

March 10, 1964

W. H. EWING
SHUTTLE AND HEDDLE DRIVE MECHANISM FOR
A PROGRESSIVE SHEDDING LOOM

3,124,164

Filed Dec. 30, 1960

5 Sheets-Sheet 1

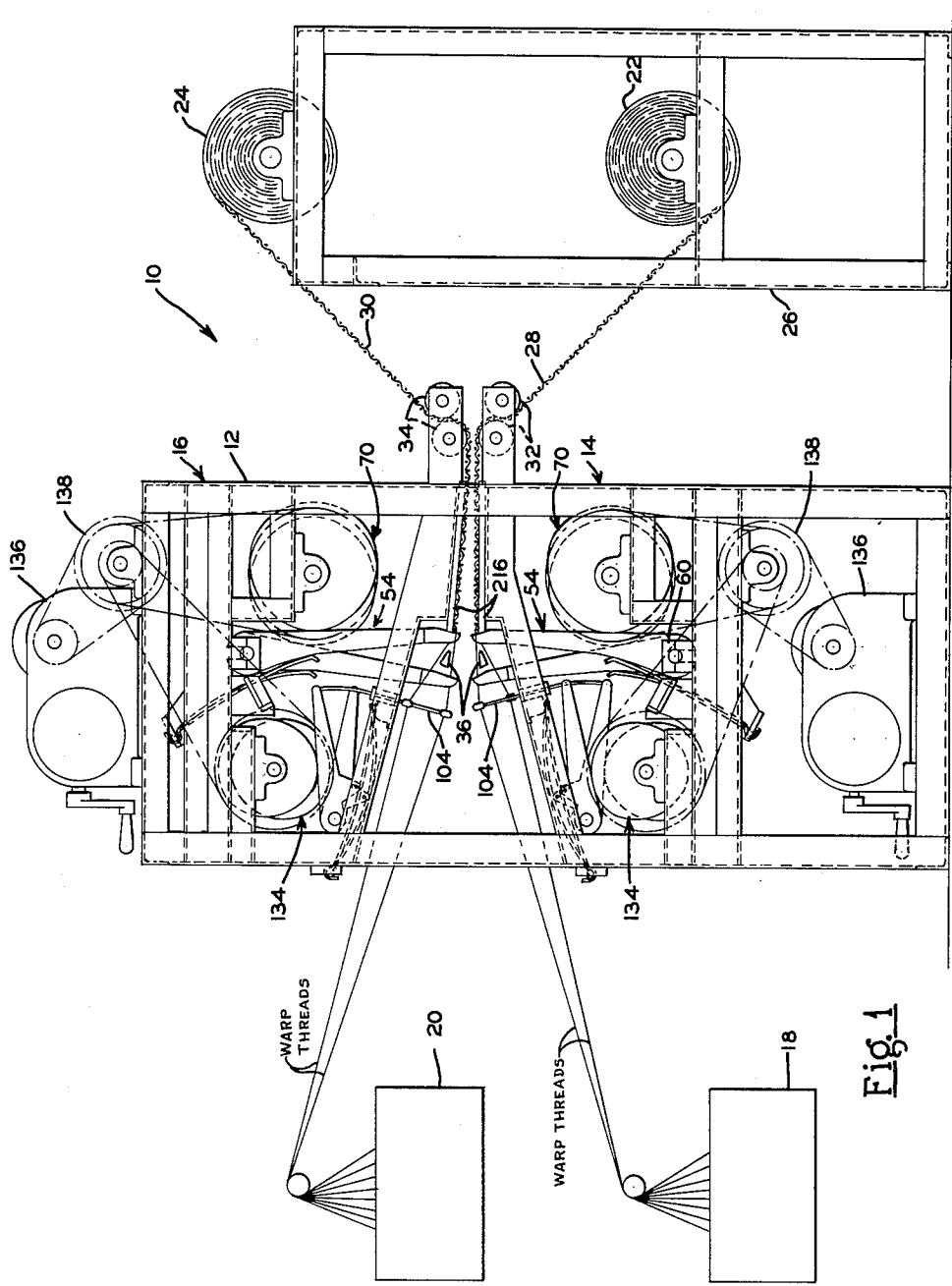


Fig. 1

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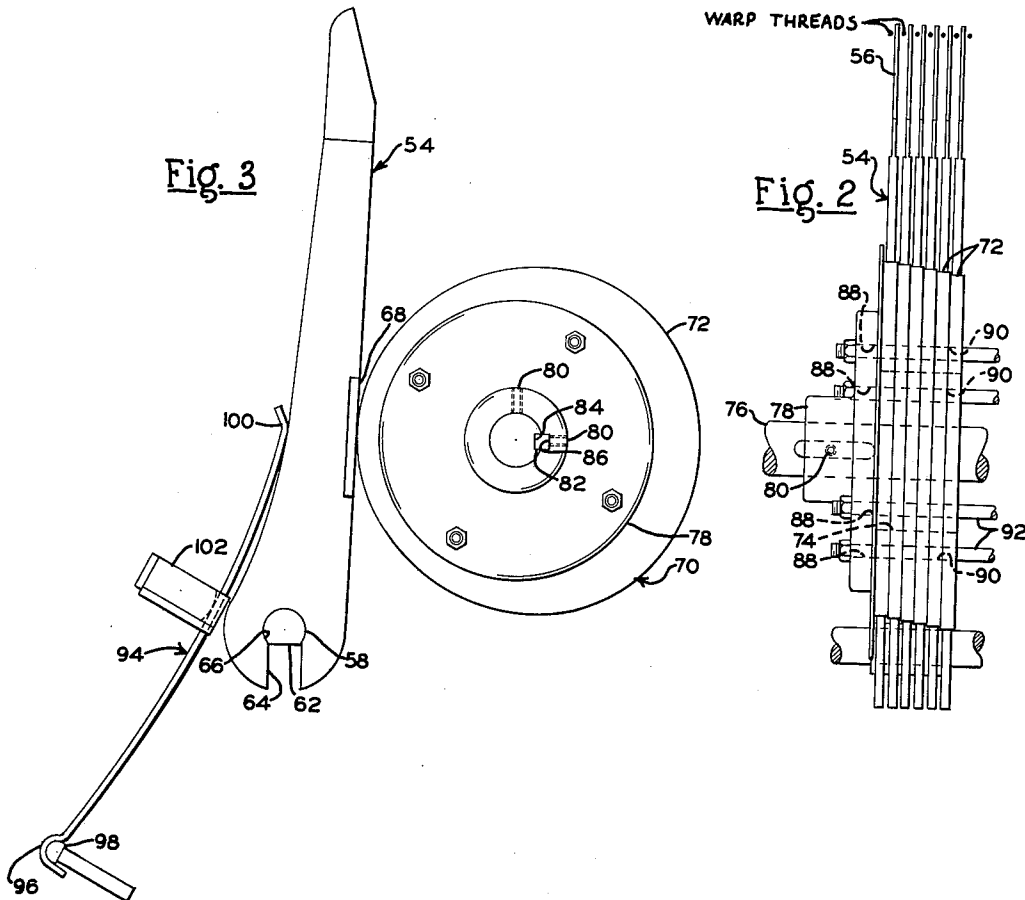
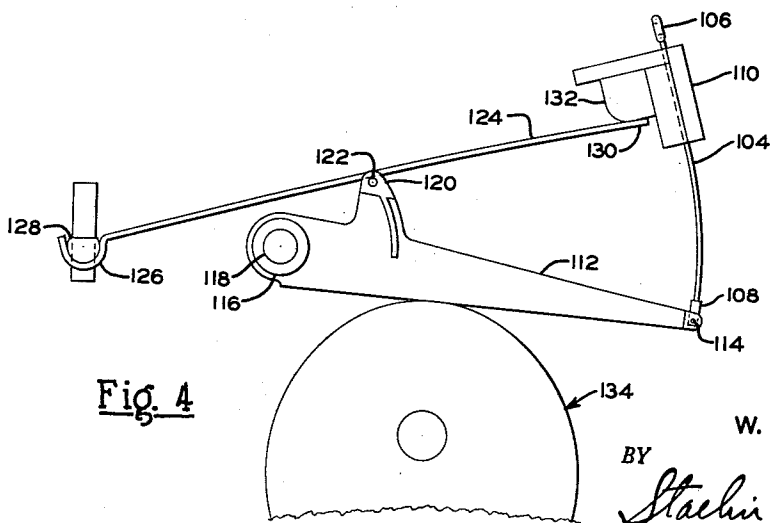
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5 Sheets-Sheet 2



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5 Sheets-Sheet 3

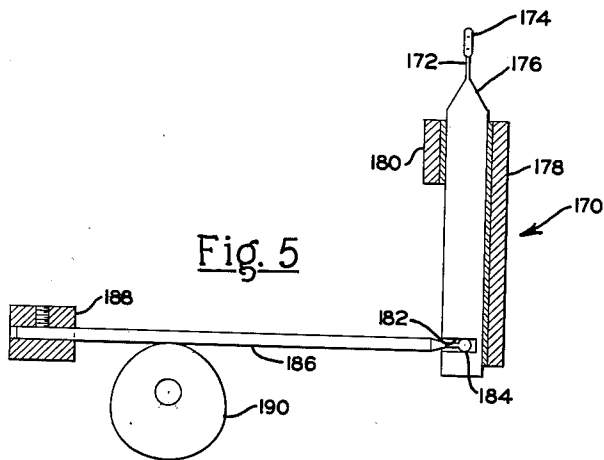


Fig. 5

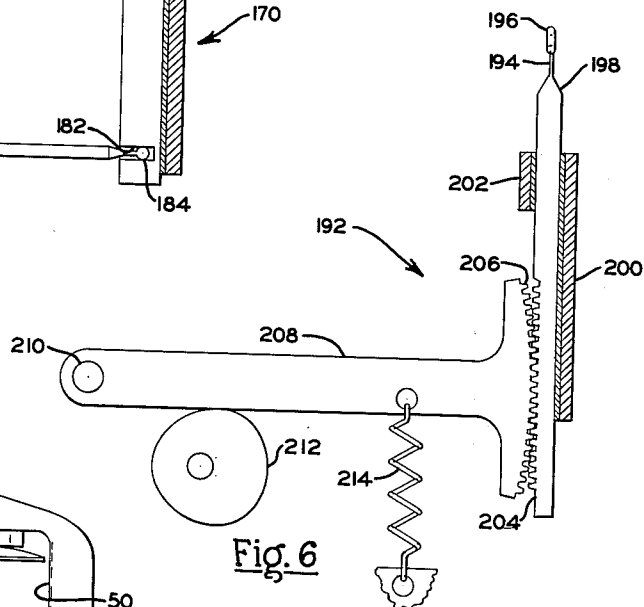


Fig. 6

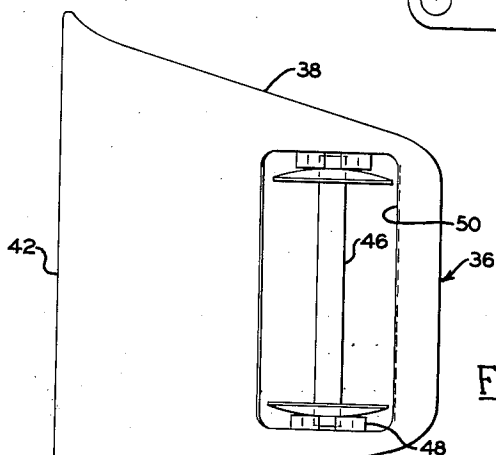


Fig. 7

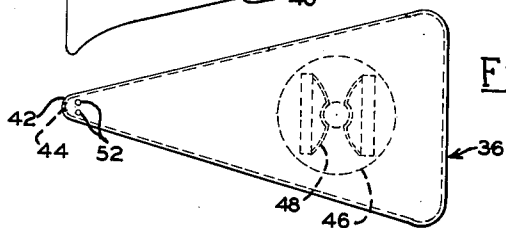


Fig. 8

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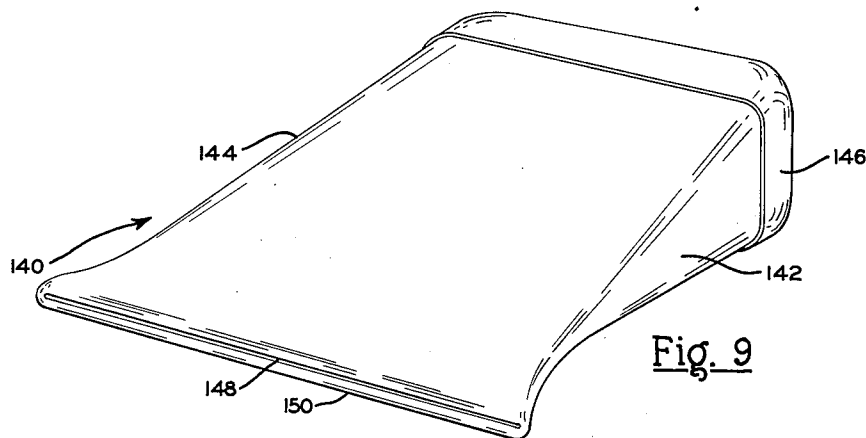


Fig. 9

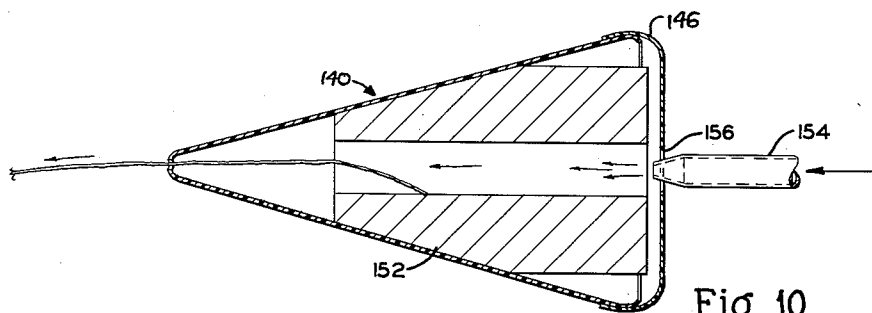


Fig. 10

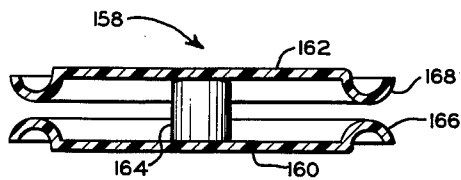


Fig. 11

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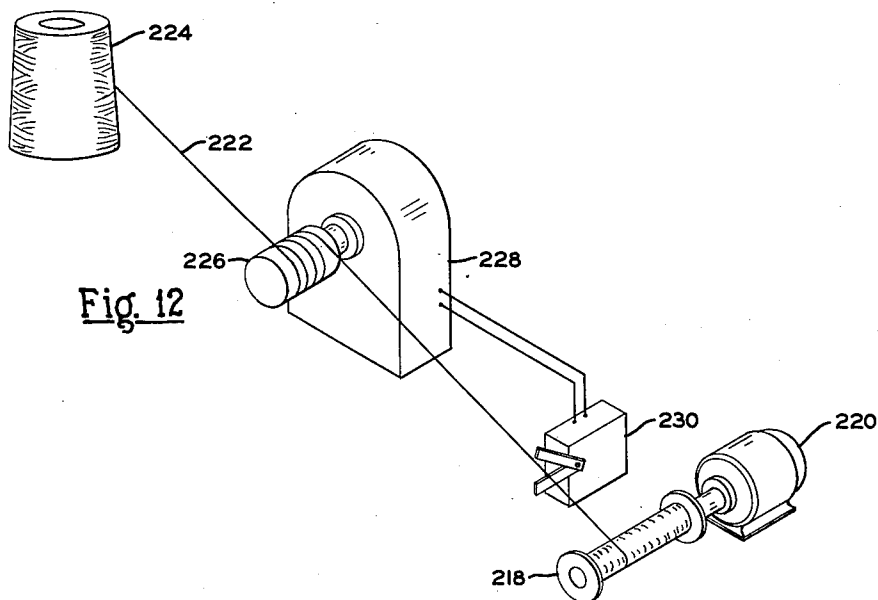
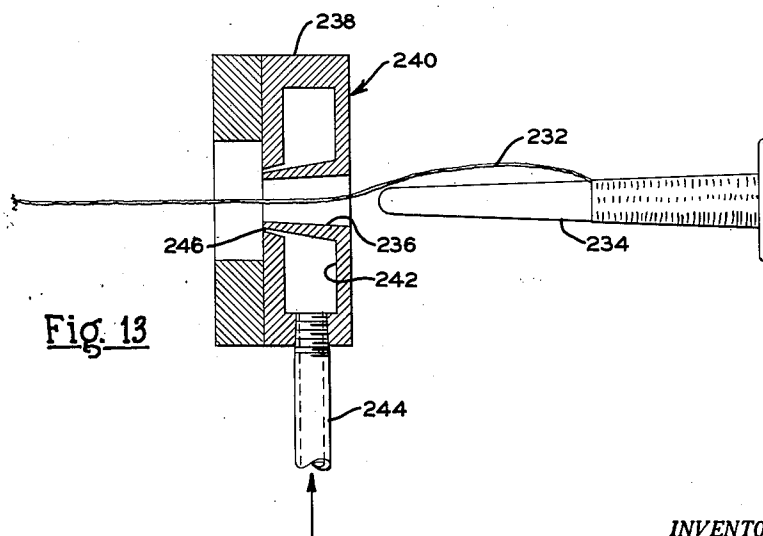
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3,124,164 SHUTTLE AND HEDDLE DRIVE MECHANISM FOR A PROGRESSIVE SHEDDING LOOM

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Filed Dec. 30, 1950, Ser. No. 79,639
7 Claims. (Cl. 139—12)

This invention relates to shuttle and heddle drive mechanism for a loom operating according to a principle of progressive shedding.

Looms using the progressive shedding principle employ a plurality of shuttles moving across warp threads at any given instant, with various types of nger mechanisms used to actuate the shuttles. By using a plurality of shuttles, rather than a single one moving across the warp, 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 moved across the wider fabric in a given period. Thus, a fabric which is twice as wide as another can have twice as many shuttles moving thereacross 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 result and there is less danger of flying, uncontrolled shuttles. Because of the fact that several 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. Another advantage of proressive shedding looms is that each fill thread thereof can be beat up sequentially rather than all at once, so that less force is needed per unit of length of the fill threads and the threads are less likely to be damaged.

The present invention provides shuttle and heddle drive mechanism for a high production loom of the progressive shedding type which has the advantages outlined above as well as many others. The loom embodying the invention employs a plurality of improved shuttles having surfaces which are angularly disposed with respect to the direction of the warp threads and reeds which operate with an undulatory or wave-like motion and strike the angular surfaces of the shuttles, causing them to move forwardly across the warp. The reeds and shuttles are designed so that several of the reeds engage the shuttle at any given instant, thus spreading the force needed to move each shuttle over several reeds. Besides advancing the shuttles, the reeds also 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 in predetermined relationship into a cam roll which is of generally helical configuration in order to drive the reeds with the desired motion. The reeds are wedged against the cam assembly by an improved spring arrangement. The heddles of the loom are also operated by a cam roll which is constructed similarly to the reed cam roll and which engages lever arms to which the heddles are connected to move the warp threads across the path of the shuttles to positions spaced therefrom. The heddles are also urged against the heddle cam roll by an improved, compact spring arrangement.

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 separate reed cams which make up the reed cam roll. The heddles, heddle lever arms, and heddle cams which make up the heddle cam roll are also alike.

The operating movements of the reeds, heddles, and their driving mechanisms are also relatively simple, involving only rotary motions of the cam rolls and reciprocatory movements of the reeds and the heddles. The shuttles move more slowly and more smoothly across the loom with no abrupt stops or abrupt changes in direction and the cam rolls move with circular motions, resulting in very little jarring or vibration. Although the reeds and the heddle lever arms reciprocate, they do so smoothly by gradually reducing speed before changing direction which keeps jarring and vibration at a low level. Very little noise is produced by the loom, perhaps the loudest noise being the contact of the reeds with the angular surfaces of the shuttles.

It is, therefore, a principal object of the invention to provide shuttle and heddle drive mechanism for a high production loom of the progressive shedding type having the advantages outlined above.

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

FIG. 1 is a side elevational view of a loom embodying the principles of the invention;

FIG. 2 is an enlarged, fragmentary, front elevational view of reeds and a reed cam roll used in the loom of FIG. 1;

FIG. 3 is a side elevational view of the reeds and reed cam roll shown in FIG. 2 and of a spring associated with the reeds;

FIG. 4 is a fragmentary, side elevational view of a heddle, a heddle lever arm, a heddle cam roll, and a spring used with the loom of FIG. 1;

FIG. 5 is a side elevational view of a modified heddle and heddle operating mechanism;

FIG. 6 is a side elevational view of a further modified heddle operating mechanism;

FIG. 7 is an enlarged plan view of a shuttle used in the loom of FIG. 1;

FIG. 8 is an end elevational view of the shuttle shown in FIG. 7;

FIG. 9 is an enlarged view in perspective of a modified shuttle;

FIG. 10 is a view in lateral vertical cross section of the shuttle shown in FIG. 9 and of an air nozzle inserted therein;

FIG. 11 is a view in lateral, vertical cross section of a further modified shuttle;

FIG. 12 is a somewhat schematic view in perspective of apparatus for winding a bobbin; and

FIG. 13 is a view of a bobbin and of a blower in cross section for stripping fill thread from the bobbin.

Referring to the drawings, and more particularly to FIG. 1, a loom mechanism 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 mechanism 10 also includes supplies 18 and 20 of warp threads and take-up spools 22 and 24 which are mounted on an auxiliary frame 26. In this instance, two separate fabrics 28 and 30, which are woven on the lower and upper weaving sections 14 and 16, respectively, are wound onto the spools 22 and 24. 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. While the take-up spools can be driven directly as the sole source of drive for the fabrics, as shown, the fabrics are driven by pairs 32 and 34 of drive rollers which are located between the take-up spools

22 and 24 and the weaving sections 14 and 16. It will be readily understood by those skilled in the art that the lower and upper fabrics 22 and 30 can be woven so as to constitute but a single fabric when opened up along one edge, particularly when coarser fabrics are woven. In such an instance, only one take-up spool would be employed for the single, double width fabric.

Referring in more detail to the lower weaving section 14, 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 36 preferably in the form shown in FIGS. 7 and 8. Each of the shuttles 36, which can be of sheet metal, has forward and trailing edge portions or angular drive surfaces 38 and 40 which are symmetrical so that they can be driven in either direction when either of the angular surfaces 38 and 40 are engaged by reeds, as will be discussed subsequently. Each of the edges 38 and 40 has a generally slanted elongated S shape with end portions which are disposed at steeper angles than the intermediate portion thereof, for a purpose which will be subsequently discussed. A rear, tapered edge portion 42 of the shuttle 36 has a slot 44 therein through which a fill thread is threaded from a bobbin 46. The bobbin is rotatably mounted in the shuttle 36 by means of spring clips 48 which enable the bobbin 46 to be inserted in the shuttle 36 through an upper or lower opening 50 and removed from the opposite opening. This facilitates the loading and unloading of the shuttle 36 because a full bobbin can be inserted into the shuttle through one of the openings 50 and at the same time push out the empty bobbin through the opposite opening. A pair of pins 52 can be located in alignment with the slot 44 to squeeze the fill thread slightly and to place it under proper tension.

As shown more fully in a co-pending application of Slayter and Ewing, Serial No. 79,894, filed on December 30, 1960, and in a co-pending application of Slayter, Serial No. 76,340, filed on December 16, 1960, a number of the shuttles 36 are moved across the warp threads at any given instant, after which they are transferred from one of the fabrics to the other, at which time they need not be turned around because of the symmetrical configuration of the forward and trailing edges 38 and 40 which then become trailing and forward edges, respectively. While the spacing between the shuttles will depend primarily upon the size of the shuttles and the width of the fabric, in a preferred form, the shuttles are approximately 4 inches long and are spaced at 6 inch intervals. When moving across the warp threads each of the shuttles is adapted to ride on the portion of the warp threads which form the lower portion of the shed. Each of the shuttle surfaces 38 and 40 is disposed so that it lies at an angle relative to the warp threads and the reed face. Each shuttle slot 44 is adapted to lie in the fell of the fabric and parallel to the plane of the formed fabric.

The shuttles are moved across the warp threads by a plurality of separate and separately operated reeds 54 (FIGS. 1-3) which have upper, thin tips 56 between which warp threads are passed. The reeds 54 are moved in an undulatory or wave-like motion, as more particularly shown in the above mentioned co-pending applications, to cause the tips 56 to strike the angular surfaces 38 and 40 with successive contacts and to propel the shuttles 36 across the loom continuously and in spaced relationship. The reeds 54 are mounted in a row on a reed shaft 58 (FIG. 3) which is supported on the frame 12 by ears 60 (FIG. 1). The shaft 58 has a flattened portion 62 extending substantially over all of its length except for the end portions mounted in the ears 60. The shaft 58 is positioned after the reeds 54 are pivotally mounted thereon so that the reeds contact the rounded portion of the periphery of the shaft 58. Cooperating with the flattened portion 62 of the shaft 58 are slots 64 in each of the reeds 54, which slots extend from holes 66 for the shaft

58 to the outer, lower edges of the reeds 54. The width of the slots 64 is greater than the minimum width of the shaft 58 measured in a line perpendicular to the flattened portion so that any one of the reeds 54 can be removed laterally from the shaft 58 without disturbing the adjacent reeds, simply by turning the shaft 90 degrees and pulling the desired reed up and off of it. This is particularly advantageous should one of the reeds 54 become damaged because it can then be replaced without the necessity of removing all of the reeds and the shaft from the loom.

The reeds 54 are preferably made of a light-weight material in order to reduce the overall weight of the loom 10 and also to minimize the momentum of the reeds during their reciprocatory motions. While many materials can be used for the reeds 54, a straight grained hard wood such as maple has been found to be suitable. Various plastic materials can be used as well as laminations of plastic materials and glass fiber cloth or similar glass fiber reinforcement. If desired, a steel insert 68 can be used at an intermediate portion of the reed 54 to reduce wear thereon.

The undulatory motion of the row of the reeds 54 and the reciprocatory motion of the individual reeds is established by a reed cam roll 70. The reed cam roll 70 includes a plurality of individual cams 72, one for each of the reeds 54, all of which cams are identical and are arranged in a predetermined fixed position, one slightly offset with respect to adjacent ones, so that the desired undulatory motion is established for the row of the reeds 54 when the cam roll 70 is rotated. The shape of the cam roll 70 and the individual cams 72 in FIGS. 2 and 3 is shown only for purposes of illustration and is not intended to represent the exact shape of the roll or cams.

For assembling and positioning the individual cams, each of the cams 72 has a large centrally located hole 74 therein through which an assembly shaft 76 is passed. A pair of hubs 78 is mounted on the ends of the shaft 76 by suitable set screws 80, with the hubs 78 mounted in fixed positions by a key 82 which extends into keyways 84 and 86 in the shaft 76 and the hub 78, respectively. Both ends of the shaft 76 have similar keys and keyways so that the hubs will be positively aligned when they are fixed on the shaft 76. This assures that positioning holes 88 in the hubs 78, which holes are spaced from the assembly shaft 76 and are uniformly circumferentially spaced around the hubs 78, will be in alignment when the hubs 78 are assembled on the shaft 76. The individual cams 54 have similar positioning holes 90 which are spaced a distance from the assembly shaft 76 equal to the spacing of the positioning holes 88 therefrom and are also spaced uniformly circumferentially around the cams 72. However, the positioning holes 90 of the individual cams 72 are circumferentially spaced from the corresponding holes in the adjacent cams 72 when the cams are in alignment. With this arrangement, when the positioning hole 90 of adjacent cams, are aligned by positioning rods 92, the adjacent cams in which the holes are located will be out of alignment or circumferentially spaced by a predetermined number of degrees. This assures that the adjacent cams will be uniformly circumferentially spaced in such a manner that a desired contour is established for the overall cam roll 70 and that the desired motion will be obtained for the row of the reeds 54. By way of example, in a loom having four ends per inch with one reed for each end and with the shuttles spaced apart six inches, the four positioning holes 90 in each of the cams 72 will be circumferentially spaced from the adjacent ones by an angle of 7½ degrees so that the adjacent cams will be circumferentially spaced by 7½ degrees when the cam roll 70 is assembled. For finer count fabrics with more reeds and with thinner cams, the angle would have to be decreased, of course. The aligned positions of the hubs 78 on the shaft 76 assures that the positioning rods 92 cannot be canted with respect to the axis of rotation:

of the cam roll 70 and thereby throw the motion of the reeds 54 out of position.

The individual reeds 54 move more slowly near the ends of their reciprocatory motions than at intermediate portions. To compensate for this, the forward and trailing surfaces 38 and 40 have an elongated S shape so that the surfaces are steepest at those portions where the reeds 54 move the slowest. This establishes a more uniform motion for the shuttles 36 and also enables more of the reeds 54 to be in contact with the surfaces 38 and 40 because the elongated S shape of the surfaces conforms more closely with the overall undulatory shape of the row of the reeds 54.

The reeds 54 are urged against the cams 72 by means of cantilever spring wires 94 (FIG. 3), there being one of the spring wires 94 for each of the reeds 54, with the spring wire and the reed lying in a common plane. The lower end of the spring wire 94 has a hook portion 96 extending partly around a lower supporting bar 98 which is mounted on the frame 12. An intermediate portion of the spring wire 94, between the hook portion 96 and an upper tip portion 100, which is engaged with a rear edge of the reed 54, is engaged and urged toward the reed 54 by an upper positioning bar 102 which is also mounted on the frame 12. The bars 98 and 102 thus position the spring wires 94 parallel to the reeds 54 and to each other, and maintain the tip portion 100 against the reed 54, thereby urging each reed against its cam 72. The bars 98 and 102 preferably have lateral grooves therein which maintain the spring wires 94 in their vertical positions. It will be readily appreciated that any one of the spring wires 94 can be removed from the loom 10 without disturbing the adjacent ones and also that the spring wires can be compacted laterally in the loom in a minimum of space. The spring wires 94 are all alike and are also easy to manufacture.

The warp threads are operated with a sequential lateral motion as the shuttles 36 are moved thereacross by means of heddles 104 (FIG. 4) which have eyes 106 through which the warp threads pass. At their opposite ends, the heddles have pivotal connections 108 and at intermediate portions, the heddles are encompassed by a guide bar 110 which extends the width of the fabric and is supported by the frame 12. The pivotal connections 108 of the heddles 104 are pivotally attached to heddle lever arms 112 by means of pins 114 or similar devices. The heddle arms 112 are mounted in a row somewhat similarly to the reeds 54 by means of hubs 116 which are pivotally supported on a heddle lever arm shaft 118. At an intermediate portion of the heddle 112 is a bifurcated projection 120 having a bridging pin 122 extending across the gap between the bifurcated parts. In contact with the pin 122 is a heddle spring wire 124 having a hook portion 126 at one end partially surrounding a guide bar 128 which preferably has lateral grooves therearound to aid in aligning the spring wire 124 with the heddle 112 and for maintaining the adjacent spring wires in parallel relationship. An opposite end 130 of the spring wire 124 is urged upwardly against a bearing bar 132 which is supported by the frame 12 along with the guide block 110. It may be noted that the pin 122 is above a line between the supporting rod 128 and the bearing bar 132 so that the spring wire 124 is maintained in a slight arc so as to urge the pin 122 and the lever arm 112 downwardly. This arc is maintained in the spring wire 124 for any position of lever arm 112 and, since the arc will vary in radius, the end 130 of the wire 124 must be free to move longitudinally. The lever arms 112 are held against a heddle cam roll 134 constituting a plurality of individual cams which are assembled in the same manner as the cams 72 of the reed cam roll 70. The relationship of the adjacent, individual heddle cams, however, will vary according to the particular weave desired; for example, in a one-over, one-under weave, the adjacent heddle cams will be placed in opposite positions, 180 degrees out of phase.

While there will be one heddle for each reed in many instances, there may also be fewer heddles with two reeds between adjacent warp threads, or there may be more heddles than there are reeds with more than one warp thread between adjacent reeds, particularly where the ends of the reeds are slotted as set forth more fully in the aforementioned Slayter application.

The lower and upper weaving sections 14 and 16 of the loom mechanism 10 are substantially identical, each containing the reeds 54, the reed cam rolls 70, the heddles 104, and the heddle cam rolls 134. The reed cam roll 70 and the heddle cam roll 134 for each of the weaving sections 14 and 16 are driven by a motor and variable speed drive 136 through suitable chain and sprocket connections indicated at 138. Any suitable drive can be employed as long as a proper coordination is maintained between the drive for the reed cam roll 70 and the heddle cam roll 134 to provide synchronization between these cam rolls and between the reeds 54 and the heddles 104.

While the operation of the loom mechanism 10 will be evident from the above discussion, a brief description of the operation will be set forth. Accordingly, the shuttles 36 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 54 which are operated with an undulatory motion by rotation of the cam roll 70 through the motor 136 and the connections 138. When the shuttles reach the end of one of the fabrics, they are transferred to the other fabric, and traverse it in the opposite direction. What was formerly the trailing edge of the shuttle 36 then becomes the leading edge, and vice versa, with the fill thread sliding to the opposite end of the slot 44 as the motion is reversed. While the shuttles are moving across the warp, the heddles 104 control the positions of the warp threads through the heddle arms 112 and the heddle cam roll 134. For a one-over, one-under weave, the heddles move the warp threads across the path of the shuttles until one of the shuttles has passed, after which they move the warp threads across the path of the next shuttle and maintain it to one side of this shuttle until it has passed. For weaves other than a one-by-one weave, the heddles may maintain the warp threads to one side of the shuttle path until two or more shuttles have passed thereby.

A modified shuttle, particularly suitable for the loom mechanism 10, is shown in FIGS. 9 and 10. This shuttle, indicated at 140, has forward and trailing edges 142 and 144 which are symmetrical and similar in configuration to the edges 38 and 40 of the shuttle 36. In this instance, the body of the shuttle 140 is completely enclosed with a cap 146 slipped over the large end thereof. A slot 148 is located in a rear edge 150 of the shuttle 140 in a manner similar to the slot 44 in the rear edge 42 of the shuttle 36. Instead of a conventional bobbin, however, a cop 152 is used in the shuttle 140, which cop is wound generally to the shape of the interior of the shuttle 140 so that a maximum amount of fill thread or yarn can be packed therein. After the cop 152 is loaded, an air nozzle 154 is inserted through an opening 156 in the cap 146, after which air is blown through the nozzle to separate the inner free end of the fill thread and blow it out the slot 148. Of course, after the cop is used, there is no bobbin or spool within the shuttle which need be replaced. Hence, this type of package and method of threading reduce loading and unloading time to a minimum. While the shuttle 140 has been shown with the cap 146, in many instances, the cap may not be necessary and the cop 152 can be simply wedged into the shuttle 140 and maintained therein by friction.

Another modified, simple shuttle 158 is shown in FIG. 11. This shuttle essentially is a light weight spool of plastic or the like and includes lower and upper sides 160 and 162 and a central, connecting hub 164. The annular edges of the lower and upper sides 160 and 162 are turned in to form annular ridges 166 and 168 which are spaced

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close together so as to engage the fill thread wound on the hub 164 as it is pulled from the shuttle 153, to place it under slight tension. The spool is forced across the warp threads by means of the reeds 54 which contact the edges of the shuttle 153 and push it forwardly in a manner similar to that employed with the shuttle 36 and the shuttle 140. The shuttle 153 can be loaded by removing one of the sides 160 or 162 or it may be possible to make the shuttles 153 at a sufficiently low cost to enable them to be thrown away when empty.

A modified heddle drive assembly 170 is shown in FIG. 5. In this instance, a heddle 172 has an upper eye 174 for a warp thread, with the lower end of the heddle 172 being attached to or integral with a heddle strip 176 which is guided by a rear plate 178 and a front bar 180, with the heddle strip 176 being in slidable contact with adjacent heddle strips to prevent it from turning or twisting. A notch 182 is formed in a lower portion of the strip 176 into which notch is inserted a ball joint 184 of a heddle lever arm 186 which is made of spring wire and is mounted at its opposite end in a fixed bar support 188 which can be attached to the loom frame 12. The support 188 positions the wire lever arm 186 downwardly against a heddle cam roll 190 so that the lever arm 186 always is urged against it. Thus, no auxiliary spring or resilient means are needed to maintain the lever arm in contact with the cam roll. The ball joint 184 enables the lever arm 186 to remain in engagement with the heddle strip 176 whether it is in an upper or lower position.

Still another modified heddle drive 192 is shown in FIG. 6. In this instance, a heddle 194 has an eye 196 for a warp thread and the lower end of the heddle 194 is attached to or made an integral part of a heddle strip 198. The heddle strip 198 is guided by a rear guide plate 200 and a front guide bar 202 and is prevented from twisting or turning by being in slidable contact with adjacent heddle strips. A lower portion of the heddle strip 198 has a plurality of teeth 204 forming a gear rack, which teeth are engaged with other teeth 206 formed in an arc to constitute a segment of a pinion gear. The teeth 206 are formed on an end of a heddle lever arm 208, the opposite end of which is pivotally mounted on a lever arm shaft 210, with the lever arm 208 being urged against a heddle cam roll 212 by a suitable spring 214. The arrangement of the rack and pinion segment teeth 204 and 206 enable the lever arm 208 to remain in engagement with the heddle strip 198 whether the strip 198 is in an upper or a lower position.

For conventional fabrics, the reeds can beat the fill threads against adjacent fill threads. However, for screening or other woven material in which the fill threads are spaced one from another, the end of the forward motion of the reeds 54 can be relied upon to properly position the fill threads parallel one to another, or a positive stop can be used to limit forward motion of the reeds, such a stop being shown at 216 in FIG. 1. When the fabrics 28 and 30 are moved continuously, for any weave, the reed cam roll 70 and the row of the reeds 54 are placed at a slight angle to the fabric so that the fill threads will be laid perpendicularly to the warp threads. The stops 216 will also be placed at a similar angle when used. By way of example, for a very coarse woven material having four ends per inch in a four-by-four weave, and with the shuttles spaced apart six inches when moving across the warp threads, the aforementioned loom components will be placed at an angle of approximately 2.5° to a line perpendicular to the warp threads.

While it is conventional in the art to employ various mechanical or electrical feelers to determine when the fill thread wound on a bobbin used in a shuttle is almost gone, this technique requires rather expensive equipment and results in more waste thread than is usually desirable. To overcome these and other advantages inherent in such an operation, the length of fill thread wound on each of the bobbins used in the shuttles can be carefully

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measured and then a predetermined number of passes can be made with the shuttle carrying this bobbin. Thus, by way of example, for a three foot wide fabric, 24 feet of fill thread can be wound on the bobbin and a shuttle carrying the bobbin can be used to make eight passes over the three foot fabric. The thread can be carefully measured so that only two or three inches of fill thread need be wasted. Apparatus for accomplishing a measured wind is shown in FIG. 12. Here a suitable bobbin 218 is placed on a shaft of a motor 220 and suitable fill thread 222 is wound on the bobbin 218 from a package 224. The fill thread 222 is first wound around a roll 226 several times and then onto the bobbin 218. The roll 226 is of known diameter and circumference so that by knowing the number of revolutions the roll 226 makes, the length of thread passing therearound and onto the bobbin 218 can be easily determined. The roll 226 is rotatably mounted on a housing 228 which includes a counter for counting the number of revolutions made by the roll. When the roll has made a predetermined number of revolutions, an electrical impulse is sent to a cutter 230 which then severs the thread and stops the operation. A new bobbin is then placed on the shaft of the motor 220 and the operation is repeated. The roll 226 can be driven in synchronism with the bobbin 218 by a motor in the housing 228, if desired.

The little remaining thread on a bobbin after it is removed from the loom can be stripped with the apparatus shown in FIG. 13. In this instance, a fill thread 232 wound on a bobbin 234 is that remaining after the bobbin has been moved from the loom. The free end of the thread is then inserted through a cylindrical bore 236 located centrally in a housing 238 of a blower designated 240. The blower 240 also includes an annular plenum chamber 242 to which air or other compressible fluid is admitted through a supply line 244, the air passing around the manifold 242 and out an annular nozzle 246 located concentrically with respect to the bore 236. The generally annular stream of air issuing from the nozzle 246 inspirates additional air through the cylindrical bore 236 and quickly draws the thread 232 therethrough, quickly stripping the bobbin 234. The bobbin can be stripped very quickly with just a few pounds of air pressure.

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 spirit of the invention, if within the scope and tenor of the accompanying claims.

I claim:

1. In mechanism for a loom of the progressive shedding type, a frame, a shaft mounted horizontally on said frame, said shaft having a flattened portion on its periphery extending longitudinally over a substantial portion of its length, a plurality of reeds, said reeds having holes for pivotally mounting said reeds on said shaft and slots in said reeds extending from said openings to outer edges thereof, the width of said slots being greater than the minimum width of said shaft at said flattened portion, whereby said reeds can be removed laterally from said shaft without removal of the other reeds, a reed cam roll rotatably supported on said frame in a position spaced from said shaft, said reed cam roll comprising a plurality of individual cams having a common, predetermined contour, each of said cams having a centrally located hole, an assembly shaft extending through said holes and beyond each end of said roll, a hub mounted on each end of said assembly shaft, each hub having a positioning hole spaced from said assembly shaft, said assembly shaft having means on each end for positioning said hubs on said assembly shaft with their positioning holes in alignment, each of said cams also having a positioning hole spaced from said assembly shaft a distance equal to the spacing of the positioning holes of said hubs from said

assembly shaft, the positioning holes of adjacent cams being circumferentially positioned one from another at a predetermined angle so that each of said cams is out of alignment by the same angle with respect to adjacent cams when their positioning holes are aligned, a positioning rod extending through all of the positioning holes of said cams and said hubs to hold said cams in predetermined positions to establish a predetermined contour of said cam roll, means for rotating said reed cam roll about an axis parallel to said positioning rod, said cam roll being positioned to contact portions of said reeds spaced from said shaft, said reeds having inserts of a material harder than the material of which the reeds are made at those portions contacted by said cam roll, a cantilever spring for each of said reeds, means supported by said frame for holding end portions of said springs and for urging the other ends of said springs against said reeds, whereby said reeds are urged against said reed cam roll, a supply of warp threads, a take-up spool, a pair of rollers engaging fabric woven on the loom, said rollers being in front of said take-up spool, a plurality of heddles, ends of which engage said warp threads, means supported by said frame for guiding said heddles through movements laterally of said warp threads, said heddles having pivotal means at ends opposite said warp-engaging ends, a plurality of lever arms for said heddles, said lever arms being pivotally connected at common end portions to said pivotal means, a lever arm shaft supported by said frame, said lever arms being pivotally mounted on said lever arm shaft at portions spaced from said pivotal means, 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, said heddle cam roll being positioned to contact portions of said lever arms spaced from said shaft, means for rotating said heddle cam roll about an axis parallel to said lever arm shaft, each of said lever arms having a projection extending from a portion thereof spaced from said lever arm shaft and from said heddles, a spring wire for each of said lever arms, each of said spring wires being supported at both ends by said frame with at least one of the ends being free to move longitudinally, each of said spring wires contacting the projection of its corresponding lever arm and urging the lever arm toward the corresponding heddle cam of said heddle cam roll, a plurality of shuttles adapted to ride on said warp threads, each of said shuttles having a surface lying at an angle to a path in which said reeds are moved and to said warp threads, said surface having a generally slanted, elongated S-shaped contour, a bobbin in each of said shuttles, spring clip means releasably and rotatably holding said bobbins in said shuttles, said shuttles having slots generally parallel to a plane in which a portion of said warp threads lie, fill threads from said bobbins extending through said slots, said shuttles being moved across said warp threads by said reeds when the surfaces of said shuttles are engaged by said reeds, said warp threads being moved to positions spaced on each side of the paths of said shuttles by said heddles, and means associated with the two rotating means for coordinating movement of said reed cam roll and said heddle cam roll.

2. In mechanism for a loom of the progressive shedding type, 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, said reed cam roll comprising a plurality of individual cams having a common, predetermined contour, means associated with said roll for positioning said cams to establish a predetermined contour of said cam roll, means for rotating said reed cam roll, said cam roll being positioned to contact portions of said reeds spaced from said shaft, a cantilever spring for each of said reeds, means supported by said frame for holding end portions of said springs and

for urging the other ends of said springs against said reeds, whereby said reeds are urged against said reed cam roll, a plurality of heddles, a plurality of lever arms for said heddles, said lever arms being pivotally connected at common end portions thereof to said heddles, a lever arm shaft supported by said frame, said lever arms being pivotally mounted on said lever arm shaft at portions spaced from said heddles, 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, each of said lever arms having a projection extending therefrom at a portion thereof spaced from said lever arm shaft and said heddles, a spring wire for each of said lever arms, said spring wires being supported by said frame, each of said spring wires contacting the projection of its corresponding lever arm and urging the lever arm toward the corresponding heddle cam of said heddle cam roll, a plurality of shuttles, each of said shuttles having a surface lying laterally to a path in which said reeds are moved, a bobbin in each of said shuttles, means releasably and rotatably holding said bobbins in said shuttles, said shuttles being moved across said warp threads by said reeds when the surfaces of said shuttles are engaged by said reeds, said warp threads being moved to positions spaced on each side of the paths of said shuttles by said heddles, and means associated with the two rotating means for coordinating movement of said reed cam roll and said heddle cam roll.

3. In mechanism for a loom of the progressive shedding type, a frame, a shaft mounted horizontally on said frame, said shaft having a flattened portion on its periphery extending longitudinally over a substantial portion of its length, a plurality of reeds, said reeds having holes for pivotally mounting said reeds on said shaft and slots extending from said openings to outer edges thereof, the width of said slots being greater than the minimum width of said shaft at said flattened portion, whereby said reeds can be removed laterally from said shaft without removal of the other reeds, a reed cam roll rotatably supported on said frame in a position spaced from said shaft, said cam roll being positioned to contact portions of said reeds spaced from said shaft.

4. In mechanism for a loom of the progressive shedding type, 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, said reed cam roll comprising a plurality of individual cams having a common, predetermined contour, each of said cams having a centrally located hole, an assembly shaft extending through said holes and beyond each end of said roll, a hub mounted on each end of said assembly shaft, each hub having a positioning hole spaced from said assembly shaft, said assembly shaft having means on each end for positioning said hubs on said assembly shaft with their positioning holes in alignment, each of said cams also having a positioning hole spaced from said assembly shaft a distance equal to the spacing of the positioning holes of said hubs from said assembly shaft, the positioning holes of adjacent cams being circumferentially positioned one from another at a predetermined angle so that each of said cams is out of alignment by the same angle with respect to adjacent cams when their positioning holes are aligned, a positioning rod extending through all of the positioning holes of said cams and said hubs to hold said cams in predetermined positions to establish a predetermined contour of said cam roll, said positioning rod being substantially the same size as said positioning holes, and means for rotating said reed cam roll, said cam roll being positioned to contact portions of said reeds spaced from said shaft.

5. In mechanism for a loom of the progressive shedding type, a frame, a plurality of heddles, means supported

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by said frame for guiding said heddles through reciprocatory movements, said heddles having pivotal means at common ends thereof, a plurality of lever arms for said heddles, said lever arms being pivotally connected at common end portions thereof to said pivotal means, a lever arm shaft supported by said frame, said lever arms being pivotally mounted on said lever arm shaft at portions spaced from said pivotal means, 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, said heddle cam roll being positioned to contact portions of said lever arms spaced from said shaft, means for rotating said heddle cam roll for rotation about an axis parallel to said lever arm shaft, each of said lever arms having a projection extending from a portion thereof spaced from said lever arm shaft and from said heddles, and a spring wire for each of said lever arms, each of said spring wires being supported at both ends by said frame with at least one of the ends being free to move longitudinally, each of said spring wires contacting the projection of its corresponding lever arm and urging the lever arm toward the corresponding heddle cam of said heddle cam roll.

6. In mechanism for a loom of the progressive shedding type, a frame, a plurality of heddles, means supported by said frame for guiding said heddles through reciprocatory movements, said heddles having pivotal means at common ends thereof, a plurality of lever arms for said heddles, said lever arms being pivotally connected at common end portions thereof to said pivotal means, a lever arm shaft supported by said frame, said lever arms being pivotally mounted on said lever arm shaft at portions spaced from said pivotal means, 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, said heddle cam roll being positioned to contact portions of said lever arms spaced from said shaft, means for rotating said heddle cam roll for rotation about an axis parallel to said lever arm shaft, each of said lever arms having a projection extending therefrom at a portion thereof spaced from said lever arm shaft and from said heddles, and a spring wire for each of said lever

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arms, each of said spring wires being supported by said frame parallel to said heddles and to each other, each of said spring wires contacting the projection of its corresponding lever arm and urging the lever arm toward the corresponding heddle cam of said heddle cam roll.

7. In mechanism for a loom of the progressive shedding type, a frame, a supply of warp threads, means for moving said warp threads across said frame, a plurality of shuttles adapted to ride on the warp threads, each of said shuttles having a surface lying angularly to said warp threads, said surface having a generally slanted, elongated S-shaped contour, a bobbin carrying a fill thread in each of said shuttles, spring clip means releasably and rotatably holding said bobbins in said shuttles, and said shuttles having slots generally parallel to a plane in which a portion of said warp threads lie, fill threads from said bobbins extending through said slots.

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