United States Patent [19]

Libby

[11] **3,752,195**

[45] **Aug. 14, 1973**

[54] **LOOM**

[75] Inventor: **Carl F. Libby,** Stoughton, Mass.

[73] Assignees: **John D. Riordan; Gertrude C. Libby,** Brockton, Mass. ; Trustees under Trust dated Oct. 13, 1955

[22] Filed: **Mar. 23, 1970**

[21] Appl. No.: **21,967**

[52] **U.S. Cl.** ..... **139/124 A,** 139/191

[51] **Int. Cl.** **D03d 47/46,** D03d 49/68

[58] **Field of Search** ..... 139/122 R, 123, 124 R, 139/124 A, 188, 190, 191

[56] **References Cited**

UNITED STATES PATENTS

2,625,959	1/1953	Turner	139/124 A
3,102,557	9/1963	Gustavson et al.	139/124 A
2,980,146	4/1961	O'Neill	139/124 A
3,320,980	5/1967	Gustavson	139/124 R

OTHER PUBLICATIONS

German Publication No. 1,197,036, 9–1959

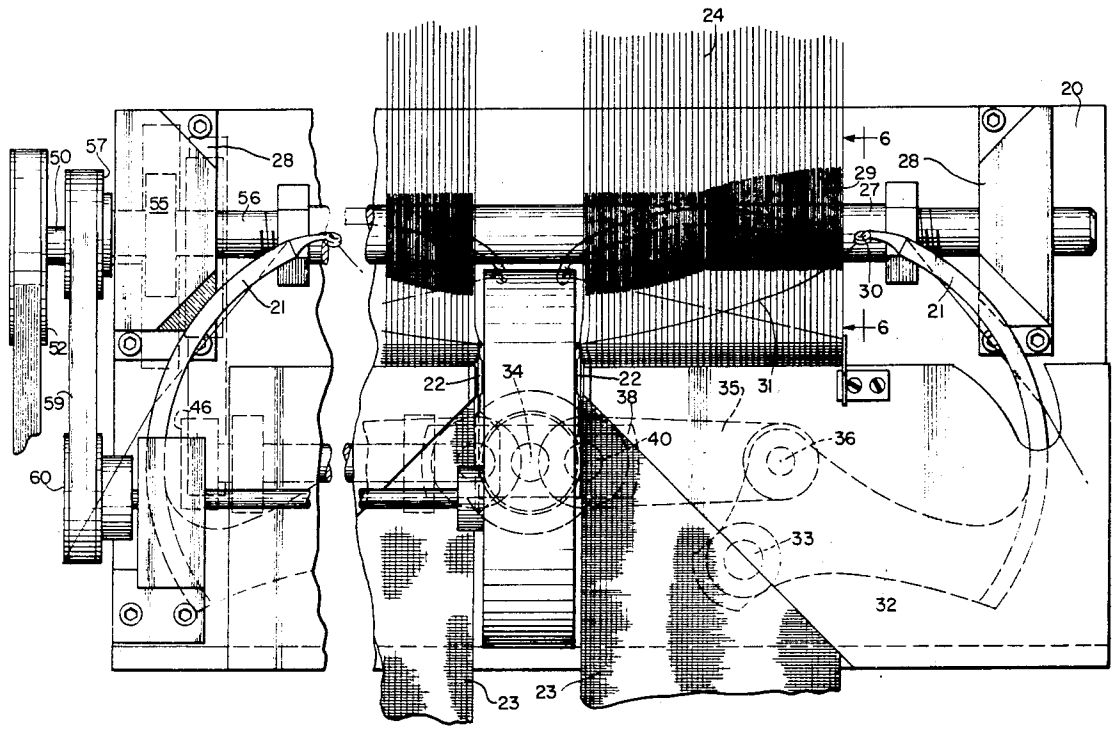
Primary Examiner—Henry S. Jaudon

Attorney—Wolf, Greenfield, and Sacks

[57] **ABSTRACT**

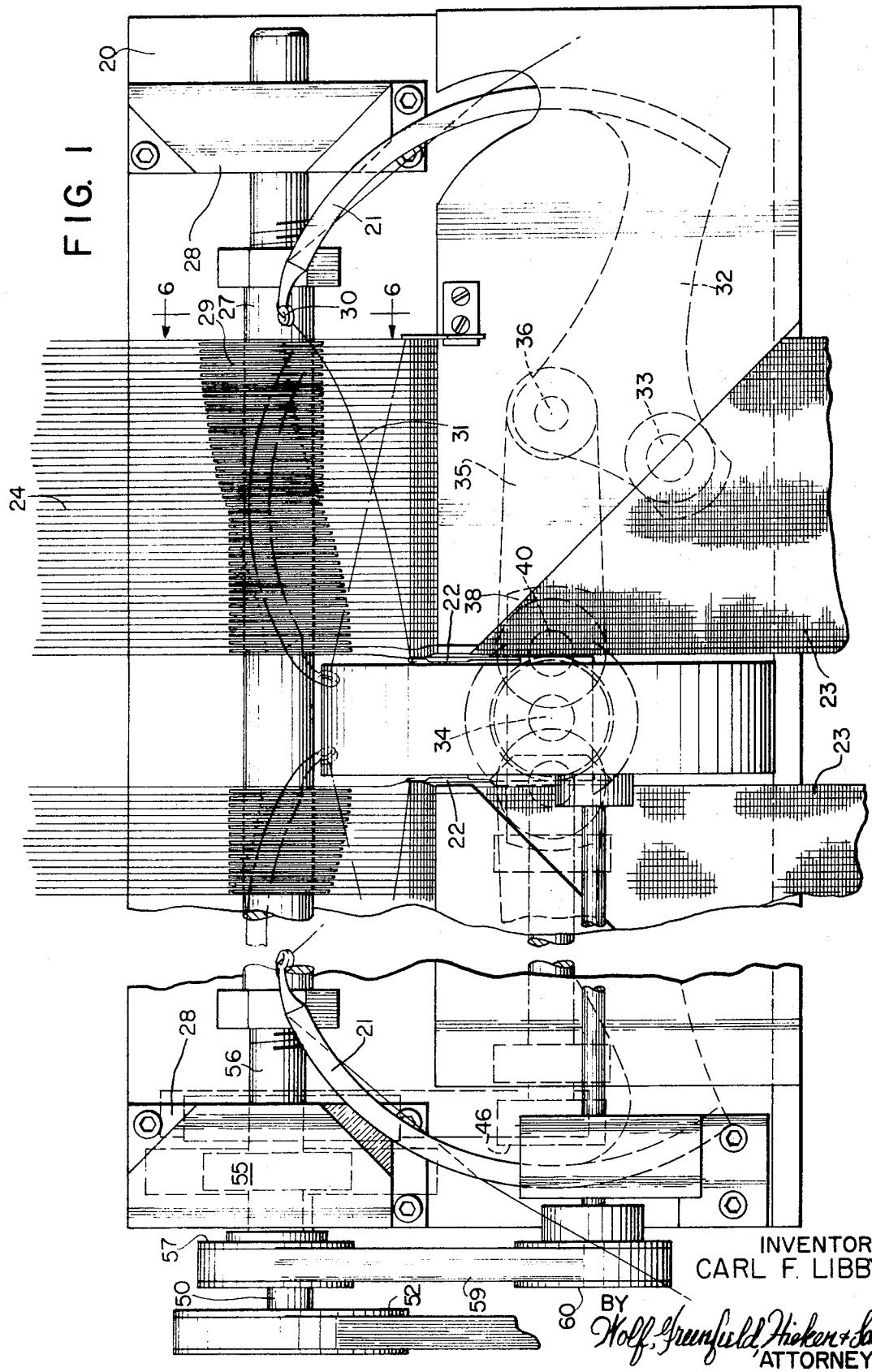
A shuttleless loom for simultaneously weaving two fabrics or webs independently of each other, but using a balanced common crank drive linkage with a flywheel to minimize inertial vibrations, a common knitting needle drive assembly, one needle for each fabric, a common rotating reed shaft with helically arranged beat-up dents, and a common power source. The knitting needles are held in a crank and pivot mechanism that causes the ends of the needle tips to move in a looped path that intersects the path of the weft-laying fingers to provide positive engagement of knitting needles and weft yarns, and the height of such looped paths are adjustable at their extremities by changes in the crank throw.

11 Claims, 10 Drawing Figures



6 Sheets-Sheet 1

FIG. 1



INVENTOR
CARL F. LIBBY

BY
Wolff, Greenfield, Hicken & Socks
ATTORNEYS

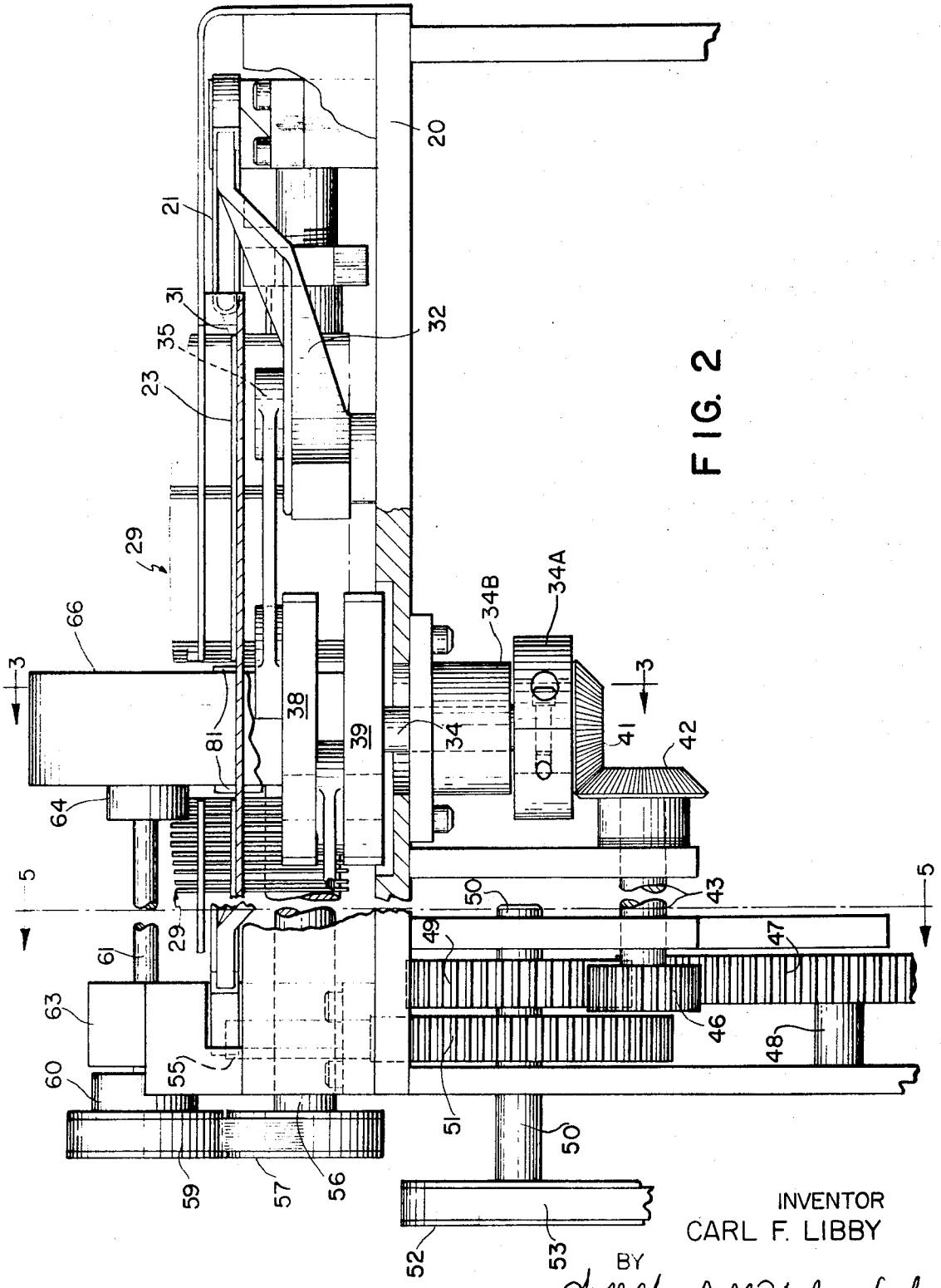


FIG. 2

INVENTOR
CARL F. LIBBY
BY
Wolff, Greenfield Hieken & Sacks
ATTORNEYS

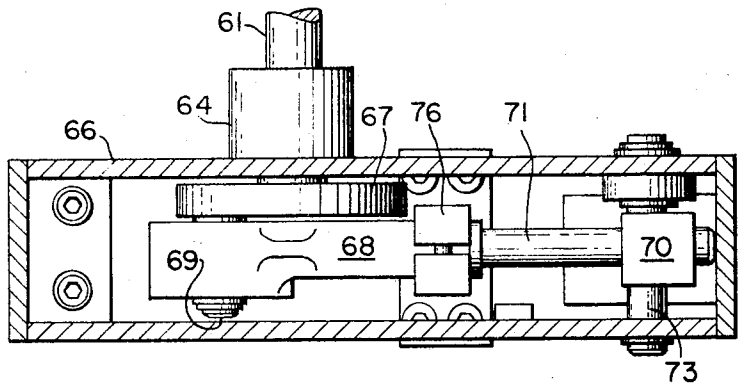


FIG. 4

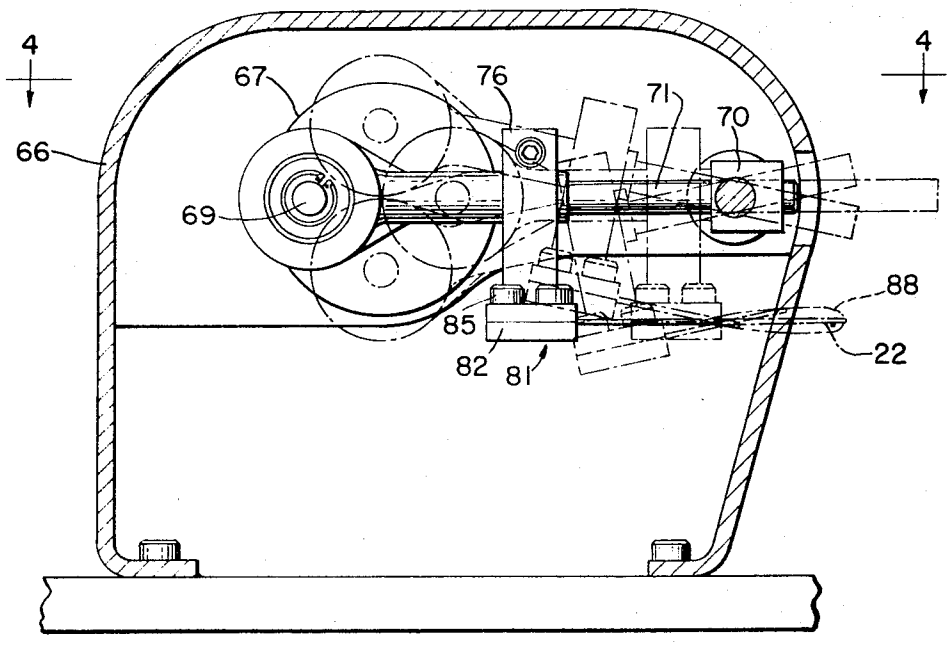


FIG. 3

INVENTOR
CARL F. LIBBY
BY
Wolf, Greenfield Hieken & Sacks
ATTORNEYS

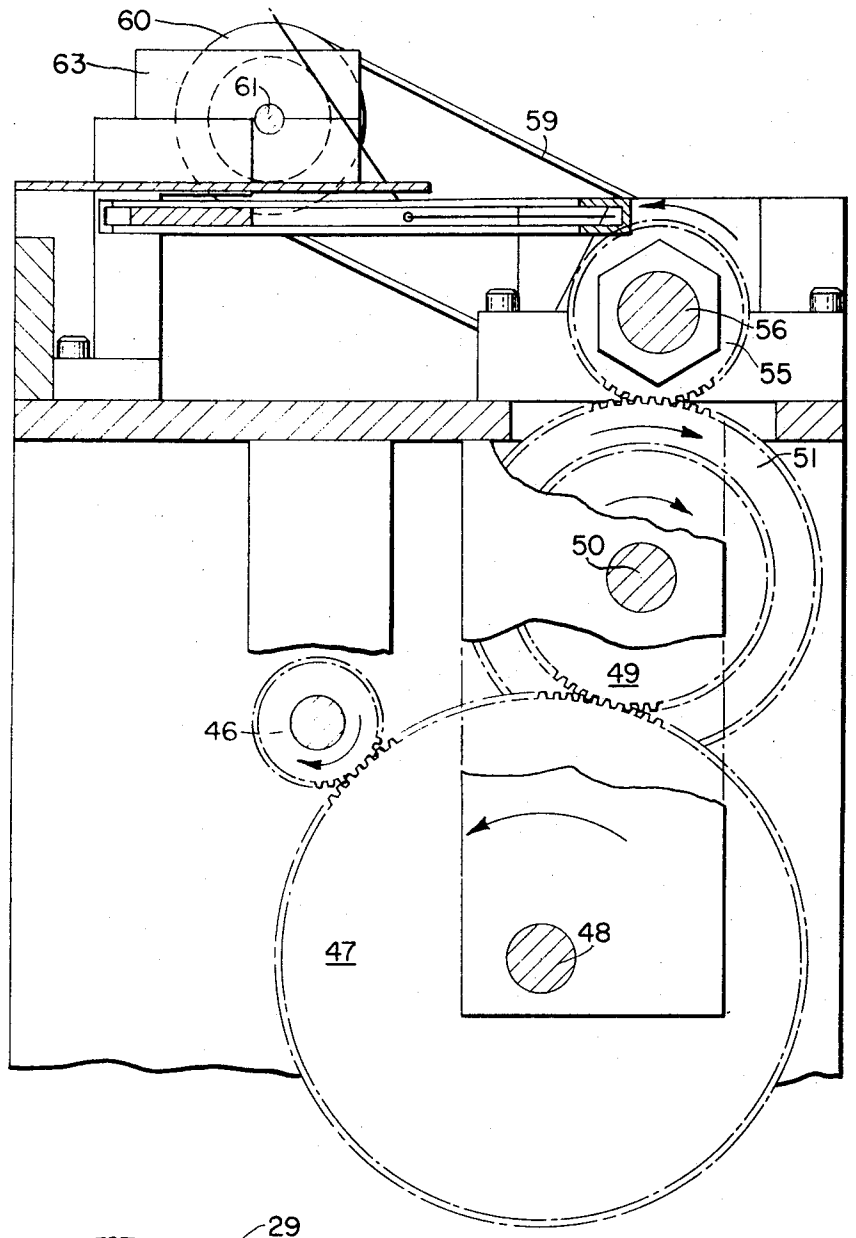


FIG. 5

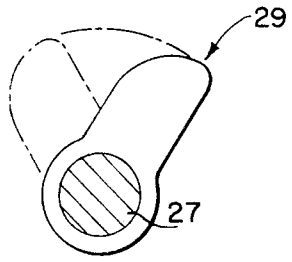


FIG. 6

INVENTOR
CARL R. LIBBY
BY
Wolff, Greenfield Hueken & Sacks
ATTORNEYS

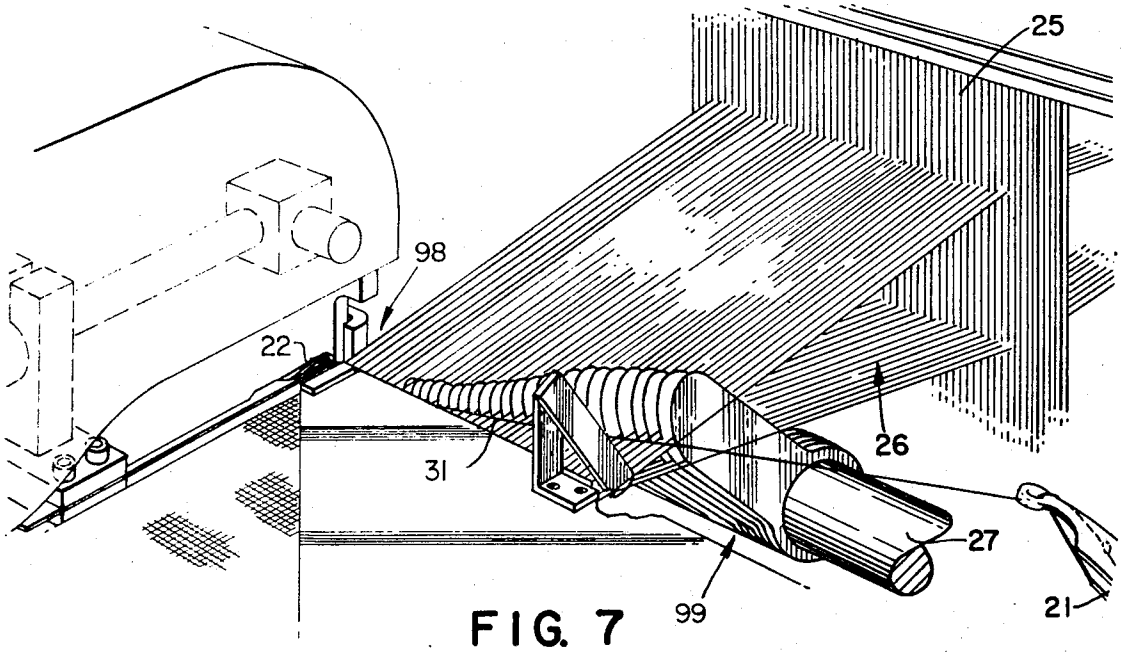


FIG. 7

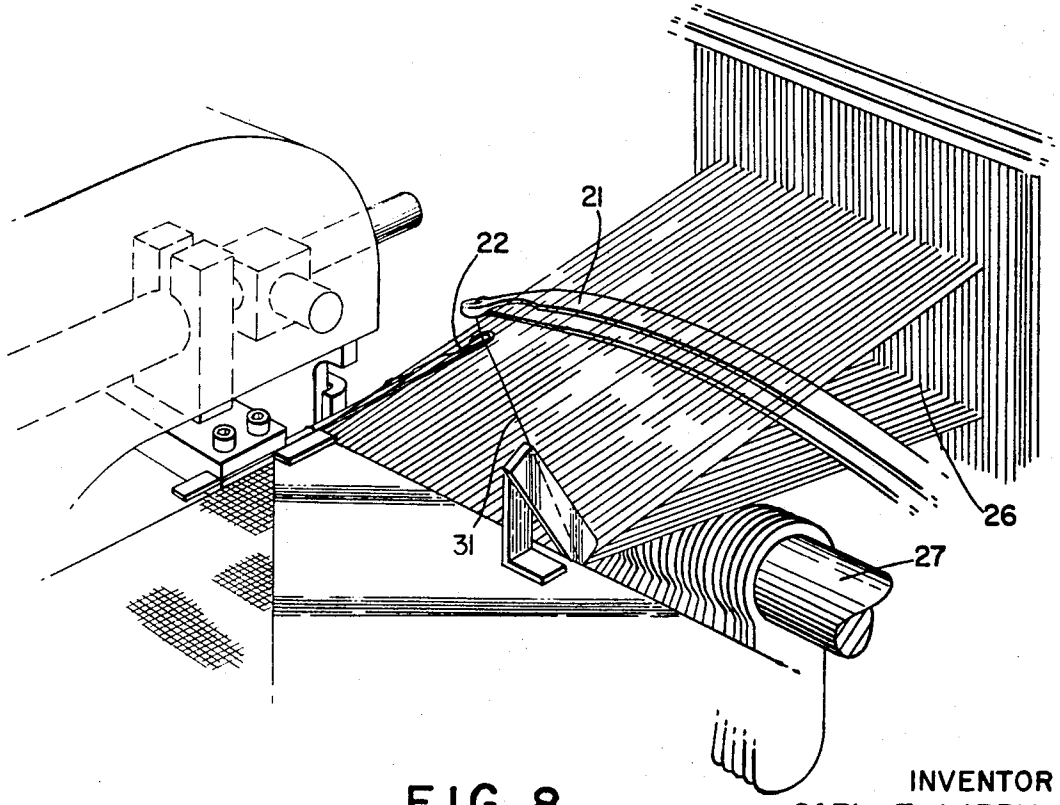
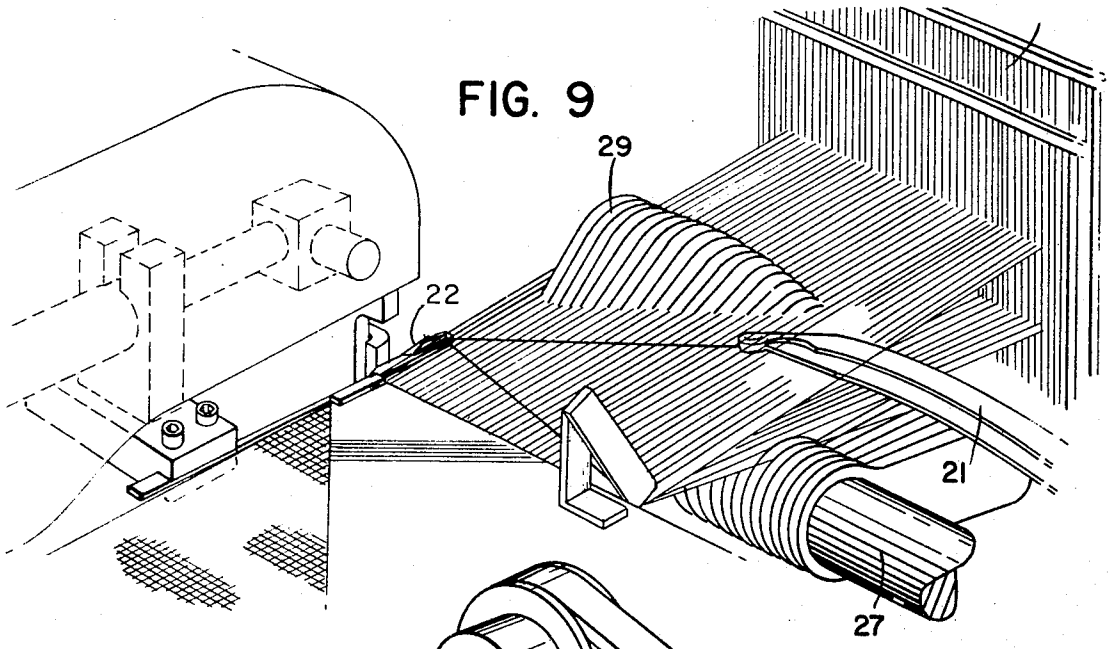


FIG. 8

INVENTOR
CARL F. LIBBY
BY
Wolff, Greenfield Hieken & Sacks
ATTORNEYS

FIG. 9



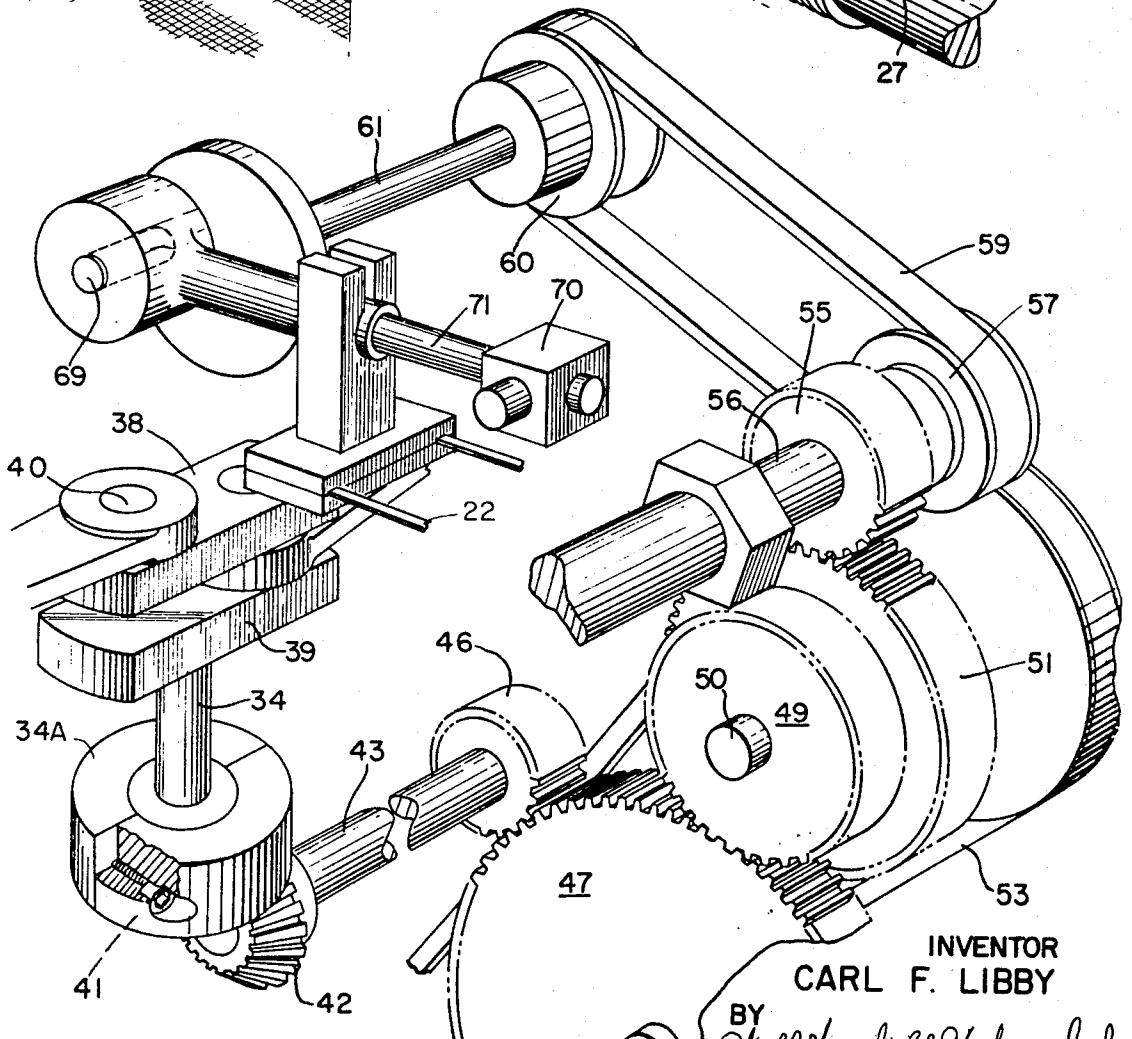


FIG. 10

INVENTOR
CARL F. LIBBY

BY Wolf, Greenfield Hacken & Sacks
ATTORNEYS

LOOM

SUBJECT OF INVENTION

The present invention relates to a shuttleless loom for weaving narrow fabrics at high speeds.

BACKGROUND OF INVENTION

Generally, most shuttleless looms provide motion to the weft-laying fingers and the reciprocating reeds with a crank drive or a cam assembly, or a combination of both. The crank is more efficient from a mechanical arrangement, but the travel of the finger must be extended two or three times the width of the fabric to provide time for the reed to enter and retract from the shed. To limit the travel required, the finger tip is made to describe an oval motion, leaving the shed near the fell of the fabric. By so doing, at high speeds the finger tip is deflected due to inertia and will not always properly engage the needle. Those looms which employ cams can be designed with proper dwell to allow time for the reed to enter and leave the shed, but in so doing sacrifice speed, due to the increased acceleration and deceleration necessary for the limited cycle required for the finger to enter and leave the shed.

To acquire maximum efficiency, shuttleless looms are designed to weave a fabric of a particular width with limited ability to adjust the loom to weave fabrics of varying widths. For example, shuttleless looms ordinarily cannot be adjusted to weave fabrics varying in width between one-quarter inch and 4 inches, or wider.

Another limitation of existing shuttleless looms results from the tolerance required for engagement of the weft-laying finger and the knitting needle. Vibration of either member often will result in a skip or missed transfer of weft thread, causing an obvious defect in the fabric.

Another limitation of existing shuttleless looms, especially when weaving a dense fabric, relates to the stress exerted on the weft thread when the reciprocating or revolving reed impacts the entire length of the weft thread within the shed at the same time. This stress causes distensions of the thread and narrowing of the fabric, and causes breakage of the filling.

SUMMARY OF THE INVENTION

The present invention is designed to overcome the limitations described above. In the present invention there is provided a means by which a needle or tandem operation of a pair of needles engage loops of weft threads by movement over a continuous loop, which preferably is a generally oval path. The free end of each needle is arranged to move beyond the filling and then downwardly to positively engage the weft thread when the loop of the weft thread is thrust beyond the shed. This means for moving the needle tip over a looped path eliminates the likelihood of skipping which has heretofore been caused by normal vibrations of the needle tip and finger tip that move the needle tip from the prescribed course.

It is also an object of the present invention to provide an improved drive means for simultaneous operation of a pair of needle and fingers whereby two webs may be simultaneously woven at comparatively high speeds.

In the present invention, a common crank, located midway between a pair of finger arms, is used to drive two weft-laying fingers carried by the arms. As the motions of the finger arms are opposed, the momentum

generated by each finger is balanced by that of the other and vibration is minimized. To further minimize vibration caused by the acceleration and deceleration of the finger arms during the cycle, a flywheel is attached to the center drive shaft. In addition, by having the weft-laying finger tips reciprocate in the same arc,deflection of the finger tips is minimal. The finger motion,in conjunction with the staggered or helically arranged dents on the revolving reed, is such that each weft-laying finger need travel only one-half to three-quarters of an inch in excess of the width of the fabric being woven, and because of the shorter travel, deflections due to inertia at high speeds are minimized.

In addition, the helically-arranged,beat-up dents on the present invention are adjustable so that the edge dent closest to the needle can be made to properly reach its beat-up position just after the stitch has been cast, thus assuring that a tight stitch is knitted. The staggered arrangement of the beat-up dents provides for the rolling of the weft into the fell of the fabric without the stress that normally occurs when the weft is beaten into the fell along the entire width of the fabric by conventional reciprocating or revolving reeds.

The knitting needle drive mechanism of the present invention is such that the tips of the knitting needles prescribe looped paths. By altering the crank throw, the looped motion can be increased or decreased to assure positive engagement of the needles and the weft yarn despite variations in yarn thickness and despite the occurrence of finger, needle, or yarn vibration. In addition, the knitting needle drive mechanism is designed so that as the needle assembly moves, the needle always passes through a fixed point adjacent to the fell of the fabric, thus minimizing strain on the filling and on the needle.

Further, the present invention incorporates a central finger motion drive crank that is held in place by a single locking screw. By substituting a new crank, the finger throw can be increased or decreased and the loom can be used to weave narrow fabrics varying in width between one-quarter inch and 4 inches or more, without sacrificing speed or efficiency.

DESCRIPTION OF DRAWINGS

These and other objects and advantages of the present invention will be more clearly understood when considered in conjunction with the accompanying drawings in which:

FIG. 1 is a fragmented top view of a shuttleless loom for simultaneously weaving a pair of webs and showing only one of the two operating fingers in complete layout;

FIG. 2 is a front view with portions broken away showing one of a pair of the simultaneously operating fingers;

FIG. 3 is a cross-sectional detail of the needle crank and pivot mechanism substantially along line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional detail of the needle crank and pivot mechanism taken substantially along the line 4—4 of FIG. 3;

FIG. 5 is a cross-sectional detail taken substantially along line 5—5 of FIG. 2 showing the drive gears and mechanisms;

FIG. 6 is a cross-sectional detail taken substantially along line 6—6 of FIG. 1 and showing the detail of the rotating reed and dents;

FIG. 7 is a perspective view showing the needle fully retracted, the weft-laying finger out of the shed, and the weft heddles changing position;

FIG. 8 is a perspective view similar to that of FIG. 7, but with the needle moving down on the warp thread while the finger is fully extended into the shed;

FIG. 9 is a perspective view similar, but subsequent in time to that of FIG. 8, showing the needle retracting and pulling a weft thread towards the fell while the rotating dents are approaching the weft and the finger is moving out of the shed; and

FIG. 10 is a fragmentary perspective of the drive and associated mechanism with portions omitted for clarity.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings, there is illustrated a shuttleless loom for weaving narrow fabric webs. The loom is illustrated for tandem operation wherein two webs are simultaneously woven.

Referring first to FIGS. 1 and 2, there is shown a main frame 20 that supports a pair of syncronously operated weft fingers 21. These fingers 21 are symmetrically arranged with respect to a pair of commonly mounted and actuated parallel needles 22 for simultaneously weaving two parallel webs of fabric 23. For convenience, only the right-hand weft finger needle and associated mechanism will be described in detail. The left-hand mechanism, only fragmentarily shown, is essentially a mirror image and functions in a fashion similar to and simultaneous with the right-hand portion of the mechanism. The warp yarns 24 forming the fabric are conventionally fed to the loom through heddles 25 (FIGS. 7–9) which are conventionally operated by means not shown to form the shed 26. A rotating reed assembly 27 is supported at its ends by suitable journals 28. The reed is provided with two sets of dents 29, one for each of the webs being woven. The reed is positioned below the shed with the dents aligned to project upwardly into the shed and beat the warp thread against the fell as hereafter described. The weft finger 21 is arcuate in configuration and is provided with any eye 30 at one end through which the weft yarn 31 passes. The weft finger 21 is secured at its end remote from the eye 30 by an arm 32 in turn pivoted on a shaft 33. The arm 32 of the weft finger assembly is linked to a drive shaft 34 (FIG. 10) by a link 35 pivotally engaging the arm 32 by pin 36 and the parallel crank arm 38, by pin 40. The shaft 34 is suitably supported for rotation on the frame 20 in a suitable bearing 34B. A flywheel 34A is secured to the shaft 34. The flywheel is of sufficient mass to effectively minimize vibrations of the system. The lower end of the shaft 34 is connected to a power source (not shown) through the inter-engaged beveled gears 41 and 42. Beveled gear 42 is mounted on shaft 43, which also has secured to it gear 46 which meshes with larger gear 47. Gear 47 journaled on shaft 48 meshes with gear 49 mounted on shaft 50 (FIGS. 5 and 10). Shaft 50 also has keyed to it gear 51 and drive pulley 52 (FIG. 2). Pulley 52, in turn, may be connected by a suitable belt drive 53 to a power source (not shown). Gear 51, in turn, meshes with gear 55 that is supported on a shaft 56 above shaft 50. A pulley 57 mounted on shaft 56 carries the endless timing belt 59 that in turn rotates pulley 60. Pulley 60 is mounted on shaft 61 suitably journed in means 63 and 64. Shaft 61 drives the needle assembly, best illustrated in FIGS. 3 and 4. Rotatable shaft extends into housing 66 where one end is secured to the crank 67. A connecting rod 68 has one end driven by crank pin 69. The other end of connecting rod 68 is slidably supported in a rockable journal 70. The journal 70 may comprise essentially a block having a cylindrical hole therein with the link 68 having a cylindrical section 71 that extends through this cylindrical hole in the block 70. Block 70 is in turn supported for a rocking or rotational movement about a fixed axis by a shaft 73 that is suitably journaled in the housing 66 for rotation. A bracket 76 is suitabled secured and locked to the connecting rod link 68 and adjustable. The bracket 76 is provided with a lower end 81 (FIG. 3) with a clamping mechanism 82 designed to hold a pair of knitting needles 22. The clamping mechanism 82 may comprise a pair of facing blocks suitably locked together by screws 85. The needles 22 are secured in spaced parallel relation for a loop-like movement over a path 88 lying preferably in a plane essentially perpendicular to the plane of movement of the weft fingers 21. By selective substitution of larger or smaller cranks 67, the amplitude of movement of the tips of the needle 22 over a loop-like path 88 may be adjusted for larger or smaller movements. Greater movements would normally be desired when wider fabrics are being woven; and, consequently, there is a greater deflection of the weft yarn as it passes through the shed. Greater movements are also desired with higher speeds of operation.

The reed assembly 27 (FIG. 9) is provided, as described, with a set of dents 29 for each web being woven. These dents are suitably fixed to the reed shaft, but the dents 29 are helically arranged as illustrated with the innermost dents arranged helically in advance of the outermost dents with respect to the direction of movement of the reed.

The operation of this loom will best be understood from a consideration of FIGS. 7–9. First, referring to FIG. 7, the needles 22 are in a rear or back position as the weft yarn is being cast from the needle and the weft finger has moved out of the shed. At the same time, the reed assembly 27 is rotating so that its dents are beating the weft yarn 31 into the fell. Since the dents 29 are helically arranged with those at end 98 in advance of those at end 99, the dents closest to the needles 22 have begun to beat the weft yarn while the weft-laying finger 21 is moving from the shed but has not completely cleared it. In a subsequent instant of movement as illustrated in FIG. 8, the needle 22 is moving downward as the weft finger 21 has moved entirely through the shed 26 carrying the weft yarn under the needle which then engages the loop. Because of the vertical looping movement of the needle 22 when the weft loop has been formed, the chances of the needle missing the weft yarn are substantially minimized. As the loom continues to operate (FIG. 9), the needle 22 starts to retract, having engaged the weft yarn, and the weft finger retracts through the shed. At the same time and while the weft finger 21 is still in the shed on its cross movement, the dents 29 closest to the needle are already beating up the weft yarn into the fell.

The shed action is conventional in nature and is controlled by conventional means (not shown) synchronized in operation with respect to the fingers, reed and needles. The sheds may be formed at a greater speed than heretofore possible since the weft yarn may be

beat up before the weft finger has completely moved from the shed.

I claim:

1. In a loom having a means for forming a warp shed, a weft laying finger for inserting successive loops of a continuous weft yarn through said shed from one side thereof to the opposite side for the purpose of weaving a web, and a knitting needle positioned on the opposite side of said shed to form a knitted selvedge, means for moving the tip of said knitting needle in a looped path intersecting the path of the weft-laying finger, to provide positive engagement of the knitting needle and the weft yarn.

2. In a loom having a means for forming a pair of warp sheds, a pair of weft-laying fingers for inserting successive loops of continuous weft yarns through said sheds from one side thereof to the opposite sides for the purpose of weaving two webs, and knitting needles positioned on the opposite sides of said sheds to form knitted selvedges, means for moving the tips of said knitting needles in looped paths intersecting the paths of said weft-laying fingers, to provide positive engagement of the knitting needles and the weft yarns.

3. A loom as set forth in claim 1 having means for supporting said needle whereby said looped path extends angularly to a straight line coincident with and extending from the fell, and said loop substantially intersects said line at one point, with a portion of the length of said needle also intersecting said one point.

4. A loom as set forth in claim 1 wherein said means for moving said knitting needle comprises a crank geared to a power source, a connecting arm having two ends, one of said ends operatively connected to said crank and the opposite end of said connecting arm slidable through a pivoted journal, said pivoted journal adapted to control movement of means securing a needle to said connecting arm, said means for moving said knitting needle arranged to limit movement of a portion of the needle adjacent to the fell of the fabric to include a point in fixed relationship to the fell.

5. A loom as set forth in claim 1 having a plurality of needles for weaving a plurality of fabrics, each of said knitting needles having means for moving said knitting needle comprising a crank geared to a power source, a connecting arm having two ends, one of said ends operatively connected to said crank and the opposite end of said connecting arm slidable through a pivoted journal, said pivoted journal adapted to control movement of means securing a needle to said connecting arm, said means for moving said knitting needle arranged to limit movement of a portion of the needle adjacent to the fell of the fabric to include a point in fixed relationship to the fell.

6. In a shuttleless loom as set forth in claim 2, a single crank means, a pair of linkage means with each connected at one end to said crank means and at the other end to finger, said linkage means each including a pivot member whereby rotation of said crank means causes said fingers to move in opposite directions over a reciprocating path.

7. In a shuttleless loom as set forth in claim 6, a flywheel attached to said crank means to absorb the stresses of acceleration and deceleration.

8. In a shuttleless loom having means forming a pair of warp sheds into which separate weft threads are inserted; a common, continuously rotating reed shaft with two sets of helically arranged weft yarns, beat-up dents secured thereto, having opposed pitches, and arranged to progressively beat up said weft threads across the fells of the fabrics.

9. A shuttleless loom as set forth in claim 1 including means for forming a pair of parallel sheds, a pair of weft-laying fingers and a pair of said knitting needles, means commonly supporting said pair of needles at adjacent sides of said sheds for simultaneous movement of said tips over looped paths, and said means for moving said weft laying fingers including means for simultaneously reciprocating each of said fingers about an axis remote from said adjacent sides.

10. A shuttleless loom as set forth in claim 9 including a drive shaft, linkage means operatively interengaging said drive shaft with said pair of weft-laying fingers for simultaneous operation thereof, and a flywheel interengaged with said drive shaft.

11. A loom as set forth in claim 9 including a reed shaft located below said pair of parallel sheds and carrying two sections of dents with a section within each of said sheds, said dents arranged on said reed shaft in parallel helical configuration, means for rotating said shaft with the dents closest to said needles moving through the shed and towards the fell of said shed in advance of the dents remote therefrom.

* * * * *