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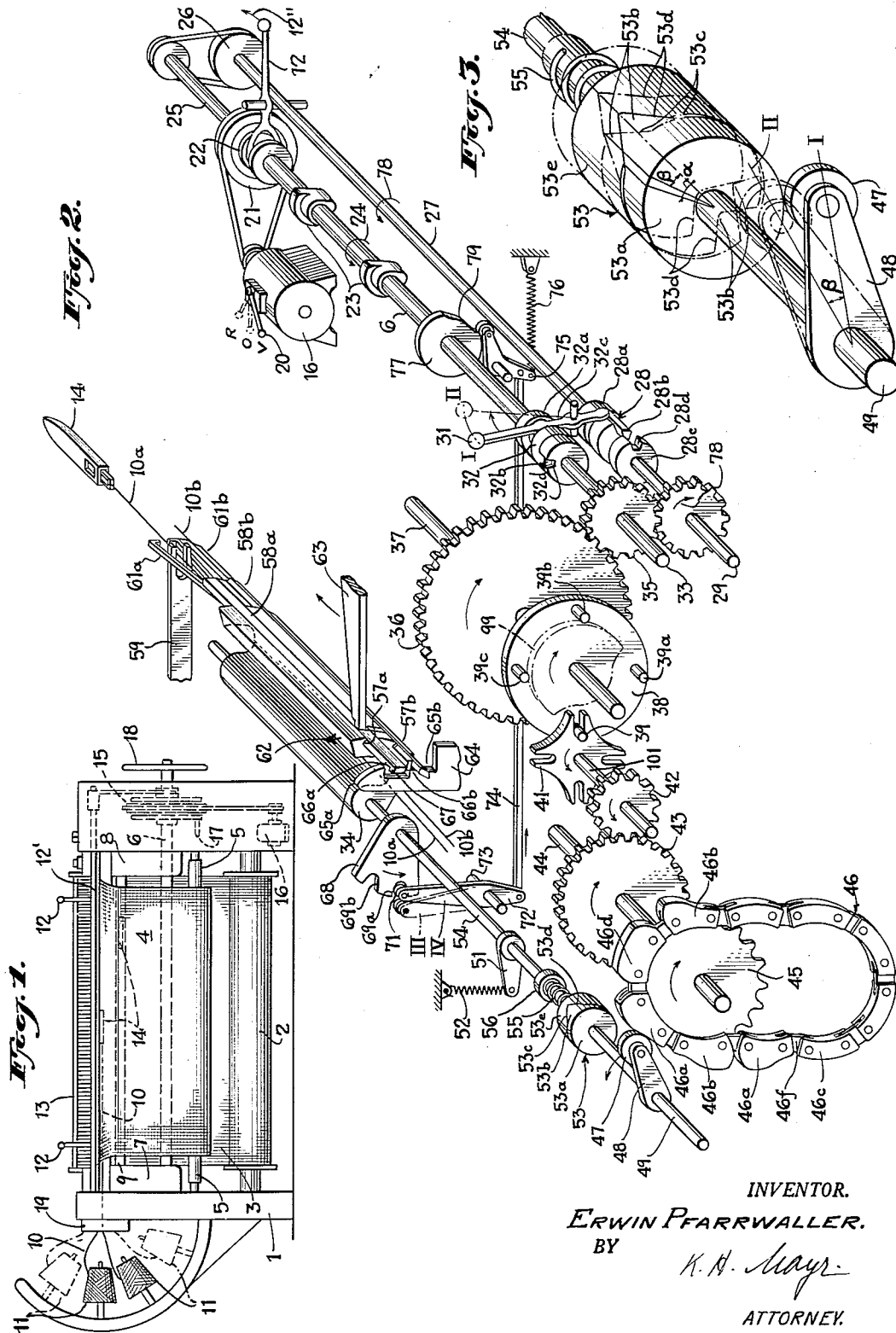
E. PFARRWALLER

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WEFT THREAD FEED DEVICE FOR LOOMS FOR WEAVING

Filed July 16, 1954

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 4

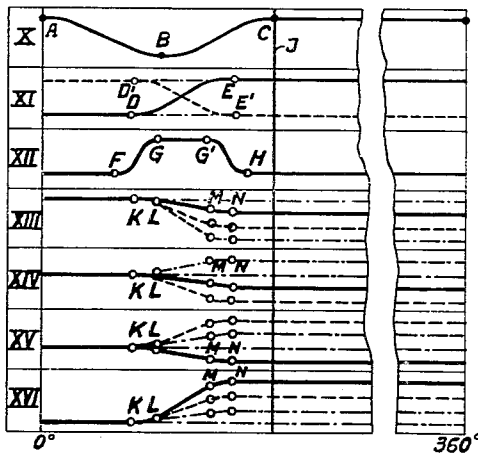


Fig. 5

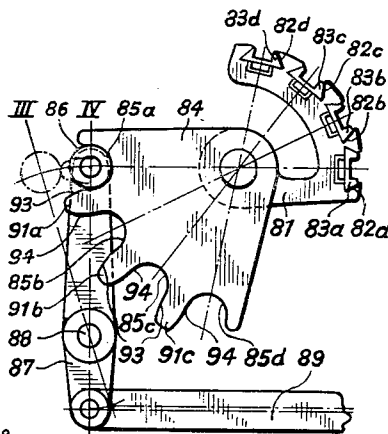


Fig. 7

	A	B	C
a	⊙		xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
b	⊙		xxoxoxoxoxoxoxoxoxoxoxoxoxoxoxox
c	⊙		xxoxoxoxoxoxoxoxoxoxoxoxoxoxoxox
d	⊙		xoxoxoxoxoxoxoxoxoxoxoxoxoxoxox
e	⊙		xoooxoooxoooxoooxoooxoooxoooxooox
f	⊙	⊙	xoooxoooxoooxoooxoooxoooxoooxooox
g	⊙	⊙	xoooxoooxoooxoooxoooxoooxoooxooox
h	⊙	⊙	xoooxoooxoooxoooxoooxoooxoooxooox
i	⊙	⊙	xxoxoxoxoxoxoxoxoxoxoxoxoxoxoxox
k	⊙	⊙	xoooxoooxoooxoooxoooxoooxoooxooox
l	⊙	⊙	xoooxoooxoooxoooxoooxoooxoooxooox
m	⊙	⊙	xoooxoooxoooxoooxoooxoooxoooxooox
n	⊙	⊙	xxoxoxoxoxoxoxoxoxoxoxoxoxoxoxox

Fig. 6

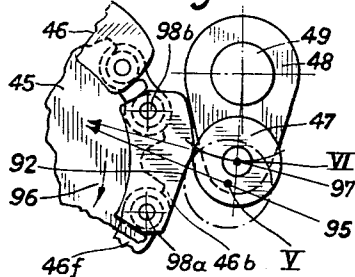
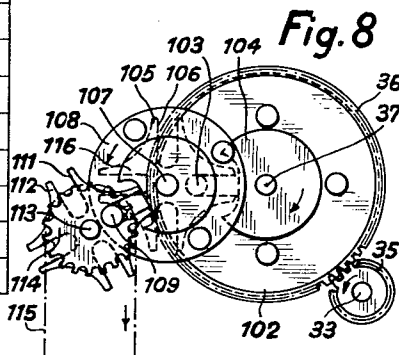


Fig. 8



INVENTOR.

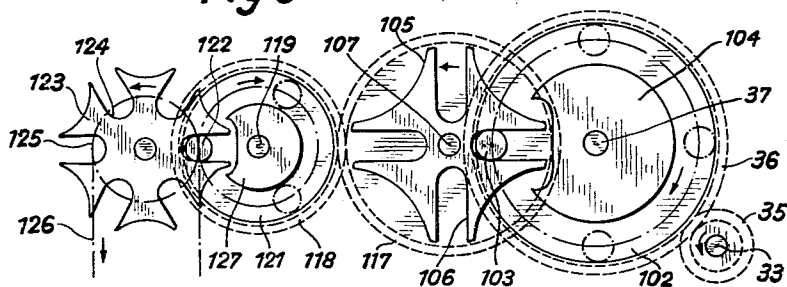
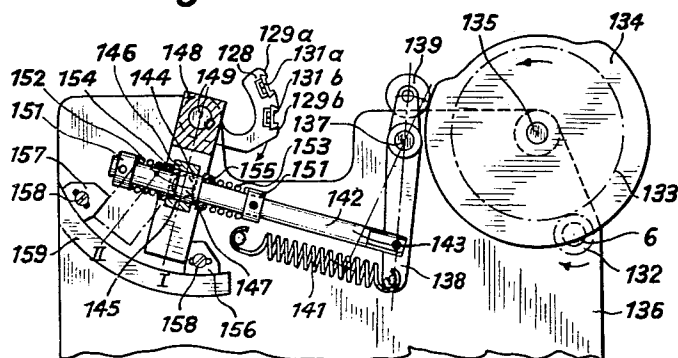
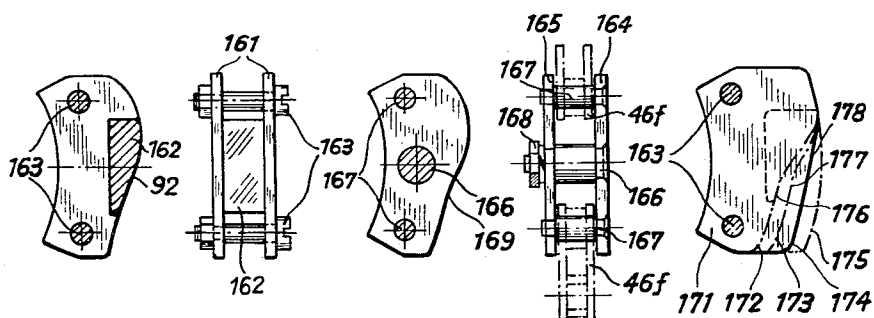
ERWIN PFARRWALLER

BY

K. B. Meyer
ATTORNEY.

2,726,685

3 Sheets-Sheet 3



K.B. May.
ATTORNEY.

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2,726,685

WEFT THREAD FEED DEVICE FOR LOOMS FOR WEAVING

Erwin Pfarrwaller, Winterthur, Switzerland, assignor to
Sulzer Freres, Societe Anonyme, Winterthur, Switzer-
land, a corporation of Switzerland

Application July 16, 1954, Serial No. 443,940

Claims priority, application Switzerland
September 19, 1953

16 Claims. (Cl. 139—126)

The invention relates to a loom for weaving having elements provided with thread clamps for gripping a weft thread to be inserted into the shed.

The present application is a continuation-in-part of my copending application Serial No. 376,780, filed August 27, 1953.

An object of the invention is to provide in a loom for weaving in which the weft threads are individually gripped by clamps forming part of elements which insert the weft threads into the shed, a thread changing device having at least two thread feeders and placing the weft threads in a predetermined sequence into a position in which the thread held by a feeder is transferred to a weft thread inserting element which is in a position ready to be picked, the thread being pulled from a package which is arranged separately from the weft thread inserting element.

The invention resides more particularly in the provision of an actuating mechanism for the thread changing device which includes a rough adjustment for transferring the thread changing device from one position into another position, and a fine adjustment which places the feeders, after they have been brought into thread transfer position, into the exact position relatively to the weft inserting element.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself however and additional objects and advantages thereof will best be understood from the following description of embodiments thereof when read in conjunction with the accompanying drawing in which:

Fig. 1 illustrates the loom for weaving seen from the fabric side;

Fig. 2 is a schematic perspective view of a thread changing mechanism having two thread feeders and a rough and fine adjustment according to the invention;

Fig. 3 is a large scale diagrammatic perspective view of a clutch forming part of the mechanism shown in Fig. 2;

Fig. 4 is a diagram showing the movements of the lay, of the thread changing device, and of the fine adjustment during one picking period;

Fig. 5 is an end view of a modified thread changing mechanism having four thread feeders for feeding four different weft threads;

Fig. 6 shows a detail of the mechanism illustrated in Fig. 2 and the direction of the forces acting therein;

Fig. 7 is a diagram showing the weft thread insertion schedules at different arrangements of the pins actuating the control chain;

Fig. 8 shows a large scale end view of a rough adjustment mechanism forming part of the device shown in Fig. 2;

Fig. 9 is a large scale end view of a modified rough adjustment mechanism;

Fig. 10 is a part sectional end view of a combined

2

rough and fine adjustment mechanism for a thread changing mechanism having two thread feeders;

Figs. 11, 13 and 15 are views of different links of the control chain forming part of the mechanism shown in Fig. 2;

Figs. 12 and 14 are views of the links shown in Figs. 11 and 13, respectively, taken at a right angle to the views shown in Figs. 11 and 13.

The same numerals designate the same parts in all figures.

Referring more particularly to Fig. 1 of the drawing, the motor 16 driving the loom is arranged on the right side of a frame 1. This motor operates all power-driven elements of the loom, such as the warp beam 2 for the warp 3, which is controlled by heddles 13 to form a shed, and the cloth beam 5 for the fabric 4. The main loom shaft 6 which is driven by the motor 16 through a clutch 15 operates a picking mechanism 7 and a shuttle receiving mechanism 8. A weft thread 10 is presented to a shuttle 14 in the picking device 7, the weft thread being pulled from one of four packages 11 which are arranged outside of the shuttle 14, the weft thread being picked by the shuttle 14 through the shed to the receiving mechanism 8. The idle shuttles are returned below the shed from the receiving mechanism 8 to the picking mechanism 7 by means of a shuttle return device 9. A shaft 12' for engaging and disengaging the clutch 15 is actuated by manipulating one of two levers 12. A brake 17 is provided for quickly stopping the main shaft 6 and the loom. If the clutch 15 is disengaged, the shaft 6 can be rotated by means of a hand wheel 18. On the left side of the loom, a device 19 is provided for rough and fine adjustment of an element for changing the weft threads to be presented to a shuttle.

The driving motor 16 in Fig. 2 is electrically connected for forward drive by means of a switch lever 20 and drives the main shaft 6 in the direction of arrow 24 for normal weaving operation by means of a belt and a belt wheel 21 which is engaged by a cone-shaped clutch disc 22. The shaft 6 carries two cams 23 for actuating the lay, not shown. The cone disc 22 is axially moved on the shaft 6 by means of a lever 12. The disc is disengaged from the wheel 21 upon movement of the lever 12 in the direction of the arrow 12'.

A shaft 25 is rigidly connected with the belt wheel 21 and rotates an auxiliary shaft 27 at relatively slow speed by means of a belt drive 26, both when the shaft 6 is or is not rotated.

A clutch 28 is provided at the left end of the auxiliary shaft 27, the clutch 28 having a sleeve 28a provided with an axial tooth 28b. A clutch sleeve 28c having a recess 28d is mounted on a shaft 29. The sleeve 28a can be axially moved on the shaft 27 by means of a lever 31, so that the tooth 28b is inserted into the recess 28d. Since there is only one tooth 28b on the sleeve 28a and since the sleeve 28c has only one recess or notch 28d, the relative angular position of the shafts 29 and 27 is always the same when the clutch 28 is engaged.

The lever 31 actuates also a clutch 32 by axially moving a sleeve 32a having an axial tooth 32b on the shaft 6 and inserting the tooth 32b into a corresponding gap 32d in a sleeve 32c. If the lever 31 is in position I, the clutch 32 is engaged and the clutch 28 is disengaged; if the lever 31 is in position II, the clutch 28 is engaged and the clutch 32 is disengaged. A shaft 33 which is rigidly connected with the sleeve 32c is always in the same angular position relatively to the shaft 6 when the clutch 32 is engaged because of the provision of only one tooth 32b.

The rough adjustment for the thread changing ele-

ment 34 comprises the shaft 33 supporting a pinion 35 which drives a tooth wheel 36 on a shaft 37. The wheel 36 has four times as many teeth as the pinion 35, so that a pin disc 38 on the shaft 37 makes only a quarter of a revolution at each full turn of the shaft 33. Up to four pins 39 may be plugged into the disc 38 for actuating a Geneva movement 41. The latter is connected by means of a shaft 101 with a pinion 42 which engages a tooth wheel 43 on a shaft 44, the latter carrying a sprocket wheel 45 for a control chain 46.

The chain 46 is composed of differently shaped links 46a to 46d which are interconnected by means of links 46f. The gear ratio of the wheels 42, 43 is such that at each revolution of the main shaft 6 and of the shaft 33 the control chain 46 is advanced by one link, i. e. by the distance between the centers of two neighboring links 46f.

A roller 47 on an arm 48 extending from a shaft 49 is in engagement with the link 46a in the position of the mechanism shown in Fig. 2, engagement pressure being produced by a spring 52 having one end connected with a stationary part of the loom and the other end connected with an arm 51 on the shaft 49. The roller lever 48 is shown in Fig. 2 in a position prior to the end of the movement of the lever from its highest to its lowest position. The movement of the arm or lever 48 is transmitted to the thread changing element 34 through a yielding clutch 53 and a shaft 54.

A sleeve 53a of the clutch 53 is mounted on the shaft 49 and is provided with two claws 53b which are 180° apart and provided with inclined flanks 53c (Fig. 3). The claws 53b engage corresponding V-shaped notches or gaps 53d in a clutch sleeve 53e which is axially movable on the shaft 54 and which is pressed against the sleeve 53a by means of a spring 55 resting against a shoulder 56 on the shaft 54. In this way the shaft 49 is yieldingly connected with the shaft 54.

The thread changing element 34 is keyed to the shaft 54 and is provided with two guide grooves 57a and 57b in which the thread feeders 58a and 58b, respectively, are longitudinally movable. In the illustrated position of the element 34, the feeder 58a is in the direction of the pick. A clamp opener 59 has opened a thread clamp 61a of the feeder 58a, the shuttle 14 pulling the thread 10a through the shed which thread has been fed to the shuttle by the feeder 58a. A thread 10b is held ready for transfer to a shuttle by a clamp 61b of a feeder 58b, the transfer being effected after the element 34 has been moved in the direction of the arrow 62.

A lever 63 longitudinally moves the feeder 58a or 58b, whichever is in the picking line, to the right to the edge of the fabric for gripping the thread 10a or 10b, after completion of the pick, in the neighborhood of a conventional thread cutter, not shown, and for returning the end of the thread to the transfer position. The actuation of the thread feeders by a lever 63 is shown in my copending application Serial No. 376,780.

A locking shield 64 which is mounted on the loom frame has a nose 65b inserted in a slot 66b of the thread feeder 58b, holding the latter in the idle position. The feeder 58a which is in the picking line is slidable in a recess 67 of the shield 64. When the feeder 58a is in the position above the picking line, it is held against longitudinal movement by the nose 65a which is inserted in a recess 66a of the feeder 58a.

The fine adjustment mechanism includes an adjustment plate 68 which is mounted on the shaft 54 and has two notches 69a and 69b adapted to receive a roller 71 mounted at one end of a lever 72 which swings on a shaft 73 which is supported by the loom frame. The lever 72 is connected with one end of a lever 75 by means of a rod 74, the other end of the lever 75 carrying a cam follower roller engaging a cam 77 mounted on the main loom shaft 6. Engagement of the roller with the cam 77 is ensured by a spring 76.

The device operates as follows:

If the lever 31 is in the position I, the shaft 6 drives the shaft 33 and places the thread changing element 34 in a predetermined angular position during one revolution of the main shaft 6. The thread clamp 61a or 61b of the thread feeder 58a or 58b which is in the line of the pick must be in an exact position relatively to the thread clamp of a shuttle 14 which has been placed in picking position, for example, by a conventional shuttle lifter, to ensure faultless transfer of the weft thread from the feeder 58a or 58b to the shuttle 14. For this purpose a fine adjustment mechanism 68 to 77 is provided in addition to the rough adjustment mechanism 33 to 56. The control links 46a and 46d merely move the thread changing element from one position to another. Wear and elasticity of the linkage between the control chain 46 and the element 34 may cause a considerable deviation of the position of the thread feeders from the correct thread transfer position. Since the adjusting plate 68 is placed as closely as possible to the element 34 and the notches 69a and 69b are made with greater accuracy and the position of the plate 68 is accurately defined by the lever 72 swinging on a stationary pivot and by the roller 72, inaccuracies of the rough adjustment are compensated.

After or nearly after the position of the element 34 has been changed, the cam 77 effects a clockwise rotation of the lever 75 so that the lever 72 is moved from the free position III into the illustrated position IV until the roller 71 is fully inserted in the notch 69a or 69b, not only adjusting the position of the plate 68 but also locking it against movement.

When correcting weaving errors caused by a broken weft thread or by an unscheduled weft insertion, so many recently inserted weft threads must be pulled out of the fabric until the faulty weft thread is reached. The fabric, the shed control mechanism and, if necessary, the warp beam are reversed pick by pick for removing the individual weft threads. In order to obtain the scheduled sequence of the weft threads when weaving is resumed, the shaft 33 must be reversed by as many revolutions as weft threads must be removed. For this purpose, the lever 31 is moved to position II. The main shaft 6 has been stopped by actuation of the lever 12 and disengagement of the clutch 22. Upon connection of the auxiliary shaft 27 with the shaft 29 by means of the clutch 28, the shaft 29 is rotated in the direction of the arrow 78. The pinion 35 revolves clockwise and the tooth wheel 36 revolves in a direction opposite to that of the arrow shown thereon. Therefore, rotation of the pin disc 38, the Geneva movement 41, the tooth wheels 42 and 43, and the sprocket wheel 45 is reversed, i. e. these parts rotate oppositely to the arrow shown on these parts. Since the main shaft 6 stands still, the thread changing element 34 is arrested by the plate 68 which is locked by the lever 72 in all positions in which a movement is not desired, i. e. in which the thread feeders 58a and 58b are not at least close to the thread changing position or in which movement of the element 34 is undesirable for other reasons. The element 34 is locked at least from the moment of the thread transfer from the feeder 58a or 58b to a shuttle 14 to the moment in which a weft thread 10a or 10b is seized again by the feeder 58a or 58b; it is never locked longer than to the moment when a thread feeder has returned to the thread changing position.

If the lever 48 is moved upon movement of the control chain 46, the yielding clutch 53 is actuated (Fig. 3). If rotation of the shaft 54 is prevented and shaft 49 is rotated, the sleeve 53a is rotated relatively to the sleeve 53e, the latter being pushed to the right in Figs. 2 and 3. The V-notch 53d is so shaped that the flank 53c of the claw 53b engages a side wall of the notch 53d during rotation of the sleeve 53a through an angle α which is greater than the angle β between the extreme positions I and II of the lever 48 which controls the thread changing element 34 (Fig. 2).

5

After removal of the faulty weft thread and after reverse operation of the control chain 46, normal operation of the loom can be resumed, the lever 31 having been returned to position I and the main shaft 6 having been connected with the loom drive by manipulation of the lever 12. If the yielding clutch 53 was actuated by the reverse movement of the control chain 46, the position in which the element 34 was held by the lever 72 did not correspond to the position of the lever 48 which is determined by the control chain 46. The spring 55 presses the sleeve 53e against the sleeve 53a of the yielding clutch 53 at the moment in which the roller of lever 75 runs into the recess 79 of the cam 77 and in which the roller 71 is pulled out of the recess 69a. Thereby the flank 53c of the claw 53b slides along the wall of the V-notch 53d and the shaft 54 and consequently the element 34 is moved to a position corresponding to that of the lever 48. The motor 16 is reversed by moving the switch lever 20 to position R whereupon the auxiliary shaft 27 is rotated against the arrow 78 and the rough adjustment, i. e. the control chain 46, is actuated to move forward upon engagement of the clutch 28. If the main shaft 6 is connected with the motor 16 by means of clutch 21, 22, the switch lever 20 should not be placed in the reversing position R.

The diagram Fig. 4 indicates the movements during the available angles of rotation while the main shaft 6 rotates through 360°. The position 0° of the main shaft 6 corresponds to the beginning of the movement of the lay, which is represented by the line X, towards the apex of the shed. Beating up of the weft thread occurs at the moment designated by the letter B. The lay is returned to its initial position during the period between the moments designated by the letters B and C. The lay remains in its initial position until the main shaft has completed one revolution, i. e. has rotated through 360°, when the lay is in position for making the next following beat.

The movements of the thread changing element 34 (Fig. 2) are indicated by the line XI. The element 34 is in its lowest position at 0°. The guide groove 57a, the thread feeder 58a and the thread 10a are in the picking line. The element 34 remains in this position until the moment marked by the letter D. Thereupon the thread changing movement begins and continues in upward direction until the moment designated by the letter E whereby the groove 57b, the thread feeder 58b, and the thread 10b are moved into the picking line. After the transfer of the thread 10b to the gripper shuttle 14, the shuttle is picked at the moment designated by the line J, for inserting the thread 10b into the shed. The thread changing element 34 remains in the upper portion from the moment E until the shaft 6 has completed its revolution. The opposite thread changing movement occurs along the dotted line D'—E'; the element 34 remains in the lower position D—E' or in the upper position D'—E, if the thread is not changed.

The lever 72 moves according to the line XII. The roller 71 engages one of the recesses 69a or 69b of the plate 68 from the main shaft position 0° to the moment F whereby the element 34 is locked (Fig. 2). From the moment F the roller 71 moves to the left, releasing the element 34. This movement ends at the moment G. As long as the roller on the lever 75 is in the recess 79 (Fig. 2), the roller 71 is in the releasing position III which is indicated by the line portion G—G'. Between the moments G' and H the roller 71 moves to the right into one of the recesses 69a or 69b of the plate 68 defining the fine adjustment position and locking the element 34. The roller 71 remains in this position (IV) during the completion of the revolution of the shaft 6 and thereafter till the moment F.

For weaving fabrics having more than two different weft threads the thread changing element 81 (Fig. 5) is provided with a plurality of guide grooves 82a to 82d and with a plurality of thread feeders 83a to 83d cor-

6

responding in number to the number of different weft threads. The device illustrated in Fig. 5 is for four different weft threads. A plate 84 is provided with four recesses 85a to 85d for receiving a roller 86 on a lever 87 which swings on a stationary axis 88 and is actuated by a rod 89 and a cam on shaft 6, which cam corresponds to the cam 77 in Fig. 2. The lever 87 and the roller 86 arrest the plate 84 when in the position IV and release the disc 84 for a thread changing movement when in the position III.

The length of the teeth 91a to 91c is such that the teeth just clear the roller 86 in the releasing position III. Rotation of the element 81 and of the disc 84 is effected by a surface portion 92 of a chain link 46 (Fig. 6), and begins already at a moment at which the roller 86 has passed only through a minor portion of the total movement from position III to position IV. The configuration of the flank 93 of the tooth 91a, which is engaged by the roller 86, is made to correspond to the resultant of the two movements (that of the plate 84 and that of the roller 86). The movements are illustrated in Fig. 4, line XII between points F and G, and lines XIII and XIV between the points K and L corresponding to the flanks 93, and line XII between the points G' and H, and lines XIII to XV between the points M and N corresponding to the flanks 94. The plate 84 is thereby accurately guided during the entire thread changing movement, preventing undesirable oscillation of the element 81 when operating the loom at high speed, i. e. with a great number of picks per minute. The line XIII of Fig. 4 indicates the movement of the element 81 upon movement of the plate 84 between the recess 85a and the other recesses. The lines XIV and XV, respectively, indicate the movement of the element 81 between the recesses 85b, 85c, and 85d, and each of the other recesses. The vertical distances between the points K and L and the points M and N are the same in all lines, all flanks 93 and all flanks 94 of the teeth 91a to 91c having the same configuration.

Fig. 6 shows the forces acting on the control links 46 when the roller 47 is on the surface 92. The line of force 95 corresponds to position V of the roller 47 in the middle of the cam portion 92, the control chain moving in the direction of the arrow 96. The line of force 97 shows the condition when the roller 47 is in the position VI at the end of the surface 92. The latter is so formed that the pressure produced by the roller 47 always acts between the link pins 98a and 98b which connect the link 46 with the connecting links 46f and 46g, respectively. Therefore, the link 46 is always pressed against the sprocket wheel 45 by the roller 47 without tilting the member 46.

Instead of four driving pins 39, as shown in Fig. 2, only two or one pin may be inserted in the disc 38. In this way, different control sequences of the control chain 46 in relation to a certain number of revolutions of the main shaft 6 may be produced. If there are less than four pins, a conventional locking disc or cam 99 for locking the Geneva movement 41 must be provided, the configuration of the disc 99 corresponding to the number of pins 39 inserted into the disc 38. Fig. 2 shows a locking disc 99 which is suitable, if the pins 39b and 39c are omitted. The disc 99 engages the arcuate recesses 101 of the Geneva movement 41 upon termination of the movements effected by the pins 39 and 39a.

Fig. 7 illustrates a few control sequences. Column A shows the pin disc 38 and the pins 39 inserted therein. The resulting control sequences are shown in column C. X indicates that at one revolution of the main shaft 6, the control chain 46 is advanced by one link; O indicates that the control chain 46 is not advanced during one revolution of the main shaft 6. Whereas in the line a weft thread change occurs at every revolution of the shaft 6, in the lines b to e weft thread changes are omitted at certain revolutions of the shaft 6.

In order to increase the number of different control se-

quences, the rough adjustment mechanism may include two Geneva movements arranged in series, as shown in Fig. 8. The shaft 33 and the pinion 35 drive the tooth wheel 36. On the shaft 37 of the latter a pin supporting disc 102 is mounted carrying driving pins 103; also mounted on the shaft 37 is a locking disc 104. The pins 103 are adapted to individually engage slots 106 of a Geneva movement 105 which is mounted on a shaft 107, the latter also carrying a pin-supporting wheel 108. A pin 109 inserted into the pin wheel 108 engages slots 111 of a Geneva movement 112 on a shaft 113 on which also a sprocket wheel 114 for a control chain 115 is mounted. Shaft 107 carries a locking disc or cam 116 for the Geneva movement 112 in case less than four pins 109 are inserted into the pin wheel 108.

If four pins 103 or 109 are inserted into one of the pin wheels 102 or 108, and one pin is inserted into the other pin wheel, the control sequences shown in line *e* of Fig. 7 are produced. If two pins are provided in the other pin wheel, the sequences shown in lines *d* and *c* are produced. If three or four pins are inserted into the other pin wheel, the sequences shown in lines *b* and *a* are effected. If less than four pins are inserted into the discs or wheels 102 and 108, the control sequences *f* to *i* are effected. Column A shows the disc 102 and column B the disc 108 with the pins inserted to produce the desired control sequences. Since the control path of the Geneva movement 112 corresponds to one-fourth of a revolution of the shaft 113 and of the sprocket wheel 114 advancing the control chain 115 a distance equal to the distance between the centers of two consecutive connecting links, the control chain 115 is advanced only after sixteen revolutions of the shaft 33 and of the main shaft 6, as shown by line *f* in Fig. 7, if only one pin is inserted in each of the wheels 102 and 108.

Fig. 9 illustrates a Geneva movement 102, 105, as in Fig. 8, which is driven by the main shaft 6 and the shaft 33 through a tooth wheel transmission 35, 36. A toothed wheel 117 is mounted on the shaft 107 of the Geneva movement 105, the tooth wheel 107 engaging a toothed wheel 118 mounted on a shaft 119 which also carries a pin wheel 121. Not more than three pins 122 may be inserted into the pin wheel 121 for actuating a Geneva movement 123 which is provided with six slots. A sprocket wheel 125 carrying a control chain 126 is mounted on the shaft of the Geneva movement 123.

The gear ratio of the wheels 117, 118 effects rotation of the shaft 119 through an angle of 120° upon one-fourth of a revolution of the shaft 107, whereby the Geneva movement 123 is advanced by 60°. The locking discs or cams 104 and 127 mounted on the shafts 37 and 119 are designed according to the number of the inserted driving pins.

The lines *k*, *l*, *m*, and *n* in Fig. 7 illustrate the control sequences corresponding to the number of inserted driving pins. Column A shows the pin wheel 102, column B shows the pin wheel 121, and column C illustrates the control sequences effected at the illustrated pin wheel positions. If only one pin is inserted into the discs 102 and 121, each twelfth revolution of the shaft 6 advances the control chain 126 by the length of one link, as shown in row *k*.

The rough adjustment and the fine adjustment mechanisms may be combined as shown in Fig. 10. The thread changing element 128 is provided with two grooves 129*a* and 129*b* for two thread feeders 131*a* and 131*b*. A pinion 132 mounted on the main shaft 6 drives a tooth wheel 133 which is mounted on the shaft 135 which also carries a cam 134. The shafts 6 and 135 and a pin 137 forming the fulcrum for a lever 138 are supported by a frame 136. The lever 138 carries a roller 139 which is pressed against a cam 134 by a spring 141.

A rod 142 is pivoted by a pin 143 to the lever 138. The rod 142 is provided with a collar 144 which is guided

in a bore 145 of a transverse member 146. The latter is provided with two pins 147 which are revolvably supported in a fork 148 which is keyed to a shaft 149, the latter carrying also the thread changing element 128. Fixing rings 151 are provided on the rod 142 on either side of the collar 144, the rings 151 forming abutments for one end of the springs 152 and 153. The other ends of the springs rest against collars 154 and 155. Two abutments 156 and 157 are adjustably mounted on the frame 136 and can be fixed thereto by screws 158.

The stroke of the cam 134 and the leverage of the lever 138 are so that the rod 142 travels farther for moving the fork 148 than the stroke of the transverse member 146 which is limited by the abutments 156 and 157 for the fork 148.

The rough adjustment mechanism includes the cam 134, the lever 138, and the rod 142, the fine adjustment mechanism being formed by the spring arrangement 144 and 151 to 155, and the abutments 156, 157. The collars 144, 154, and 155 define a middle position of the rod 142 in the transverse member 146, the collars 154 and 155 resting on the collar 144 as well as on the transverse member 146 as long as the fork 148 does not abut against the abutments 156 and 157. The bore of the collars 154 and 155 is smaller than the outside diameter of the collar 144, the outside diameter of the collars 154 and 155 being greater than the bore 145 of the transverse member 146. If, upon changing the position of the thread changing element 128, the fork 148 is pressed against the abutment 156 in position I, the collar 154 comes to rest on the transverse member 146, and the collar 144 moves to the right out of the bore 145 so that the collar 155 rests against the collar 144. Therefore, the transverse member 146 and the fork 148 are firmly pushed by the spring 152 against the abutment 156. The adjustable abutment 156 affords exact placement of the thread feeder 131*b* in the normal line of shuttle movement, the tension of spring 152 holding the thread changing element 128 in the respective position. In position II, in which the thread feeder 131*a* is in the normal line of shuttle movement, the spring 153 is effective, the collar 154 resting against the collar 144 which moves to the left out of the bore 145. An arcuate guide member 159 mounted on the frame 136 facilitates adjustment of the position of the abutments 156, 157 by holding same in the correct position relatively to the fork 148.

The links 46 of the control chains 115 and 126 may be made of one piece, Figs. 11 and 12, the side plates 161 being formed by cutting a cavity into the piece and leaving a web portion 162. Bolts 163 inserted in the side plates 161 serve for connecting the links with the intermediate links 46*f* (Fig. 2). The web 162 of the links which effect a control motion is provided with an appropriate surface 92 which is distal of the sprocket wheel for the control chain.

Figs. 13 and 14 illustrate a modified construction of a control chain link having side plates 164 and 165 which may be stamped out of sheet metal and which are disconnectably interconnected by means of bolts 166. The right end of the bolt 166 as well as the right end of pins 167, which serve for interconnecting the chain links with connecting links 46*f*, are riveted or welded to the right side plate 164. The left plate 165 is provided with bores for the bolt 166 and the pins 167, and is clamped to the bolt and pins by means of a nut 168. The connecting links 46*f* can be fastened to the pins 167 after removal of the nut 168 and of the left plate 165. The outer edge 169 of the side plates 164 and 165 is formed as a cam surface in those links which must effect a web thread change, and as an arc in those links which must not actuate the thread changing element.

Whereas the control links 46 (Fig. 2) can produce only two different positions of the thread changing element, the control links, for example, of the type shown in Fig. 15 serve for alternately placing the four thread feeders

in the thread changing element 81 (Fig. 5) in the normal line of movement of the shuttle. The control link 171 actuates a lever, such as the lever 48 in Fig. 2, the cam surface 172 placing the feeder 83a in the normal line of shuttle movement, and the cam surfaces 173 to 175 placing the feeders 83b to 83d, respectively, in the normal line of shuttle movement. There is, of course, a different control link for each of the cam surfaces 172 to 175, these surfaces all being shown in Fig. 15, to avoid showing four cams in four different figures. The intermediate cam portions 176, 177, and 178 guide the cam follower roller from one cam portion to another.

Fig. 15 illustrates cams in which the cam portions 172, 173, 174 run into a convex cam portion of the shape designated by numeral 175. The links may be modified to have cams in which the cam portions 172, 173, 175 run into cam portions of different shapes.

The control link 171 shown in Fig. 15 is made of one piece, like the link 161, 162 shown in Figs. 11 and 12.

While specific embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A weft thread feed device for looms for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, said device comprising a weft thread changing element including at least two weft feeders for individually transferring a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread transfer position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another position, and a fine adjustment mechanism affording exact alignment of the feeder from which a thread is to be transferred to a weft inserting element with said last mentioned element.

2. A weft thread feed device for looms for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, said device comprising a weft thread changing element including at least two weft feeders for individually transferring a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, and for seizing the same weft thread after completion of its insertion into the shed by the thread inserting element, said feeders being adapted to reciprocate in said thread changing element, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread transfer position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another position, and a fine adjustment mechanism affording exact alignment of the feeder from which a thread is to be transferred to a weft inserting element with said last mentioned element, said fine adjustment mechanism including locking means for locking said thread changing element at least from the moment of thread transfer from the thread feeder to the weft inserting element to the moment the same thread is seized by the feeder, and not longer than until the thread feeder which has seized the thread is returned to thread changing position in the thread changing element.

3. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and

supplied from a package outside of said elements, comprising a motor, a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element, a main loom shaft, a clutch disconnectably connecting said motor with said main loom shaft, an auxiliary shaft permanently connected with said motor to be driven thereby, and clutch means for selectively connecting said rough adjustment mechanism either with said main shaft or with said auxiliary shaft.

4. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a motor, a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeder in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element, a main loom shaft, and a clutch disconnectably connecting said motor with said main loom shaft, said fine adjustment mechanism being connected with said main loom shaft to be operated thereby.

5. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element; said fine adjustment mechanism including a locking plate connected with said thread changing element to move therewith, said locking plate having a marginal portion provided with recesses, and a locking element adapted to be selectively received in one of said recesses for preventing movement of said plate and of said thread changing element as long as said locking element is received in one of said recesses.

6. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a motor, a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position

11

to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element, a main loom shaft, a clutch disconnectably connecting said motor with said main loom shaft, and an auxiliary shaft permanently connected with said motor to be driven thereby, said rough adjustment mechanism being normally connected with and driven by said auxiliary shaft, and said fine adjustment mechanism being connected with and driven by said main loom shaft, the movements of said fine adjustment mechanism partly overlapping those of said rough adjustment mechanism.

7. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element; said fine adjustment mechanism including a locking plate connected with said thread changing element to move therewith, said locking plate having a marginal portion provided with recesses and teeth therebetween, and a locking element adapted to be selectively received in one of said recesses for preventing movement of said plate and of said thread changing element as long as said locking element is received in one of said recesses, said teeth having flanks engaged by said locking element for exactly guiding said locking plate and said thread changing element during the start and the conclusion of each of their movements.

8. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element; said rough adjustment mechanism including a sprocket wheel, a chain moved by said wheel and having links formed as cams, and a cam follower element adapted to be engaged and actuated by said cams for actuating said rough adjustment mechanism.

9. A loom for weaving according to claim 8, said links being pivoted to and interconnected by connecting links, all imaginary lines which are perpendicular to the cam surface of a link extending between the pivot points of said link.

10. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said

12

thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element; said rough adjustment mechanism including intermittently acting drive means for intermittently driving said rough adjustment mechanism.

11. A loom for weaving according to claim 10, said intermittently acting drive means being in the form of a Geneva movement.

12. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element; said rough adjustment mechanism including a cam and cam follower device and a yielding clutch interposed between said device and said thread changing element.

13. A loom for weaving of the type having weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and supplied from a package outside of said elements, comprising a weft thread changing element including at least two weft feeders for individually presenting a weft thread to the clamp of a weft thread inserting element which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to place said feeders in a predetermined sequence into thread presenting position; said actuating mechanism including a rough adjustment mechanism for moving said thread changing element from one position to another, a fine adjustment mechanism affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element; said rough adjustment mechanism including cam means, a lever having a free end carrying a cam follower roller engaged by said cam means, a shaft connected to and adapted to be rotated by said lever, a shaft connected to and actuating said thread changing element, a yielding clutch interposed between said shafts, said clutch having a part rigidly connected with one of said shafts and a part axially movably connected with the other of said shafts, a spring for urging said clutch parts against each other, one of said parts having a wedge shaped claw, the other of said parts having a recess conforming with and adapted to receive said claw, said claw engaging said recess during a relative angular movement of said two parts which is greater than the maximum angular movement of said lever.

14. A loom for weaving comprising weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and individually supplied from packages outside of said elements, an oscillatory weft changing element including at least two weft thread feeders for individually presenting a weft thread to the clamp of one of said weft thread inserting elements which is in a position ready to be inserted into the shed, an actuating mechanism for oscillating said thread changing element to individually move said feeders in a predetermined sequence from an idle

13

position into thread presenting position and therefrom into an idle position, said actuating mechanism including a rough adjustment mechanism for oscillating said thread changing element substantially between the idle positions and the weft inserting positions of said feeders, fine adjustment means affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element, the oscillations produced by said rough adjustment mechanism extending through a greater angle than needed for moving a feeder between the idle position and the weft presenting position, and said fine adjustment means including adjustable abutments for limiting the extent of the oscillations of said thread changing element.

15. A loom for weaving comprising weft thread inserting elements individually provided with a clamp for gripping the weft thread to be inserted into the shed and individually supplied from packages outside of said elements, a movable weft changing element including at least two weft thread feeders for individually presenting a weft thread to the clamp of one of said weft thread inserting elements which is in a position ready to be inserted into the shed, an actuating mechanism for moving said thread changing element to individually move said feeders in a predetermined sequence from an idle position into thread presenting position and therefrom into an idle

14

position, said actuating mechanism including a rough adjustment mechanism for moving said thread changing element substantially between the idle positions and the weft inserting positions of said feeders, fine adjustment means affording accurate alignment of the feeder presenting a weft thread to a weft inserting element with said last mentioned element, the movements produced by said rough adjustment mechanism extending through a greater range than needed for moving a feeder between the idle position and the weft presenting position, and said fine adjustment means including adjustable abutments for limiting the extent of the movements of said thread changing element.

16. A loom for weaving according to claim 15, said rough adjustment mechanism including a cam and cam follower mechanism, means interconnecting said last mentioned mechanism with said thread changing element, and yielding means interposed in said last mentioned means for affording excessive movements of said cam and cam follower mechanism when said thread changing element has been stopped by said abutments.

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