

Oct. 1, 1946.

J. O. HUNT

2,408,645

LOOM

Filed June 24, 1944

3 Sheets-Sheet 1

Fig. 2,

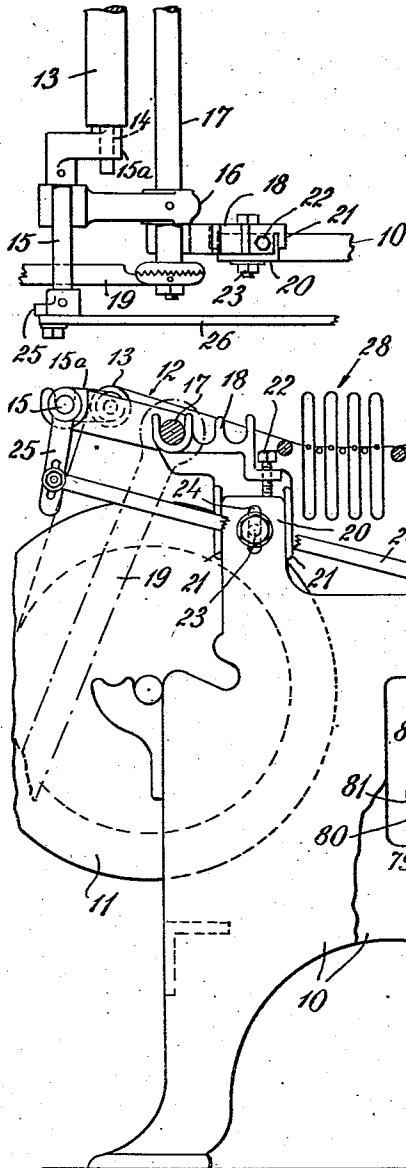
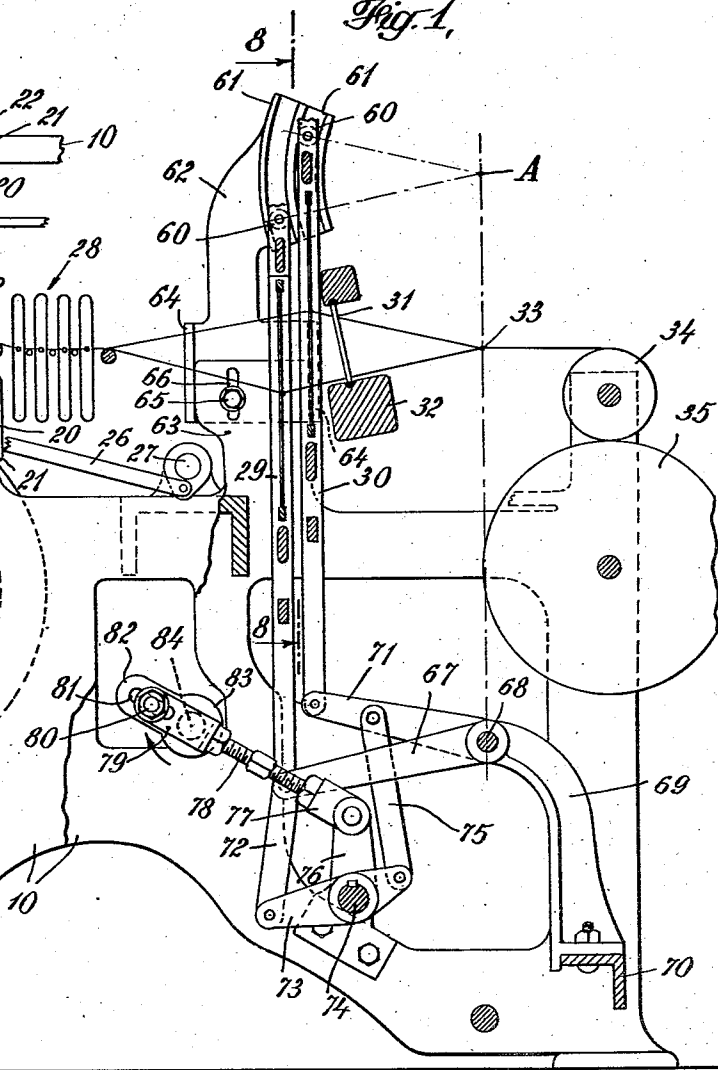


Fig. 1,



INVENTOR.
John O. Hunt
BY *Reine Hans Marion Thomas*
ATTORNEYS

Oct. 1, 1946.

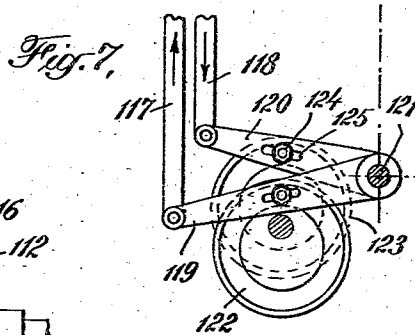
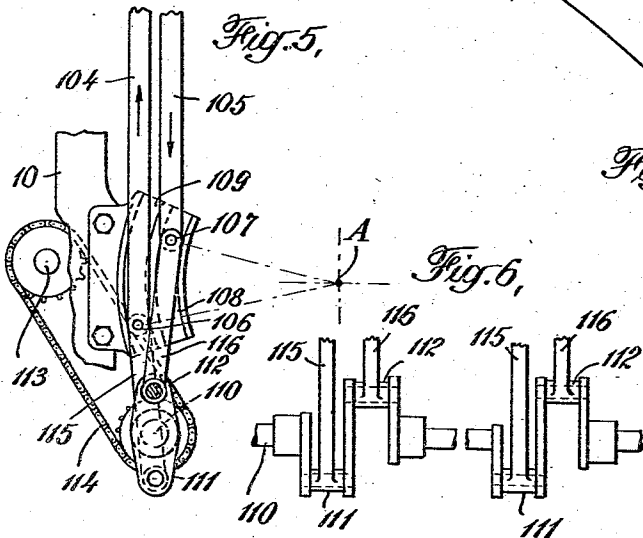
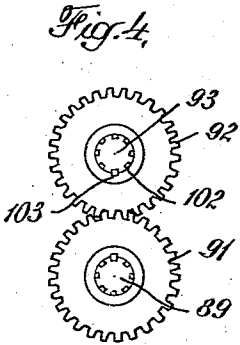
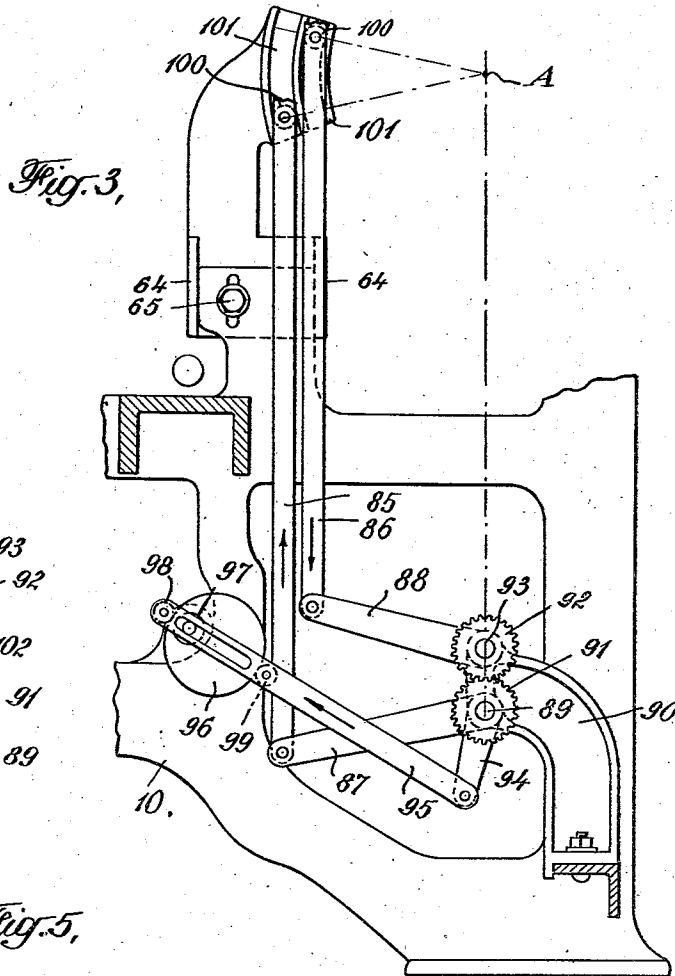
J. O. HUNT

2,408,645

LOOM

Filed June 24, 1944

3 Sheets-Sheet 2



INVENTOR.

BY *John O. Hunt*
Frederic Davis Marston - Edmunds
ATTORNEYS

Oct. 1, 1946.

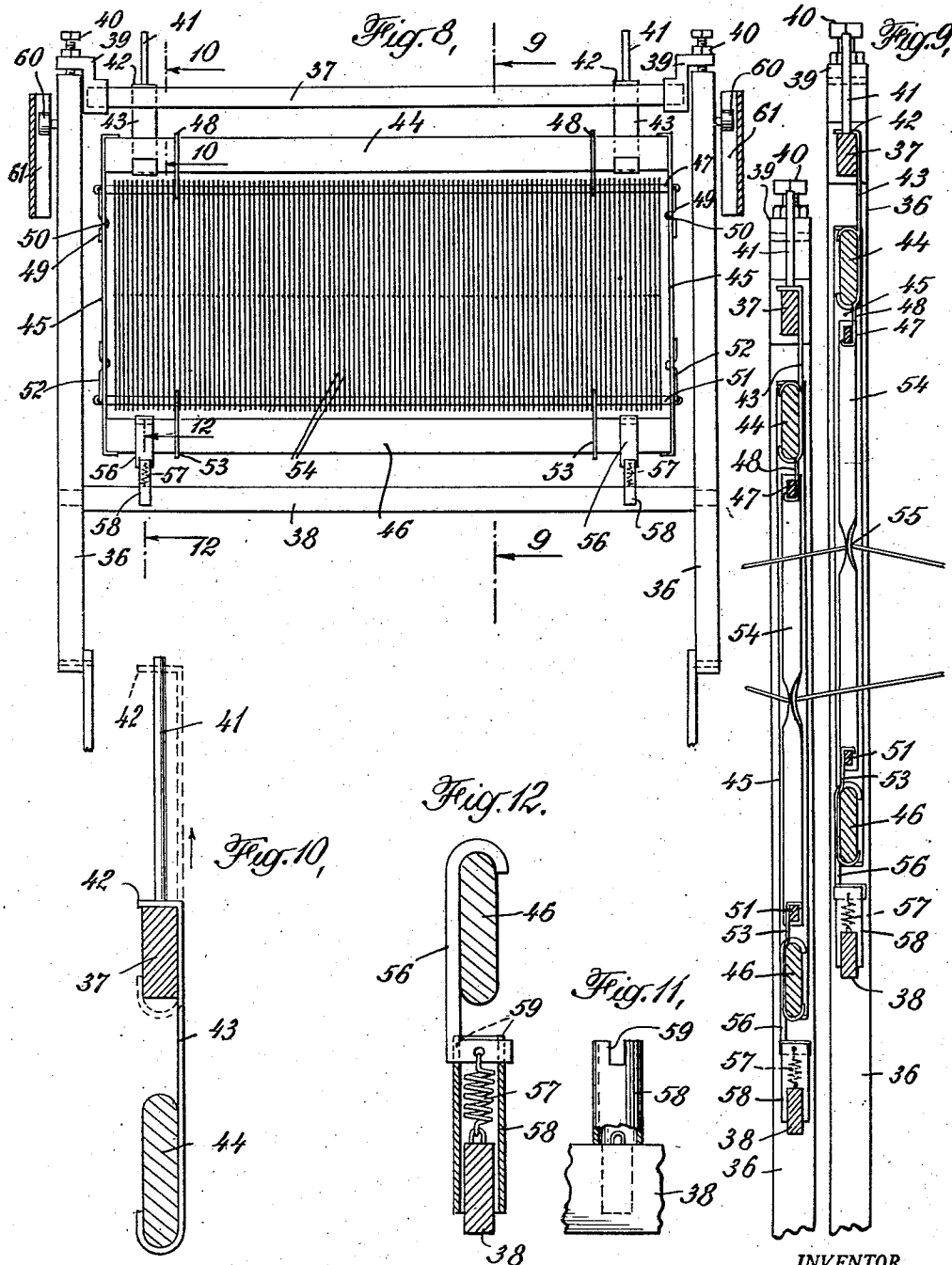
J. O. HUNT

2,408,645

LOOM

Filed June 24, 1944

3 Sheets-Sheet 3



INVENTOR.

John O. Hunt
BY
Rennie Davis
ATTORNEYS

UNITED STATES PATENT OFFICE

2,408,645

LOOM

John O. Hunt, Greenville, S. C., assignor to
Mountain City Foundry and Machine Co.,
Greenville, S. C., a corporation of South Carolina

Application June 24, 1944, Serial No. 541,893

4 Claims. (Cl. 139—55)

1

This invention relates to looms for weaving fabrics and of the type in which the warp threads are manipulated in groups by heddle frames to form the shed through which the shuttle is passed in the weaving operation. More particularly, the invention is concerned with a loom equipped with a novel motion for actuating the heddles in such manner that they perform their functions without injuring the warp threads by wear or abrasive action. A loom equipped with the new motion can, accordingly, be operated with less interruptions arising from breakage of warp threads, has a greater output, and produces material of better quality than looms of present construction.

A simple heddle loom of present conventional form includes two heddle frames which lie in parallel vertical planes and are reciprocated in those planes by suitable mechanism. Each frame is provided with a set of vertical wires having eyes through which a group of warp threads pass and, as one heddle is raised, the other is lowered, so that the threads of one group form the top of the shed and the threads of the other group form the bottom. In their movements, the threads swing about the fell of the goods as an axis.

Since the frames move in vertical planes while the threads swing about the fell, it follows that a point on a thread which lies in contact with a heddle eye when the frames are level will lie forward of the eye toward the fell when the frames are in their extreme upper and lower positions. In order that that point may reach such a position, the thread must move through its eye and an advance of $\frac{3}{8}$ " of that point toward the fell during the formation of the shed is not unusual. This means that, in the formation of a shed, the point on each warp thread, which lies, for example, $\frac{3}{8}$ " to the rear of the heddle eye for that thread, when the frames are level, will advance to lie in contact with the eye in the extreme position of its frame and every point on each thread to the rear of the eye within a length of $\frac{3}{8}$ " will pass through that eye. When the frames move back to level position, the warp threads are drawn backward through the eyes, but the point on each thread that previously lay in contact with the eye in the level position of the frames will now lie forward of the eye by the width of one pick. In a fabric having 80 picks to the inch, which is a common construction, $\frac{3}{8}$ " of warp thread represents about 30 picks, so that before a point on a warp thread lying $\frac{3}{8}$ " to the rear of a heddle eye, when the frames are level, will have finally passed on through the eye, that point will have moved back and forth through the eye

2

during the formation of the sheds for about 29 picks. As each thread must lie first in the top of a shed and then in the bottom for each cycle of 2 picks, it follows that each point on the warp thread will pass both back and forth through its eye two times for each cycle, or each point will move through its eye in one direction or the other a total of the order of $2 \times 29 = 58$ times before the point will have finally passed beyond the eye toward the fell.

The large number of movements of the warp threads through their heddle eyes during weaving, as above described, causes abrasion and wear on the threads and leads to breakage of the threads at thin spots. When such a breakage occurs, the loom stops automatically and the weaver must find and tie the ends of the broken thread before the loom can be started. As a result, looms of present construction lose production because of the wear and abrasion of the warp threads and the tying of broken warp threads results in imperfections in the fabric.

The present invention is directed to the provision of a novel heddle loom, in which abrasion of the warp threads as a result of their movement back and forth through the heddle eyes during the formation of the shed, is avoided and breaking of the threads produced by such abrasion is eliminated. In the new loom, these results are obtained by imparting to the heddle frames a compound movement in which the frames move both edgewise and broadside on in forming the shed. The movement of the frames is such that their eyes describe arcs about the fell of the fabric as a center as the frames move from their level to their extreme positions. Accordingly, as the frames move to form a shed, the point on each warp thread which was in contact with a heddle eye when the frames were level, remains in contact with that eye throughout the movement of the frames to their extreme positions and during their return. The result is that there is no movement of the warp threads back and forth through the eyes during shedding and thus the threads do not rub on the surfaces of the eyes and become worn through.

The mechanism by which the heddle frames are moved as described may take various forms and may include, for example, lever arms connected to one end of each frame and guides which control the movement of the other end of the frame. In another construction, both ends of each frame are guided to have the desired movement and the frames are actuated by con-

necting rods which may be driven by a crank shaft or in any other suitable way.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a view in side elevation through a loom equipped with the new heddle motion, certain parts being broken away and others omitted;

Fig. 2 is a fragmentary plan view of a part of the loom;

Fig. 3 is a vertical sectional view through a part of the loom showing a modified drive for the heddle frames;

Fig. 4 is an elevational view of a detail of Fig. 3;

Fig. 5 is a fragmentary elevational view of a modified drive for the frames;

Fig. 6 is a view in elevation of a crank shaft employed in connection with the parts shown in Fig. 5;

Fig. 7 is a view similar to Fig. 5 of another modified drive for the frames;

Fig. 8 is a sectional view on the line 8—8 of Fig. 1;

Figs. 9 and 10 are sectional views on the lines 9—9 and 10—10, respectively, of Fig. 8;

Fig. 11 is an enlarged sectional view showing parts of a heddle frame; and

Fig. 12 is a sectional view on the line 12—12 of Fig. 8.

In the drawings, the loom illustrated includes the usual side frame members 10 on which is mounted the warp beam 11 from which the warp threads 12 are let off by appropriate means to pass over a whip roll 13. The whip roll is mounted on a shaft 14 supported in arms 15a attached to shafts 15 which are supported in arms 16 attached to a shaft 17. Shaft 17 is mounted in brackets 18 and the angular position of the shaft is determined by arms 19 forming part of the usual let-off mechanism. Each bracket 18 is secured in face to face contact with an upward projection 20 from one of the side frame members 10 and each bracket is formed along its edges with flanges 21 which overlie the edges of its projection 20. Each bracket is vertically adjustable on its projection by means of a screw 22 passing through the bracket and bearing on top of the projection. The bracket is held in adjusted position by a bolt 23, which passes through a slot 24 through the projection and an opening through the bracket, and the engagement of the flanges 21 with the sides of projection 20 prevents the bracket from twisting out of position. The whip roll is swung up and down by arms 25 attached to shafts 15 and actuated by connecting rods 26 eccentrically attached to a rotating shaft 27 mounted in bearings on side frames 10.

The warp threads pass forward from the whip roll through a detector mechanism, generally designated 28, which is effective to stop the loom whenever a warp thread breaks. Beyond the detector mechanism, the threads pass through heddle frames, of which two designated 29, 30 are shown, and then through a reed 31 on a lay 32, which beats up the inserted picks. The fell of the fabric is indicated at 33 and the fabric passes therefrom around a sand roll 34 and is taken up on a roll 35 in the usual way.

Each heddle frame (Fig. 8) comprises vertical side frame members 36 connected by an upper cross-bar 37 and a lower cross-bar 38. The lower cross-bar 38 is secured rigidly to the side frame members and the upper cross-bar is mounted in brackets 39, through which are threaded adjust-

ment screws 40 which enter the ends of the respective side frame members and may be adjusted to vary the spacing of the cross-bars. The top cross-bar 37 is provided with a pair of pins 41 which extend through openings in the top portions 42 of hooks 43, such portions overlying the cross-bar. The hooks can be raised relative to the cross-bar, as indicated in Fig. 10, but cannot be removed therefrom without removal of the pins.

Hooks 43 support an upper cross-bar 44 forming part of a sub-frame, which includes side members 45, the upper ends of which overlie cross-bar 44 while the lower ends support a lower cross-bar 46. An upper horizontal member 47 is supported in the sub-frame by means of hooks 48 engaging the cross-bar 44 and also by means of wires 49 formed with loops 50 which may be snapped through openings in the side members 45. A lower horizontal member 51, which is similar to member 47, is mounted on the side members 45 by wires 52 of the same general construction as wires 49 and having loops which pass through openings in the side members 45. The lower horizontal member 51 is also held in place by hooks 53 engaging the member and the cross-bar 46. A plurality of thin metal strips 54 are threaded on the upper and lower horizontal members 47, 51 and the middle portion of each strip is twisted out of its plane and is formed with a heddle eye 55.

To keep the frame structure taut, the lower cross-bar 46 of the sub-frame is drawn downwardly toward cross-bar 38 by hooks 56 which overlie the top of bar 46 and are connected by springs 57 to the top of cross-bar 38. Each hook is held against sidewise movement by a tubular member 58, which encloses its spring 57 and is cut away to permit the member to straddle the cross-bar 38. At its upper end, the member 58 is provided with a slot 59 in which the lower end of a hook 56 is received.

Each heddle frame is provided at its upper end with rollers 60 on studs projecting outwardly from the vertical side members 36. These rollers are movable in curved guides 61 mounted on brackets 62 which are attached to upward projections 63 from the loom side frames. Each bracket is provided with lateral flanges 64 between which the projection 63 is received and the bracket is adjustably attached to the projection by a bolt 65 passing through a slot 66 in the projection and an opening through the bracket.

In the construction shown in Fig. 1, the lower ends of the side frame members 36 of heddle frame 29 are attached to the ends of arms 67 pivotally mounted on a fixed shaft 68 supported in brackets 69 attached to the front girt 70 of the loom. The lower ends of the side frame members 36 of heddle frame 30 are similarly attached to the ends of arms 71 also pivotally mounted on shaft 68. Each arm 67 is connected by a link 72 to one end of an arm 73 fast on a rock-shaft 74 mounted in bearings attached to the loom side frames and each arm 71 is connected by a link 75 to the other end of arm 73. The rock shaft is provided with a crank 76, to which is secured a member 77 connected by a screw 78 to a member 79. Member 79 is pivotally attached by a pin 80 adjustably mounted in a slot 81 in a crank arm 82 projecting from a hub 83 fast on shaft 84. Screw 78 permits adjustment of the spacing between members 77 and 79 and resultant adjustment in the initial position of crank 76 and rock shaft 74. These adjustments make it possible to bring the heddle

frames to level position and to vary the length of their movements from level position.

As previously described, the guides 61 for the rollers 60 are formed on the arcs of circles about a center A which lies in a vertical plane through the fell 33 of the fabric and the center of shaft 63 also lies in that plane. Accordingly, as arms 67 and 71 swing about shaft 63, their ends describe arcs of circles about a center lying in the vertical plane through the fell.

In the operation of the loom, the heddle frames are reciprocated by the swinging of arms 67, 71 about shaft 63, one frame being raised as the other is lowered from level position. In such movements of the frames, the lower end of each frame describes an arc about the axis of shaft 63, which lies in the vertical plane through the fell of the fabric and, at the same time, the upper ends of the frames are guided by guides 61 through similar arcs about an axis in that plane. The frames thus have a movement compounded of an edgewise and a broadside on motion and the eyes of each frame describe arcs about the fell as an axis. Accordingly, a point on a warp thread which is in contact with a heddle eye when the heddle frame is in level position remains in contact with the eye as the heddle is moved to its upper or lower position. There is, therefore, no movement of the thread through the eye until after the insertion of a pick, when the point on the thread previously in contact with the eye will pass beyond the eye a distance corresponding to the width of a pick. Accordingly, in the new loom, the compound movement imparted to the heddle frames eliminates the repeated back and forth movements of the warp threads through the heddle eyes and breakage of the threads resulting from abrasion and wear are prevented.

In the construction illustrated in Fig. 1, the lower ends of the frames are connected to the ends of arms 67, 71, which are independently actuated by links connected to the ends of the lever 73 on rock shaft 74. A modification of this construction is illustrated in Fig. 3, in which the lower ends of the heddle frames 85, 86 are connected, respectively, to arms 87, 88. Arms 87 are fast on the shaft 89 mounted in bearings on brackets 90 and provided with a gear 91 meshing with a gear 92 on shaft 93 on which arms 88 are fast. Shaft 89 is provided with cranks 94, each of which is attached to a member 95 which is actuated by an eccentric disc 96 mounted on a rotating shaft 97. Member 95 is provided with follower rollers 98, 99 engaging disc 96 diametrically. With this arrangement, rotation of shaft 97 operates through the parts described to rock shafts 89 and 93 and this causes heddle frames 85 and 86 to move up and down in opposite directions. At their upper ends, the heddle frames are provided with rollers 100 movable in guides 101. The shafts 89, 93 lie one above the other with their centers in a vertical plane through the fell of the fabric and the guides 101 are arcuate with their arcs described about a center in the vertical plane mentioned. The heddle frames, accordingly, have such a movement that there is no repeated drawing of the warp threads through the heddle eyes of those frames during weaving.

In the movement of the heddles by the mechanism shown in Fig. 3, the shafts 89, 93 rock through relatively short arcs, so that only a few teeth of gears 91, 92 function. In order that the wear on the gear teeth may be distributed, the shafts are formed with a plurality of splines 102

and each gear is secured to its shaft by a key 103 receivable in any of the several splines. With this arrangement, the angular positions of the gears on their shafts may be readily changed, so that all the gear teeth can be utilized at different times in the operation of the gears.

Instead of moving the lower ends of the heddle frames by means of arms swinging about an axis in a vertical plane through the fell and guiding the upper ends of the heddles, both ends of each frame may be guided and other means provided for moving the frames. This construction is illustrated in Fig. 5, in which the lower ends of frames 104, 105 are provided with rollers 106, 107 movable in arcuate guides 108, 109, the arcs of the guides being described about a center lying in a vertical plane through the fell of the goods. At their upper ends, the frames are equipped with similar rollers moving in similar guides. The movement of the frames is effected by a suitably mounted rotary crank shaft 110 having a pair of oppositely disposed cranks 111, 112 near each end at opposite sides of the loom. The crank shaft may be driven from a drive shaft 113 by a chain 114 trained around sprockets on the two shafts. The cranks are connected to the lower ends of the respective frames by connecting rods 115, 116. With this arrangement, the rotation of the crank shaft causes the heddle frames to move up and down in opposite directions and each frame is guided in its movement so that as it moves toward the limit of its travel away from level position, the frame is also moved toward the fell of the goods. The arcs of the guides are of such form that the warp threads are not drawn through the heddle eyes during shedding and abrasion of the threads is avoided.

In Fig. 7, there is illustrated another modified construction in which the lower ends of the heddle frames 117, 118 are connected, respectively, to the ends of arms 119, 120 on a stationary shaft 121 mounted with its center in a vertical plane through the fell of the goods. The respective arms are moved up and down by cams 122, 123 and each arm has a cam follower roller entering a channel in its cam. The stud 124 of each roller is mounted in a slot 125 in its arm, so that the position of the rollers relative to their cams can be varied to provide the initial adjustment of the frames in level position.

The loom illustrated in Fig. 1 is shown as having two heddle frames but it is to be understood that the heddle motion of the invention may include more than two frames, as, for example, three or four. When more than two frames are employed, the mechanism for raising and lowering the individual frames is constructed to manipulate them in the desired sequence, and, for that purpose, the construction shown in Fig. 7 is appropriate. Such mechanism includes a cam, such as cams 122, 123, for each frame and the cams have tracks which impart the desired movement to the frames actuated thereby. Thus, in a multiple harness loom, some harnesses do not change position for each pick but may remain in the same part of the shed for two picks. The cams are, accordingly, formed to give their frames the proper cycle of movements required for the weaving and the form of the cams necessary for the purpose is well known to those familiar with such matters.

In all of the constructions illustrated, the heddle frames receive a movement compounded of an edgewise and a broadside on motion, so that each eye in each frame describes an arc about

the fell of the fabric as its frame moves to upper or lower position. As the thread controlled by that eye describes an arc about the fell in the formation of a shed, it follows that in shedding, there is no drawing of the warp threads back and forth through the eyes a large number of times, as in the present looms in which the heddles reciprocate in a plane. In the new loom, abrasion of the warp threads resulting from this movement of the threads back and forth through the heddle eyes is prevented and, as a result, there is less breakage of warp threads in the new loom. The loom can, accordingly, be operated for greater periods of time without interruption than present looms and the fabric produced has less imperfections resulting from broken warp ends than that made on prior looms.

In the appended claims, I have referred to a loom containing a pair of heddle frames, but do not intend to be understood as meaning that only two frames are used, since the principles of the invention can be advantageously employed in looms containing two or more frames, as desired.

I claim:

1. In a loom for weaving fabric, the combination of a pair of heddle frames provided with eyes through which warp threads pass, the frames being reciprocable in opposite directions from a level position, pivoted arms connected at their free ends to the lower ends of the frames, the pivots of the arms lying in a plane through the fell of the fabric and at right angles to the warp threads when the frames are level, means for oscillating the arms in opposite directions about their pivots to reciprocate the frames, guides at the upper ends of the frames having guideways of the form of arcs of circles about a center in said plane, and elements on the frames entering the guideways, said guides cooperating with the arms to cause the frames to have a broadside movement as the frames are moved up and down by the arms.

2. In a loom for weaving fabric, the combination of a pair of heddle frames provided with eyes through which warp threads pass, the frames being reciprocable in opposite directions from a level position, pivoted arms connected at their free ends to the frames adjacent the lower ends of the frames, the pivots of the arms lying in a plane through the fell of the fabric and at right angles to the warp threads when the frames are level, means including a rock shaft for oscillating the arms in opposite directions about their pivots to reciprocate the frames, guides at the

upper ends of the frames having guideways which have the form of arcs of circles about a center in a vertical plane through the fell of the fabric, and elements on the frames entering the guideways, said guides cooperating with the arms to cause the frames to have a broadside movement as the frames are moved up and down by the arms.

3. In a loom for weaving fabric, the combination of a pair of heddle frames provided with eyes through which warp threads pass, the frames being reciprocable in opposite directions from a level position, pivoted arms connected at their free ends to the lower ends of the frames, the pivots of the arms lying in a plane through the fell of the fabric and at right angles to the warp threads when the frames are level, a rock shaft, means including an eccentric and pitman for actuating the rock shaft, a pair of arms mounted to swing in vertical planes about a center lying in a vertical plane through the fell of the fabric, the arms being connected at their ends to the lower ends of the frames and being connected to the rock shaft to be oscillated thereby to raise and lower the frames, guides at the upper ends of the frame having guideways of the form of arcs of circles about a center in a vertical plane through the fell of the fabric, and elements on the frames entering the guideways, said guides cooperating with the arms to cause the frames to have a broadside movement as the frames are moved up and down by the arms.

4. In a loom for weaving fabric, the combination of a pair of heddle frames provided with eyes through which warp threads pass, the frames being reciprocable in opposite directions from a level position, arms connected at their free ends to the lower ends of the frames, a pair of rock shafts on which the arms are rigidly mounted, the axes of the shafts lying in a plane through the fell of the fabric and at right angles to the warp threads when the frames are level, gears attached to the rock shafts and meshing with one another, means for rocking the rock shafts to cause the arms to oscillate in opposite directions about the axes of the rock shafts to reciprocate the frames, guides at the upper ends of the frames having guideways of the form of arcs of circles about centers in said plane, and elements on the upper ends of the frames entering the guideways, the guides cooperating with the arms to cause the frames to have a broadside movement as the frames are moved up and down by the arms.

JOHN O. HUNT.