Jan. 1, 1952 W. J. BUDZYNA ET AL 2,580,994

MECHANISM FOR WEAVING

Filed Aug. 26, 1949 3 Sheets-Sheet 1

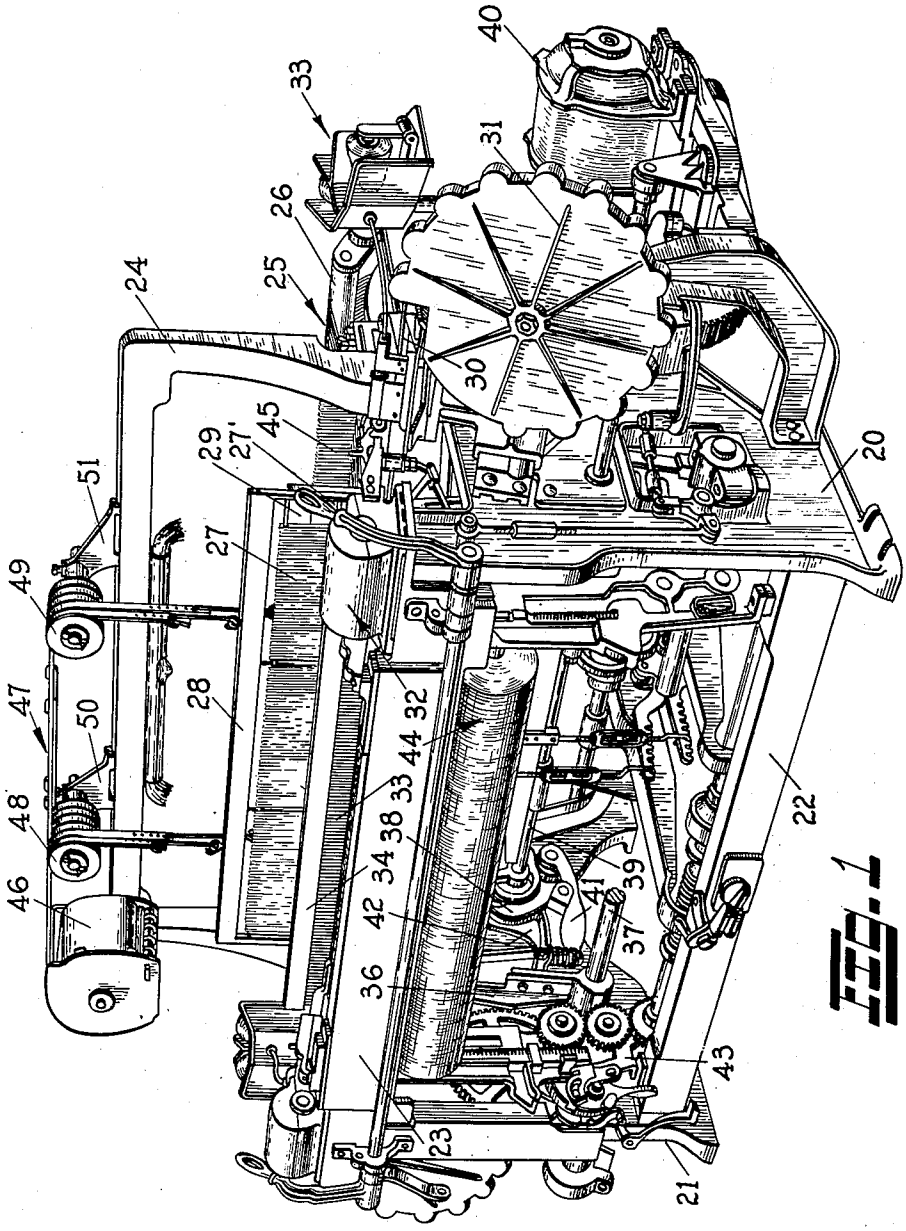


FIG. 1

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MECHANISM FOR WEAVING

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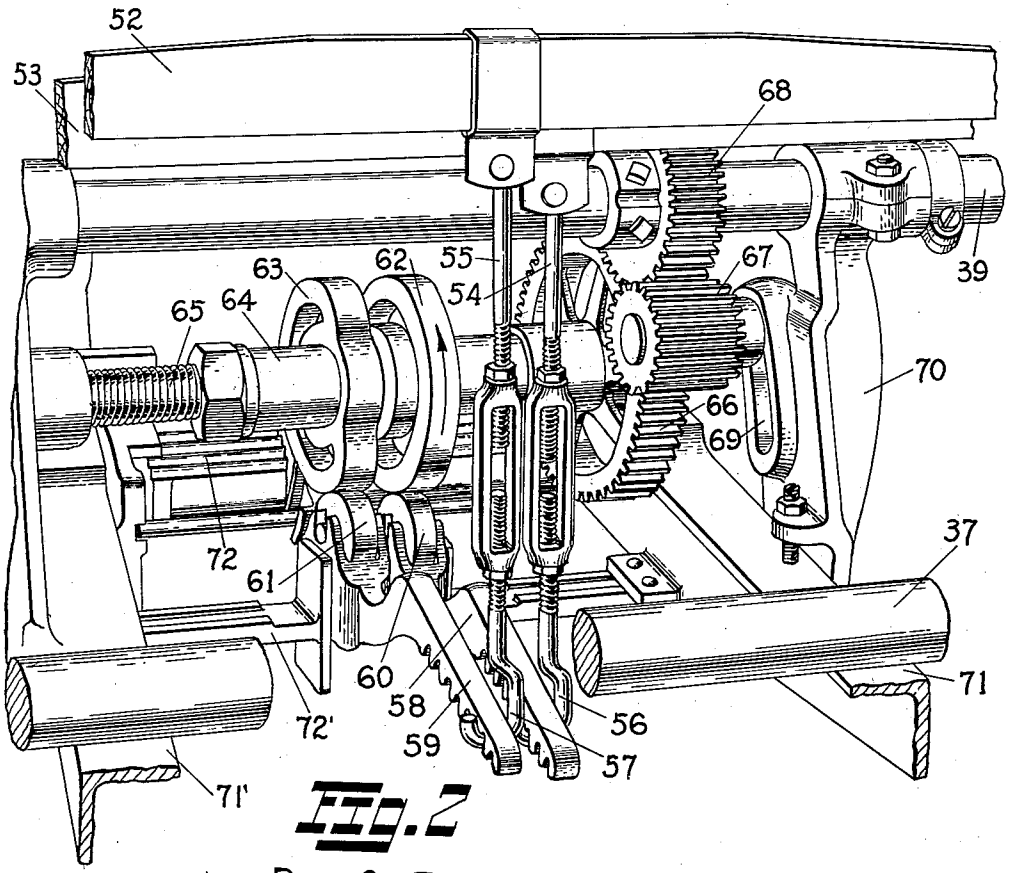


Fig. 2

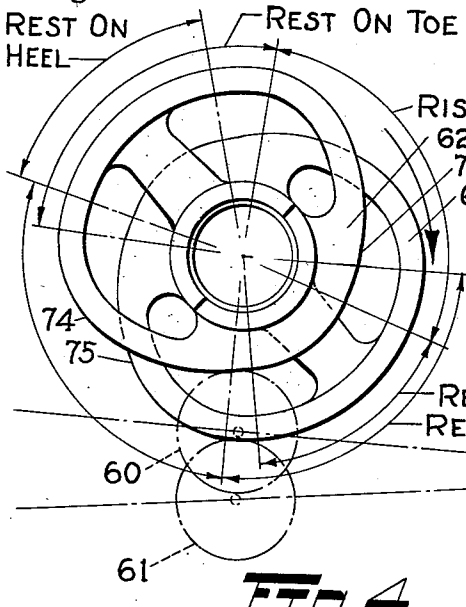


Fig. 4

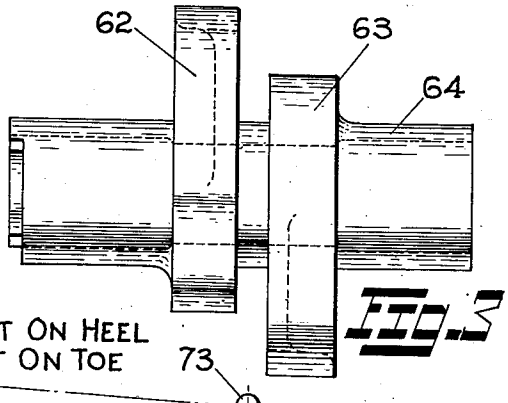


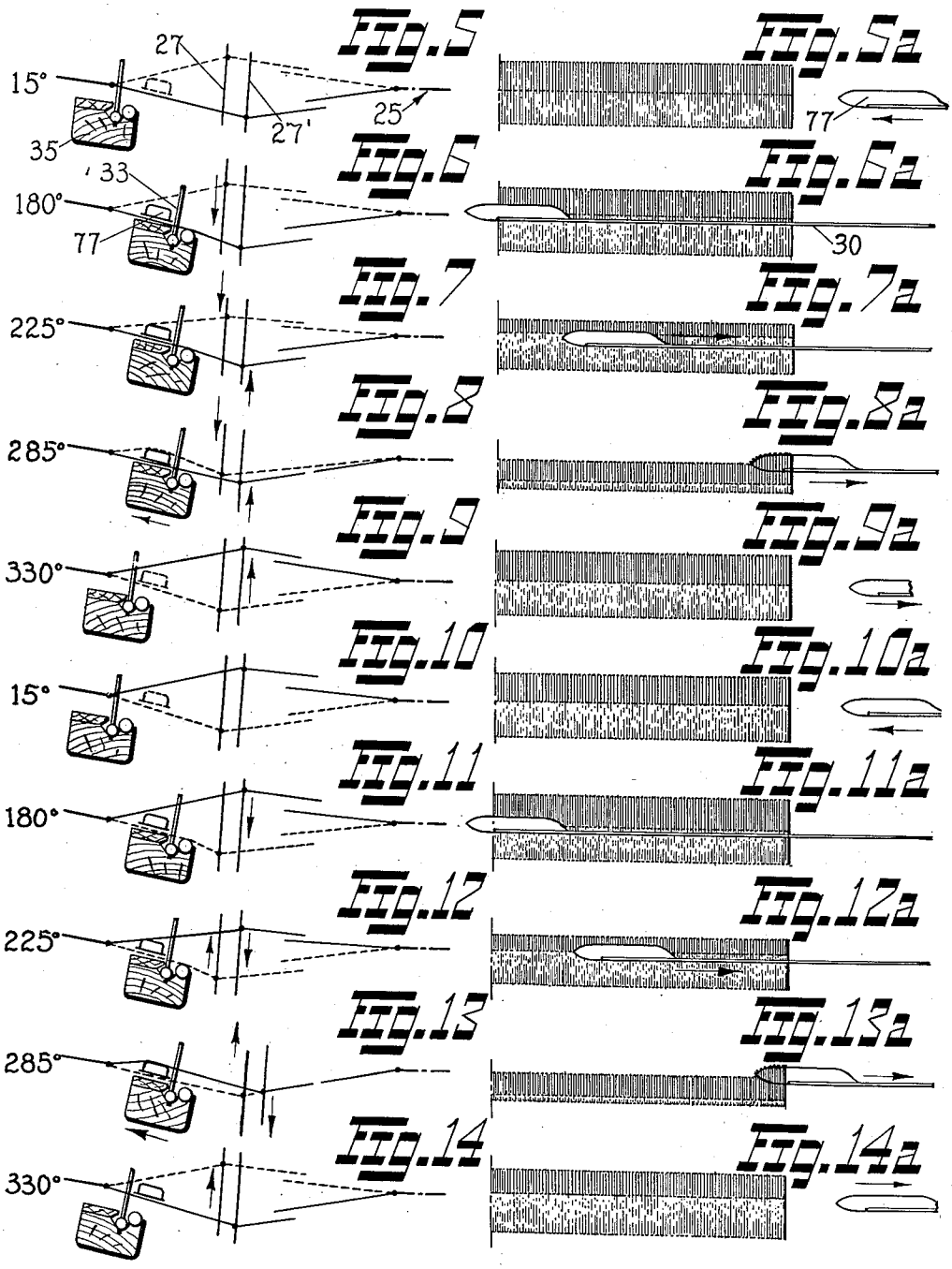
Fig. 3

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Filed Aug. 26, 1949 3 Sheets-Sheet 3



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2,580,994

MECHANISM FOR WEAVING

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Application August 26, 1949, Serial No. 112,570

8 Claims. (Cl. 139—79)

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This invention pertains to a method and mechanism for controlling the filling thread in shuttleless looms or in looms adapted to insert cut lengths of filling from a relatively stationary supply. More specifically, the invention pertains to improvements in such looms whereby the control of the cut or non-continuous lengths of filling thread is so regulated that the filling is locked in the shed under conditions such that the action of filling feeling forks or other mechanisms adapted to stop the loom upon failure of filling to be inserted properly shall have no adverse effect upon the filling.

It is a general object of the invention to alter the control of the harness mechanism in a manner to improve the operation of looms of the type described and to so time that harness mechanism relatively to the movements imparted to the filling inserting members that the shed may be closed and the filling locked between the warp threads while it is under the tension with which it is inserted and before there is any opportunity for release of that tension.

It is a further object of the invention to improve the operation of looms of the type described in such manner that the shedding movements imparted through the harness mechanism shall not adversely affect the smooth and intended operation of the filling inserting carriers.

A more specific object of the invention is that of improving the method and mechanism by means of which the warp threads are caused to alternate or shift their positions during the shedding operation and to close the shed quickly and before tension is released in the filling thread being inserted and without so moving those warp threads which form the lower part of the shed that the rectilinear movement of the filling inserting carrier is disturbed thereby to impart to the rapidly moving carrier an erratic motion.

In looms in which filling is inserted by carriers functioning upon cut or non-continuous lengths of material drawn from relatively stationary sources of supply, there is, usually at each pick inserted, a releasing of a cut end by the carrier which may give rise to certain difficulties not experienced in the more conventional fly shuttle looms in which the filling is inserted as a substantially continuous length of thread. The action of filling feeling forks operating adjacent the central portion of the material being woven or intermediate the terminal warp threads at the shed will, if the filling is uncontrolled, tend to draw some of the thread back away from the edges of the fabric being woven and therefore, may form loops or loose portions in the filling which are very obvious in the completed fabric. These loose portions of filling show as stripes extending throughout the length of the fabric at areas where the filling fork or forks have functioned.

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The quality of fabric is to an extent dependent upon maintaining a uniform tension in the filling as it is laid across the warp threads and in retaining that even tension throughout the entire length of the pick until it is locked into the fabric and beaten into the fell, that being easily accomplished in more conventional looms since the filling is always under tension due to its being held at the shuttle and under tension between the shuttle eye and the selvage from which it last emerged. There the action of filling forks or other means tending to draw back or to loosen the filling is suitably resisted so that no particular problem is involved.

According to the invention hereinafter described in greater detail, shuttleless looms such as, for example, that described in co-pending application Serial No. 71,622, filed January 19, 1949, are so improved that the shedding movement or movement imparted to the harness mechanism is considerably modified and at the same time so coordinated with the movement of the filling carriers or tapes that the two function in unison to lock the filling just prior to its release by the carrier and to accomplish that without disturbing the movement of the filling carriers or tapes as might otherwise occur if the timing of the harness mechanism conventionally operated were to be altered without further modification of the entire movement.

The method involved may briefly be stated to comprise a control of the harness mechanism by which the shed is closed upon the filling thread being inserted before the release thereof by the carrier by which it is being laid and while it is under that tension to which it is subjected as the carrier rapidly draws it through the shed. In looms of this type it is to be understood that the filling is cut to a length such that at each pick, the end of the filling projects from the shed a very short extent thereby to provide a sufficient amount of filling material to extend across the fabric, yet to avoid any excessive waste of that material. The carrier, one example of which is to be observed in the application, above mentioned, after releasing the filling, can, of course, exercise no influence thereon, and the situation is then one in which, according to operation heretofore envisioned, the filling inserted in the shed

was without control for a brief interval of time. The cams which control the harness mechanism, as will hereinafter be described in greater detail, are so modified that the motion imparted to the harnesses is not instantaneously symmetrical about the center point or the point at which the warp threads cross, but involves a movement of whichever portion of the warp threads is uppermost at the shed throughout a considerable extent downwardly before there is any corresponding movement of the warp threads in the lower portion of the shed upwardly. The shed is actually closed upon the pick of filling just being laid prior to its release by the carrier. More preferably, that shed is closed before actual withdrawal of the carrier from the shed so that for the last small portion of the carrier travel within the shed, the filling is locked by closing or crossing warp threads and the carrier itself is actually held between or encompassed between the said warp threads which then close or cross just after the carrier emerges from between them.

The peculiar control and movement of the harness mechanism and its attendant effect upon the warp threads at the shed accomplishes the intended locking of the filling thread without disturbing the most advantageous movement of the filling carrier or carriers. It is to be understood that in looms of this type there is a carrier at either side of the loom and that each moves inwardly to a point adjacent the center of the shed while one inserts a pick to about the half way point whereupon the other carrier receives the pick and withdraws it endwise to complete the laying of that pick. The carriers may function to draw filling entirely from one side of the loom, in which event one of the carriers always functions as an inserter and the other receives the thread transferred from the first and withdraws it to complete the laying of the pick, but in other cases where filling is drawn from both sides, each carrier performs both functions in the particular timed relationship necessary for weaving fabric, there being several different schemes or methods which may be employed. The fact that these carriers move at a very rapid rate makes it imperative that the movement of the warp threads in changing the shed shall not disturb the intended rectilinear movement thereof. The movement of the lower group of warp threads at the shed is delayed until the carrier has reached the end of its movement outwardly thereof, or to a point where the carrier has reached substantially the outermost end of the shed and thereafter the lower threads are moved at a very rapid rate so that the crossing occurs very quickly, it being understood, however, that the majority of the movements of the warp threads incidental to crossing the harnesses and locking the filling is accomplished by whichever group of warp threads is in uppermost position.

A more complete description of one embodiment of the invention and of the general characteristics thereof will be given in the following detailed description of the invention and by reference to the accompanying figures of drawing in which:

Fig. 1 is a perspective view showing a shuttleless loom to which the invention has been applied.

Fig. 2 is a perspective view showing the harness control means including cams, means for driving said cams, followers, treadles and interconnecting parts by which the movement from said cams is conveyed through to the harness frames themselves.

Fig. 3 is an elevation showing the harness cams.

Fig. 4 is an end view of Fig. 3 showing the cams and the contours thereof.

Figs. 5 and 5*a* are two cooperating views, the first of which shows the warp threads forming a shed and the filling carrier, lay and reed in position relatively thereto, the shed being open at this point, the second showing the relative position of the filling carrier with respect to the warp threads as they form a shed into which the said carrier may be projected.

Figs. 6–14*a* are corresponding views taken at different angular positions of the mechanism and going through two opening and closing movements of the shed.

Now referring to Fig. 1, a shuttleless loom to which the invention has been applied comprises a framework made up of loomsides **20** and **21** and a plurality of girts such as the lower front girt **22**, a breast beam **23** and other structural parts including the arch **24**. A warp beam is provided with a suitable let-off mechanism and a series of warp threads generally indicated by numeral **25** pass over a whip roll **26** and half of these are threaded through heddles **27** in a heddle frame **28**, the other half being passed through a plurality of heddles **27'** similar to the heddles **27** in a second heddle frame **29**, and each of these frames is so mounted and controlled that they are reciprocated in alternate directions to form and to change the shed of warp threads through which the filling is passed.

The insertion of filling is accomplished by means of tapes as specifically shown here, there being one such tape **30** at the right hand end of the loom, that tape **30** being passed about an oscillated tape wheel (not shown) which is protected or encased within a closure member **31**, there being certain guiding mechanism not necessarily to be described here.

A filling motion part of which is enclosed within casing **32** and operated by suitable cam or other means presents filling drawn from a supply **33** to a carrier portion at the end of the tape **30**, it being understood that the said carrier projects a length of filling toward the center of the fabric being woven and within the shed formed by the warp threads at which position a similar or cooperating carrier member in a second tape at the other side of the machine draws that end outwardly to complete the insertion of the pick. It is to be understood at this point that single picks might be laid in which event no selvage would naturally be formed at either side of the fabric, but preferably double lengths are employed, these lengths being inserted as "hairpins" all as described in the application above mentioned. In either instance, the carriers function to insert an end which is cut and which extends only a short distance from the opposite edge of the fabric. In the event the insertion is all from the same side the cut ends may be bound by a twisted selvage in a manner well known by those conversant with this art. If insertion is from supplies at both sides, then a natural selvage is formed at each side and the employment of special selvage-forming devices will not be found necessary.

After insertion of a pick of filling, both carriers and tapes are withdrawn outwardly beyond the filling presenting means or filling motion and the pick is beaten into the fell of the fabric by a

reed 33 disposed between the hand rail 34 and a lay beam 35, Fig. 5. The movement of this lay structure which preferably extends only slightly beyond the terminal warp threads is one in which a considerable portion of the cycle is consumed in maintaining the parts stationary. The lay is carried at the upper ends of swords 36 pivoted on a rock shaft 37 and rocks to and fro by certain cam means generally indicated by numeral 38 and rotatable with the constantly rotating cam shaft 39, it being understood that all of the loom mechanism is driven in unison by any suitable source of power, that herein employed being shown as an individual electric motor 40. The cams 38 function upon followers on arms 41 and 42 which are connected as a functional part of the swords 36.

After being woven, the fabric is then controlled by temples in a conventional manner to maintain its width and is then passed about take-up mechanism and wound upon a cloth roll which may be supported and driven by the conventional mechanism generally indicated by numeral 43 to form the roll of material shown here at 44.

Such a loom is started and stopped and driven through clutch means (not shown). It is, of course, desirable that stop motions be provided and to that end warp stop means 45, either of mechanical or electrical type, functions to stop the loom upon failure of any one of the warp threads, while other stop mechanism such as described in the co-pending application Serial No. 109,036, filed August 6, 1949, is employed to stop the loom upon failure to insert a pick of filling in the intended fashion.

Since the filling threads do not extend for any appreciable distance beyond the edges of the fabric being woven and since they are not susceptible of being contacted by feeler mechanism other than at some point intermediate the edges of the warp sheet, so-called center fork means is employed for stopping the loom. That center fork mechanism must employ filling contacting fingers or tines which are preferably relatively light in weight and press upon the filling with a minimum of force. However, it is quite evident that the filling feeling function must be sufficiently positive to be certain in its action and to avoid any possibility of operation after a stop should have been indicated, so that the lack of tension at the ends of the filling contra to the case when weaving in a conventional loom, makes it particularly difficult to use such center forks or stop means without the effect thereof being evident in the finished fabric. Even with the lightest possible pressure, just enough of the filling is drawn back and loops of the same formed by each individual tine or feeler member so that stripes will be evident in the finished material, that obviously being something which cannot be tolerated.

Now referring to Figs. 1–4, each of the harness frames 28 and 29 is urged in an upward direction by more or less conventional harness spring mechanism enclosed within a casing 46 and from which suspending straps generally indicated by numeral 47 pass to be connected to the upper rail of the frames, said tapes passing over freely rotatable pulleys or sheaves 48 and 49 as shown. These sheaves 48 and 49 of which there are a plurality depending upon the number of harness frames and thus the number of tapes, are rotatable on spindles projecting from brackets 50 and 51, in turn attached to the arch 24. For details of spring mechanism for drawing the frames upwardly reference is hereby made to U. S. Patent 2,455,263.

As more clearly illustrated in Fig. 2, each of the harness frames has depending from its lower rail certain jack sticks 52 and 53 to which are attached adjacent their mid points certain jack wires 54 and 55 the lower ends of which are formed into hooks or stirrups 56 and 57 which are hooked into appropriate notches in their respective treadles 58 and 59. Each of the treadles has a follower 60 or 61, as the case may be, and these followers impart movement from the harness cams presently to be described, to the heddle frames and heddles thereby to change the shed formed by the two separate groups of warp threads in a manner as herein described. The cams act positively to draw the frames downwardly while the springs, above mentioned, return the frames upwardly, although it is to be understood that that arrangement may be varied depending upon the general construction of the loom, it being understood that there may be a reversal of this system so that the positive movement causes elevation of the frames which may be returned by some resilient means. Again, the method and mechanism is to be understood to encompass a system wherein the movement of the harness frames and other attendant parts is a positive one in each direction. In that event the cams herein described and illustrated should merely be modified as will be evident to qualified mechanics so that positive movement of the harness frames in each direction is provided.

The harness cams designated by numerals 62 and 63 are integrally formed on a hub 64, Figs. 3 and 4, and the cams are cut away at certain portions in the interest of lightening the structure. These cams are clamped on a shaft 65 and rotate therewith being keyed to and driven through a gear 66 fixed to the shaft, an idler 67, and pinion 68 fixed to the cam shaft 39, or to any other convenient rotating part of the loom. The idler 67 is rotatable on a stud held in a slot 69 formed as a part of bracket 70 attached to the framework such as the structural members 71 and 71'.

These beams support a treadle bracket, a treadle gear 72 upon which the treadles 58 and 59 are pivoted and a guiding structure 72'. The gear ratios are such that for each pick of filling inserted, that is, for every revolution of cam shaft 39, the shaft 65 and the treadle cams make one-half revolution.

As illustrated in Fig. 4, each cam has concentric or dwell portions, that at the heel, so-called, extending for 62° while that at the toe extends for 92°. It is to be understood that these figures are merely illustrative of what has been employed by way of a practical cam system on one particular loom. Variation of certain factors would likewise change these values, but it is to be understood that the general principles herein set forth would still apply. Between these concentric cam portions, there is to be found a cam contour adapted to push downwardly or lower the cooperating treadles by swinging them about their pivots, and complementarily, a second contour portion governing the movement of the cooperating treadles and attached harness frames on the reverse or return movement.

The actual contour of these cams adapted to impart to the frames a particular and unusual motion is laid out to effect, in cooperation with the position of the center 73 about which the treadles swing and the relative position at which

the followers 60 and 61 engage their cooperating cam surfaces, to cause the downward movement of the top or uppermost harness frame to occur about 45° (with reference to cam shaft travel) in advance of the start of movement of the lower frame upwardly. It is to be understood that a half of each of the cams functions throughout a cycle of inserting a pick, or that the two cams when moved throughout a complete revolution of 360° for shaft 65, control the changing of the harness mechanism throughout the insertion of two adjacent picks.

An inspection of Fig. 4 in which the direction of rotation is illustrated by the arrow will serve to assist in the explanation of the sequence of movements for the two groups of warp threads which are so controlled by the harness mechanism as to form the shed. In the position shown, the follower 60 has just been permitted to rise and, of course, its harness frame will be in a corresponding or top position. The parts will remain in that position throughout about 62° according to the contours of the cams herein described by way of illustration of a preferred embodiment which the invention may take. Follower 61 has been forced downwardly by the active surface 75 of the cam 63 and has for a few degrees been resting upon the extended concentric or dwell portion of the cam which extends for about 92° of arc. The shed then remains open until the upper harness frame is caused to descend by engagement of the active contour 76 of cam 62, that occurring an appreciable period of time before the lower harness frame has any movement imparted thereto. According to the layout of the cams as employed here, there is actually a 22½° movement of shaft 65 or of the harness cams themselves before the lower harness starts to move upwardly, but during which time, the upper harness frame has been moved very rapidly toward its central position or toward a position in which the warp threads controlled thereby will meet and cross those controlled by the harness frame which had occupied the lower position. Since the harness cams move at a speed one-half as great as the speed at which the main cam shaft and most of the other parts are operated, there is actually a 45° movement of the other parts of the loom or 45° of movement of parts which affect the filling carriers between the start of downward movement of the upper harness and the movement of the lower harness, that delay being employed so that the filling carriers will be permitted to move outwardly along their intended rectilinear pathway and will not be disturbed or caused to fluctuate erratically as would otherwise be the case if both harnesses move more or less at the same time and throughout the same angular extents. The timing hereby provided permits the tapes or other filling carrying instrumentalities to move practically to the ends of the shed before the lower harness has made any appreciable upward movement. It is to be understood that the tapes and filling inserting and transferring instrumentalities fixed at the ends thereof bear at least throughout a portion of their extent upon the lower warp threads and thus any movement thereof in an upward direction would lift the tapes and appurtenant thread controlling means in a manner to impart thereto an unintended and erratic movement which would adversely affect the efficiency and speed with which the mechanism is otherwise operated.

The movement of the parts continues and the two groups of warp threads meet and cross at which time the filling just inserted by the filling carrier will be gripped between the warp threads, adjacent ones of which are moving in opposite directions and will thereby be sufficiently held or retained against endwise displacement so that tension with which the thread is inserted will be maintained. Thus action of the filling fork or other instrumentalities will not adversely affect or tend to alter the position or manner in which the filling thread is then retained and there will be no visible evidence in the finished fabric to indicate that said instrumentalities have displaced that thread after it has been inserted.

The movement of the harnesses progresses until an extreme is reached at which the harness which was at the uppermost position then assumes the lowermost position and vice versa. Parts then dwell as before indicated and then the cycle is repeated, the opposite groups of warp threads being moved in the reverse direction from that on the previous cycle.

In Fig. 5 the heddles are indicated and in the particular position shown, the 15° position of the main cam shaft, the harnesses are in the opposite or extreme positions so that the shed is opened to its fullest extent. At that particular time the tape and the filling inserter indicated by numeral 77 are, as indicated by the arrow, Fig. 5*a*, moving inwardly to project a length of filling into the shed. The lay beam, reed, etc., have started toward their rearmost position.

In Fig. 6 the parts have moved so that the cam shaft now occupies a 180° position, it being understood that during the major part of the interval between the 15° and 180° positions, the dwell portions of the harness cams have caused the harnesses to remain stationary. The lay beam, reed, etc., have practically reached their rearmost position after which they are maintained stationary. The 180° position has been chosen here because at that point the filling carriers have been moved to mid position, it being understood that in Figs. 5*a*–14*a*, the shed indicated by the rectangular dot-and-dash area within which the tape and carrier 77 are projected is of double the actual length herein illustrated. A transfer occurs at the mid position as understood by those conversant with this art and the opposite carrier (not shown) receives and carries the filling to the opposite selvage. At this angular position the top harness has started to move downwardly but the lower harness is still maintained stationary.

At the 225° position, Fig. 7, that is, 45° of cam shaft travel or 22½° of harness cam travel after the position of Fig. 6, the topmost harness has moved downwardly to a considerable extent while the lowermost harness has just started to move upwardly. In Fig. 7*a* the carrier has started to move outwardly or be retracted after transfer and, of course, the shed has closed to an appreciable extent.

At the 285° position, Fig. 8, the warp threads have been brought into alignment, or in effect, have crossed sufficiently to lock the filling. At that time all except about two or three inches of the carrier has been withdrawn from the shed, Fig. 8*a*. However, the filling is locked and, it is to be understood that the feeler mechanism forming a part of the filling stop motion may be employed at any time thereafter without drawing loops of the filling or otherwise disturbing it so that its effect may be obvious in the completed, woven material.

At the 330° position, Fig. 9, the carrier has been

completely withdrawn from the shed and has moved outwardly almost to its extreme position, Fig. 9*a*, in preparation for receiving and inserting the next pick at that side. The harnesses have moved so that the harness which was in topmost position has now attained its lowermost extent of travel and that which was lowermost at the 15° position, above indicated, has reached the uppermost position which it may occupy.

In the following Figs. 10–14*a* the cycle of movement incidental to the next pick is shown and corresponds to that above described except that the opposite harnesses are to be found in upper and lower positions as indicated by the arrows accompanying the heddles. The same timing is obvious and the parts will be found to occupy similar positions at the same angular positions of the cam shaft.

The invention has been described by reference to a simple type of loom in which only two harnesses are used, but it is to be understood that the principles may be applied to looms employing a greater number of harness frames and which may be employed for patterning effects. The actual control of the harnesses by means of the harness cams may be varied greatly since in some instances the harness frames are more directly or positively operated in both directions rather than being moved in one direction by cam means and returned through resilient or spring means. The same principles may be employed and cams or other means capable of controlling the movement of the parts in both directions rather than a single direction will then be utilized.

By way of illustration of one preferred embodiment of the invention which has taken practical form, certain angular extents of cam contours and a particular timing of parts has been described. It is to be understood, however, that this portion of the description is only an example of one set of dimensions and angular extents which have been found satisfactory in actual practice, and therefore, the description is not to be interpreted as limiting the practice of the invention to precisely what is described since it is obvious that the change of certain other parts or other alterations or differences in mode of operation may vary these dimensions or angular movements and also the timing to an appreciable extent.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive concept may be carried out in a number of ways. This application is, therefore, not to be limited to the precise details described, but it is intended to cover all variations and modifications thereof falling within the spirit of the invention and the scope of the claims.

We claim:

1. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, the method of locking picks of filling within their respective sheds formed by the warp threads which comprises the steps of closing the shed upon the filling by first lowering the topmost warp threads which form the shed into contact with the filling carrier before moving the lower warp threads which form the shed any appreciable distance thereby to reduce the opening of the shed without disturbing the filling carrier and then continuing movement of said warp threads to close the shed upon the filling as it is deposited by the carrier prior to withdrawal of the carrier from the shed and before release of the pick of filling by that carrier.

2. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a stationary source of supply, the method of locking picks of filling within their respective sheds formed by the warp threads which comprises the steps of closing the shed upon the filling before insertion of the pick is completed and by first moving the upper group of warp threads downwardly into proximity to the pick before any substantial movement of the lower group of warp threads is effected, and then continuing to close the shed upon the filling to a point of crossing the warp just prior to withdrawal of the carrier from the shed and subsequent release of the pick thereby.

3. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, means for shedding warp threads and cooperating means for reciprocating said filling carriers into and from a shed formed by the warp threads, said means for shedding the warp threads comprising harness mechanism and cams for actuating said harness mechanism to close the shed by first lowering those warp threads which form the upper portion of the shed an appreciable distance before causing any substantial movement of the warp threads at the lower part of the shed.

4. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, means for shedding warp threads and cooperating means for reciprocating said filling carriers into and from a shed formed by the warp threads, said means for shedding the warp threads comprising harness frames and heddles, cam means for reciprocating said frames and heddles to change the shed, said cam means having contours so formed that the upper portion of the shed is first lowered into substantial contact with the filling carrier before any appreciable change of position of the threads forming the lower portion of the shed is effected, and thereafter, both portions of the shed are moved to cross the warp.

5. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, means for reciprocating said filling carriers into and from a shed formed by the warp threads, means for shedding the warp threads comprising harness frames and heddles through which the warp threads are passed, cam means for actuating said frames and heddles alternately in reverse directions to change the shed, said cam means having contours such that the warp threads forming the upper portion of the shed are lowered a considerable distance before an appreciable movement of the threads forming the lower portion of the shed is effected, and means for rotating said cam means in timed relationship to the reciprocatory movement of the carriers to close the shed to lock the filling against endwise displacement just prior to the time a carrier is withdrawn from the shed to a position to release its pick of filling.

6. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, means for reciprocating said filling carriers into and from a shed formed by the warp threads, means for shedding the warp threads comprising

harness frames and heddles through which the warp threads are passed, cam and follower means connected to said harness frames for imparting movement thereto, each said cam having a portion of its contour for lowering its respective frame, a portion for raising it and dwell portions for maintaining the frame stationary, said cams being generally opposed so that one frame is raised as the other is lowered, said cam and follower means further having such contours and being so disposed with respect to their followers that the motion imparted to the frames at each cycle is one in which the downward movement of the upper frame precedes the upward movement of the lower frame by an amount such that the harnesses are substantially to a point of crossing before the filling carrier is withdrawn from the shed, and do cross to lock the filling before it is released by the carrier.

7. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, means for reciprocating said filling carriers into and from a shed formed by the warp threads, means for shedding the warp threads comprising harness frames and heddles through which the warp threads are passed, cam and follower means connected to said harness frames for imparting movement thereto, each said cam having a portion of its contour for lowering its respective frame, a portion for raising it and dwell portions for maintaining the frame stationary, said cams being generally opposed so that one frame is raised as the other is lowered, said cam and follower means further having such contours and being so disposed with respect to their followers that the motion imparted to the frames at each cycle is one in which the downward movement of the upper frame precedes the upward movement of the lower frame by an amount such that the harnesses are substantially

to a point of crossing and the lower group of warp threads is not raised to disturb the rectilinear movement of the filling carrier as it is withdrawn from the shed, but do cross to lock the filling before it is released by the carrier.

8. In a loom adapted for weaving by inserting cut lengths of filling by filling carriers which take filling from a relatively stationary source of supply, transfer that filling from one carrier to another at a point intermediate the shed in which the pick is inserted and then extend the free end of that cut length through the remainder of the shed, the method of locking said picks of filling within their respective sheds formed by warp threads which comprises the steps of closing each shed upon its pick of filling substantially at the time at which the carrier which extends the free end of filling reaches the point at which it is withdrawn from the shed, but maintaining the warp threads clear of the filling until the carrier is moved substantially to that point, and releasing the said cut or free end of the filling after the pick has been gripped by the warp threads, but after the carrier has been withdrawn from the shed and while the filling is under tension.

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Number	Name	Date
782,569	Lacey	Feb. 14, 1905
789,845	Draper	May 16, 1905
1,580,178	Talbot	Apr. 13, 1926
1,805,046	Menschner	May 12, 1931
2,042,422	Brown	May 26, 1936
2,106,727	Drobile	Feb. 1, 1938
2,497,077	Firing	Feb. 14, 1950