothly connect the small half of plate cam **70** between *a and c* and the large half of plate cam **70** between *c* and *f*. It will be appreciated that plate cam **70** may be aligned with eccentric mechanism **51** such that movement of needle **24** between planes **128** and **130** may take place at any point on the elliptical excursion path where needle **24** is withdrawn from the sheds. That is, the primary concern is that eye **26** of needle **24** moves in a substantially constant plane while in the sheds and be moved alternately above and below slide fastener element strip **22** at any point while out of the sheds.

The movement of weft laying needle **24** through the sheds is illustrated in FIG. **7** wherein the warp threads **16** are illustrated as having alternate ones grouped to form sheds to facilitate understanding of the present invention. It should be appreciated, however, that the warp threads may be selectively moved in various changing groups to weave any desired pattern. Knitting needle **88** is moved in synchronization with weft laying needle **24** alternately in a first plane **132** (FIG. **5**) and a second plane **134** intersecting planes **128** and **130**, respectively, to catch loops of the weft thread **28** as it is carried through each shed. Thus, knitting needle **88** is moved back and forth along a path parallel to the path of movement to tape **91**.

Knitting needle **88** is displaced by rotation of cam member **124** on shaft **44** in the same manner as weft laying needle **24** is moved in that plate cams **70** and **122** have the same configuration and are aligned such that risers **80** and **108** are raised and lowered simultaneously. Riser **108** is controlled by vertical displacement of roller **118** which operates through lever **112** and link **110** to raise riser **108** when roller **118** engages the large half of plate cam **122**. Upward movement of riser **108** raises pillow-blocks **106** and **106'** and pivot pin **105** and causes carrier **90** to pivot about pin **92** to lower knitting needle **88** to move reciprocatingly in plane **132**. Since cam members **66** and **124** are both rotated on shaft **44**, the vertical displacement of weft laying needle **24** coincides with the vertical displacement of knitting needle **88**; and, as weft laying needle **24** moves through a shed in either of planes **128** or **134**, knitting needle **88** will be positioned to catch the weft thread without any vertical movement being imparted to the weft laying needle.

Displacement mechanism **93** is particularly effective for knitting a selvedge edge in that as the tape is moved through the loom loops of weft thread are properly positioned to have succeeding weft thread loops pulled therethrough. If a vertical knitting needle is used to form the selvedge edge, the knitting operation becomes quite complex and the advantage of the simplified apparatus is lost.

Thus, it may be seen that the weft laying needle is maintained in a constant plane as it moves through the warp threads thereby permitting decreased and less accurate movement of the warp threads and the weaving of wider fabrics. It should be appreciated that, as illustrated in FIG. **6**, the warp threads need not be moved past a midpoint between planes **128** and **130**; and, if no pattern is to be woven in the tape or part thereof, corresponding warp thread groups need not be provided with shedding movement as long as they are maintained between planes **128** and **130**.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a needle loom of the type for weaving a tape and for providing shedding movement to a plurality of warp threads at a weaving area, a weft laying needle having an end carrying a weft thread, a driving mechanism for projecting the weft laying needle from a withdrawn position through the warp threads at the weaving area to a projected position and withdrawing the weft laying needle to the withdrawn position, and a knitting needle provided with reciprocating movement parallel to movement of the woven tape for catching the weft thread when the weft laying needle is in the projected position, the improvement for weaving a slide fastener element strip along an edge of the tape comprising

guide means supplying the slide fastener element strip to the weaving area in a substantially constant plane;

control means for alternately driving the end of the weft laying needle through the warp threads in a first plane and a second plane, said first and second planes being in spaced parallel relation on opposite sides of said guide means;

displacement means for alternately moving the knitting needle to a first position coinciding with said first plane and a second position coinciding with said second plane;

the knitting needle being supported in a carrier pivotable on first and second pins, the first pin riding in slots in a guide block, a lever having one end connected with said second pin and another end connected with a reciprocating arm, and said displacement means including a riser connected with a pivot pin in a portion of the lever between the ends and cam means for raising and lowering said riser to pivot the carrier about the first pin to place the knitting needle in said first and second positions.

2. The invention as recited in claim 1 wherein said cam means includes a cam member having a groove therein following the contour of a plate cam, a roller disposed in said groove to follow said plate cam contour, a lever movable about a fulcrum in response to displacement of said roller, and a link connecting said lever with said riser.

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