F. DUERRENBERGER.

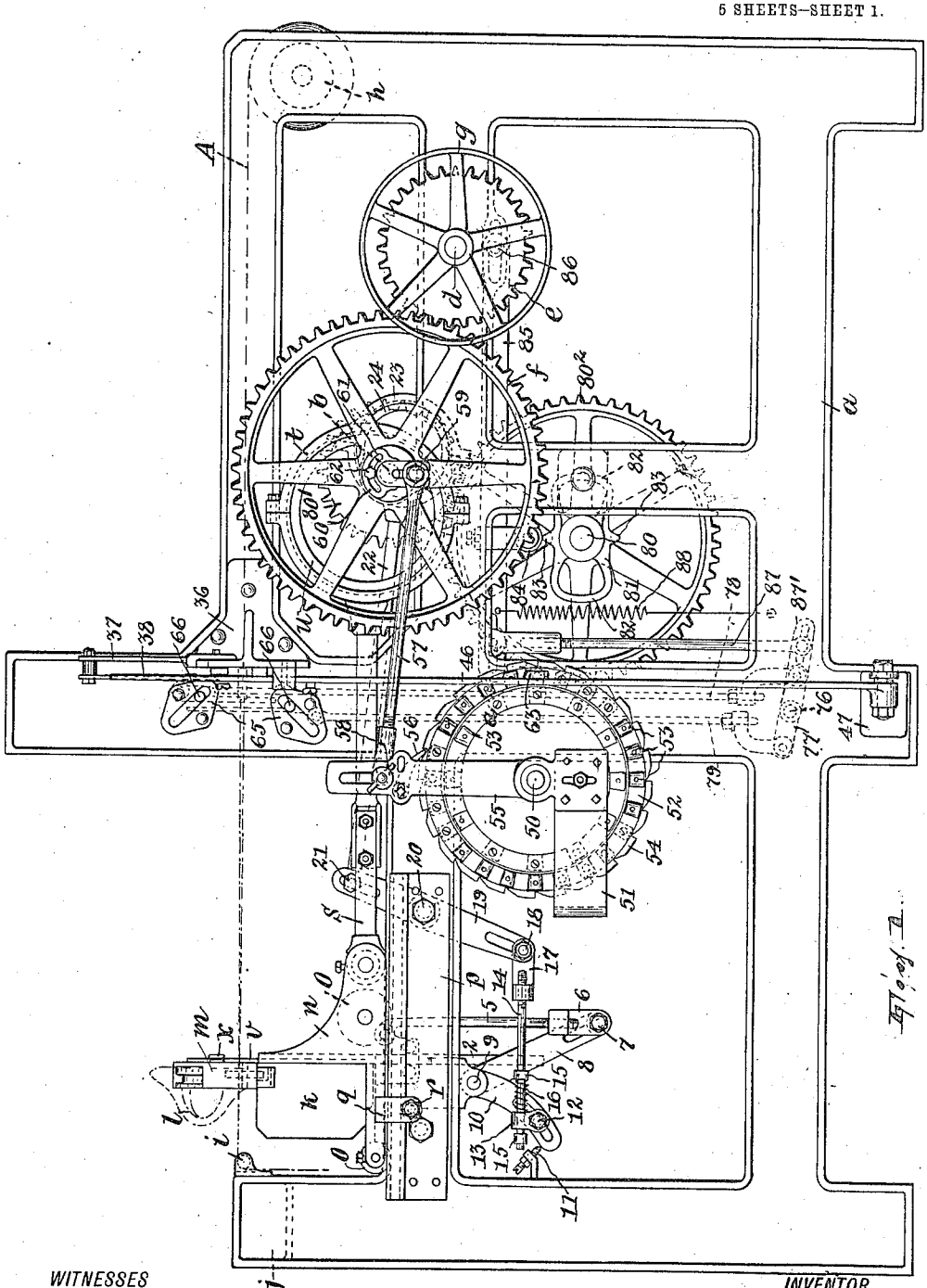
LOOM.

APPLICATION FILED MAY 17, 1911.

1,041,254.

Patented Oct. 15, 1912.

5 SHEETS—SHEET 1.



WITNESSES

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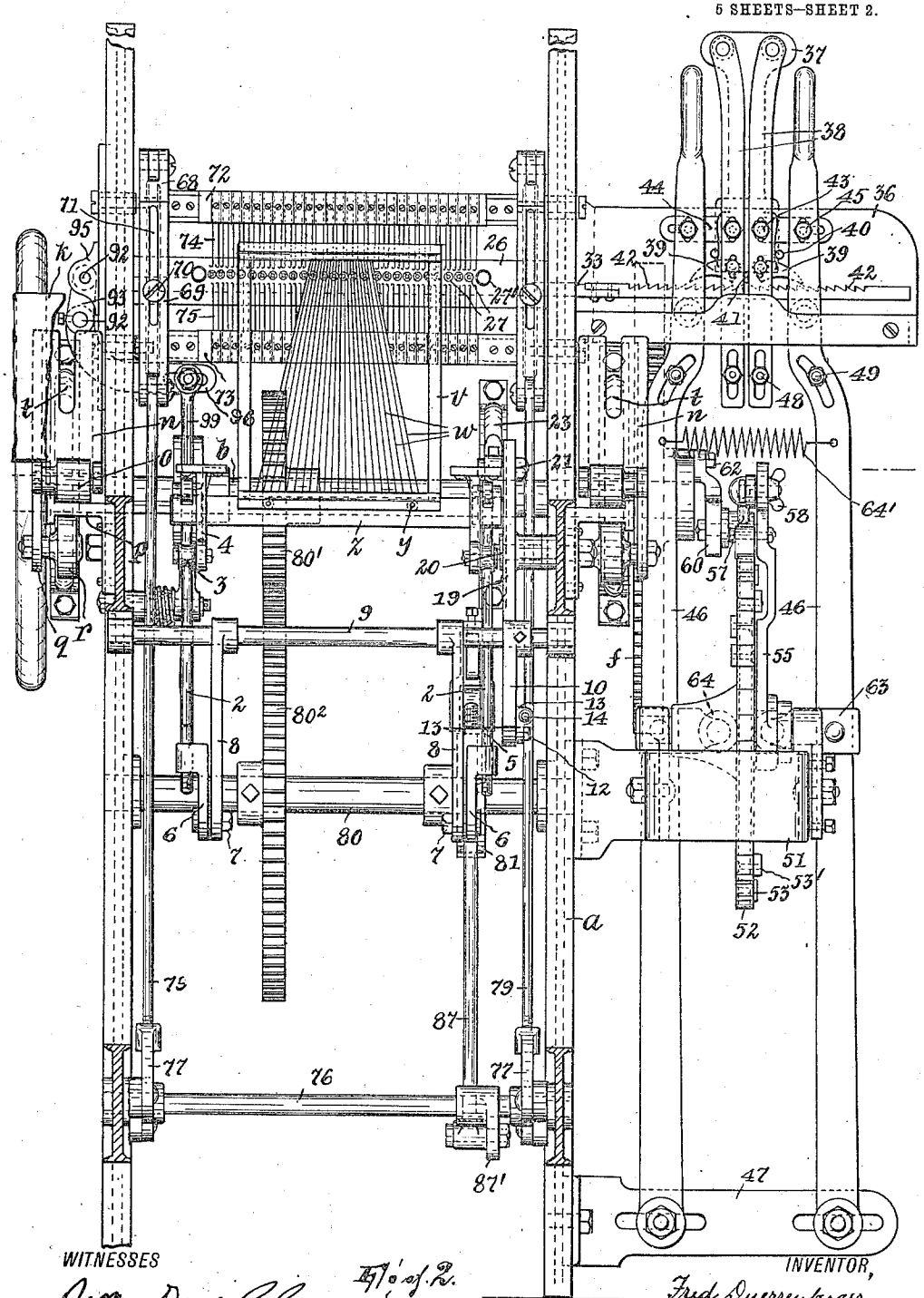

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Fig. 2.

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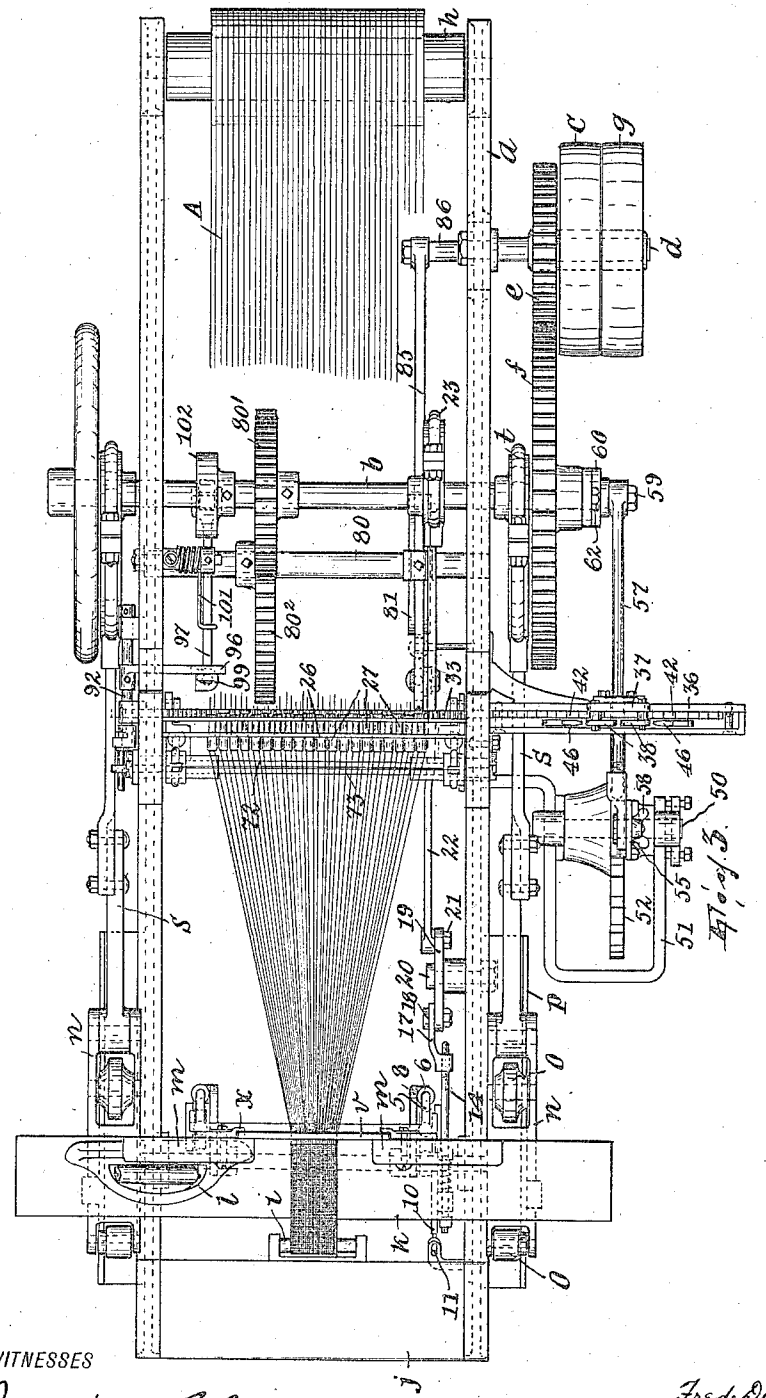

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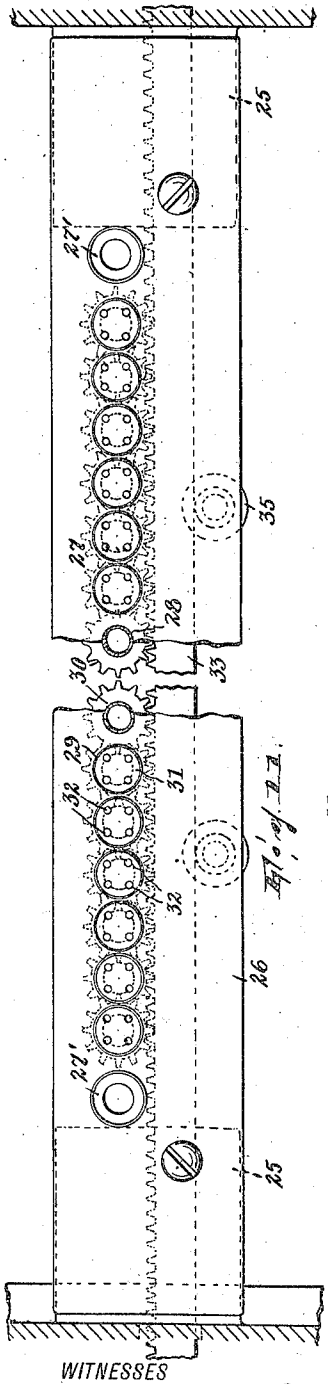

Fig. 1.

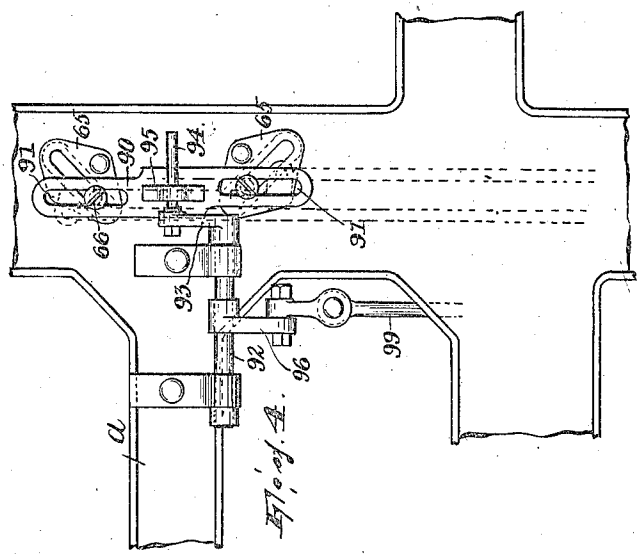

Fig. 4.

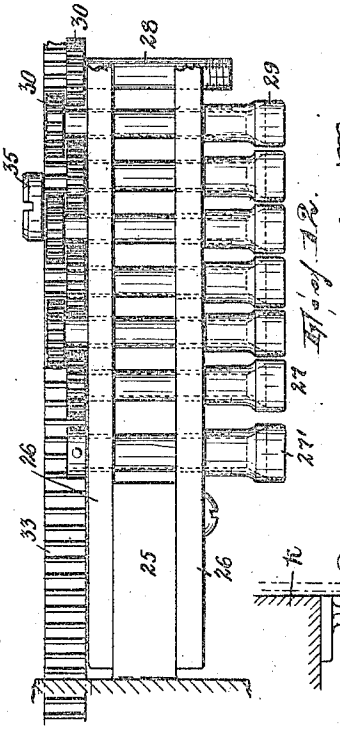

Fig. 2.

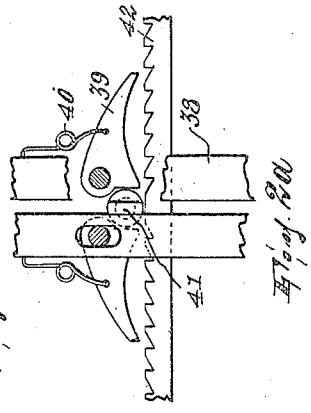

Fig. 3.

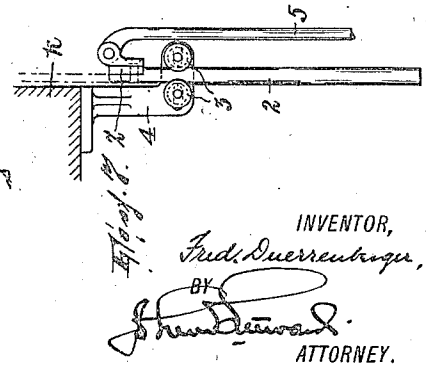

Fig. 5.

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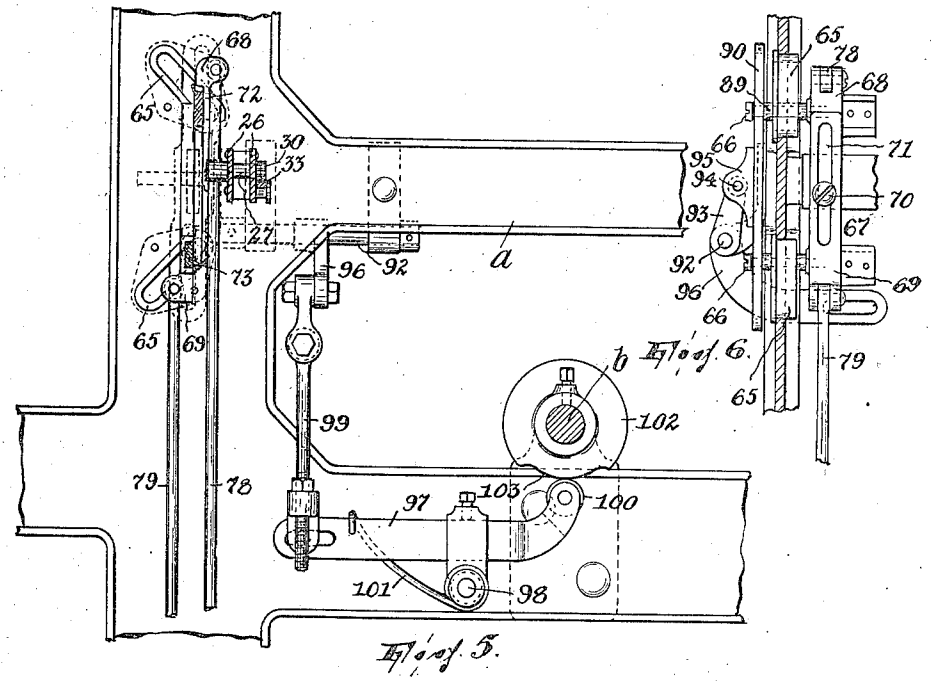

Fig. 5.

Fig. 6.

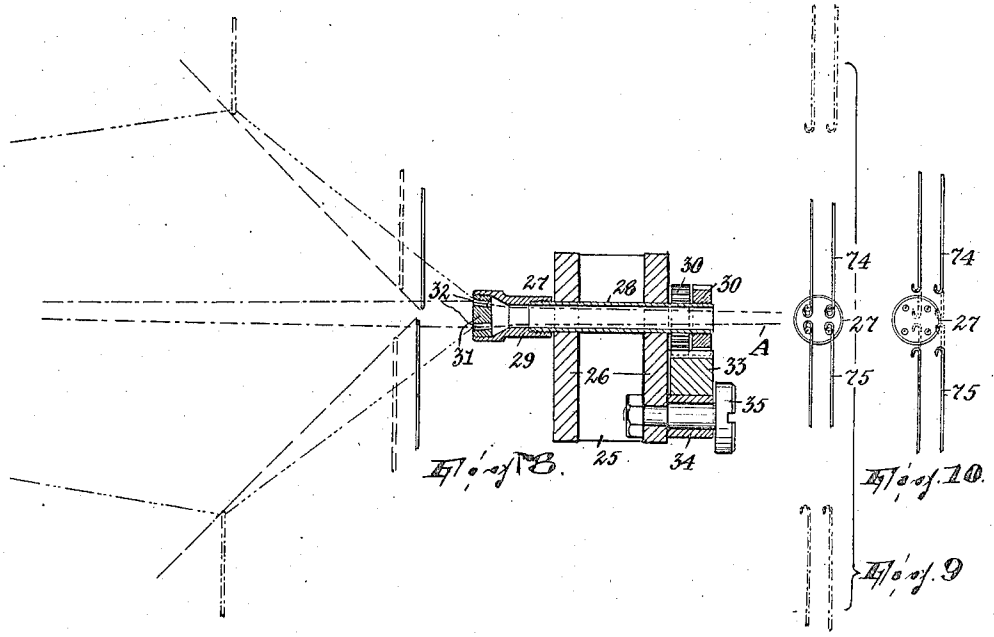

Fig. 8.

Fig. 10.

Fig. 9.

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UNITED STATES PATENT OFFICE.

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LOOM.

1,041,254. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed May 17, 1911. Serial No. 627,718.

To all whom it may concern:

Be it known that I, FREDERICK DUERRENBERGER, a citizen of the United States, residing at Paterson, in the county of Passaic and State of New Jersey, have invented certain new and useful Improvements in Looms, of which the following is a specification.

This invention relates to looms, and it has reference particularly to those parts of the mechanism of machines of this character which have to do with the forming of the sheds in the warp and the beating-up of the filling or weft.

My objects are to improve the construction of looms in respect to the mechanisms mentioned in various particulars, among which may be mentioned, first, to make the entire apparatus more simple and compact than is now the case; second, to eliminate the employment of specially formed devices, such as jacquard cards or their equivalents, to select the warp threads in the manipulation thereof to form the sheds and the use, incidental to such cards or the like, of the mechanism necessary thereto for effecting their operative control of the warp threads and transmit their influence to the latter, and simplify the preparation necessary to effect any desired coöperation of the warp threads with the filling in the production of different designs of fabric; third, to reduce to the minimum the noise, lost-motion and jar incident to the operation of a machine of this character; and fourth, to bring the shed-forming mechanism within the convenient view and reach of the weaver.

In the accompanying drawings, Figure 1 is a right side elevation of the improved loom; Fig. 2 a vertical sectional view on a larger scale, taken in a plane between the breast-beam and batten and looking from front to rear; Fig. 2ª shows a detail of Fig. 2; Fig. 3 is a plan view on the same scale as Fig. 1. Figs. 4, 5 and 6 are, respectively, a left side elevation, a longitudinal sectional view and a transverse sectional view of a fragment of the loom including the shed-forming means; Fig. 7 is a detail of the reed-actuating and guiding means; Fig. 8 illustrates the manner of operation of the warp-thread controllers and shed-forming hooks; Figs. 9 and 10 illustrate the relation positions of said controllers and hooks at different stages of their operation; and Figs. 11 and 12 show the warp-thread controllers and their adjuncts in front elevation and in plan.

In the frame *a*, of substantially the usual construction, is journaled the main shaft *b* to which rotary motion is transmitted from the fast pulley *c* on the counter-shaft *d* by the intermeshing gears *e* and *f* respectively fixed to rotate with the pulley *c* and shaft *b*; *g* is a loose pulley on counter-shaft *d*.

h is the warp-supply roll from which the warp A extends forward in a horizontal plane in the usual manner over the guiding roller *i* carried by the breast-beam *j*.

The batten *k* carries suitable means for throwing the weft or filling back and forth through the sheds of the warp, which means has suitable mechanism for operating it. As the weft-carrying means and its actuating mechanism form no part of my invention it will suffice to note that at *l* in Figs. 1 and 3 is shown a weft carrier or shuttle of the kind used in narrow ware looms and at *m m* are the guiding blocks in which it travels. The batten *k* is mounted in two supports *n* each of which has rollers *o* running on the grooved rails *p* bolted to the sides of the loom and a depending projection *q* in which is journaled a roller *r* bearing against the under side of said rail. The batten is thus adapted to reciprocate in a horizontal plane instead of, as usual, oscillating.

s designates pitmen each pivotally connected at one end to a support *n* and at the other end having a circular strap *t* embracing an eccentric *u* on the shaft *b*, by which mechanism it will be seen the batten is reciprocated from said shaft.

For a reason which will appear later herein the warp threads A are spaced greater distances from each other backwardly from the transverse line in which the warp-controllers (to be described) are disposed than are the portions of the warp incorporated as a part of the fabric, so that between the line referred to and the fabric the intervening portions of the warps diverge rearwardly (Fig. 3). Each time the weft or filling is laid in the shed the reed, carried by the batten, is caused to move forward to beat-up the filling to the fell of the cloth, and in order that this reed may be adapted to the fan-like disposition of the diverging portions of the warps it is constructed and operated as follows: The reed *v* has its dents

w arranged to diverge downwardly as shown in Fig. 2. It is arranged at the back of the batten so as to reciprocate vertically in guides *x*, being removably secured by pins, screws or the like *y* to a horizontal bar *z* (Figs. 2 and 7) having depending rods 2 guided between grooved rollers 3 journaled in brackets 4 depending from the batten. Pivotally connected to each end of the bar *z* is a pitman 5 having at its free end a head 6 adjustable thereon. The heads 6 are connected adjustably, by the slot and bolt connection 7, with cranks 8 on a rock-shaft 9 journaled in the frame, the said rock-shaft carrying another crank 10 which may contact with a set-screw 11 on the frame employed to adjust the forward rocking movement of the structure comprising rock-shaft 9 and its cranks, and consequently the downward movement of the reed. By a slot and bolt connection 12 a clevis 13 is adjustably attached to the crank 10 and penetrating this clevis is the end-portion of a pitman 14 having collars 15 both sides of the clevis, a spring 16, coiled about the pitman, being interposed between the clevis and the rear collar 15; the rear end of the pitman is provided with an adjustable head 17 pivoted by an adjustable slot and bolt connection 18 with one end of a lever 19 fulcrumed between its ends in the frame on a stud 20. The other end of the lever 19 has pivoted to it, by the adjustable slot and bolt connection 21, one end of a pitman 22 whose other end has a strap 23 embracing an eccentric 24 on the shaft *b*. Thus, each time the batten moves forward to cause the reed to beat up the filling, through the described train of parts connecting the shaft *b* with the reed the latter moves downwardly, the rate of its descent being proportioned to the rate of forward advance of the batten so that in any position of the reed the spaces between the dents thereof in the line where the plane thereof and the plane of the warps cross each other will be the same as the spaces between the warps in said line; when the batten moves back the relation of the dents of the reed to the warps will of course be the same in any position of the batten as it was in the forward movement of the batten. The adjustments described, it will be understood, permit the movements of the reed to be so timed as to produce this result.

Projecting inwardly from the sides of the frame in opposite relation to each other are two lugs 25 to which are secured the spaced, parallel and horizontal strips 26 (Figs. 1, 3, 11 and 12). In these strips are journaled, in a horizontal row, the warp-controllers 27. Each warp-controller comprises a tube 28 journaled in the strips 26 and having a cylindrical head 29 screwed onto its forward end and a pinion 30 screwed onto its rear end. The heads 29 retain the warp-controllers against longitudinal movement rearwardly, while their pinions serve to prevent their forward longitudinal movement, the pinions of alternating warp-controllers bearing against the back of the rear strip and receiving against their rear faces the contact of the remaining pinions (Fig. 12). In the head 29 of each warp-controller is a block 31 having two or more (as shown, four) thread eyelets 32 through each of which is passed a warp thread. Meshing with the pinions, and disposed under the same, is a rack 33 supported on rollers 34 which rotate on headed studs 35 projecting from the rear strip 26. Upon longitudinally moving this rack it will be apparent that the warp-controllers will be rotated and that the several warps controlled by each warp-controller will be caused to change their positions rotatively around the axis of the warp-controller. In view of the fact that each group of warps corresponding to each warp-controller are made to change their positions rotatively, instead of by moving in vertical planes, as usual, it will be apparent that the character of the weave produced by the present loom differs from that produced in a loom of the ordinary type. As it may be however desired that the edge or selvage of the fabric be manipulated in the usual manner, I have shown at 27′ (Figs. 11 and 12) a device which is the same as each of the warp-controllers 27 except that it has no perforated head 31 and is preferably not adapted to rotate, by lacking a pinion to engage the rack. The movement of the rack 33 may be either a simple reciprocating movement, or a reciprocating movement modified by interruptions, according to the character of weave which it is desired to produce. In the present instance, the mechanism for accomplishing the movement of the rack is shown as adapted to produce a reciprocating movement modified by interruptions.

A plate 36 projects from one side of the loom; standing in a vertical plane and pivotally depending from a bracket 37 rising therefrom is a pair of levers 38. In these levers are pivoted pawls 39 each normally forced toward the rack by a spring 40 but being held out of engagement with the rack in the position shown in Fig. 2 by a pin 41 against which it abuts at that time. The portion of the rack with which the pawls coact is shown as provided with reversely set series of ratchet teeth 42. By adjustable connections 43 outwardly projecting arms 44 are secured to the levers 38, and pivotally attached to the outer end of each arm, by the adjustable connection 45, is the upper end of a lever 46, the two levers being pivoted in a bracket 47 projecting laterally from the base of the frame *a*. On each movement of either lever 46 outwardly relatively to the levers 38 the corresponding lever 38

will move to the right or left as the case may be and, its pawl clearing the pin 41, said pawl will engage the rack and advance the latter; on the return stroke of levers 46 and 38 the rack will remain unactuated by the corresponding pawl, as will be obvious. To change the extent of movement of each lever 38 with its lever 46 the arm 44 may be secured to the lever 38 farther from the fulcrum thereof, 48 being the fittings for securing the arm 44 in this position and 49 fittings for pivotally connecting said arm with the lever 46. The movements of the levers 46 are effected from a pattern mechanism, now to be described.

On a shaft 50 in a bracket 51 projecting from the side of the frame is journaled a pattern wheel 52 to the opposite faces of which in circular series are removably secured the cam pieces or blocks 53. The pattern wheel has a ratchet periphery 54 and it is caused to rotate intermittently from an oscillating lever 55, fulcrumed on the shaft 50 and having a pawl 56 engaging the ratchet of the pattern wheel. The lever is oscillated from the shaft *b* through a pitman 57 pivotally connected at one end, by the adjustable connection 58, with said lever, and at the other end having an adjustable pivotal connection 59 with a crank-piece 60 which is secured to the hub of the gear *f* and has a slot 61, concentric with the axis of shaft *b*, receiving a screw 62 whereby the crank-piece may be adjusted rotatively relatively to shaft *b* to time the movements of the lever 55 relatively to shaft *b*. The levers 46 are provided with brackets 63 carrying anti-friction rollers 64 which are held against the opposite faces of the pattern wheel in the circular paths of the cam-pieces 53 by a spring 64′ connecting levers 46. At 53ª other cam-pieces, arranged in concentric relation to but spaced at intervals different from those between the cam-pieces 53, are shown; if the brackets 63 are shifted so as to bring the rollers 64 into position to be engaged by the cam-pieces 53ª, or the arms 44 of levers 38 are moved to the fittings 48 and 49, or both of these changes are effected, it will be apparent that different extents of movement will be imparted to the rack each time from the pattern wheel. Of course, according as the throw of the rack is changed, so the rotary movement which it imparts to each warp controller varies in extent. The rotary movement imparted to each group of warp threads controlled by any warp-controller of course involves the changing of said warp threads to different radial positions relating to the axis of their rotary movement, and in view of this, or by altering the number of warp-threads in each group, or by resort to both of these expedients, the design of the fabric may be altered at will.

I now proceed to describe the means whereby the upper and lower warp threads of the several groups may be respectively raised and lowered to form the shed.

Forward of the series of warp-controllers and above and below the horizontal plane thereof there are mounted in the sides of the frame *a* in opposite relation to each other the slotted guides 65 whose inclined slots diverge forwardly. In these slots slide the studs 66 of brackets each comprising upper and lower parts 68 and 69 having, respectively, a headed stud 70 and a longitudinal slot 71 whereby said parts are connected in such manner that the bracket is extensible and contractible vertically. The upper parts 68 of the two brackets are rigidly connected by a bar 72, while the lower parts 69 are rigidly connected by a bar 73, each bar and its brackets thus forming a rigid frame. To the bars 72 and 73 of these frames are suitably secured downwardly and upwardly projecting series of hooks 74 and 75, the number in each series corresponding in the present instance to one-fourth of the number of warp threads, that is, there is one hook in each series to correspond to each group of warp threads. The frames carrying the series of hooks move toward each other and then apart, standing always in a vertical plane on account of the manner in which their bracket parts 68 and 69 are connected (Fig. 6), although following the diverging paths corresponding to the slots of the guides 65. When the hooks approach each other they are made to catch certain of the warp threads so as to draw them apart and form the shed upon the hooks receding from each other. The object in causing the hooks to move in diverging paths, instead of remaining always in the same vertical plane, is to reduce the tension on the threads when the hooks move apart, which tension would be so great if the hooks moved in vertical planes that the threads would be cut or unduly abraded by the hooks as well as by the blocks 31 of the warp-controllers where they enter the eyelets thereof. The raising and lowering of the hook-carrying frames are accomplished as follows: 76 is a rock-shaft on which are fixed two levers 77. The opposite ends of each of these levers are connected by pitmen 78 and 79 with the corresponding bracket-parts 68 and 69 (Figs. 1, 2, 5 and 6). On a counter-shaft 80 journaled in the frame is fixed a symmetrical cam 81 having two opposite major rises 82 and two opposite minor rises 83; power is transmitted to shaft 80 from shaft *b* by inmeshing gears 80′ and 80². Against the cam 80 bears a roller 84 on a lever 85 fulcrumed at 86 in the frame, the lever being connected by a pitman 87 with a lever 87′ on shaft 76 (Fig. 1) and its roller being held in contact with the cam by the spring

88. While the roller 84 is in contact with either major rise of the rotating cam the hooks are receding, from each other, then, having reached the limits of their receding movements, stand at a dwell, and then approach each other; it is during this time that the shed opens and closes. While the roller is riding over the minor rise of the cam the hooks again slightly recede from and approach each other; the receding movement thus accomplished by the hooks has for its purpose to withdraw them from the circular path in which the several groups of warp threads rotate to change their relative positions, so that the rotary movement of the threads will not be interfered with by the hooks. Each time the hooks approach each other the discharge or release of the threads therefrom must be accomplished, and to effectuate this I provide means for imparting a slight lateral movement to the hooks.

Referring now to Fig. 6 it will be seen that the hook-carrying structure is permitted slight lateral movement. The actual contact for said structure in the guides 65 is afforded by anti-friction rollers 89 journaled on the studs 66 and fitted between the outer ends of the rollers and the heads of the studs is a plate 90 having vertical slots 91 receiving said studs. (The parts now being described are provided only at one side of the machine.) 92 in Figs. 2 to 6 is a rock-shaft whose crank 93 is provided with a long crank-pin 94 penetrating a lug 95 on the side of the plate 90 and whose crank 96 is pivotally connected with a lever 97, fulcrumed at 98 in the frame, by a pitman 99, the lever carrying a roller 100 which, by means of a spring 101 fixed to the stud affording the fulcrum for the lever and engaging the latter, is held against a cam 102 on the shaft b; a part of the periphery of this cam, which is otherwise concentric, is depressed, as at 103. The ratio of the gears $80'$ and 80^2 is two to one, so that the cam 102 performs two complete rotations to a single rotation of cam 81. Thus, each time a minor rise on the cam 81 effects the minor receding movement of the hooks, as described, the low portion 103 of cam 102 is presented to the roller 100, with the consequence that lever 97, through its connections with plate 90, causes said plate to shift inwardly toward the frame, the hook-including structure moving with it.

In Figs. 9 and 10 the positions of the hooks in different stages of their operation are illustrated. While the major parts of the cam 81 are acting the hooks, engaged with warp threads recede from the full line position to the broken line position in Fig. 9 to form the shed, and then return; during this period the high part of cam 102 is presented to roller 100, so that so far as lateral movement is concerned the hook-carrying structure is fixed. Having returned the threads to their normal or horizontal positions, the lower part 103 of cam 102 and a minor rise of cam 81 become active, the former to effect sufficient lateral movement of the hooks so that they will be out of the vertical planes of the warp threads last engaged by them and the latter to effect the minor receding of the hooks from each other sufficiently to clear the horizontal planes of the warp controllers so that they may be rotated; the minor receding movement of the hooks being completed and the positions of the warp threads rotatively changed the minor rise of cam 81 allows the hooks again to approach each other, this being followed by the high part of cam 102 again becoming active to move the hooks laterally to their normal positions, ready to catch and separate the threads when the shed is again to be formed. It will be understood that the movements of the rack 33 are so timed as to occur when the hooks are performing their minor movements from and toward each other.

I have already indicated herein certain ways in which the character of the weave accomplished may be varied. In addition to the instances thus mentioned I may add that the designs of weave may further be varied by causing some of the warp-controllers to rotate in one direction while the others are rotating in the reverse direction, as by employing the pinion in each pair of warp-controllers alone to transmit motion to them, the pinion of the other warp-controller being in mesh with the first-named pinion.

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

1. In a loom, the combination of a supporting structure, warp-sustaining means, a plurality of rotary warp-twisting devices each having a plurality of warp-holding portions, and means, including a pattern mechanism, for rotating said devices back and forth together all in the same direction on each rotation, substantially as described.

2. In a loom, the combination of a supporting structure, warp-sustaining means, a plurality of rotary warp-twisting devices each having a plurality of warp-holding portions, and means, including a pattern mechanism, for synchronously rotating said devices back and forth together all in the same direction on each rotation each through a definite stage or a multiple thereof, substantially as described.

3. In a loom, the combination of a supporting structure, warp-sustaining means, a series of rotary warp-twisting devices each having a plurality of warp-twisting portions, a reciprocatory actuating member for said device having a positive advancing

engagement with each of them in the movement of said member in each direction, and means for reciprocating said member, substantially as described.

4. In a loom, the combination of a supporting structure, warp-sustaining means, a series of rotary warp-twisting devices each having a plurality of warp-twisting portions, a reciprocatory actuating member for said devices having a positive advancing engagement with each of them in the movement of said member in each direction, and means, including a pattern mechanism, for reciprocating said member, substantially as described.

5. In a loom, the combination of a supporting structure, means for sustaining the warp, a series of rotary warp-twisting devices each having a plurality of warp-twisting portions, an actuating member for said devices movable back and forth and having a positive advancing engagement with each of them in the movement of said member in each direction, and means, comprising oppositely acting members engageable with said actuating member, for effecting the back and forth movements of the actuating member, substantially as described.

6. In a loom, the combination of a supporting structure having means for sustaining the ends of the warp and fabric, means, comprising warp-engaging members movable toward and from the warp, for moving certain warp-threads into shed-forming relation to other warp-threads, and means, comprising a pattern mechanism and revoluble warp-controllers, for shifting some of the warp-threads into position to be engaged by said members, substantially as described.

7. In a loom, the combination of a supporting structure having means for sustaining the ends of the warp and fabric, means comprising warp-engaging members movable toward and from the warp, for moving certain warp-threads into shed-forming relation to other warp threads, and means, comprising a pattern mechanism and revoluble warp-controllers, for shifting some of the warp-threads into, and others out of, position to be engaged by said members, substantially as described.

8. In a loom, the combination of a supporting structure having means for sustaining the ends of the warp and fabric, means, comprising warp-engaging members movable toward and from the warp, for moving certain warp-threads into shed-forming relation to other warp-threads, and means, comprising a pattern mechanism and revoluble warp controllers, for shifting the warp-threads toward and from said members respectively into and out of position to be engaged by said members, substantially as described.

9. In a loom, the combination of a supporting structure having means for sustaining the ends of the warp and fabric, means, comprising warp-engaging members movable toward and from the warp, for moving certain warp-threads into shed-forming relation to other warp-threads, and means, comprising a pattern mechanism and revoluble warp controllers, for shifting the warp-threads laterally into and out of position to be engaged by said members, substantially as described.

10. In a loom, the combination of a supporting structure, warp-sustaining means, means, comprising series of warp-engaging members movable toward and from the warp and toward and from each other, for forming a shed in the warp, means for moving said series of members and means for shifting a part of the warp threads back and forth into position to be engaged by one, and the remainder of the warp threads into position to be engaged by the other, of said series of members, substantially as described.

11. In a loom, the combination of a supporting structure, warp-sustaining means, means, comprising series of warp-engaging members projecting toward each other and movable in opposite directions, for forming a shed in the warp, one being arranged above and the other below the warp, means for moving said series of members, and means for shifting a part of the warp threads back and forth into position to be engaged by one, and the remainder of the warp threads into position to be engaged by the other, of said series of members, substantially as described.

12. In a loom, the combination of a supporting structure, warp-sustaining means, means, comprising shed-forming series of devices projecting toward each other and arranged one above and the other below the warp and movable toward and from the warp, for forming a shed in the warp, means for actuating said series of devices, and means, having back and forth movement crosswise of the warp, for shifting a part of the warp threads into position to be engaged by one, and the remainder of the warp threads into position to be engaged by the other, of said series of devices, substantially as described.

13. In a loom, the combination of a supporting structure, shed-forming means, means for effecting movement as between said shed-forming means and the warp toward and from each other whereby to form the shed, means for effecting movement of the shed-forming means laterally of the warp, and means for causing the second and third-named means to coöperate with each other, substantially as described.

14. In a loom, the combination of a supporting structure, warp-sustaining means,

shed-forming hooks movable toward and from the warp into engagement with the threads thereof and also movable laterally of the threads and a common means for effecting both the movements of said hooks toward and from the warp and their movements laterally, substantially as described.

15. In a loom, the combination of a supporting structure having means for supporting the warp and fabric, means for forming a shed in the warp comprising a series of warp-thread-engaging devices movable toward and from the warp, means for causing said devices to reciprocate toward and from the warp-threads, means for changing the positions of some of the warp-threads relatively to others thereof and to said devices and for effecting lateral movement of said devices, substantially as described.

16. In a loom, the combination of a supporting structure comprising means for sustaining the warp and fabric, means for moving vertically threads at intervals of the warp relatively to the remaining threads therein, and shed-forming means comprising two sets of warp-catching devices movable toward and from the warp from above and below the same, substantially as described.

17. In a loom, the combination of a supporting structure comprising means for sustaining the warp and fabric, means, comprising a pattern mechanism, for decussating the warp-threads and shed-forming means comprising two sets of warp-catching devices movable toward and from the warp from above and below the same, substantially as described.

18. In a loom, the combination of a supporting structure comprising means for sustaining the warp and fabric, means, maintaining the threads in upper and lower series, for causing back and forth horizontal movements of the warp-threads of each series and shed-forming means comprising two sets of warp-catching devices movable toward and from the warp from above and below the same, substantially as described.

19. In a loom, the combination of a supporting structure comprising means for sustaining the warp and fabric, means, comprising a pattern mechanism, for causing reverse horizontal movements of the warp-threads relatively to each other and shed-forming means comprising two sets of warp-catching devices movable toward and from the warp from above and below the same, substantially as described.

20. In a loom, the combination of a supporting structure comprising means for sustaining the warp and fabric, and a shed-forming means movable toward and from the normal plane of the warp threads engaged thereby and obliquely thereto, substantially as described.

21. In a loom, the combination of a supporting structure comprising means for sustaining the warp and fabric, controlling devices engaging the warp-threads, and a shed-forming means coacting with said devices and movable toward and from the same and the plane of the warp and obliquely to the latter, substantially as described.

22. In a loom, the combination of a support, an actuated part movable back and forth and having reverse series of ratchet teeth, separately movable pawl-carrying members having their pawls engaging the respective series of ratchet teeth, and means for actuating said members comprising a pattern-wheel and independently movable members engaging the pattern wheel and connected with the pawl-carrying members and adapted to transmit actuation from the pattern wheel to the latter, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FRED. DUERRENBERGER.

Witnesses:

JOHN W. STEWARD,

WM. D. BELL.