

April 8, 1930.

J. THEXTON, JR., ET AL

1,753,840

LOOM

Filed Feb. 1, 1928

3 Sheets-Sheet 1

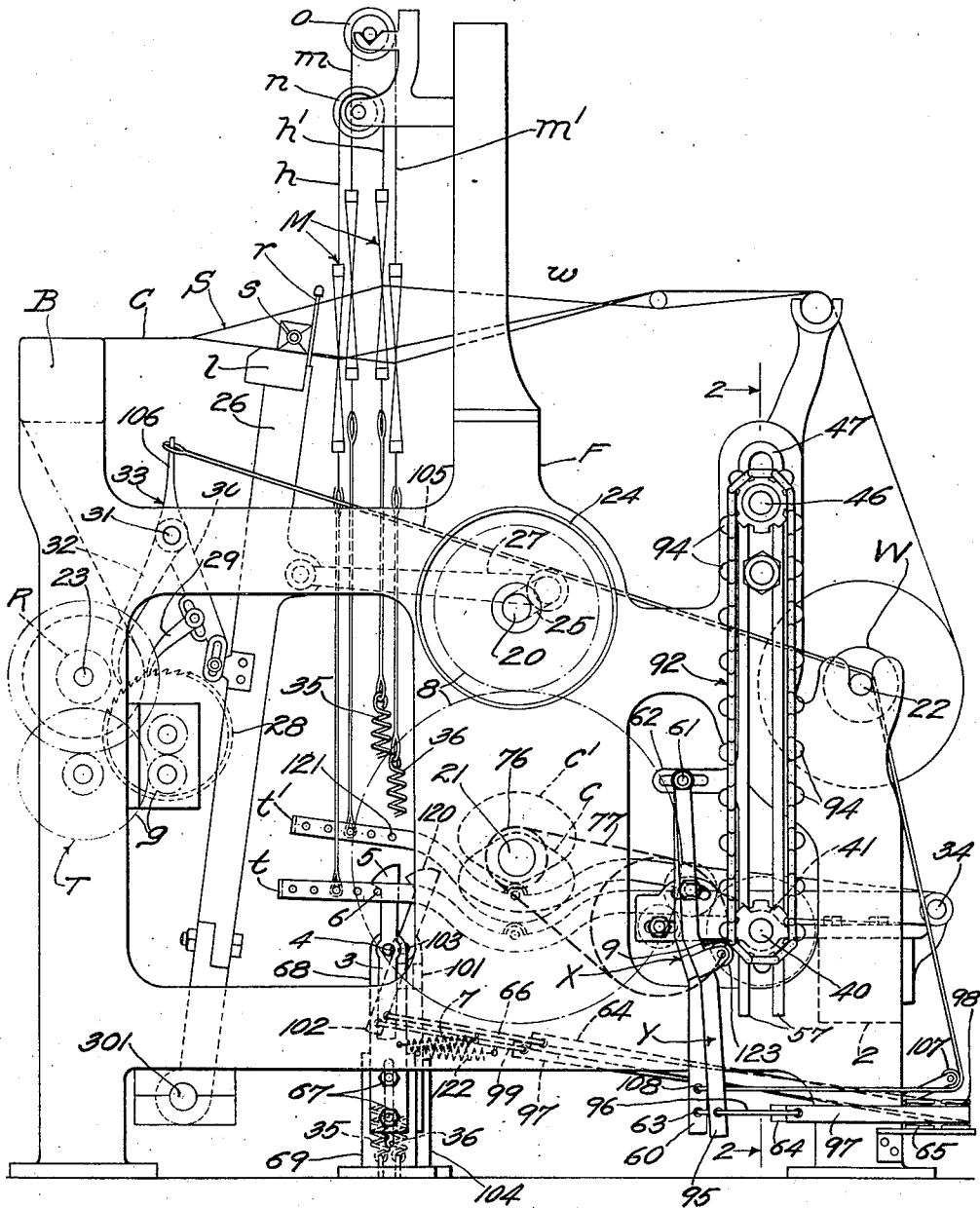


Fig. 1.

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3 Sheets-Sheet 2

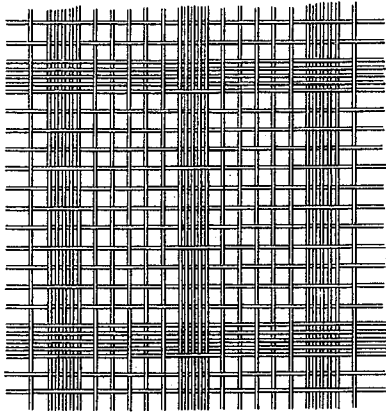


Fig. 5.

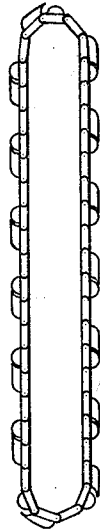


Fig. 6.

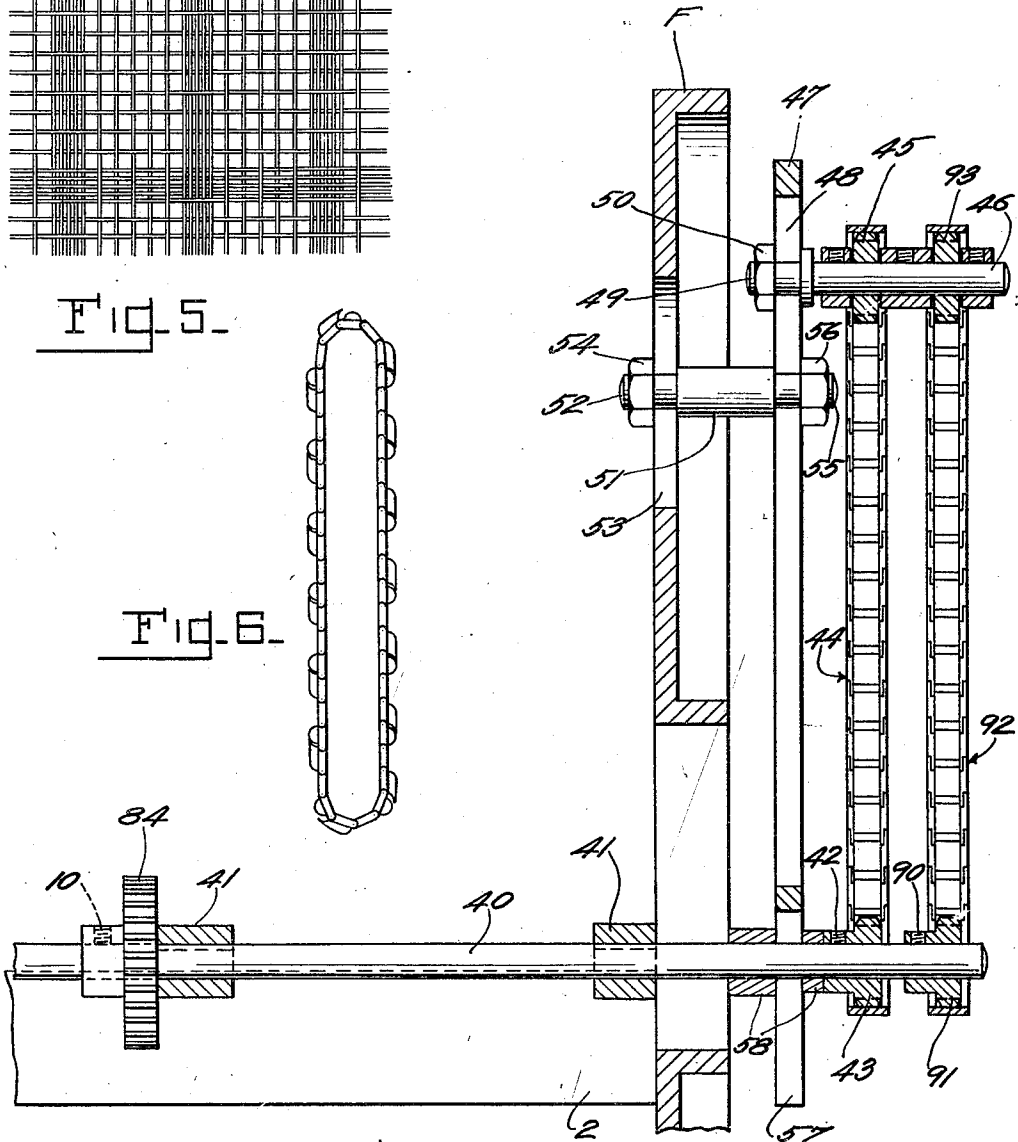


Fig. 2.

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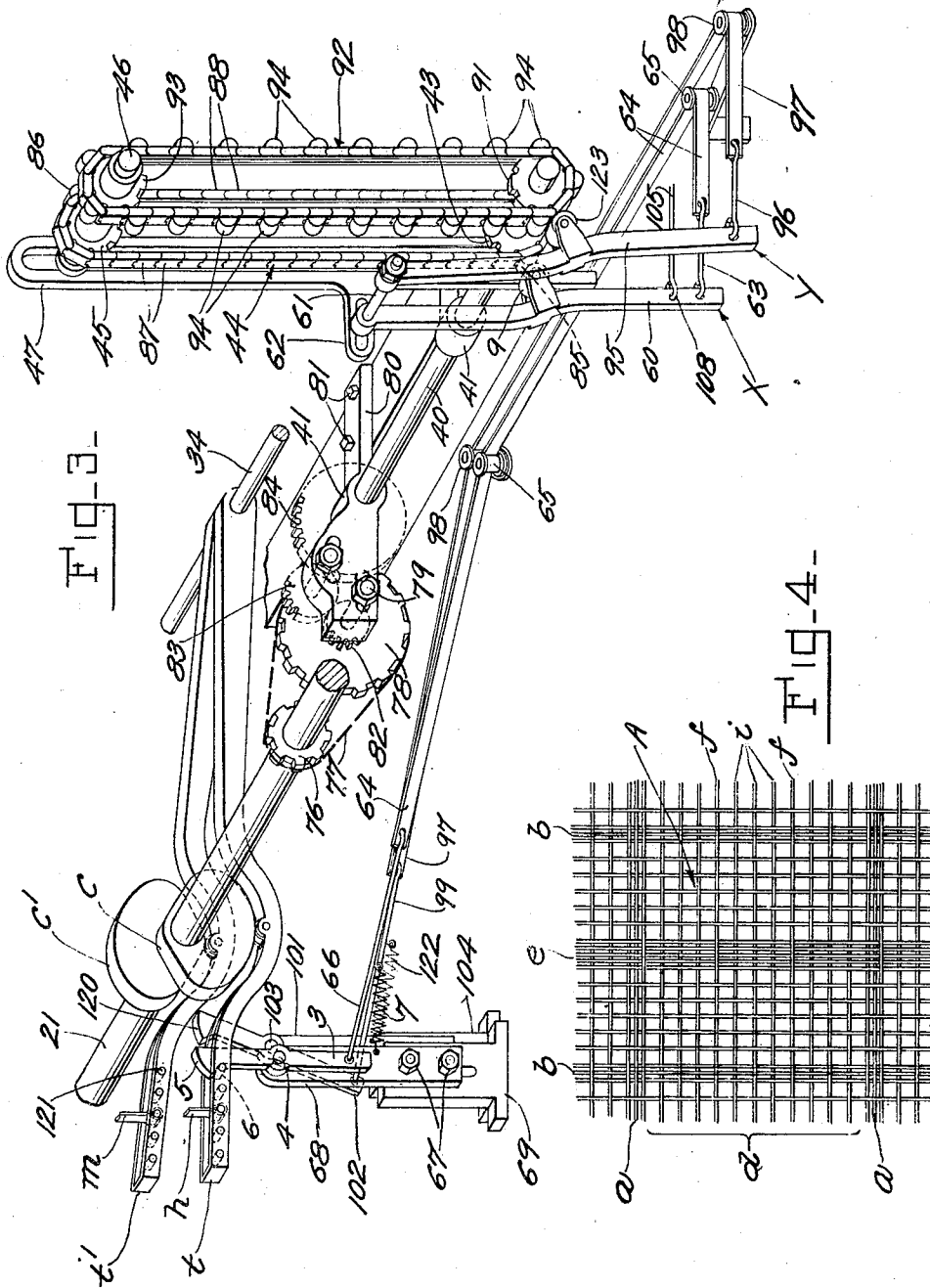
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LOOM

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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LOOM

Application filed February 1, 1928. Serial No. 251,153.

The invention relates to looms and particularly to mechanism to be attached to a plain loom for controlling the pattern as it is woven into the cloth to form checks and so-called "broken stripes".

Pattern controlling mechanisms now commonly employed for such a purpose are complicated devices requiring considerable time in setting up and making ready for the weavers. Furthermore they require considerable power to operate and their speed is limited with a consequent limited output. They also require considerable attention thus limiting the loom fixer and weaver as to the number they can take care of, with a consequent high cost in overhead expense.

The invention has for its general object to provide pattern controlling mechanism of relatively simple and inexpensive construction to be attached to a plain loom so that pattern cloth of the above description can be woven thereon or the loom used for weaving plain cloth.

The foregoing and other objects of the invention together with means whereby the latter may be carried into effect will be understood from the following description when taken in connection with the accompanying drawings, in which the novel features will be clearly pointed out and defined in the claims hereunto appended.

In the drawings:

Fig. 1 is a side elevation of a loom having attached thereto pattern controlling mechanism embodying the invention, the parts of which are shown in operative position.

Fig. 2 is an enlarged sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a view in perspective of the mechanism shown in Fig. 2 together with other associated parts.

Fig. 4 is a diagram of "broken-stripe and check" weave produced by mechanism embodying the invention.

Fig. 5 is a diagram of similar weave of slightly modified construction.

Fig. 6 is a detail view of the pattern chain employed in producing the weave shown in Fig. 5.

As herein shown the pattern controlling

mechanism embodying the invention is applied to a plain loom employing four harnesses. Referring to Fig. 1 of the drawings, at F is shown one of the side frames of such a loom which is provided with bearings for the crank shaft 20, the cam shaft 21, the shaft 22 of the spool W from which the warp threads *w* are drawn in the process of weaving, and the shaft 23 of the cloth drum R upon which the finished cloth C is wound after passing over the breast beam B. The crank shaft 20 has fixed thereto a pulley 24 by which it is driven from any suitable source of power (not shown). It is provided with cranks 25 which impart an oscillating motion to the lay beam *l* carried by the lay swords 26 to which the cranks are connected by links 27. The lay swords are pivoted at 301 to the frame of the loom. The cam shaft 21 is rotated by the crank shaft to which it is connected by gears 8.

The take-up motion of the loom, shown at T, is of the intermittent type and comprises a train of gears *g* and a ratchet 28 which receives motion from a pawl 29 carried by an arm 30 pivoted at 31 to the frame and actuated by one of the lay swords 26. The ratchet 28 is locked against retrograde movement after each action of the pawl 29 by one arm 32 of a lever 33 pivoted at 31 to the frame, said arm acting as a locking pawl. This motion draws down the cloth after it is woven and winds it upon the drum R.

The shedding motion of the loom is indicated at M and includes two shedding cams, two treadles, four harnesses, two coiled springs and two harness rollers. The shedding cams indicated at *c* and *c'* are mounted fast on the cam shaft 21 and operate the treadle *t* and *t'* respectively which are pivoted at 34 to the frame. The front and back harnesses indicated at *h* and *h'* respectively are connected at their upper ends to the harness roller *n*, while the front and back harnesses indicated at *m* and *m'* respectively are connected at their upper ends to the harness roller *o*. The front harness *h* is connected at its lower end to the treadle *t* and the rear harness *h'* is connected to the floor by a coiled spring 35. The front harness *m*

is connected at its lower end to the treadle t' , and the rear harness m' is connected to the floor by a coiled spring 36. As the front harness h is depressed by the extended portion of its cams c , the rear harness h' is raised, thus storing up energy in the spring 35. At the same time the front harness m is permitted to rise by the action of the cam c' and the rear harness m' is depressed under the influence of the spring 36. When the front harness m is depressed by the extended portion of its cam c' the rear harness m' is raised and at the same time the front harness h is permitted to rise and the rear harness h' is depressed by the pull of the spring 35. In this manner the shed S is formed which permits the passage therethrough of the shuttle s to lay the weft threads or filling. The shuttle s , actuated by the picking motion (not shown), travels on the lay beam l which is actuated by the crank shaft as heretofore described. At r is shown the reed which beats up the last pick of the filling after it has been laid in the shed by the shuttle, the constant repetition of which results in the formation of the cloth.

Referring now to Fig. 4 of the drawings there is shown in diagram a fragmentary view of "broken-stripe and check" cloth made in accordance with the present invention. The checks, one of which is indicated at A , are defined by bars a composed of weft threads or filling and cords b composed of warp threads. Each bar a in the pattern herein shown is made up of three threads or picks and each pair of these bars has plain weave designated d therebetween. The stripes, one of which is indicated at e and in this instance is composed of five threads, are off the warp and intersect the checks intermediate the warp cords b . Each stripe e is overlaid or "broken" by one pick of each of the bars a and also by a single pick f of the plain weave d at regular intervals. As herein shown every fourth pick f of the plain weave overlies the stripe while the three picks designated i between each pair of picks f run underneath the stripe.

It is with the laying of the bars a and the plain weave d of the filling to define the checks and "break" the stripes that the invention is concerned and it is the general object of the present invention to provide pattern controlling mechanism adapted for application to a plain loom and capable of producing the pattern above referred to.

In accordance with the present invention and with particular reference to Figs. 1 to 3 inclusive of the drawings, at 40 is indicated a shaft journaled in bearings 41 secured to a cross member 2 connecting the side frames F of the loom. A portion of this shaft extends outwardly beyond one of the side frames and has secured thereto by a set screw 42 a sprocket 43 which engages a pattern

chain 44. This chain is provided with cams for a purpose to be hereinafter described, and extends upwardly in a plane parallel to the loom frame, and at its upper end runs over a sprocket 45 loosely mounted on a stud 46 which is adjustably secured to a bracket 47 located between said chain and the side frame of the loom. The bracket 47 is provided with an elongated slot 48 for the reception of the threaded end portion 49 of the stud 46, said stud being fixed in adjusted position therein by a nut 50. The bracket is itself adjustably secured to the side frame of the loom by a stud 51 the reduced threaded portion 52 of which is received in an elongated slot 53 in the side frame F to which the inner end of said stud is clamped by a nut 54. The stud 51 is provided at its outer end with a reduced threaded portion 55 which is received in the slot of the bracket to which it is clamped by a nut 56. The bracket terminates at its lower end in a fork indicated at 57 which engages the shaft 40 and is held immovably in place thereon between collars 58.

It will thus be seen that adjustment is provided between the side frame F of the loom and the bracket 47, and furthermore between the bracket 47 and the stud 46 which carries the upper sprocket 45 for the pattern chain 44. In this manner various lengths of pattern chains for a wide variety of patterns may be employed.

The pattern chain 44 comprises a series of links for engagement with the sprockets 43 and 45 and is provided on its periphery with knobs or cams adapted, at certain periods of time during the operation of the loom, to actuate mechanism to engage the treadle t and restrain the harnesses h and h' . These harnesses are connected to all of the warp threads w except those which form the stripes e . As shown in Figs. 1 and 3 this treadle engaging mechanism indicated at X includes an arm 60 having its upper end loosely mounted on a stud 61 adjustably secured to an extension 62 on the bracket 47. The lower end of the arm 60 has attached thereto a wire 63 which is connected to a belt 64 that passes around pulleys 65 and is connected to a wire 66 that is attached to the lower end of a latch 3 pivoted intermediate its ends at 4 to a post 68. The post 68 is adjustably secured by bolts 67 to a slotted standard 69 fixed to the floor directly under the forward end of the treadle t . The upper end of the latch 3 is provided with a hook 5 adapted to engage a pin 6 on the forward end of the treadle t when the treadle engaging mechanism X is actuated. The hooked end of the latch 3 is released to free the treadle t , when the treadle engaging mechanism X is inoperative, by a coiled spring 7 attached at one end to the post 68 and at the other end to the wire 66. The arm 60 is provided, intermediate its pivot point 61 and its connection with the flexible

member that connects it to the latch 3, with a roller 9 which lies in the path of movement of the cams on the pattern chain 44 and normally rests against the plain links thereof due to the force exerted by the spring 7 in retracting the connections 63, 64 and 66.

The cams on the pattern chain 44 actuate the treadle engaging mechanism X above described to restrain the harnesses *h* and *h'* while the bars *a* are being laid to define the checks in the cloth, and as shown for the particular pattern illustrated in Fig. 4 comprise two cams indicated at 85 and 86 (see Fig. 3). Between the cams on each side of the chain are twenty-two plain links indicated at 87 and 88, which permit the treadle engaging mechanism X to release the harnesses under the influence of the spring 7, at which time the plain weave indicated at *d* between the bars *a* is being laid. As shown in Figs. 1 and 3 the cam 85 of the pattern chain 44 is engaging the roller 9 of the arm 60. This action has swung the arm 60 on its pivot to the left as viewed in these figures, causing the arm to exert a pull on the lower end of the latch 3 through the intermediate connections 63, 64 and 66 and force the hooked end 5 of said latch into engagement with the pin 6 on the forward end of the treadle *t*. At this time the harnesses *h* and *h'* are held in a fixed position thus keeping the shed S in the position shown in Fig. 1 while the three picks constituting one of the bars *a* are being laid. The cam 86 of the pattern chain 44 actuates the treadle engaging mechanism X in like manner to restrain the harnesses *h* and *h'* while the next bar *a* of three picks is being laid.

Means for restraining the harnesses *m* and *m'* will now be described. The harness *m'* is connected to all the warp threads forming the stripes *e* while the harness *m* acts as an idler and is not directly connected to any of the warp threads. Fixed to the outer end of the shaft 40 by a set screw 90 is a sprocket 91 which engages a pattern chain 92. This pattern chain extends upwardly in a plane parallel to the loom frame and at its upper end runs over a sprocket 93 loosely mounted on the outer end of the stud 46 previously referred to. It comprises a series of links for engagement with the sprockets 91 and 93 and is provided on its periphery with a series of knobs or cams 94. As shown in Figs. 1 and 3 each cam link alternates with a plain link throughout the length of the chain. These cams are adapted, at certain periods of time during the operation of the loom, to actuate mechanism to engage the treadle *t'* and restrain the harnesses *m* and *m'*. As shown in Figs. 1 and 3 this mechanism indicated at Y is similar to the treadle engaging mechanism X previously described and includes an arm 95 having its upper end loosely mounted on the stud 61 heretofore referred to. The lower end of the arm 95 has attached thereto a wire 96 which is connected to a belt 97 that passes around pulleys 98 and is connected to a wire 99 that is attached to the lower end of a latch 102 pivoted intermediate its ends at 103 to a post 101. The post 101 is adjustably secured similar to the post 68 to a standard 104 fixed to the floor directly under the forward end of the treadle *t'*. The upper end of the latch 102 is provided with a hook 120 adapted to engage a pin 121 on the forward end of the treadle *t'* when the treadle engaging mechanism Y is actuated. The hooked end of the latch 102 is released to free the treadle *t'*, when its treadle engaging mechanism is inoperative, by a coiled spring 122 attached at one end to the post 101 and at the other end to the wire 99. The arm 95 is provided, intermediate its pivot point 61 and its connection with the flexible member that connects it to the latch 102 with a roller 123 which lies in the path of movement of the cams 94 on the pattern chain 92 and normally rests against the plain links thereof due to the force exerted by the spring 122 in retracting the connections 96, 97 and 99.

The pattern chains 44 and 92 are moved to actuate the treadle engaging mechanisms X and Y by means which will now be described. Secured to the cam shaft 21 for rotation therewith is a sprocket 76 which engages a chain 77 which drives a sprocket 78 loosely mounted on a stud 79 projecting from a bracket 80 which is secured to the cross member 2 of the loom frame by bolts 81. Attached to the sprocket 78 for rotation therewith is a pinion 82 which meshes with an idler gear 83 which in turn meshes with a gear 84 secured to the shaft 40 by a set screw 10. It will thus be seen that the shaft 40, upon which are mounted the sprockets 43 and 91 which engage and drive the pattern chains 44 and 92, will be rotated continuously by the sprockets and chain and train of gears above referred to. With this type of drive for the pattern chains it is only necessary to properly time said chains relative to the treadle cams.

As previously stated, the take-up motion, generally indicated at T in Fig. 1, draws down the cloth after it is woven and winds it upon the drum R. This action must take place after the reed *r* beats up each pick of the filling in the plain weave indicated at *d* in Fig. 4, but must be stopped temporarily while the bars *a* are being laid to make the picks thereof more compact in the finished cloth. Means are provided for checking the take-up motion during this operation, and as shown in Fig. 1, said means comprises a flexible connection indicated at 105, which is secured at one end to the arm 106 of the locking pawl lever 33 and extends rearwardly over the shaft 22 of the spool W, thence down-

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wardly over a pulley 107 and forwardly to its connection at 108 with the lower end of the arm 60 previously referred to which forms a part of the treadle engaging mechanism X for the treadle *t*. It will thus be seen that when the treadle engaging mechanism X is actuated to engage the treadle *t* to restrain the harnesses *h* and *h'* while the picks of each of the bars *a* are being laid, the take-up motion will be checked, thus permitting the completed bar to be laid before the cloth is again taken up.

Fig. 5 shows in diagram a fragmentary view of "broken-stripe and check" cloth employing bars and cords comprised of five threads each, which is most common in general practice. In Fig. 6 is shown the pattern chain 92^a which takes the place of the chain 92 in weaving the pattern shown in Fig. 5.

The loom herein described may be used at any time for the weaving of plain cloth by simply disengaging the chain 77 from the sprocket 76 on the cam shaft 21. This change requires but a short space of time and throws the pattern controlling mechanism out of operation thus permitting the loom to be used in weaving plain cloth. For weaving check cloth such for example as "dimity" or "broken stripe" such as shirting, dress goods and the like it is only necessary to employ one chain corresponding to the chain 92.

The operation of the hereindescribed loom will be apparent from the foregoing description but may be briefly reviewed as follows:

Assuming that the loom is in operation and one of the bars *a* is being laid, the parts will be in the position shown in Figs. 1 and 3, wherein the cam 85 on the pattern chain 44 is actuating the treadle engaging mechanism X to engage the treadle *t* and restrain the harnesses *h* and *h'*. These harnesses being attached to all the warp threads *w* except the ones forming the stripes *e*, hold said warp threads in the fixed position to form the shed S as shown in Fig. 1 for the passage of the shuttle in laying the threads of the bar *a*. During this operation the take-up motion T has been stopped by the action of the arm 60 and flexible connection 105 in disconnecting the locking pawl 32 from the ratchet 28. This permits the bar *a* to be completed before the cloth is again taken up which results in more firmly compacting the picks of said bar in the finished cloth. The first pick of the bar *a* is used to break the stripe while the other two picks pass underneath the stripe due to the action of the cam *c'* in actuating the treadle *t'* to reverse the harnesses *m* and *m'*. At the completion of the bar *a* the pattern chain 44 releases the treadle engaging mechanism X thus freeing the treadle *t* and permitting the harnesses *h* and *h'* to operate under normal action of the cam *c* and the spring 35, to weave the plain cloth between the bars *a* indicated at *d* in Fig. 4. During

this operation the cams on the pattern chain 92 are intermittently actuating the treadle engaging mechanism Y to engage the treadle *t'* to restrain the harnesses *m* and *m'* while the groups of three picks each indicated at *i* in Fig. 4 are being laid under the stripes *e*. The plain links on the pattern chain 92 permit the treadle engaging mechanism Y to free the treadle *t'* and release the harnesses *m* and *m'* while the single picks indicated at *f* in Fig. 4 are laid in a manner to "break" the stripes. At the completion of the plain weave *d* the cam 86 on the pattern chain 44 actuates the treadle engaging mechanism X to again restrain the harnesses *h* and *h'* and stop the take-up motion T while the next bar *a* is being laid. In this manner the checks are defined by the bars *a* and the stripes are "broken" by picks *f* of the filling.

From the foregoing description it will be seen that a plain loom equipped with pattern controlling mechanism embodying the invention is adapted to weave pattern cloth, one construction of which is herein shown, i. e., "broken stripe and check" cloth, or at short notice can be adapted to weave plain cloth.

Furthermore the mechanism hereindescribed is relatively simple and inexpensive, and requires little attention after it is set up and running. It requires considerably less power to operate than mechanisms now in common use for performing similar operations, and permits of a higher speed with a consequent greater output per machine.

The foregoing advantages therefore result particularly in a lower first cost, less power consumed, lower labor costs and increased production.

What we claim is:

1. In combination with a four harness loom including two pairs of harnesses adapted to weave plain cloth, mechanism whereby the loom is adapted to form broken stripes and checks where the warp threads are in part disposed singly and in part in groups to form stripes, said mechanism including means for actuating the two pairs of harnesses in opposite directions to each other, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yieldingly connected, means for restraining one pair of the harnesses at predetermined intervals and for a predetermined number of picks, means for releasing said restraint after the laying of the predetermined number of picks and means for restraining the other pair of harnesses at predetermined intervals alternating with intervals of operativeness of the harness motion.

2. In combination with a four harness loom including two pairs of harnesses adapt-

ed to weave plain cloth, mechanism whereby the loom is adapted to form broken stripes and checks where the warp threads are in part disposed singly and in part in groups to form stripes, said mechanism including means for actuating the two pairs of harnesses in opposite directions to each other, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yieldingly connected, means for restraining one pair of the harnesses at predetermined intervals and for a predetermined number of picks, means for releasing said restraint after the laying of the predetermined number of picks, means for restraining the other pair of harnesses at predetermined intervals alternating with intervals of operativeness of the harness motion, means for releasing said last restraint and means for controlling the restraining operation on the first pair of harnesses to occur during one of the periods of release of restraint on the second harness motion.

3. In combination with a four harness loom including two pairs of harnesses adapted to weave plain cloth, mechanism whereby the loom is adapted to form broken stripes and checks where the warp threads are in part disposed singly and in part in groups to form stripes, said mechanism including means for actuating the two pairs of harnesses in opposite directions to each other, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yieldingly connected, means for restraining one pair of the harnesses at predetermined intervals and for a predetermined number of picks, means for releasing said restraint after the laying of the predetermined number of picks, means for restraining the other pair of harnesses at predetermined intervals alternating with intervals of operativeness of the harness motion, means for releasing said last restraint, means for controlling the restraining operation on said first pair of harnesses to occur during one of the periods of release of restraint on the second harness motion and means for controlling each restraining operation on the first pair of harnesses to occur during the action of the second pair of harnesses in alternately changing the position of the stripes with relation to the upper and lower threads.

4. In combination with a four harness loom including two pairs of harnesses adapted to weave plain cloth, the upper end of each harness of both pairs being connected to a roller, the lower end of one harness of each

pair being connected to a treadle, the lower end of the other harness of each pair being connected to a support, at least one of said last two connections being yielding, mechanism by which the loom is adapted to weave broken stripes and checks where the warp threads are in part disposed singly and in part in groups to form stripes, said mechanism comprising means for actuating the two pairs of harnesses in opposite directions to each other, one pair of the harnesses being connected to all of the warp threads except those which form the stripes, one harness of the second pair being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yieldingly connected, means for restraining one pair of harnesses at predetermined intervals and for a predetermined number of picks, means for releasing the restraint after the laying of the predetermined number of picks and means for restraining the other pair of harnesses at predetermined intervals alternating with intervals of operativeness of the harness motion.

5. In combination with a four harness loom including two pairs of harnesses adapted to weave plain cloth, mechanism whereby the loom is adapted to form checks and broken stripes, said mechanism including two treadles connected respectively to the two pairs of harnesses, one pair of harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to only the warp threads which form the stripes, the other harness of said second pair being yieldingly connected to a fixed support, means for actuating the treadles in opposite directions to each other, means for restraining the first set of harnesses after predetermined periods of plain weaving to permit the laying of a predetermined number of picks to form a bar, means whereby the restraint on the harnesses is released after laying the predetermined number of picks, means for restraining the second set of harnesses intermittently, said periods of restraint on the second set of harnesses permitting the laying of a plurality of picks on one face of the warp stripes, means for releasing the restraint on the second set of harnesses while a series of single picks are being laid on the upper bar of the warp stripes.

6. In combination with a four harness loom including two pairs of harnesses adapted to weave plain cloth, mechanism whereby the loom is adapted to weave cloth to form checks and broken stripes, said mechanism including two treadles connected respectively to the two pairs of harnesses, one pair of harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to only the warp threads which form the

stripes, the other harness of said second pair
 being yieldingly connected to a fixed support,
 a cloth take-up, a rotary shaft, two cams
 mounted thereon adapted respectively to ac-
 5 tuate the two treadles in opposite directions
 to each other, an endless cam carrier, a plu-
 rality of cams mounted on said carrier at a
 distance apart from each other according to
 10 the extent of plain weave desired, means ac-
 tuated by said carrier cams to restrain the
 first set of harnesses and the cloth take-up
 after a predetermined period of plain weave,
 thereby permitting the laying of a plurality
 15 of picks to form a bar, means whereby the re-
 straint on the harnesses and cloth take-up is
 released after the laying of the picks to form
 the bar, a second endless cam carrier, a series
 of cams mounted thereon throughout the
 20 length of said carrier and with plain spaces
 between the cams, means actuated by said
 cams to restrain the second set of harnesses
 intermittently, said periods of restraint on
 the second set of harnesses permitting the
 25 laying of a plurality of picks on one face of
 the stripes, the plain spaces between the cams
 on the said second cam carrier permitting the
 temporary release of the said second harness
 restraint while a series of single picks are
 30 being laid on the other face of the stripes.
 7. In combination with a four harness loom
 including two pairs of harnesses adapted to
 weave plain cloth, mechanism whereby the
 35 loom is adapted to weave cloth to form
 checks and broken stripes, said mechanism
 including two treadles connected respective-
 ly to the two pairs of harnesses, one pair of
 harnesses being connected to all of the warp
 40 threads except those which form the stripes,
 one of the other pair of harnesses being con-
 nected to only the warp threads which form
 the stripes, the other harness of said second
 pair being yieldingly connected to a fixed
 45 support, a cloth take-up, a rotary shaft, two
 cams mounted thereon adapted respectively
 to actuate both treadles in such manner that
 the two treadles are actuated in opposite di-
 50 rections to each other, an endless cam carrier,
 a plurality of cams mounted on said carrier
 at a distance apart from each other accord-
 ing to the extent of plain weave desired,
 means actuated by said carrier cams to re-
 55 strain the first set of harnesses and cloth
 take-up after predetermined periods of plain
 weave, thereby permitting the laying of a
 plurality of picks during the said restraint
 to form a bar, means whereby the restraint
 60 on the harnesses and cloth take-up is released
 after the laying of the picks to form the bar,
 a second endless cam carrier, a series of cams
 mounted thereon throughout the length of
 said carrier and with plain spaces between
 65 the cams, means actuated by said cams to
 restrain the second set of harnesses intermit-
 tently, said periods of restraint on the second
 set of harnesses permitting the laying of a

plurality of picks on one face of the warp
 stripes, the plain spaces between the cams on
 the said second cam carrier permitting the
 temporary release of the said second harness
 restraint while a series of single picks are
 70 being laid on the other face of the warp
 stripes, one of the cams on said first carrier
 being so disposed that at the completion of
 the plain weave another cam on the first car-
 75 rier will again actuate the restraint on the
 first set of harnesses and the restraint on the
 cloth take-up.

8. In combination with a loom having at
 least three harnesses and adapted for plain
 weaving, an attachment therefor by which
 it is adapted to weave broken stripes and
 checks where the warp threads are in part
 disposed singly and in part in groups, said
 attachment comprising means for actuating
 80 one pair of harnesses in the opposite direc-
 tion to the other harness or harnesses, one
 pair of said harnesses being connected to all
 of the warp threads except those which form
 the stripes, another one of the harnesses be-
 85 ing connected to the warp threads which
 form only the stripes, means for restraining
 the first pair of harnesses at predetermined
 intervals and for a predetermined number
 of picks, means for releasing the restraint
 after the laying of said picks, and means for
 90 restraining the other harness or harnesses
 at predetermined intervals.

9. In combination with a loom having at
 least three harnesses and adapted for plain
 weaving, an attachment therefor by which
 it is adapted to weave broken stripes and
 checks where the warp threads are in part
 disposed singly and in part in groups, said
 attachment comprising means for actuating
 100 one pair of harnesses in the opposite direc-
 tion to the other harness or harnesses, one
 pair of said harnesses being connected to all
 of the warp threads except those which form
 the stripes, another one of the harnesses be-
 105 ing connected to the warp threads which form
 only the stripes, means for restraining the
 first pair of harnesses at predetermined in-
 tervals and for a predetermined number of
 picks, means for releasing the restraint after
 the laying of said picks, means for restrain-
 110 ing the other harness or harnesses at prede-
 termined intervals and means for controlling
 the restraining action on the first pair of
 harnesses to occur during the periods of re-
 lease of restraint on the second harness.

10. In combination with a loom having at
 least three harnesses and adapted for plain
 weaving, an attachment therefor by which it
 is adapted to weave broken stripes and checks
 where the warp threads are in part disposed
 125 singly and in part in groups, said attachment
 comprising means for actuating one pair of
 harnesses in the opposite direction to the
 other harness or harnesses one pair of said
 harnesses being connected to all of the warp

threads except those which form the stripes, another one of the harnesses being connected to the warp threads which form only the stripes, means for restraining the first pair of harnesses at predetermined intervals and for a predetermined number of picks, means for releasing the restraint after the laying of said picks, means for restraining the other harness or harnesses at predetermined intervals and means for controlling the restraint on the first pair of harnesses to occur during the action of one of the other harnesses to alternately change the position of the stripe with relation to the upper and lower sheds.

11. In a loom adapted for plain weaving and for forming checks and broken stripes, three or more harnesses, two of which at least are arranged as a pair, two treadles, one of which is connected to one pair of harnesses, the other of which is connected to another harness, the first pair of harnesses being connected to all of the warp threads except those which form the stripes, the other harness being connected to only those warp threads which form the stripes, means for actuating the treadles in opposite directions to each other, means for restraining the first set of harnesses after predetermined periods of plain weaving to permit the laying of a predetermined number of picks to form a bar, means whereby the restraint is released after laying said predetermined number of picks, and means for restraining the second treadle and its harness intermittently, whereby a series of single picks are permitted to be laid on one face of the warp stripes and then on the other face.

12. In a loom adapted for plain weaving and for forming checks and broken stripes, three or more harnesses, two of which at least are arranged as a pair, two treadles, one of which is connected to one pair of harnesses, the other of which is connected to one end of another harness, the other end of said harness being yieldingly connected to a fixed support, the first pair of harnesses being connected to all of the warp threads except those which form the stripes, the other harness being connected to only those warp threads which form the stripes, a rotary shaft, cams mounted thereon adapted to actuate the treadles in opposite directions to each other, a cam carrier, a plurality of cams on said carrier spaced according to the extent of plain weave desired, means actuated by said cams to restrain the first set of harnesses after a predetermined period of plain weave, thereby permitting the laying of a plurality of picks to form a bar, means whereby the restraint is released after the laying of the picks to form a bar, a second cam carrier, a series of cams mounted thereon and spaced apart from each other, means actuated by said cams to restrain the second treadle and harness to permit the laying of a plurality

of picks on one face of the warp stripe, the spaces between the cams permitting the intermittent release of restraint on the said second treadle and harness while a series of single picks are being laid on the other face of the warp stripe.

13. In a loom adapted for plain weaving and for forming checks and broken stripes, three or more harnesses of which at least two are arranged as a pair, two treadles, one of which is connected to one pair of harnesses, the other of which is connected to another harness, the first pair of harnesses being connected to all of the warp threads except those which form the stripes, the other harness being connected to only those warp threads which form the stripes, a rotary shaft, cams mounted thereon and adapted to actuate the treadles in opposite directions to each other, a cam carrier, a plurality of cams on said carrier spaced according to the extent of plain weave desired, means actuated by said cams to restrain the first set of harnesses after a predetermined period of plain weave, thereby permitting the laying of a plurality of picks to form a bar, means whereby the restraint is released after the laying of the picks to form a bar, a second cam carrier, a series of cams mounted thereon and spaced apart from each other and means actuated by said cams to restrain the second treadle and harness to permit the laying of a plurality of picks on one face of the warp stripe, the space between the cams permitting the intermittent release of restraint on the said second treadle and harness while a series of single picks are being laid on the other face of the warp stripe, one of the cams of the first cam carrier being so disposed that at the completion of the plain weave another cam on the first cam carrier will again actuate the restraint on the first set of harnesses and actuate the restraint on the cloth take-up.

14. In a loom adapted for plain weaving and for forming checks and broken stripes, three or more harnesses of which at least two are arranged as a pair, two treadles, one of which is connected to one pair of harnesses, the other of which is connected to another harness, the first pair of harnesses being connected to all of the warp threads except those which form the stripes, the other harness being connected to only those warp threads which form the stripes, a rotary shaft, cams mounted thereon and adapted to actuate the treadles in opposite direction to each other, a cam carrier, means for continuously driving said cam carrier, a plurality of cams on said carrier spaced according to the extent of plain weave desired to form a check, means actuated by said cams to restrain the first set of harnesses after a predetermined period of plain weave, thereby permitting the laying of a plurality of picks to form a bar, means whereby the restraint is released after the

laying of the picks to form a bar, a second cam carrier, a series of cams mounted thereon and spaced apart from each other and means actuated by said cams to restrain the second treadle and harness to permit the laying of a plurality of picks on one face of the warp stripe, the spaces between the cams permitting the intermittent release of restraint on the said second treadle and harness while a series of single picks are being laid on the other face of the warp stripe.

15. In combination with a plain weave loom having at least three harnesses, two of which operate as a pair, an attachment whereby the loom is adapted for weaving checks and broken stripes when the warp threads are in part disposed singly and in part in groups to form stripes, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, another one of the harnesses being connected to the warp threads which form only the stripes, means for restraining the pair of harnesses at predetermined intervals, thereby permitting a plurality of picks to be laid to form a bar, means for releasing the said harness restraint to permit plain weave, means for intermittently restraining the second treadle and its harness during the laying of one or more single picks on one face of the stripe, and means for releasing said restraint on the second harness so timed that a single pick or a series of single picks will then be laid on the reverse side of the stripe.

16. In combination with a plain weave loom having at least three harnesses, two of which operate as a pair, an attachment whereby the loom is adapted for weaving checks and broken stripes when the warp threads are in part disposed singly and in part in groups to form stripes, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, another one of the harnesses being connected to the warp threads which form only the stripes, and means for separately restraining and then releasing the restraint on the two sets of harnesses in such timed relation to each other that a predetermined number of picks will be laid transversely under the stripes alternating with the laying of a predetermined number of picks transversely over the stripes.

17. In a loom adapted for plain weaving and for weaving checks and broken stripes, two sets of harnesses and a treadle for each set, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yieldingly connected, two endless cam carriers, cams mounted on each of said carriers, means whereby the cams on the two

carriers are respectively adapted to restrain the two sets of harnesses at predetermined times in relation to each other, means whereby during the restraint on one set of harnesses a plurality of picks will be laid to form a bar, means whereby the cloth take-up will be held in restraint during the forming of the bar, means for intermittently releasing the restraint on the first set of harnesses and means for intermittently actuating the restraint on the second set of harnesses to permit the laying of picks transversely of the upper face and of the under face of the stripe.

18. In a loom adapted for plain weaving and for weaving checks and broken stripes, two sets of harnesses and a treadle for each set, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yieldingly connected, means for restraining the two sets of harnesses at predetermined times in relation to each other, means whereby during the restraint on one set of harnesses a plurality of picks will be laid to form a bar, a cloth take-up, means whereby the cloth take-up will be held in restraint during the forming of the bar and means for intermittently actuating the restraint on the second set of harnesses to permit the laying of a pick or picks transversely of one face of the stripes and then on the opposite face of the stripes.

19. In combination with a loom adapted for plain weaving, means for weaving checks and broken stripes where the warp contains stripes, said means comprising two treadles, means whereby one treadle is actuated to alternately raise and depress the warp stripes above and below the plane of the weave, and means whereby the other treadle is actuated so that at predetermined times there will be one or more picks laid on the upper side of the stripes and at other predetermined times a pick or picks will be laid on the under side of the stripes.

20. In combination with a loom adapted for plain weaving, means for weaving checks and broken stripes where the warp contains stripes, said means comprising two treadles and two sets of harness mechanisms, means whereby one harness mechanism is actuated to alternately raise and depress the stripes above and below the plane of the weave, and means whereby the other harness mechanism is actuated so that at predetermined times one or more picks will be laid on the upper side of the stripes and at other predetermined times one or more picks will be laid on the under side of the stripes.

21. In a loom adapted for plain weaving and for weaving checks and broken stripes, two sets of harnesses and a treadle for each

set, one pair of said harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to the warp threads which form only the stripes, a support to which the other harness of said second pair is yeildingly connected, two endless cam carriers, cams mounted on each of said carriers, means whereby the cams on the two carriers are respectively adapted to restrain the two sets of harnesses at predetermined times in relation to each other, means whereby during the restraint on one set of harnesses a plurality of picks will be laid to form a bar, a cloth take-up means whereby the cloth take-up will be held in restraint during the forming of the bar, means for restraining the second set of harnesses during the restraint on the first set of harnesses a sufficient time to permit the laying of a pick or picks on one face of the stripe, and means for releasing said restraint on the second set of harnesses during the restraint on the first set of harnesses to permit the laying of a pick or picks on the other face of the stripe.

22. In combination with a four harness loom adapted to weave plain cloth, a shuttle to carry the weft threads, mechanism by which it is adapted at intervals between plain weave to weave broken stripes and checks, said mechanism including two treadles connected respectively to the two pairs of harnesses, one pair of harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to only the warp threads which form the stripes, a moving pattern chain, a cam carried thereby adapted at certain periods in its travel to restrain both of said harnesses and hold in fixed position all the warp threads except those which form the stripes while the shuttle is allowed to continue movement to lay a plurality of threads to form a bar, a take-up motion, means for restraining the take-up during the laying of the bar threads, a rotary shaft and a cam mounted thereon which controls the weaving of plain cloth, means controlled by the pattern chain to permit the first pair of harnesses to operate under the normal action of the cam which controls the weaving of plain cloth, means controlled by the action of cams on the pattern chain to restrain the second pair of harnesses and permit the laying of a plurality of picks under the stripes and means to release the said last pair of harnesses after a predetermined number of picks have been laid under said stripes and permit the laying of a pick over the stripes.

23. In combination with a four harness loom adapted to weave plain cloth, a shuttle to carry the weft threads, mechanism by which it is adapted at intervals between plain weave to weave broken stripes and checks, said mechanism including two treadles

connected respectively to the two pairs of harnesses, one pair of harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to only the warp threads which form the stripes, a moving pattern chain, a cam carried thereby adapted at certain periods in its travel to restrain both of said harnesses and hold in fixed position all the warp threads except those which form the stripes while the shuttle is allowed to continue movement to lay a plurality of threads to form a bar, a take-up motion, means for restraining the take-up during the laying of the bar threads, a rotary shaft and a cam mounted thereon which controls the weaving of plain cloth, cam mechanism for controlling the movement of one set of harnesses and the bar forming pick to lay certain picks over the stripe and certain other picks under the stripe, means controlled by the pattern chain to permit the first pair of harnesses to operate under the normal action of the cam which controls the weaving of plain cloth, means controlled by the action of cams on the pattern chain to restrain the second pair of harnesses and permit the laying of a plurality of picks under the stripes and means to release the said last pair of harnesses after a predetermined number of picks have been laid under said stripes and permit the laying of a pick over the stripes.

24. In combination with a four harness loom adapted to weave plain cloth, a shuttle to carry the weft threads, mechanism by which it is adapted at intervals between plain weave to weave broken stripes and checks, said mechanism including two treadles connected respectively to the two pairs of harnesses, one pair of harnesses being connected to all of the warp threads except those which form the stripes, one of the other pair of harnesses being connected to only the warp threads which form the stripes, a moving pattern chain, a cam carried thereby adapted at certain periods in its travel to restrain both of said harnesses while a plurality of picks are being laid to form a bar, means controlled by the pattern chain to permit the weaving of plain cloth for a predetermined period, means controlled by the pattern chain to permit the laying of a plurality of picks under the stripes at predetermined periods, and means to control the harnesses whereby after a predetermined number of picks have been laid under the stripes, it will permit the laying of a pick over the stripes.

In testimony whereof we affix our signatures.

JOSEPH THEXTON, JR.
HENRY TOMLINSON.

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