

May 16, 1933.

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1,909,113

LOOM FOR WEAVING TUFTED PILE FABRICS

Filed Nov. 8, 1930

6 Sheets—Sheet 1

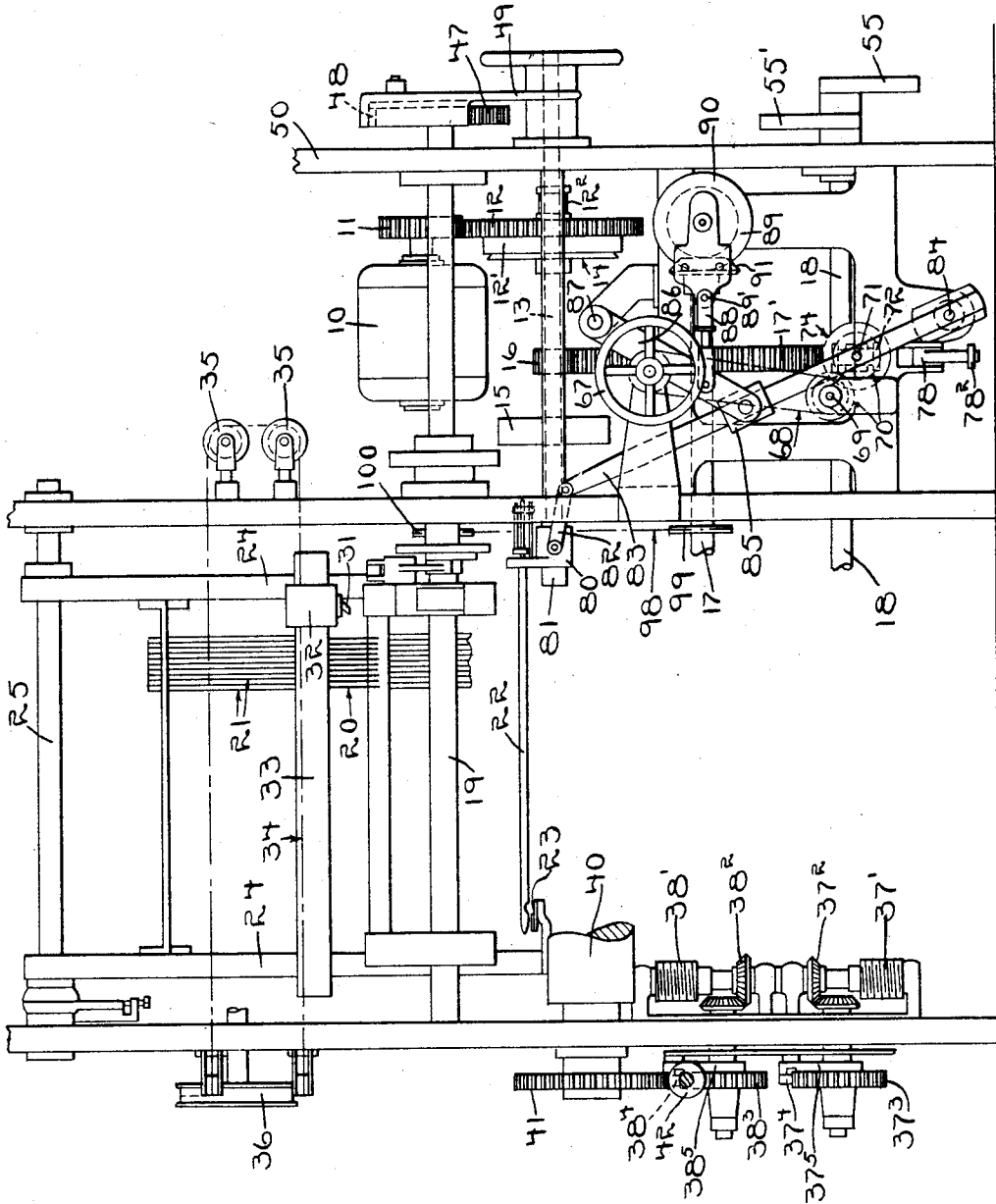


FIG. 1

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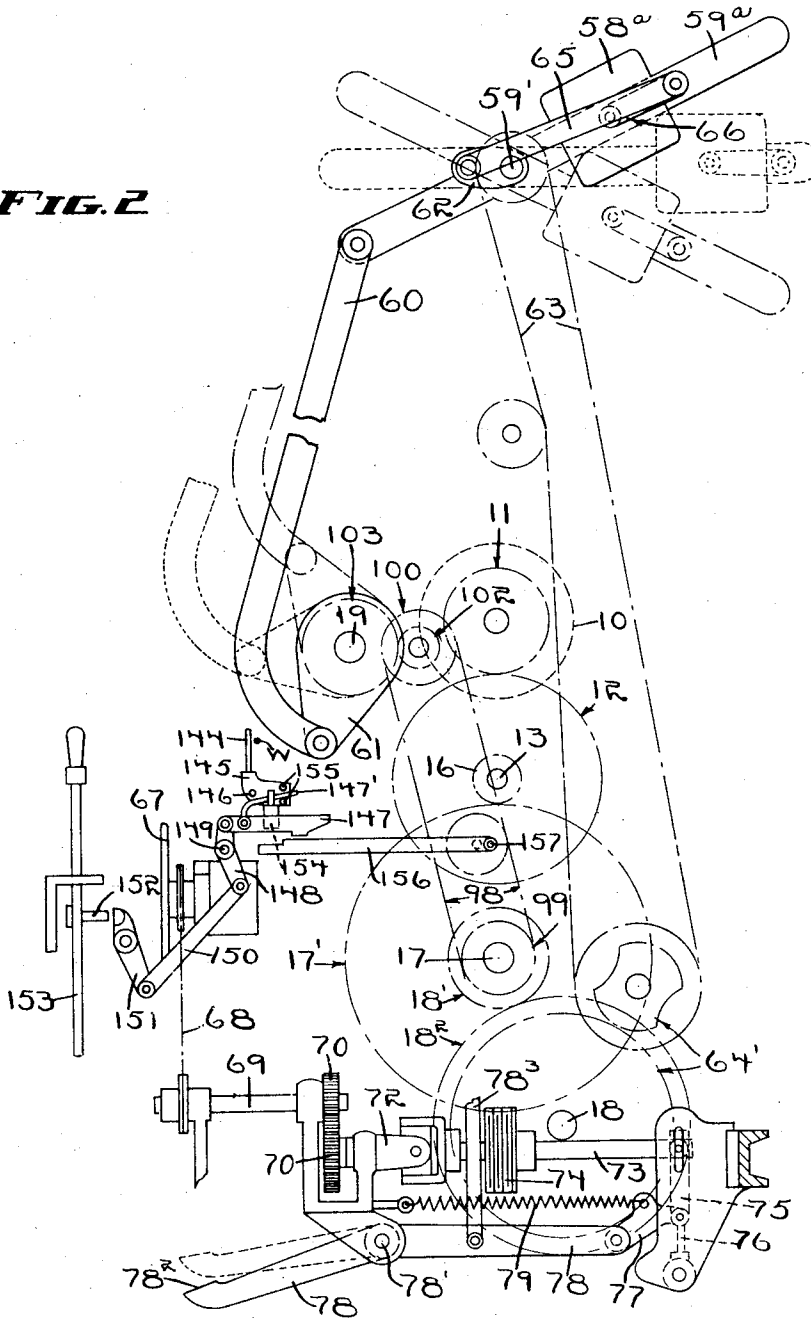
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FIG. 2



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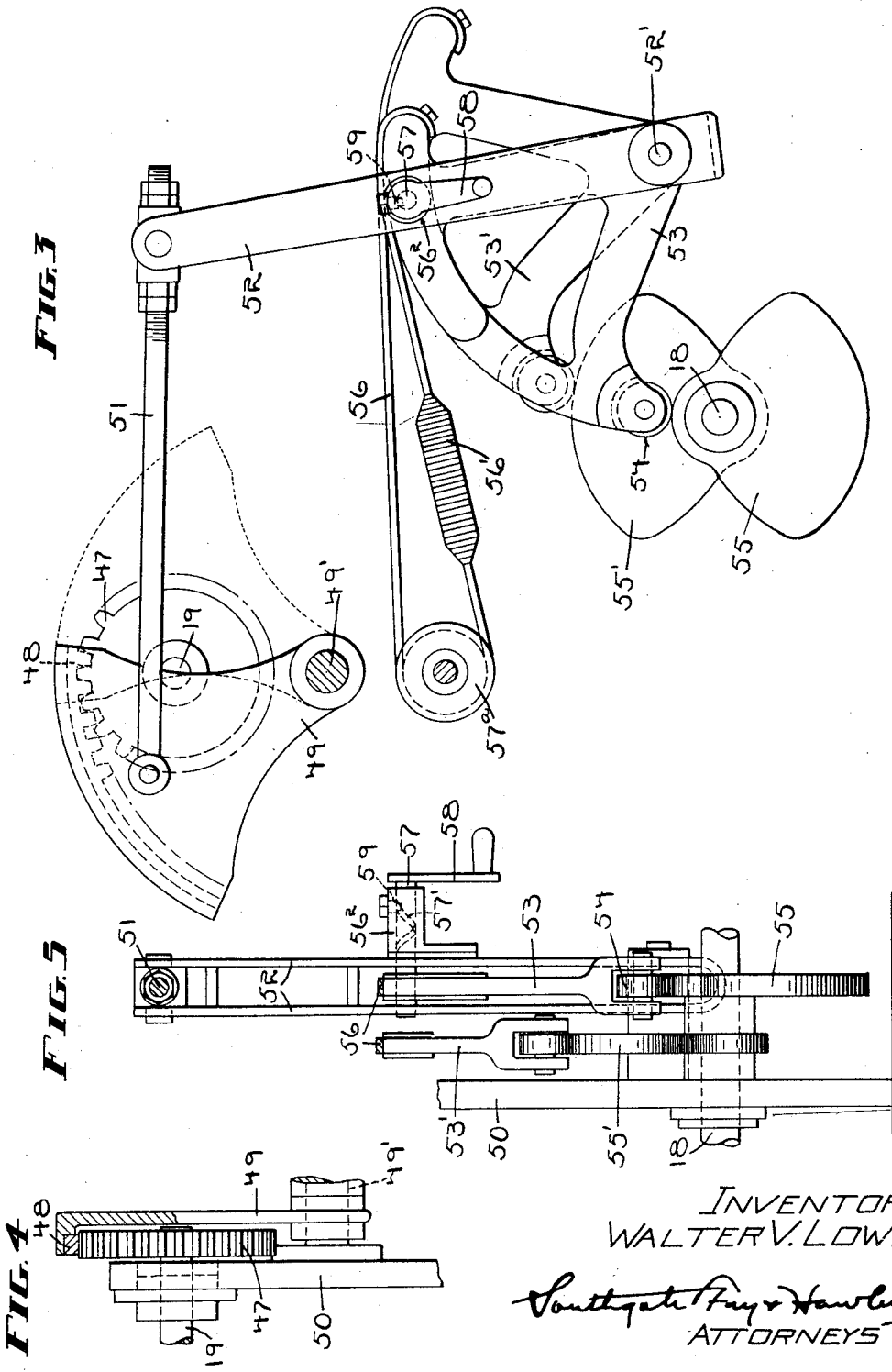
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6 Sheets-Sheet 3



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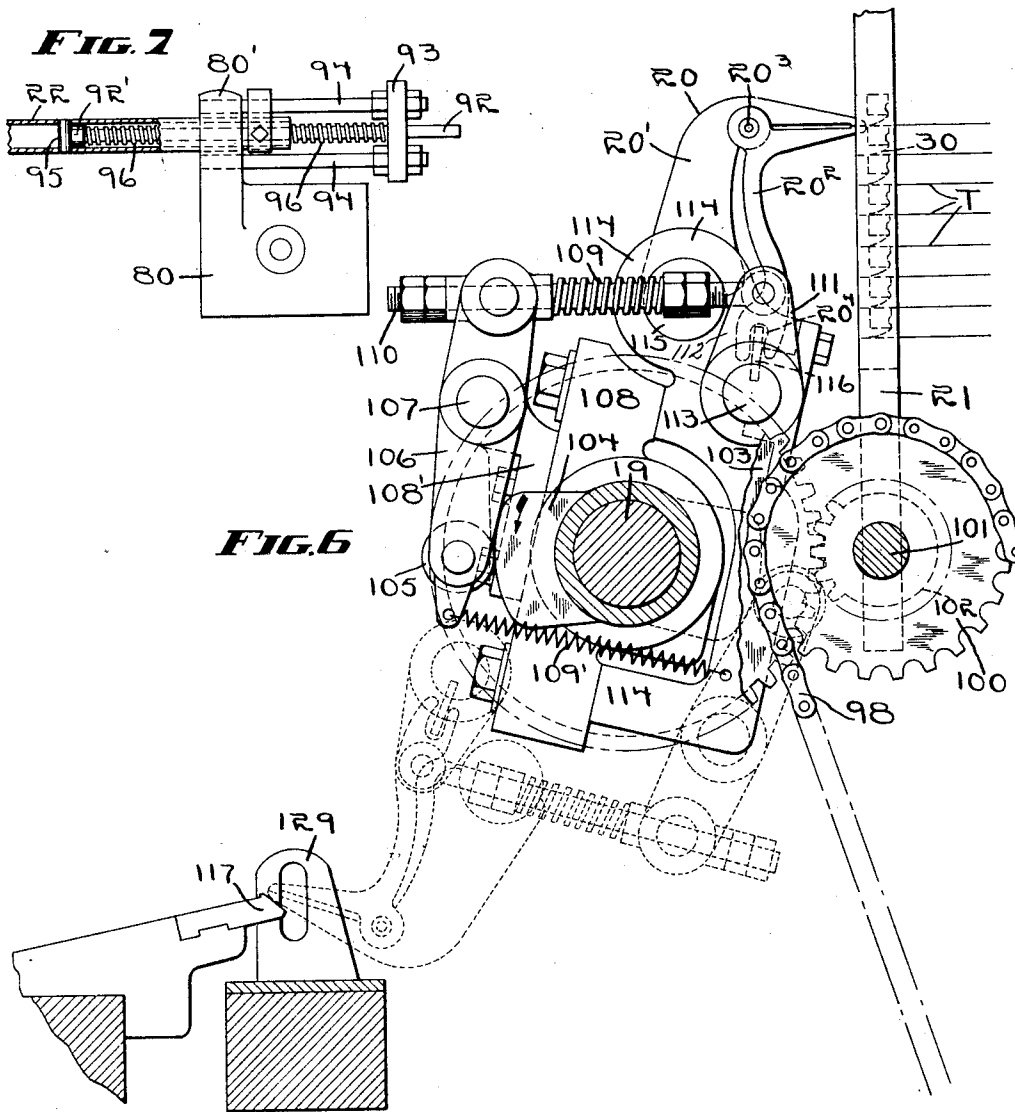
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LOOM FOR WEAVING TUFTED PILE FABRICS

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6 Sheets-Sheet 4



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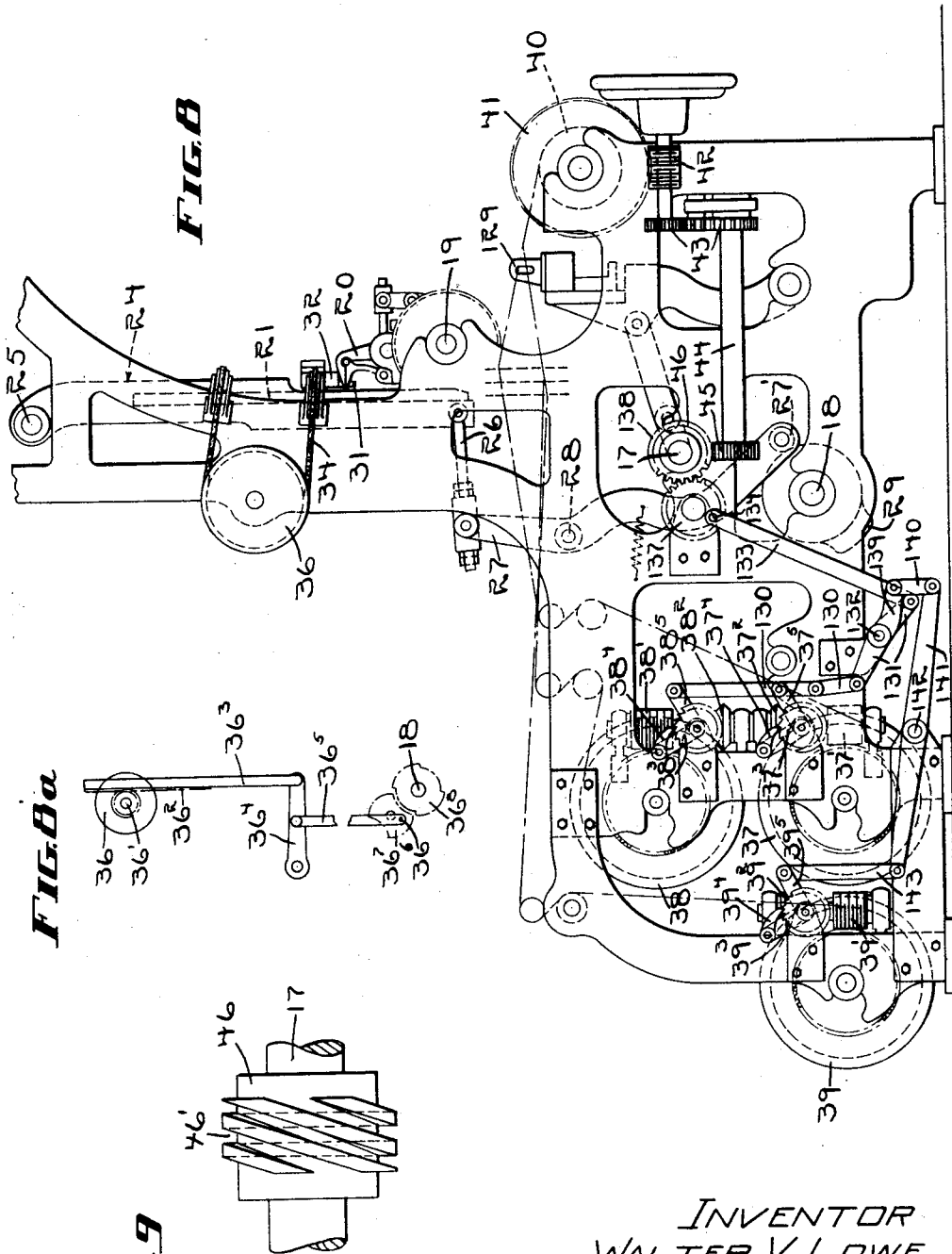


FIG. 8a

FIG. 9

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LOOM FOR WEAVING TUFTED PILE FABRICS

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FIG. 10

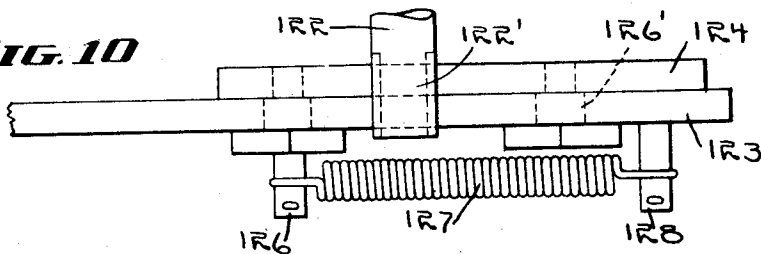


FIG. 11

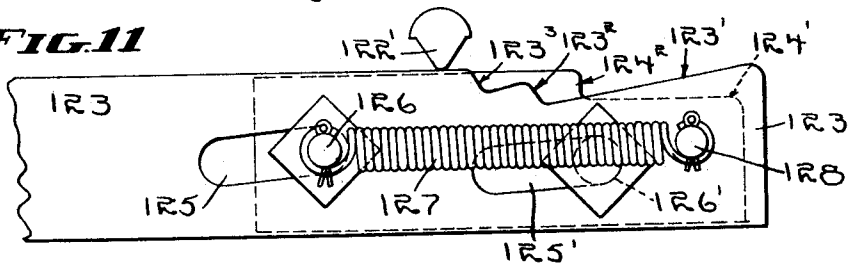


FIG. 12

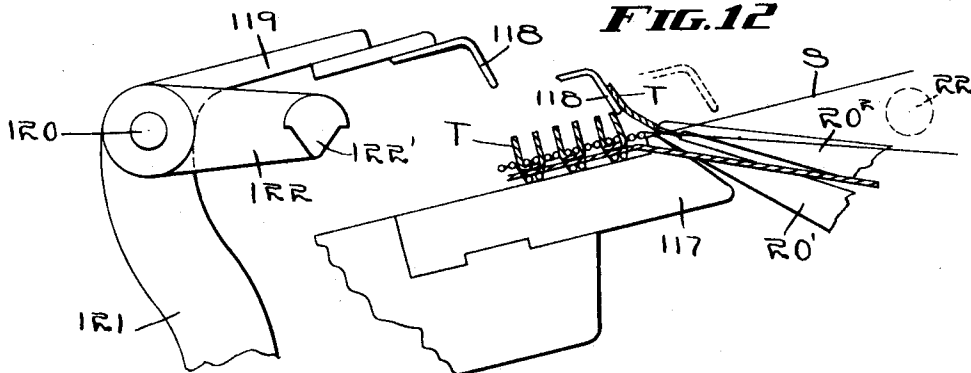


FIG. 13

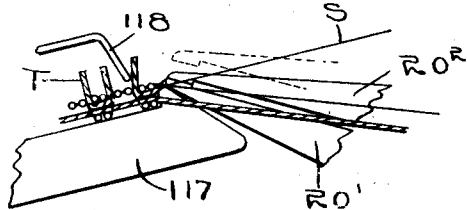
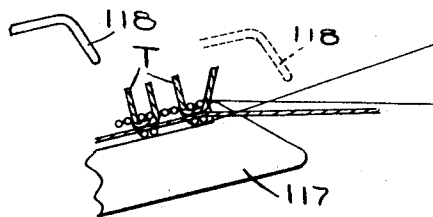


FIG. 14



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LOOM FOR WEAVING TUFTED PILE FABRICS

Application filed November 8, 1930, Serial No. 494,377, and in Great Britain November 11, 1929.

The invention relates to looms for weaving tufted pile fabrics of the kind known as Axminster or Moquette and particularly to looms for this purpose of the type wherein the pile of the fabric is composed of tufts the material for which is drawn from yarn carriers by means of grippers mounted on a rotary shaft. The shaft is turned in one direction to present the grippers, in open position, opposite the ends of yarn upon which they are then closed. The ends are then cut off at the point requisite to provide tufts of the desired length, and the gripper shaft is then partially rotated in the reverse direction to carry the grippers downwardly to a position in which the tuft yarns carried thereby are laid against the fell of the fabric. A weft or wefts is or are then run in by means of a needle to secure the tufts and the grippers are opened and returned for a new supply to form the next row of tufts.

A loom of this description depends for its practical value upon the speed and certainty of its operation, and the present invention comprises improvements in the mechanism, co-operating to constitute the loom, designed to enable the loom to be run faster, and with greater certainty as to the correct functioning of the several mechanisms, than has hitherto been possible.

The improvements referred to relate particularly to means for connecting and disconnecting the gripper-carrying shaft from the loom drive; for balancing the gripper shaft; for enabling the loom to be turned by hand; for giving the requisite horizontal movements to the weft needle and for enabling the latter to yield if it should meet with obstruction or strike the selvage shuttle employed to tie in the weft picks at the opposite side of the loom from that at which they are inserted: for opening and closing the grippers at the required times; for combing-up the tufts as they are inserted into the fabric; and also to the actuation of the warp let-off and fabric take-up mechanisms.

In the accompanying drawings:—

Fig. 1 is a front elevation of a loom embodying the invention, such parts only being

shown as are material for the purposes of description.

Fig. 2 is an end elevation, in more or less diagrammatic form, looking from the right hand end of the loom, and showing the means for enabling the loom to be turned by hand; the means for balancing the gripper shaft and gripper mechanism; and the weft stop mechanism.

Fig. 3 is a right hand end elevation of the means for driving the gripper shaft and for enabling the same to be connected to and disconnected from the loom drive;

Figs. 4 and 5 are detail front elevations of parts of the gripper shaft drive mechanism shown in Fig. 3;

Fig. 6 is a right hand end elevation of the gripper mechanism and of the means for opening and closing the grippers;

Fig. 7 is a detail showing, on an enlarged scale, the yielding mounting for the weft-inserting needle.

Fig. 8 is an end elevation, looking from the left hand end of the loom and showing the fabric take-up and warp let-off motions;

Fig. 8a is a detail end view of the means employed to traverse the knife for cutting off the tuft yarns;

Fig. 9 is a detail showing the worm employed giving intermittent actuation to the take-up motion;

Figs. 10 and 11 are, respectively, a plan view and an elevation of the device for giving vertical movements to the comb bar for combing up the tufts as they are inserted into the fabric; and

Figs. 12 to 14 are detail views illustrating successive stages in the formation of the fabric.

Referring to the drawings, the loom drive is obtained from an electric motor 10 suitably carried on the loom framework. A pinion 11 on the motor shaft meshes with a toothed gear 12 having associated with it a friction member 12' and being slidably mounted on a shaft 13 carrying a friction member 14. The extended hub of the combined gear and friction member 12 is grooved annularly for engagement by a clutch fork, not shown, by means of which sliding

movement may be given to the friction member 12 towards and away from the member 14 so as to cause the shaft 13, and consequently the loom, to be driven or to be stopped. A
5 brake pulley 15 mounted on the shaft 13 is adapted to be engaged by a brake band, not shown, for the purpose of stopping the loom.

A pinion 16 on the shaft 13 meshes with a large gear wheel 17' on the lay cam shaft
10 17, said gear 17' having a conveniently divisible number of teeth, say seventy-two, for a purpose referred to later.

The bottom shaft 18 of the loom is driven from the lay cam shaft 17 by gears 18' and
15 18², Fig. 2.

The gripper shaft is shown at 19, carrying as usual a series of grippers 20 by which the tuft yarns T are carried down from the sliders 21 and placed into the fell of the
20 fabric.

The weft needle, by which the wefts are inserted to form the fabric and tie in the tufts, is shown at 22. This needle draws yarn in the usual manner from a stationary supply through a tension device, not shown, and carries it through the shed, a selvage shuttle 23 being provided at the opposite side of the loom from that at which the weft enters, to engage and tie in the weft and
30 cause it, by the return or outward movement of the needle, to form a loop so that each shed receives a double pick of weft. The usual holding pin, not shown, is provided adjacent the selvage shuttle to enter the
35 bight of the loop formed by the double weft pick and prevent the weft from being dragged out of the shed as the needle goes outwardly.

The tuft yarn sliders 21 are mounted to slide vertically in a swinging frame 24, mounted pivotally on an upper longitudinal shaft 25, swinging movement through the arc necessary to cause the desired length of yarns to be drawn through the sliders when the yarn ends have been seized by the grippers, being imparted to the frame 24 by a connector 26 from a lever 27, mounted pivotally at 28 and having a bowl 27' adapted to engage
45 a cam 29 on the bottom shaft 18.

A tuft yarn slider is shown in Fig. 6 as having provision for eight yarns, each yarn passing beneath and being controlled by a respective spring 30 in the usual manner.

The lengths of tuft yarn drawn through the sliders by the rearward swinging movement of the tuft yarn frame are severed by a horizontally travelling knife 31, carried by a box or member 32 slidable on a guide 33 and
60 moved by a flexible connection 34 which is secured at its ends to the knife carrier, one end being passed about guide pulleys 35, 35, and the other end passed about a drum 36 to which partial rotations are given, in opposite directions alternately, to cause the knife

box to operate the knife 31 at the required time and return it to starting position.

In the construction of the fabric concerned three warp beams 37, 38, and 39 are employed, one carrying backing warps and the
70 others binder warps. These warp beams are operated in the usual way by worm wheels and worms, the respective worms 37', 38' and 39' being driven by bevel gears 37², 38², and 39², and ratchet wheels 37³, 38³ and 39³, the
75 latter being intermittently rotated by pawls 37⁴, 38⁴ and 39⁴, carried by levers 37⁵, 38⁵ and 39⁵.

The take-up roll 40 is driven as usual by worm wheel 41, worm 42, gears 43, shaft 44
80 and worm wheel 45, from a worm 46 on the lay cam shaft 17.

The parts so far described are or may be with the exception of the worm 46 on the lay cam shaft 17 all substantially of the usual
85 construction and arrangement in a loom of the description concerned and in themselves form no part of the present invention.

It is necessary to provide means, in a loom of the description concerned, to enable the
90 gripper shaft to be connected to and disconnected from the loom drive, so that when desired plain or untufted portions of fabric may be woven, to constitute for instance headings or borders to tufted portions of the fabric.
95 According to my invention the gripper shaft is provided with a gear 47 with which meshes an internally-toothed segment or quadrant 48 carried by a lever arm 49 pivoted at 49' on a stud carried by an end frame 50 of the loom.
100 An adjustable link 51 connects the quadrant lever 49 with a lever arm 52 mounted pivotally at 52' on a stud carried by the loom end frame. A segment 53, mounted on the stud
105 52' carries a bowl 54 adapted to be engaged by a cam 55 on the bottom shaft of the loom. A boss 56 carried by the lever 52 has a bore in which works a pin 57 provided with a hand lever 58. A peg 59 projects inwardly from the boss 56² into a helical groove 57' in the pin 57. The lever arm 52 has openings through which, when the arm is appropriately positioned, the pin 57 can be projected by its axial movement consequent upon rotation
110 by means of the handle 58. The segment 53 has also an opening adapted to receive the pin 57, and when the opening in the said segment is brought into alignment with those in the lever 52 the inward projection of the pin 57 causes the segment 53 and the lever
115 52 to be operatively connected so that the quadrant lever 49 is rocked and the gripper shaft thus swung to and fro by the gear 47 and toothed quadrant 48. If the pin be rotated, so as to cause it to travel axially
120 outwards along the boss 56² the end of the pin will be withdrawn from the openings in the segment 53 and lever 52 and the latter thus be left idle whilst the segment may continue
125 to oscillate. Associated with the cam 55 is

a second cam 55' set in diametrically opposite position. This second cam acts on a dummy-segment 53' also mounted on the stud 52'. To each segment there is secured one end of a chain or flexible member 56 which passes about a guide pulley 57^a, and included in this connector 56 is a spring 56', the effect of which is to maintain the bowl or runner 54 of the operative segment 53 always in contact with the surface of its cam 55.

When the gripper shaft 19 is in such a position of rotation that the grippers are substantially above it to receive the tufts, or below it to deliver the tufts, the torsional strain imposed upon the shaft is relatively small, but as the grippers either when moving upwardly or downwardly approach the horizontal position the torque is considerable particularly in a broad loom. To counteract or counterbalance the shaft I provide, as shown in Fig. 2, a weight 58^a mounted on one arm of a lever 59^a, pivoted on a stud 59' and having its other end connected by a link 60 to an arm 61 fast on the gripper shaft. A crank 62, rotatable on the stud 59' by means of a chain 63 and intermittent gears 64' from the bottom shaft 18, is connected by links 65 and 66 to the weight 58^a. In the full line position of the lever 59^a the grippers are assumed to be down at the fell of the fabric and the weight 58^a, as shown, occupies a position towards the pivot centre of the lever. As the gripper shaft 19 rotates to carry the grippers upwardly, the action of the crank 62 which is, of course, appropriately timed, causes the weight 58^a to be gradually moved outwardly along the lever so that by the time the gripper shaft is in such a position that the grippers are substantially horizontal and are thus exerting the maximum torque on the shaft, the weight occupies the position indicated in dotted lines and exerts a maximum counterbalance. As the gripper shaft continues its upward rotation the weight is caused to move gradually inwards until by the time the grippers have arrived at top position the weight occupies the position indicated in broken lines, that is to say in which it exerts a minimum counterbalancing effort, as in the full line position. As the gripper shaft rotates downwardly, the weight is actuated in the same way, that is to say it is gradually projected outwardly as the grippers approach midway of their arc of movement, and is gradually moved inwardly again as they approach bottom position.

In order that the loom may conveniently be turned by hand a hand wheel 67, situated at the front of the loom is connected by a chain drive 68 with a shaft 69 which, by gears 70, is connected to a short rearwardly extending shaft 71. The rear end of this shaft 71 is connected by a universal joint 72 to a shaft 73 carrying a worm 74. The rear end of shaft 73 is connected by toggle levers

75 and 76 and a link 77 to a lever 78 pivoted at 78' and provided at its front end with a foot pedal 78². The worm 74 is disposed beneath and is adapted, when raised, to engage the large gear 17' and this is occasioned by depression, as shown in Fig. 2, of the foot pedal 78'. Raising the worm 74 into gear is effected against the action of a spring 79 which, when pressure upon the pedal is released, acts to break the toggle and lower the shaft 73, thus removing the worm from engagement with the gear 17'. The gearing between the hand wheel 67 and the worm shaft 73 is of such ratio that one revolution of the hand wheel corresponds to revolution of the gear 17' through a distance equal to one tooth pitch. As previously mentioned, the gear 17' is preferably provided with an easily divisible number of teeth, such for instance as seventy two. By depression of the foot pedal and turning of the hand wheel, the cam shaft and consequently the motions of the loom can be turned slowly and in steps of known angular dimensions, which facilitates setting of the cams and the general timing of the motions of the loom. A connection 78³ from the lever 78 is operatively connected with the brake band on the brake pulley 15, so that as the lever 78 is depressed to enable the loom to be turned by hand the brake is removed.

The weft inserting needle 22, Fig. 1, is carried as usual by a box 80 guided for horizontal movements on a slide 81. A link 82 connects the block 80 with the upper end of an arm 83 which is mounted pivotally at its lower end on a stud 84. A block 85 slidable along the arm 83 is connected pivotally to the lower end of a pendulum lever 86 carried by a stud 87 and, between its ends, the pendulum lever is connected by a link 88 with a crank pin 89' disposed eccentrically on a plate 89 fast with a bevel wheel 90 which receives motion by a bevel wheel 91 from the lay cam shaft 17. As the bevel 90 rotates the pendulum lever is swung to and fro and by means of the block 85 imparts a swinging to and fro motion to the lever arm 83, the latter by means of the link 82 imparting horizontal movements to the weft needle. As the pendulum lever 86 and lever arm 83 swing to and fro the block 85, as will be understood rides upwardly and downwardly along the arm 83. The action of the crank, pendulum lever, and sliding block causes the needle to have the desired quick traverse during the centre part of its movement with a gradual decrease in the rate of movement towards, and a dwell at, each end.

It sometimes occurs that at the extremity of the inward movement of the needle the forward end of the needle will come into contact with the selvage shuttle 23. To avoid damage in such an event the needle is, as shown best in Fig. 7, mounted in its box

in such a manner that if its forward movement is obstructed it will yield and breakage thus be avoided. To this end the needle is hollowed out at its outer end to receive a rod 92 slidable through an opening in a block 93 spaced from a projection 80' on the needle box, in an opening in which projection the needle end is slidably supported, by bolts 94, 94. A pin 95 passes transversely through the needle at a suitable distance from its outer end and bears against the head 92' of the rod 92 and between the head 92' and the block 93 there is inserted a spring 96. This spring is of sufficient strength to resist the normal tension on the weft but if the forward end of the needle strikes the selvage shuttle the spring will yield and permit the needle to slide outwardly through the projection 80' whilst the box finishes its inward movement. A block 97 fast on the needle has an eye or opening in which one of the bolts 94 slides, the needle thus being prevented from twisting around as it is moved inwardly or outwardly.

The means I provide for opening and closing the grippers are shown in Figs. 1 and 6. A chain 98 conveys motion from a chain wheel 99 on the lay cam shaft to a chain wheel 100 on a stud 101 carried by the loom end frame. A pinion 102 fast with the chain wheel 100 meshes with a gear wheel 103 mounted loosely on the gripper shaft 19, and fast with the said gear 103 is a cam 104. This cam, as will be understood, has a constant rotation from the lay cam shaft. The cam acts on a bowl 105 on a lever arm 106 pivoted at 107 to a lug 108' on a block or boss 108 fast on the gripper shaft. The upper end of the arm 106 acts through a spring 109 on a rod 110 connected to an arm 111 fast on a gripper opening and closing shaft 113, which is supported in blocks 114, 114, fast on the gripper shaft. The fixed members 20' of the grippers 20 are carried by a fixed shaft 115 extending between the blocks 114 and the movable member 20^s of the grippers are pivoted to the fixed members at 20^s. The tails of the movable members are forked as at 20^t and straddle a blade 116 carried by the shaft 113. Rocking of the shaft 113 thus causes the movable members of the grippers to be moved pivotally and the jaws of the grippers to be opened or closed.

The grippers are shown in full line in Fig. 6 as being in top position and closed upon the selected tuft yarns, the selection of the latter being effected by vertical movement of the sliders 21 in the usual way to present any row of tuft yarns in alignment with the grippers. As the means for raising and lowering the sliders form no part of the present invention and are well known in the art, they have not been shown. When the grippers have seized the tuft yarn ends the slider frame 24 is swung rearwardly to cause a suf-

ficient length of yarns to be drawn through the sliders to form the tufts, and these lengths are severed by the travelling knife 31 in the usual way.

In the position of the grippers referred to the bowl 105 of the lever arm 106 rests on the surface of the cam 104 and the spring 109 thus exerts pressure on the arm 111 to cause the blade 116 to maintain the grippers closed. As the grippers commence to descend, the gripper shaft rotates in the same direction as the gear 103 so that the grippers keep closed. The grippers swing down, under the actuation of the quadrant mechanism previously described until they arrive at the dotted line position indicated in Fig. 6, in which they have carried down the tuft yarn portions to a position immediately in rear of the usual serrated cloth plate 117 to be formed into tufts, tied into the fabric, and combed up as will be described later. With the arrest of the downward movement of the grippers, the continued rotation of the gear 103 causes the cam 104 to ride from beneath the bowl 105, thus permitting the arm 106 to move pivotally under the action of a spring 109' and the blade 116 thus to swing the movable jaws of the grippers to release the tuft yarns held by the grippers. This releasing of the gripper yarns is, of course, timed to occur at the proper moment in the formation of the tufts. When the tuft yarns have been released and tied into the fabric, the gripper shaft commences to rotate upwardly to carry the grippers back up to the sliders for a new supply of tuft yarns. When the grippers have arrived at top position, and the selected tuft yarns have entered between the gripper jaws, the rotation of the gear 103 brings the cam 104 again beneath the bowl 105 and swings the lever 106 to close the grippers. The latter now commence their new downward journey the bowl 105 remaining as before on the cam and maintaining the grippers closed until the new tuft yarns have been carried down to, and tied in, the fell of the fabric.

The drum 36 by means of which and flexible connection 34 the knife 31 for cutting off the tuft yarns is traversed, is operated by providing on its shaft a pinion 36' which meshes with a rack 36² on a vertical, suitably guided bar 36³. This bar is connected at its lower end through a link to a lever 36⁴ mounted on a fixed pivot and adapted to be swung by a connection 36⁵ from a crank pin 36⁶ on a segment gear 36⁷ driven by a segment gear 36⁸ on the bottom shaft 18.

I shall now refer to Figs. 10 to 14 which illustrate diagrammatically the formation of the fabric and show the means provided for combing up the tufts.

A comb bar 118, Fig. 12, is carried by an arm 119 mounted pivotally on a stud 120 carried by a lever 121, which receives movements

frontwardly and rearwardly of the loom through suitable intermediate connections from an appropriately profiled cam on the bottom cam shaft 18. An arm 122 fast on the stud 120 has its free end 122' suitably shaped to ride upon the surface of a fixed bar 123 and movable plate 124. The plate 124 has permissible movement frontwardly and rearwardly within the limit of slots 125, 125', formed in the bar 123, studs 126, 126' carried by the said plate projecting through the slots and the stud 126 being anchored by a spring 127 to a stud 128 projecting from the bar 123. The spring 127 acts to hold the plate 124 normally projected rearwardly as shown, with the studs 126, 126', resting against the rearward ends of the slots 125 and 125'. The rearward end of the bar 123 is inclined as at 123' and shouldered upwardly as at 123² and 123³, and the rearward end of the plate 124 is reduced in depth as at 124' to constitute a shoulder 124², the level of the upper edge of the reduced portion 124' being such as to permit the end 122' of the arm 122 to drop on to the inclined end portion 123' of the bar 123 as will be described later. The upper edge of the plate 124 is preferably somewhat below the level of the upper edge of the bar 123 so as to permit of the plate 124 sliding forwardly beneath the end 122' of the arm 122 when the latter is resting on the upper edge of the bar. As the lever 121 moves the comb bar 118 rearwardly, the end 122' of the arm 122 rides on the upper edge of the bar 123 until it reaches the shoulder 123² and then on the upper edge of the plate 124 until it reaches the shoulder 124² on the latter, when it drops down on to the inclined surface 123' on the rearward end of the bar 123 and thus lowers the comb bar 118. As the arm 122 commences to move forwardly its end 122' rides down the inclined surface 123' until it reaches the curved shoulder 123² which raises the arm 122 partly and causes a partial elevation to be given to the comb bar. During its movement down the incline 123' the end 122' of arm 122 engages the shoulder 124² of plate 124 and commences to move the latter forwardly against the action of spring 127 as will be understood.

Continued frontward movement of the arm 122 causes its end 122', still carrying forwardly the plate 124, to ride up the second curved shoulder 123³ on to the upper edge of the bar, in doing which it elevates still further the comb bar 118. In the act of riding on to the upper edge of the bar 123 the end 122' of the arm 122 moves upwardly clear of the shoulder 124² on plate 124, thus permitting the latter to be projected rearwardly by the spring 127 to the position shown in Fig. 11, so that at the next rearward movement of the arm 122 its end 122' will not be permitted to drop on to the shoulders 123³ and 123² of the bar 123 but will be held elevated until

it reaches and clears the shoulder 124², when it is permitted to drop on to the surface 123' of the bar 123.

In the formation of the fabric the bar 118 is, before the grippers arrive at the fell with the row of tuft yarn portions, moved rearwardly to a position just above the upper part S of the shed and in rear of the fell of the fabric, the end 122' of arm 122 at this time resting on the inclined surface 123' of bar 123. The comb bar then moves forwardly and downwardly, following substantially the angle of the upper warps as the end 122' of arm 122 rides down the surface 123'. This forward movement of the comb bar causes the last-inserted row of tufts to be combed forwardly so that they are out of the way of the newly arriving row, and during the latter part of this rearward movement the end 122' of arm 122 rides up on to the shoulder 123² of bar 123, thus causing the comb bar 118 to be raised on to the top of the tufts as indicated in the central position of the comb bar in Fig. 12. The new row of tuft yarns having arrived, the comb bar has a slight forward and downward movement given to it, by dropping of the end 122' of arm 122 off the shoulder 123² of arm 123, for the purpose of placing into vertical position the front loose ends of the tuft yarns held by the grippers, as indicated in Fig. 13. As the reed 129 comes forwardly to beat up the tufts and the wefts inserted to hold them, the comb bar moves forwardly so as not to be struck by the reed, that is to say to the position indicated at the left hand in Fig. 12 in which, due to riding of the end of the arm 122 on to the upper edge of bar 123, the comb bar has been elevated to a position above the fabric and the plate 124 has been permitted to move rearwardly as before mentioned. The grippers then open and move upwardly to fetch a new supply of tuft yarns, in doing which they turn up the rearward ends of the newly inserted tuft yarns, which they have just released as indicated in Fig. 13. The grippers having moved up out of the way and the reed of course having retreated, the comb bar is moved rearwardly to the position indicated in dotted lines in Fig. 14, in doing which it rides over and clear of the fabric and drops down behind the last-inserted tufts, due to the riding of the end of arm 122 on the upper edges of the bar 123 and plate 124 until it clears the shoulder 124' on the latter. The comb bar then moves forwardly, giving a final combing up to the tufts, during which it is elevated again clear of the fabric ready to commence a new cycle of operations.

The worm 46 by which the take-up motion is driven from the lay cam shaft is so fashioned, as shown in Fig. 9, that for a portion of its revolution the threads are, as shown at 46' so formed that they are parallel to the tooth spaces of the co-operating worm

wheel, so that no rotation is imparted to the latter. This dwell of the take-up operation is arranged to occur during substantially one half of the revolution of the lay shaft, so that the take-up is stopped whilst the grippers are holding the tufts in position in the fabric and the weft is being beaten up over the tufts which are being inserted.

The left-off motions for the three warp beams 37, 38 and 39 are operated simultaneously as follows. The pawl levers 37^s and 38^s for beams 37 and 38 are connected by a link 130 (Fig. 8) which by a link 130' is connected to one arm of a lever 131 pivoted at 132. The other arm of this lever is connected by a link 133 to a pin 134 on a gear 137 driven by a gear 138 on the lay cam shaft. Also fast with the lever 131 is an arm 139 which by means of a link 140 is connected to one arm of a lever 141 pivoted at 142 and having its other arm connected by a link 143 to the pawl lever for warp beam 39.

In order to stop the loom in the event of weft breakage, or of the weft not being correctly tensioned the weft is led between the usual tension device and the weft needle, behind a finger 144, Fig. 2, carried by a block 145 pivotally mounted at 146 on a fixed bracket not shown. An arm 147 is pivotally connected at one end to one arm of a lever 148 mounted on a fixed pivot at 149 and having its other arm connected by a link 150 to a pivoted lever 151 adapted, when rocked, to engage a projection 152 on the usual knock-off lever 153 and move the latter out of its usual holding notch.

A wire or rod 147' pivoted to the arm 147 extends through a plunger 154 slidable vertically through an opening in the arm 147, and the rod 147' also passes between two lateral projections 155 on the block 145.

So long as weft W is present, and is sufficiently tensioned, to hold up the finger 144, the plunger 154 is held raised, but on breakage or insufficient tensioning of the weft the offset weight of the block and plunger cause the latter to be projected downwardly through the opening in the arm 147 into the path of a horizontally reciprocating bar 156, shown as being actuated by a pin 157 disposed eccentrically on a chain wheel 158 driven by the chain 98 which conveys motion to the gripper opening and closing cam. When the plunger 154 is permitted to fall it forms an operative connection between the reciprocating bar 156 and the arm 147, and the movement thus given to the latter rocks the lever 148 and through link 150 and lever 151 actuates the shipper handle. The reciprocating bar 156 makes a frontward movement during both the inward and outward movement of the weft needle so that a double acting detecting device is provided for each pick of weft.

It will be apparent that the mechanisms

constituting the invention are capable of variation in detail, both as regards construction and arrangement, from the particular embodiments illustrated and described.

The co-operative effect of my improvements is to facilitate the setting and running of the loom, to enable the loom to be run faster than hitherto, and to make the action of the loom generally more effective and reliable.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In an Axminster loom, a plurality of main gripper members movable collectively to and from yarn-engaging position, a plurality of additional gripper members mounted on said main gripper members and movable thereon to grip or release the yarn, and a continuously rotated cam effective to open and close said grippers, said main gripper members being supported on a gripper shaft and said cam being independently rotatable about the axis of said gripper shaft.

2. In an Axminster loom, a plurality of grippers, a gripper-carrying shaft and mechanism for oscillating said shaft, said mechanism including a continuously rotated cam, a two-part lever, one part of which is actuated by said cam, connections from the second part of said lever to said shaft, and detachable connections between the parts of said lever, whereby said gripper-carrying shaft may remain at rest while said cam shaft continues to rotate.

3. The combination in a loom as set forth in claim 2, in which the connection between the two-part lever and the gripper-carrying shaft comprises a gear on said shaft, a toothed segment engaging said gear, and a link connecting said segment to said two-part lever.

4. In a loom, a lay cam shaft having a large gear wheel with an easily divisible number of teeth, a worm shaft having a worm adapted to engage said gear wheel, a movable supporting bearing for said worm shaft, a foot pedal connected to move said bearing, and means including a hand wheel operable from the front of the loom for turning said worm shaft manually; said means being in such ratio that one revolution of said hand wheel corresponds to a movement of the gear wheel through a distance of one tooth and tooth space.

5. In an Axminster loom, a plurality of grippers, a gripper-carrying shaft, means to oscillate said shaft, and means effective to substantially counterbalance the weight of said grippers in all angular positions thereof.

6. In an Axminster loom, a plurality of grippers, a gripper-carrying shaft, means to oscillate said shaft, a counterbalance lever connected to said shaft, a weight slidable on said lever, and automatic means to move said weight toward and away from the fulcrum of the lever in predetermined relation to the

angular movement of the gripper-carrying shaft.

5 7. The combination in a loom as set forth in claim 6, in which the weight-moving means comprises a crank arm rotatable about the fulcrum of the counter-balance lever, a link connection between said crank arm and said weight, and means to rotate said crank arm in predetermined relation to the angular movement of said gripper-carrying shaft.

10 8. The combination in a loom as set forth in claim 6, in which the weight-moving means comprises a crank arm rotatable about the fulcrum of the counter-balance lever, a link connection between said crank arm and said weight, an intermittently rotated gear, and a sprocket and chain connection from said gear to said crank arm, whereby said crank arm is rotated in predetermined relation with the angular movement of the gripper-carrying shaft.

20 In testimony whereof I affix my signature:—

25 WALTER VINCENT LOWE.

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