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G. SLAYTER

3,124,163

HIGH PRODUCTION LOOM

Filed Dec. 16, 1960

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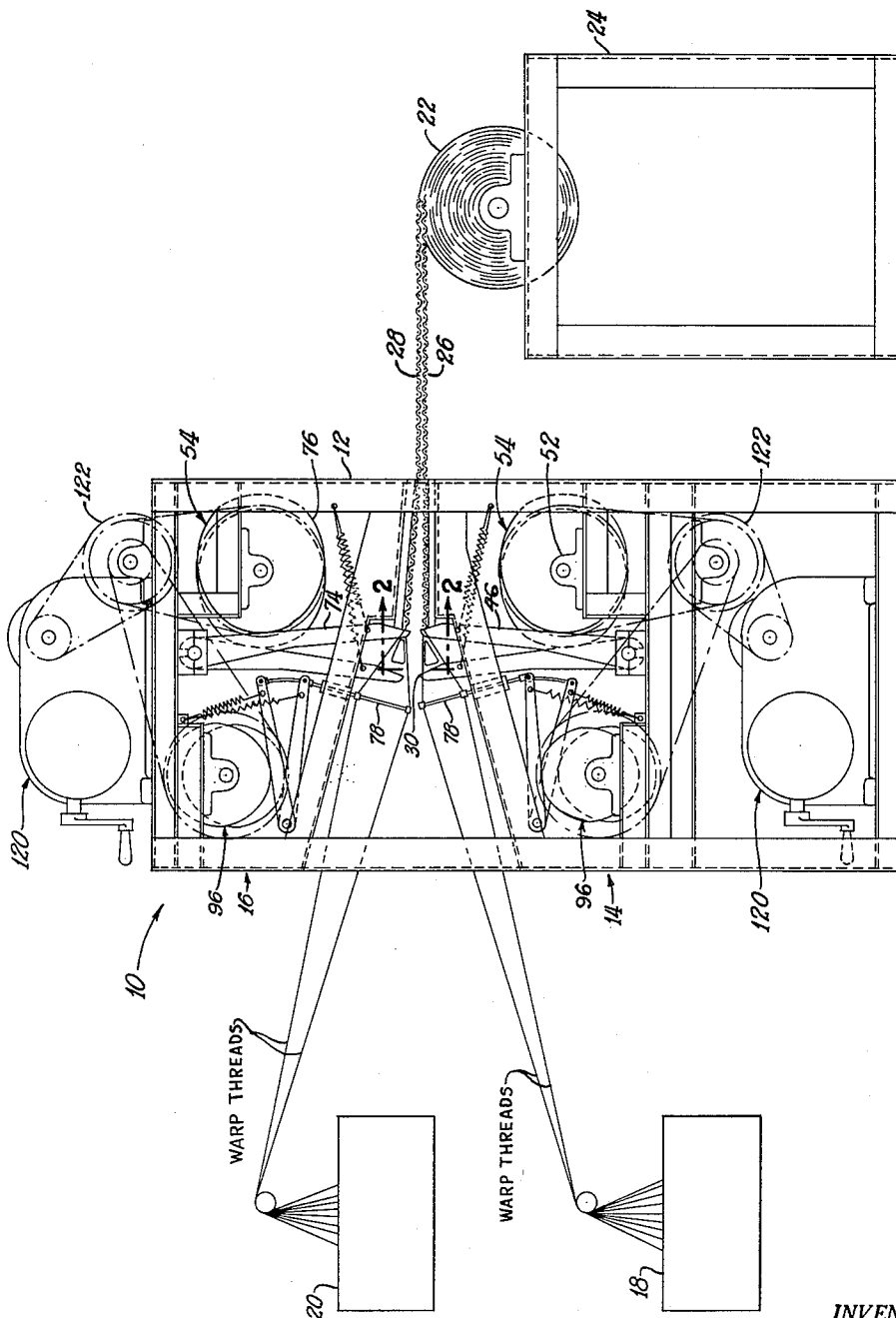


Fig. 1

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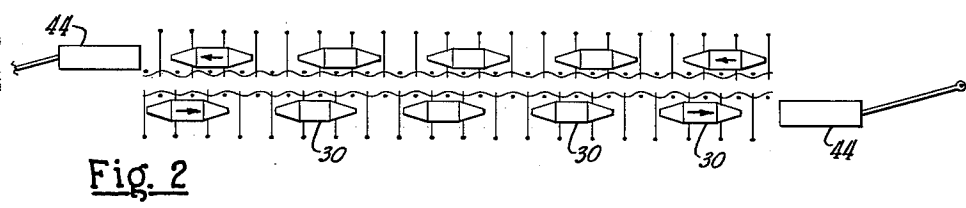
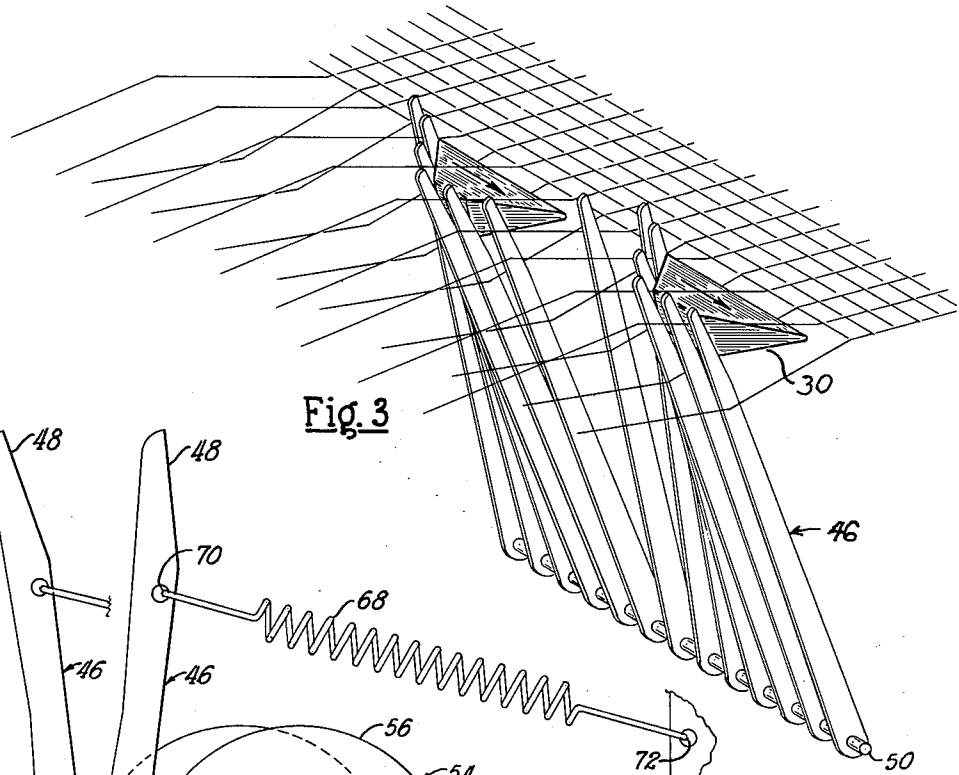
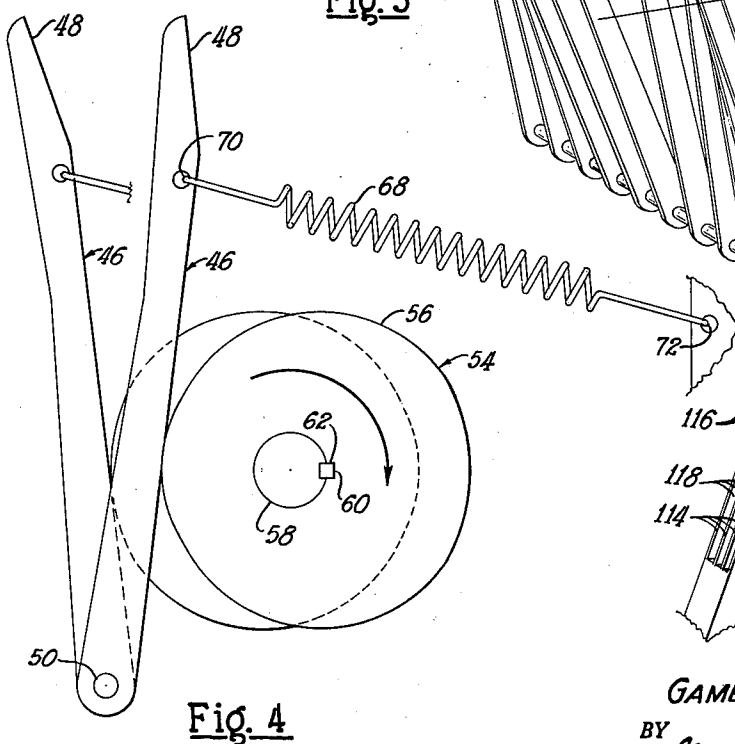
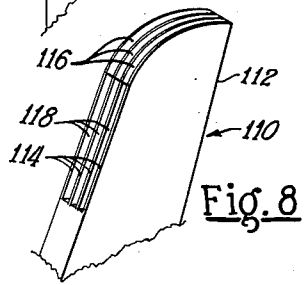
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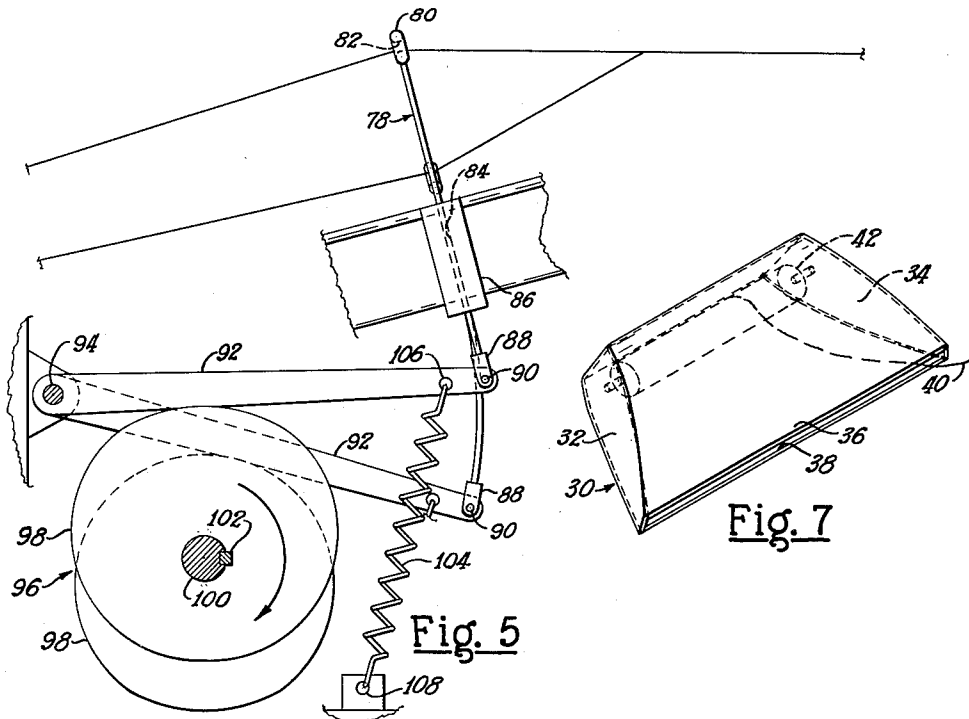
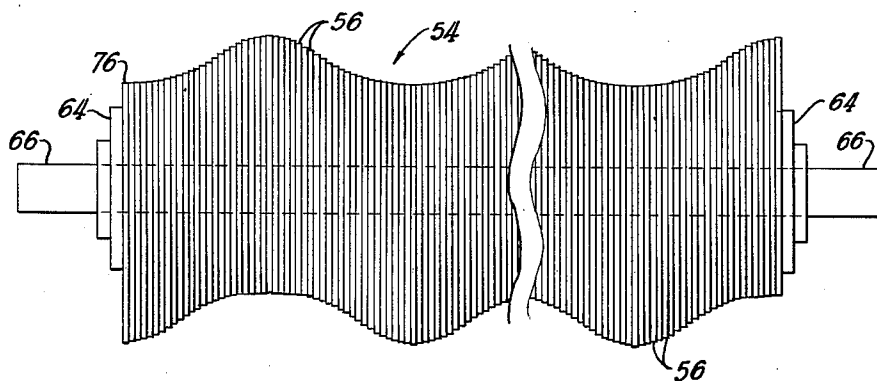
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3 Sheets-Sheet 3



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HIGH PRODUCTION LOOM

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5 Claims. (Cl. 139-12)

This invention relates to a high production loom and more particularly to a loom operating on a progressive shedding principle with improved mechanism for operating reeds and heddles of the loom.

Looms which operate on the principle of progressive shedding generally employ a plurality of shuttles moving across warp threads at any one time, with various types of fingers used to push the shuttles. By using a plurality of shuttles rather than a single one moving across the warp at any given instant, the same or a higher production rate can be obtained with slower shuttle movement. By maintaining a constant distance between the shuttles regardless of the width of the fabric being woven, wider fabrics can be woven as rapidly as narrow ones because more shuttles will be moving across the wider fabric at a given time. Thus, a fabric which is twice as wide as another can employ twice as many shuttles so that weaving will proceed at the same lineal rate with the shuttles moving at the same speed. By achieving a higher production rate, less floor space is required and less labor is needed per unit of production. In addition, by using a slower shuttle speed, less vibration and noise results and there is less vibration and noise results and there is less danger of flying shuttles. Because of the fact that a given number of shuttles are always moving across the loom at any given time, there is no lost time at the end of each trip of the shuttle across the warp, while its motion is being reversed for a return trip. Also with looms operating on the progressive shedding principle, each fill thread thereof can be beat up sequentially rather than all at once, so that less force is needed per unit of length and less injury results to the fill threads.

The present invention provides a high production loom of the progressive shedding type having the advantages outlined above and many others. The loom of the invention employs a plurality of shuttles having surfaces which are laterally disposed with respect to the direction of the warp threads and reeds which operate with an undulatory or wave-like motion and strike the lateral surfaces of the shuttles, causing them to move forwardly across the warp. In addition, the reeds, after striking the lateral surfaces of the shuttles, move beyond them to beat up the newly laid woof or fill threads deposited by the shuttles, thereby combining two operations into one. The reeds are operated by a plurality of cams assembled into a cam roll which is of a generally helical configuration to drive the reeds with the desired motion. The heddles are operated by a somewhat similar cam roll which engages lever arms to which the heddles are connected.

The heddle and reed operating mechanisms are simple to operate and to manufacture, the parts being of simple shape and similar configuration. Thus, all of the reeds are of the same shape, as are the elements that go to make up the reed cams. The elements of the heddle cams are similar to each other, and the heddle lever arms are alike. The operating movements of the reeds, heddles, and their operating mechanisms are also relatively simple involving only rotary motions of the cam rolls and reciprocatory movements of the reeds and heddles. The reeds, as previously mentioned, operate to cause both the movement of the shuttles and the beating up of the fill threads laid by them. The shuttles move more slowly and smoothly across the loom with no abrupt stops of 180° direction changes and the cam rolls move with rotary motions,

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resulting in very little jarring or vibration. Although the reeds and heddle lever arms move with reciprocatory motions, they do so in a smooth manner which keeps jarring and vibration at a low level. Very little noise is produced by the new loom, the only noise being the contact of the lateral portions of the shuttles by the reeds, which is an angular sliding contact producing very little noise.

It is, therefore, a principal object of the invention to provide a high production loom of the progressive shedding type having the advantages outlined above.

Many other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIG. 1 is a side view in elevation of a high production loom embodying the principles of the invention;

FIG. 2 is a schematic view taken along the line 2-2 of FIG. 1;

FIG. 3 is a schematic view in perspective of shuttles, reeds, warp threads, and fill threads of the loom of FIG. 1;

FIG. 4 is an enlarged, side elevational view of reeds and reed-operating cams;

FIG. 5 is an enlarged, side view in elevation of heddles, lever arms, and a heddle-operating cam roll;

FIG. 6 is a front elevational view of the reed-operating cam roll;

FIG. 7 is a somewhat schematic perspective view of one form of shuttle used with the loom and as illustrated in FIGS. 1-3; and

FIG. 8 is an enlarged, fragmentary perspective view of a tip portion of a modified reed.

Referring to the drawings and more particularly to FIG. 1, a loom 10 embodying the present invention includes a main frame 12 carrying a lower weaving section indicated at 14 and an upper weaving section indicated at 16. The loom 10 also includes supplies 18 and 20 of warp threads and a take-up spool 22 on an auxiliary frame 24 on which spool is wound two fabrics 26 and 28 which are woven by the lower and upper weaving sections 14 and 16, respectively. Any suitable source of supply can be used for the warp threads, such as a beam or creel, as is well known in the art. For the fabric drive, either the spool 22 can be driven directly for this purpose or drive rolls can be employed between the frame 12 and the take-up spool 22, as is known in the art.

Referring in more detail to the lower weaving section 14, and to FIGS. 1-3, the warp threads are carried to an intermediate point in the frame 12 where they are woven with fill or woof threads which are carried by shuttles 30 preferably of the form shown in FIG. 7. Each of the shuttles 30 has forward and trailing edge portions or drive surfaces 32 and 34 which are substantially identical and which are angularly disposed with respect to the path of reeds and the warp threads. A rear, tapered edge portion 36 of the shuttle 30 forms a slot 38 through which a fill thread 40 is threaded from a bobbin 42 rotatably mounted within the shuttle 30. The slot 38 is sized to provide a predetermined tension on the thread 40 so that it can be properly woven with the warp threads as the shuttle is moved thereacross. The symmetrical configuration of the shuttle 30 enables it to travel in either direction across the warp threads, moving in one direction in the lower weaving section 14 and moving in the opposite direction in the upper weaving section 16.

As shown in FIGS. 2 and 3, a number of the shuttles 30 are moved across the warp threads at any given instant, and as further shown in FIG. 2, the shuttles are transferred from one fabric to the other by suitable transfer mechanisms 44 which need not turn the shuttles

around during transfer because of the symmetrical configuration of the shuttles. The transfer mechanisms 44 can be of any suitable, known type and does not constitute a specific part of this invention. When the shuttles 30 are moved from one layer of fabric to the other, the initial movement necessary to start them across the other fabric is, of course, greater than when the shuttles are in motion. As the shuttles begin to move across the loom, the weft threads trailing them are intertwined with the warp threads, as the warp threads are moved up and down by the heddles, and the weft threads are also held by subsequent shuttles. Hence, at least in many instances, no separate means are required to grip the weft threads at the beginning.

The shuttles 30 are moved across the fabric by a plurality of separate and separately operated reeds 46 which are operated with an undulatory or wave-like motion to cause tip portions 48 of the reeds to strike the angular surfaces 32 and 34 of the shuttle with successive contacts. This motion propels the shuttles across the loom by a camming action, the frequency of the wave-like motion of the reeds being such that a number of reeds are being propelled across the fabric at the same time, one behind the other. The reeds 46 are pivotally mounted on a common shaft 50, which is mounted on the frame 12 by bearing blocks 52 (FIG. 1) and which is spaced a substantial distance above or below the fabrics 26 and 28.

At an intermediate point between the shaft 50 and the tips 48 of the reeds 46 is a reed cam roll 54 which includes a plurality of individual cam segments 56 (FIGS. 4 and 6) all of which are identical and are arranged in a predetermined fixed position, one slightly offset with respect to the other, so that an undulatory motion is established for the row of the reeds 46 when the cam roll 54 is rotated in contact with intermediate portions of the reeds. The shape of the cam roll 54 in FIG. 6 is shown only for purposes of illustration and is not intended to represent the exact shape of the roll. While the cam segments 56 can be mounted in a number of ways, as shown, they are mounted on a shaft 58 by a key 60 located in notches 62 of the individual cam segments 56. The notches 62 are cut in slightly different positions in the eccentric hole of each of the cams 56 so that each cam will be circumferentially displaced a predetermined constant amount from its adjacent cam when mounted on the shaft 58 and fixed thereon by the key 60. Hubs 64 (FIG. 6) are attached to each end of the cam roll 54 and axles or mounting means 66 extend outwardly from the hubs for mounting the roll in the bearing blocks 52, the axles 66 constituting the ends of the shaft 58 in this instance. While it is to be understood that the pivot shaft 50 can be located between the cam roll 54 and the tips 48 of the reeds, maximum compactness and maximum movement of the reeds 46 for a given movement of the cam roll 54 can be obtained by the arrangement shown in the drawings.

A spring or resilient means 68 is employed to maintain each of the reeds 46 against its corresponding cam 56 of the roll 54. The spring 68 can be attached through a hole 70 in the reed 46 and attached through a hole 72 in the frame 12. If necessary, the holes 70 and 72 for each of the springs 68 can be laterally spaced with respect to the holes for adjacent springs to prevent the adjacent springs from interfering with one another.

To impart initial motion to the shuttles 30, which requires a force greater than that necessary to maintain the shuttles in motion, a heavier reed 74 (FIG. 1) is provided at the leading side edge of each of the lower and upper fabrics 26 and 28. The reed 74 is preferably from $1\frac{1}{2}$ to twice as thick as the reeds 46. The reed 74 is driven by a cam 76 which is mounted on the end of the cam roll 54 in the present instance. However, the reed 74 can equally well be driven by separate means which are coordinated with the cam roll 54.

The warp threads are operated with a sequential vertical

motion as the shuttles 30 are moved thereacross. The warp threads are controlled by heddles 78 (FIG. 5) with enlarged heads 80 forming eyes 82 through which the warp threads pass. The heddles 78 reciprocate in vertically extending grooves 84 in a guide bar 86 which extends the width of the fabric and is attached at its ends to the frame 12. The lower ends of the heddles 78 have bifurcated connectors 88 which are pivotally connected through pins 90 to heddle lever arms 92. The lever arms 92 are pivotally mounted on a shaft 94 which is supported by the frame 12. Between the shaft 94 and the heddles 78 is a heddle cam roll 96 which includes a plurality of separate heddle cam segments 98 supported on a shaft 100 and positioned by a key 102. Hence, the heddle cam roll 96 is constructed similarly to the reed cam roll 54 although the configuration of the cams 98 differs from the configuration of the cams 56 and the adjacent cams 98 are positioned relative to one another differently than the adjacent cams 56 in the roll 54. The cams 56 of FIG. 4 and the cams 98 of FIG. 5 are shown in their extreme positions and not in their adjacent relationship. The lever arms 92 are urged against the cams 98 by springs or resilient means 104 which are attached through holes 106 in the lever arms 92 and are attached to a part of the frame 12 through holes 108.

The heddles 78 are operated by the cam roll 96 to maintain the associated warp thread either above or below one of the shuttles 30 when it is passing thereacross. After a shuttle has passed, the warp thread then may be moved to the opposite position and maintained there until the next shuttle has passed. The particular design of the cams 98 and the cam roll 96 will depend upon the desired weave, as is known in the art.

In the schematic view, FIG. 3, the reeds 46 are shown spaced from each other a substantial distance. In the preferred form of the actual loom, the reeds are either contiguous or nearly so, and each reed cooperates with its own cam segment. The reeds 46 can be spaced a slight distance apart on the shaft 50 or the tip portions 48 of contiguous reeds can be made thinner to enable the warp threads to pass between the reeds. Where a finer count or finer woven fabric is desired, a modified reed 110 shown in FIG. 8 can be employed. The reed 110 is similar to the reeds 46 except that a tip portion 112 thereof constitutes a plurality of thin partitions 114 held apart by spacers 116 at the upper end of the tip 112 to provide a plurality of slots 118 therebetween. With this particular arrangement, one warp thread can pass through each of the slots 118 so that three times as many warp threads can be employed with the reeds 110 as are employed with the reeds 46, for the same reed thickness. By subdividing the tip portion the reeds 110 can still be thick enough to provide proper lateral stiffness for cooperating with the slanted surfaces of the shuttles 30 and yet enable the use of many more warp threads.

It will be seen from FIG. 1 that the lower and upper weaving sections 14 and 16 are substantially identical, each containing sets of reeds 46 and 74, the reed cam rolls 54, the heddles 78, and the heddle cam rolls 96. The reed cam roll 56 and the heddle cam roll 96 for each of the weaving sections 14 and 16 are driven by a motor and variable speed drive 120 through suitable chain and sprocket connections indicated at 122. Any suitable drive can be employed so long as there is a proper inter relationship between the drive for the reed cam roll 54 and the drive for the heddle cam roll 96 to provide proper synchronization between these cam rolls and between the reeds 46 and the heddles 78.

While the operation of the loom 10 will be evident from the above discussion, nevertheless, a brief description of the operation will be set forth. The shuttles 30 are moved at a constant speed and with constant spacing across each of the sets of warp threads for the lower and upper weaving sections 14 and 16 by the reeds 46 which are operated with an undulatory motion by rotation of the cam roll 54

through the motor 120 and the connections 122. When the shuttles reach the end of one of the fabrics, moving toward the right for the lower fabric 26, as shown in FIG. 2, and moving toward the left on the upper fabric 28, they are transferred to the opposite fabric by the transfer mechanisms 44. What was formerly the trailing edge of the shuttle 30 then becomes the leading edge, and vice versa, with the woof thread 40 sliding through the slot 38 to the opposite end thereof as the shuttle begins movement in the opposite direction. With this particular design of the shuttle 30, and with the close spacing between the fabrics 26 and 28, a minimum of excess woof thread is laid between the selvage edges of the lower and upper fabrics 26 and 28. While the shuttles 30 are moving across the warp, the heddles 78 control the positions of the warp threads through the lever arms 92 and the heddle cam roll 96, which also is rotated by the motor 120 through the connection 122.

It will be seen from the accompanying drawings and the above discussion that the loom according to the invention can be relatively compact because of the nature of the relatively simple operating mechanisms for the reeds and heddles. The individual parts are of relatively simple shape and the parts of each unit, such as the reeds 46, the reed cams 56, the heddles 78, the heddle lever arms 92, and the heddle cams 98 are all alike so that their manufacture is easy and relatively inexpensive. Vibration is also kept to a minimum in the new loom because there is a minimum of jarring motion or abrupt change in direction. Thus, the cam rolls 54 and 96 move only with a rotary motion and, while the reeds 46, the heddles 78, and lever arms 92 move with reciprocatory motions, they do so smoothly with a reduction in speed before their direction of movement is reversed. Further, there are substantially as many reeds 46, heddles 78, and lever arms 92 moving in one direction as in the other at a given instant so that there is no cumulative inertia effect of the reciprocatory motions thereof. This is in sharp contrast, for example, to conventional looms in which all of the reeds move toward and away from the woof threads at any given instant during the beating motion so that the vibration or jarring resulting therefrom is substantial. The shuttles 30 also move smoothly with no abrupt reversal in direction but, rather, two movements generally at right angles during their transfer from one fabric to the other. Further, the reeds 46 strike the angular driving surfaces of the shuttle 30 smoothly and quietly compared to the loud slap which occurs in conventional looms when the picker sticks bat the shuttles back and forth across the warp.

While the loom according to the invention has been shown and described with respect to separate lower and upper weaving sections 14 and 16, to produce lower and upper fabrics 26 and 28, it is to be clearly understood that the loom can also be used to weave a single fabric with the shuttles returned through a separate path spaced from the fabric.

Various modifications of the above described embodiments of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if within the spirit and tenor of the accompanying claims.

I claim:

1. In a loom of the progressive shedding type having a frame, a shaft mounted horizontally on said frame, a plurality of reeds pivotally mounted on said shaft, a reed cam roll rotatably supported on said frame in a position spaced from said shaft, means for rotating said reed cam roll about an axis parallel to said shaft, said cam roll being positioned to contact portions of said reeds spaced from said shaft, means for establishing a supply of warp threads, means spaced from said supply means for moving said warp threads through said frame, a plurality of heddles, ends of which are engageable with the warp threads, a

plurality of shuttles adapted to ride on said warp threads, each of said shuttles having a surface adapted to lie laterally to a path in which said reeds are moved and to said warp threads, said shuttles being movable across the warp threads by said reeds, and said warp threads being movable to positions above and below the paths of said shuttles by said heddles, the improvement comprising means supported by said frame for guiding said heddles through generally up and down movements, said heddles having pivotal means at the ends opposite the ends engageable with the warp threads, a plurality of rigid lever arms for said heddles, said lever arms being pivotally connected to said pivotal means, a lever arm shaft supported by said frame, said lever arms being pivotally mounted on said lever arm shaft, a heddle cam roll comprising a plurality of individual heddle cams rotatably mounted on said frame at a point spaced from said lever arm shaft, means for rotating said heddle cam roll for rotation about an axis parallel to said lever arm shaft to contact portions of said lever arms spaced from said shaft, and means associated with the two rotating means for coordinating movement of said heddle cam roll and said reed cam roll.

2. The combination according to claim 1 and a heavier reed located at the edge of the warp threads at which the shuttles are started to aid in initiating movement of the same, and means for moving said heavier reed in synchronization with the other reeds.

3. In a loom of the progressive shedding type having a frame, a shaft mounted horizontally on said frame, a plurality of reeds pivotally mounted on said shaft, a reed cam roll rotatably supported on said frame in a position spaced from said shaft, means for rotating said reed cam roll about an axis parallel to said shaft, said reed cam roll being positioned to contact portions of said reeds spaced from said shaft, means for establishing a supply of warp threads, means spaced from said supply means for moving said warp threads through said frame, a plurality of heddles, ends of which are engageable with said warp threads, a plurality of shuttles adapted to ride on said warp threads, each of said shuttles having a surface adapted to lie laterally to a path in which said reeds are moved and to said warp threads, said shuttles being movable across said warp threads by said reeds, and said warp threads being movable to positions above and below the paths of said shuttles by said heddles, the improvement comprising a plurality of lever arms connected to said heddles, a lever arm shaft supported by said frame, said lever arms being pivotally mounted on said lever arm shaft, a heddle cam roll comprising a plurality of individual heddle cams rotatably mounted on said frame at a position spaced from said lever arm shaft, means for rotating said heddle cam roll for rotation about an axis parallel to said lever arm shaft to contact portions of said lever arms spaced from said shaft, resilient means for urging said lever arms toward said heddle cam roll and away from the warp threads, and means associated with the two rotating means for coordinating movement of said reed cam roll and said heddle cam roll.

4. In a loom of the progressive shedding type having a shaft, a plurality of rigid reeds pivotally mounted on said shaft, a reed cam roll for sequentially driving said reeds, means for guiding a plurality of warp threads above said cam roll, and a plurality of shuttles adapted to ride on the warp threads, each of said shuttles having a drive portion adapted to lie at an angle to the path in which said reeds reciprocate and being contacted and moved forwardly by said reeds, the improvement comprising each of said reeds being of equal thickness throughout its length and having a plurality of spaced partitions at its upper end between which separate warp threads can pass, said partitions adapted to be positioned parallel to the warp threads.

5. In a loom of the progressive shedding type having a shaft, a plurality of reeds pivotally mounted on said shaft, a reed cam roll mounted for rotation parallel to said shaft

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to contact portions of said reeds spaced from said shaft, means for rotating said cam roll, means for guiding a plurality of warp threads along paths spaced from said cam roll, said cam roll being shaped to reciprocate successive reeds with a generally undulatory motion of all of said reeds when said cam roll is rotated, a plurality of shuttles adapted to ride on the warp threads, each of said shuttles having a drive surface adapted to be disposed angularly to the warp threads and to the path in which said reeds move, whereby said shuttles are moved progressively forwardly by said reeds, the improvement comprising a spring for each of said reeds which is separable from the associated reed and engages the associated reed at a portion

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spaced from said reed cam roll to urge the reed in a direction toward said cam roll and toward said shuttles.

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