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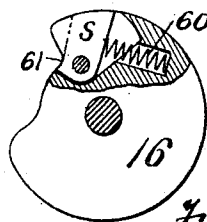
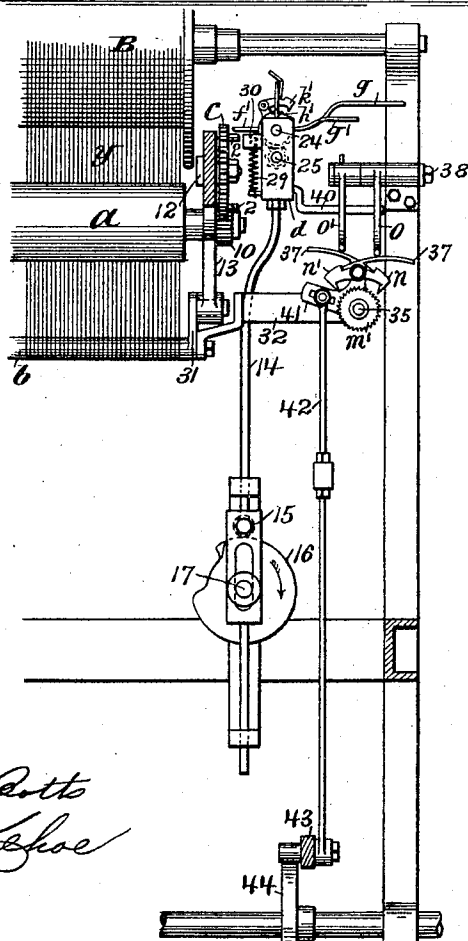
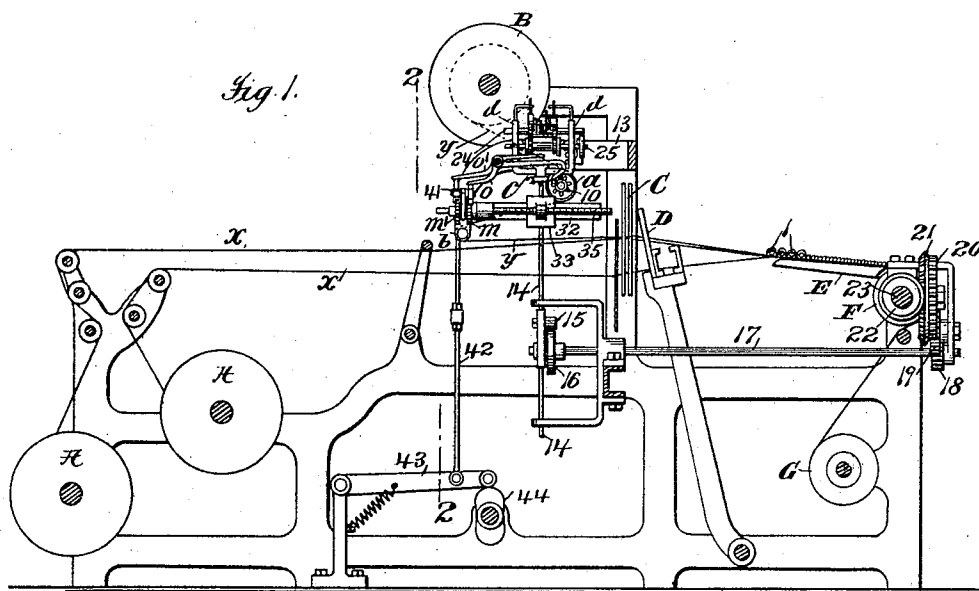
2 Sheets—Sheet 1.

A. CLAPPERTON.

PATTERN MATCHING MECHANISM FOR LOOMS.

No. 581,336.

Patented Apr. 27, 1897.



Attest:
George H. Hart
T. F. Schoe

Inventor:
Alexander Clapperton
By Philip M. M. Phelps
Attys

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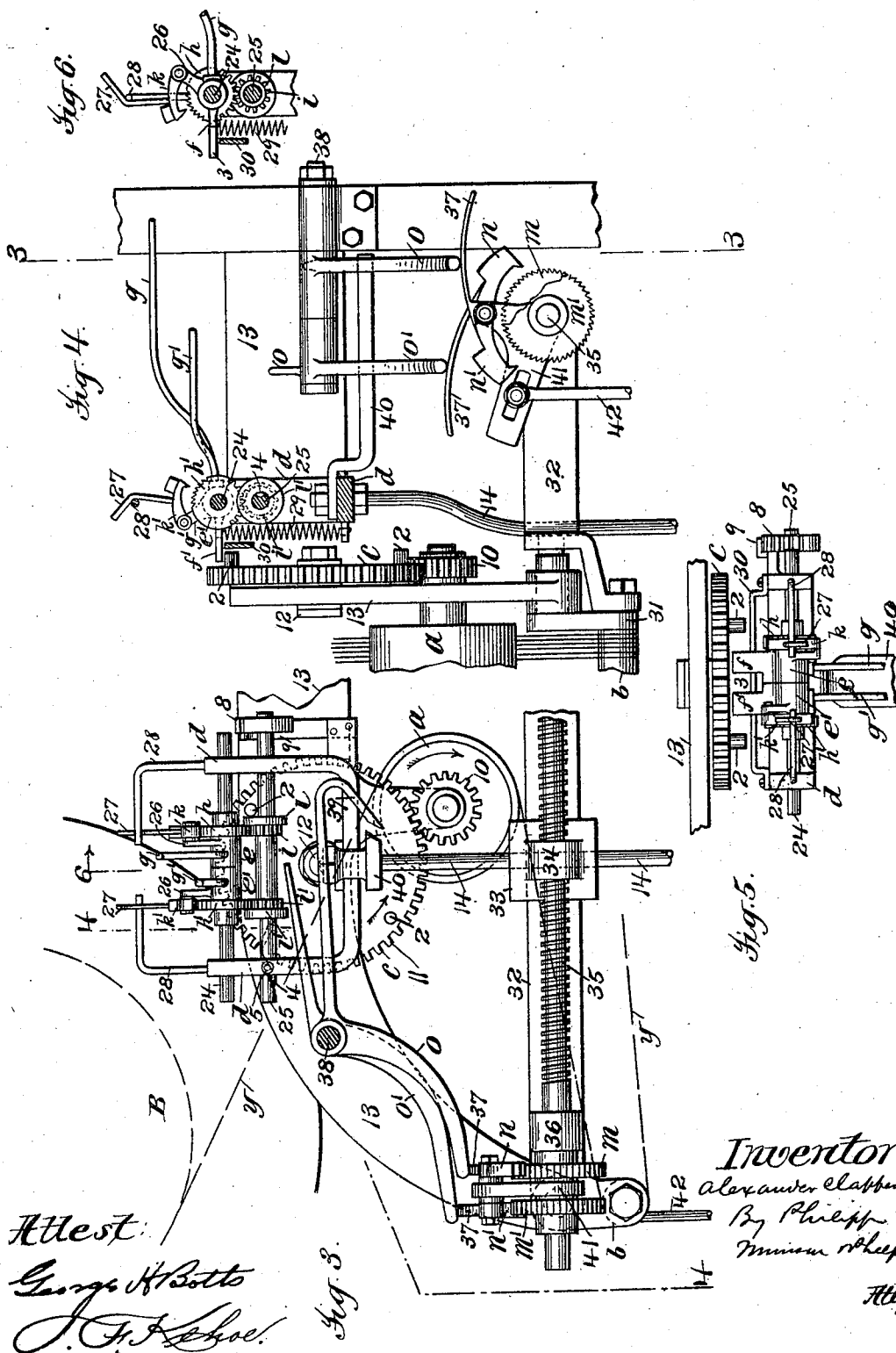
2 Sheets—Sheet 2.

A. CLAPPERTON.

PATTERN MATCHING MECHANISM FOR LOOMS.

No. 581,336.

Patented Apr. 27, 1897.



Attest:
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J. F. Schae.

Inventor
Alexander Clapperton
By Philip
Munroe Phelps
Atty

UNITED STATES PATENT OFFICE.

ALEXANDER CLAPPERTON, OF YONKERS, NEW YORK.

PATTERN-MATCHING MECHANISM FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 581,336, dated April 27, 1897.

Application filed September 18, 1896. Serial No. 606,197. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER CLAPPERTON, a citizen of the United States, residing at Yonkers, county of Westchester, and State of New York, have invented certain new and useful Improvements in Pattern-Matching Mechanism for Looms, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In the manufacture of fabrics consisting of a body formed by ground or body warp and weft threads and a pattern-surface formed by pattern-warp threads, such as pile fabrics of the various classes, a serious difficulty arises from the fact that the pattern-warp is liable to run unevenly relatively to the ground or body warp, so that the successive blocks of the pattern formed by the pattern-warp are long or short, while it is necessary that the successive pattern-blocks should be of the same length and register accurately with successive portions of the warp-strands, so as to secure the uniform appearance of a single breadth of the fabric and the matching of the pattern in successive breadths when placed side by side. Heretofore this difficulty has been overcome only by constant watchfulness on the part of the operative and frequent hand adjustment of some part of the loom to secure the proper action.

The object of the present invention is to provide means by which the proper uniform length of the pattern-blocks and their accurate registry with different portions of the body of the fabric shall be secured and any irregularity therein automatically corrected by the action of the loom. I secure this result by combining with the loom a pattern-matching mechanism controlled by the pattern-warp, so as to shorten or lengthen the pattern-blocks in case the pattern runs long or short, and thus correct any irregularity in the pattern registry, and in the preferred form this matching mechanism acts by adjusting the tension of the pattern-warps in accordance with the irregularity to be corrected, the tension being increased if the pattern runs too short and decreased if it runs too long, and the mechanism is controlled by the movement of the pattern-warps. This result may be secured by constructions of

many different forms, but I preferably employ a weight acting upon a tension-bar and adjustable to vary the tension of the pattern-warps and control the adjustment of this weight by the movement of the pattern-warp through a roll over which the pattern-warp runs and which is thus rotated at a speed which varies with the movement of the pattern-warp.

The invention therefore consists, broadly, in the combination, with a loom, of a pattern-matching mechanism controlled by the pattern-warp and in various constructions and combinations of parts in a loom embodying said invention, all of which will be fully described hereinafter and specifically pointed out in the claims.

For a full understanding of the invention a detailed description of a construction embodying all the features of the invention in their preferred form as applied to a pile-fabric loom of a well-known class will now be given in connection with the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a diagrammatic side elevation of the loom inside the frame. Fig. 2 is a vertical cross-section of one side of the loom on a larger scale, looking to the right from line 2 of Fig. 1. Fig. 3 is a detail enlarged view similar to Fig. 1. Fig. 4 is a sectional elevation looking to the right from the line 4 of Fig. 3. Fig. 5 is a detail plan view of a portion of the matching mechanism. Fig. 6 is a detail section looking to the right from the line 6 of Fig. 3. Fig. 7 is a detail view of a cam, hereinafter described.

The loom to which my pattern-matching mechanism is shown as applied is substantially the same as the Bigelow looms now well known and in common use in weaving tapestry carpets, so that a full illustration and description of this loom is unnecessary, it being understood that the construction and operation of the parts of the loom, aside from my novel mechanism, is or may be of any suitable form, and that the matching mechanism may be applied to many other looms of the same class or of other classes employing pile or similar pattern warps.

In the loom shown A are the warp-beams for the ground or body warp x , B the pile-

warp beam for the pile or pattern warp *y*, C the heddles, D the lay, E the breast-beam, over which the woven fabric passes to the draw-off roll F and wind-up roll G, all these parts and their actuating mechanisms being of any common or suitable construction and operated in any suitable manner, and the loops in the pile-warp *y*, which form the pile-surface, being formed by pile-wires 1, which are inserted and withdrawn by any suitable pile-wire movement, all as will be readily understood by those skilled in the art.

Referring now to the parts in which the present invention is embodied, the pile-warp *y* passes from the warp-roll B downward over a roll *a*, thence over a tension-bar *b*, and thence to the heddles C. The roll *a* in the construction shown is the roll previously referred to as actuated by the pile-warp and controlling the matching mechanism, and it is important, therefore, that the roll should be actuated by the pile-warp without slip, so that the speed of the roll will vary accurately with that of the pile-warp. For this purpose the roll *a* is preferably faced with rubber or similar material or otherwise suitably formed, so as to secure the accurate movement of the roll with the pile-warp. The tension-bar *b* in the construction shown is a smooth-faced bar, but it may be a roll, if desired. It will be understood that the position of the roll *a*, as shown, is not essential, and that this or a similar roll may be placed in any other position and mounted in any suitable manner to secure its proper movement by the pile-warp. If a roll be used for the tension-bar, it is obvious that this roll may be used to control the matching mechanism.

The shaft of roll *a* carries at one side of the loom a pinion 10, which meshes with and drives a gear 11, formed on the edge of a disk *c*, mounted on a stud 12 in a bracket 13, supported on the loom-frame, and this disk *c* carries on its outer face two pins or projections 2, placed diametrically opposite each other. Between the bracket 13 and the side loom-frame is a U-shaped frame *d*, carried by a bar 14, mounted to move vertically in brackets on the loom-frame, which bar 14 carries at its lower end a bowl 15, which engages cam 16 on a shaft 17, extending longitudinally of the loom and having on its end a pinion 18, meshing with an intermediate 19, which meshes with a gear 20, which has fixed to it a beveled gear 21, meshing with a beveled gear 22 on the shaft 23 of the draw-off roll F, so that the shaft 17 and cam 16 are driven from the draw-off roll, this gearing being so timed that the cam 16 makes one revolution to each pattern-block of the fabric, which may be varied in length, but is usually about ten inches long. The cam 16 is formed so as to permit the frame *d* to drop quickly when the cam reaches the proper position and, therefore, has a sharply-cut shoulder off which the bowl 15 drops. To permit this shoulder to pass the bowl 15 in running the

loom backward, as is sometimes desirable, the cam is preferably formed, as shown, with the shoulder on a portion *s* of the cam, which is hinged to swing rearward and into the body of the cam as the shoulder is engaged by the bowl in the reverse movement of cam 16, and thus allow the shoulder to pass the bowl 15. The portion *s* is held in normal position and returned thereto when it has passed the bowl 15 on this reverse movement by a spring 60, and the outward movement of the cam portion *s* is limited by the engagement of a stop-surface 61 thereon with the body of the cam.

The frame *d* carries two horizontal shafts 24 25, mounted one above the other and so as to rotate and slide longitudinally in the frame *d*. Upon the upper shaft 24 are loosely mounted two sleeves *e e'*, which sleeves carry inwardly-extending arms *f f'* and outwardly-extending arms *g g'*, by which the sleeves *e e'* may be rocked in opposite directions. The inwardly-extending arms *f f'* on the sleeves *e e'* are cut away, as shown in Fig. 5, so as to form a slot 3 between them, and these arms extend toward the disk *c*, so as to lie opposite the pins or projections 2, carried thereby. Outside the sleeves *e e'* the shaft 24 carries disks *h h'*, the upper surfaces of which disks are provided with ratchet-teeth and the lower surfaces with gear-teeth adapted to engage the pinions *i i'* on the lower shaft 25, previously referred to, and the sleeves *e e'* have arms 26, which carry, respectively, weighted pawls *k k'*, pivoted to engage the ratchet-teeth on the disks *h h'* to rotate the latter in opposite directions, and these pawls are normally held out of engagement with the disks *h h'* by fingers 27 on the pawls engaging stops 28, carried by the frame *d*. The inwardly-extending arms *f f'* on the sleeves *e e'* are normally drawn downward, so as to rock the sleeves *e e'* into position to throw the pawls *k k'* out of engagement with the ratchets on disks *h h'* by springs 29, and the downward movement of these arms is limited by the stop 30, carried by the frame *d* and extending beneath both arms *f f'*.

The lower shaft 25 in the frame *d*, which carries the pinions *i i'*, engaged by the toothed lower surfaces of the disks *h h'* on sleeves *e e'*, is provided outside these pinions with disks *l l'* of such size as to engage the disks *h h'* as the shaft 25 is moved in opposite directions, and this shaft 25 is provided with a cam-groove 4, entered by a pin 5, fixed in the frame *d*, so that by the rotation of the shaft 25 it is moved longitudinally by the engagement of the cam-groove 4 with the pin 5, and the shaft 24 thus moved with it in one or the other direction by the engagement of one of the disks *l l'* with the corresponding disk *h h'*. The shaft 25 carries at one end a toothed disk 8, which is engaged by a spring stop-pawl 9 to hold the shaft against accidental rotation. The same result may be secured by any suitable friction device.

The tension-bar *b* is carried by arms 31, pivotally mounted in brackets 13, of which there is one at each side of the loom, so that the tension-bar *b* is held against rearward movement by the loop of the pile-warp *y*, and one of these arms 31 has fixed to it a horizontal arm 32, upon which is mounted a weight 33, which slides upon the arm to vary the pressure thereon, and consequently the tension of the pile-warp. To move this weight longitudinally of the bar 32, and thus vary the tension, the weight has a threaded portion 34, which engages a screw-shaft 35, mounted in a bearing 36 on the arm 32, which shaft 35 carries two ratchet-disks *m m'*, arranged to be engaged by weighted pawls *n n'*, so as to rotate the shaft 35 in opposite directions, and having extensions 37 on the opposite side of the pawl-pivots from the pawls, upon which extensions normally rest the weighted ends of levers *o o'*, which are mounted on a stud 38 in the loom-frame, the other ends of these levers *o o'* extending, respectively, into the path of the arms *g g'* on the sleeves *e e'* when actuated, as hereinafter described. This end of the lever *o'* is formed or provided with a bent portion or hook 39, and the frame *d* carries a projection 40, which is adapted to engage this hook, so as to hold this arm of the lever depressed and the opposite weighted end of the lever raised in a certain position of the parts.

The pawls *n n'* are normally held out of engagement with the ratchets by the engagement of the weighted arms of lever *o o'* with the extensions 37, and these pawls *n n'* are carried by a lever 41, moving concentrically with the ratchet-disks and reciprocated by connecting-rod 42 and lever 43, actuated by cam 44, which may be driven from the main driving-shaft in any suitable manner, this cam being arranged and driven so as to secure the desired movement of the pawls *n n'*.

The operation is as follows: As the pile-warp *y* passes from the warp-beam B over rubber-faced roll *a* it drives the latter, and thus, through the pinion 10, drives the disk *c*, carrying the pins 2, and by the cam 16 on shaft 17 the frame *d* is reciprocated vertically once to the formation of each pattern-block of the fabric, so as to carry the inwardly-extending arms *f f'* of the sleeves *e e'* across the path of one of the pins 2 as the frame drops. As long as the movement of the pile-warp is such that the proper registry of the pattern-warp and the formation of uniform pattern-blocks is secured the roll *a* and disk *c* are rotated by the pile-warp at such a speed that one of the pins 2 on the disk *c* is opposite the slot 3, formed between the arms *f f'* when the frame *d* drops, so that these arms always pass the pin freely and no action of the matching mechanism is obtained. If, however, the pattern-warp runs out of register, so that a pattern-block is not of the proper length, the pile-warp *y* will be drawn off the beam B slower or faster, according as

the pattern is long or short, and the roll *a* and disk *c* will thus be rotated slower or faster by the pile-warp, and one of the pins 2, instead of lying opposite the slot 3 between the arms *f f'* when the frame *d* is lowered, so as to allow the free passage of the arms past the pin, will lie in the path of one or the other of the arms *f f'*, according as the movement of the pile-warp is slow or fast, so as to actuate it and thus cause the shifting of the weight 33 by the rotation of shaft 35, and thus diminish or increase the leverage of the weight on the tension-bar *b*, and thus diminish or increase the tension on the pile-warp, which will shorten or lengthen the pattern-blocks and thus bring the pattern again into registry.

Let us suppose that the irregularity is such that the pattern-block is long, so that any point of the pattern does not reach the proper point. In such case the pile-warp *y* is drawn off the beam B more slowly and the consequent slow movement of the roll *a* will rotate the disk *c* at such speed that the pin 2 will not have reached the slot 3 when a downward movement of the frame *d* takes place. Consequently as the frame *d* drops the arm *f* on the sleeve *e*, which is the right-hand arm in Figs. 3 and 5, will strike the pin 2 and be thrown up so as to rotate the sleeve *e* and throw the arm *g* down. As this arm *g* is thrown down it will strike the end of the weighted lever *o*, which projects into its path when thus lowered, and throw up the opposite weighted end of this lever *o* from the projection 37 on weighted pawl *n* and thus release the latter and allow it to drop into engagement with the ratchet-disk *m*, and the reciprocation of the lever 41 by the cam 44 through lever 43 and connecting-rod 42 then actuates the ratchet-disk *m* so as to rotate the shaft 35 to the right in Fig. 4 and move the weight 33 on arm 32 to the left in Fig. 3, which shortens the leverage of the weight 33 on arm 32 on the tension-bar *b* and thus decreases the tension on the pile-warp, so that the pile-warp is taken up to a greater extent in forming the pile-surface and the pattern-blocks correspondingly shortened.

If the pattern be short, so that the tension upon the pile-warp is to be increased, the pile-warp *y* will be drawn off the beam B more rapidly, and the operation is the same except that the pin 2 on the disk *c* will have been carried past the slot 3 by the faster movement of the roll *a* at the time the frame *d* moves downward, and the other arm, *f'*, will strike a pin 2 and, through the arm *g*, weighted lever *o'*, pawl *n'*, and ratchet-disk *m'*, cause the rotation of the screw-shaft 35 in the opposite direction or to the left in Fig. 4, so as to move the weight 33 on arm 32 to the right in Fig. 3, and thus increase the leverage of the weight upon the tension-bar *b* and increase the tension of the pile-warp, so that the pile-warp will not be taken up so much in forming the pile and the pattern-blocks will

thus be lengthened and registry again secured.

For the purpose of moving the shaft 24 longitudinally in the frame *d*, so as to move the arms *ff'* to the right or left and thus bring the slot 3 into proper registry with the pin 2, after the matching mechanism has been operated as above described, so as to correct any irregularity, and so that the matching mechanism will not be operated on the next downward movement of the frame *d*, the shaft 25 is moved longitudinally, so as to shift the shaft 24 and arms *ff'* to one side or the other to bring the slot 3 over the next pin 2. This feature is important, although fair results may be attained without it, as it secures a closer registry. The desirability of this feature results from the fact that the correction of the registry, after the shifting of the weight sufficiently for this purpose, is gradual and extends over several successive pattern-blocks, so that the movement of the roll *a* by the pile-warp *y* may not bring the pin 2 opposite the slot 3 in time for the next downward movement of the frame *d*, so that the matching mechanism will be actuated again and the weight thus shifted and the tension diminished or increased too much for securing close registry.

As one or the other of the sleeves *ee'* is rotated by the engagement of one of the arms *ff'* with a pin 2 the corresponding pawl *k* or *k'*, carried by the sleeve *e* or *e'*, engages the ratchet portion of the disk *h* or *h'*, and thus, through the toothed portion of the disk and pinion *i* or *i'*, rotates the shaft 25 in one or the other direction and, by the engagement of the cam-groove 4 with the fixed pin 5, moves the shaft 25 longitudinally to the right or left in Fig. 3, which, by the engagement of the disk *l* or *l'* with the disk *h* or *h'*, moves similarly the shaft 24 so as to shift the sleeves *ee'* and their arms *ff'* sidewise to bring the slot 3 into registry with the pin 2 on the next downward movement of the frame *d*, if this movement is sufficient for that purpose, which will be the case if the previous action of the matching mechanism is sufficient to secure the proper registry of the pile-warp.

If the pattern is but slightly out of registry, a single action of the matching mechanism by the engagement of one of the arms *ff'* with a pin 2, on a single downward movement of the frame *d*, will be sufficient to correct the registry. If, however, the pattern is far out of registry, so that the slot 3 does not register with the pin 2 at the next downward movement of the frame *d*, the action will be repeated and the lack of registry corrected partially on successive pattern-blocks until registry is secured. In the construction shown three successive actions of the matching mechanism are sufficient to correct any possible irregularity, but the construction may be varied as desired in this respect. As shown, the frame *d* makes one movement to each pattern-block and two movements to each ro-

tation of the disk *c*, and the latter therefore rotates once to each two pattern-blocks and carries two pins, but it will be understood that this is not essential, as the timing of the frame *d* and disk *c* and the number of pins carried thereby may be varied and for convenience will depend somewhat upon the length of the pattern-blocks.

It is obvious that, in the construction shown, as the pins 2 on disk *c* are moving toward the slot in passing arm *f* a pin 2 may pass the arm *f* without moving it sufficiently to cause the desired movement of the matching mechanism if the registry be only slightly incorrect, so that the pin 2, when the frame *d* drops, has reached a point close to the slot edge of the arm *f*. As the pin 2 is moving away from the slot 3 as it passes arm *f'* this difficulty does not occur in the case of the latter arm. For the purpose of avoiding this difficulty in the case of arm *f* and securing the desired action of the matching mechanism, although the registry be but slightly incorrect, so that the pin 2 would pass into line with the slot 3 without the matching mechanism being operated as desired, the hooked end 39 of the lever *o* and the projection 40 on the frame *d* are employed. As the arm *g*, thrown downward by the rocking of the sleeve *e* by the engagement of arm *f* with pin 2, throws the hooked end of the lever *o* downward on the descent of the frame *d* the hook 39 catches under the projection 40, so as to be held downward thereby, and the weighted end of the lever *o* is thus held raised off the pawl *n* until the frame *d* moves upward, so as to release the hook 39 and lever *o*.

It will be understood that the invention is not to be limited to the details of the construction illustrated, but that many modifications may be made therein by those skilled in the art without departing from the invention. I believe that I am the first to provide a matching mechanism by which the proper matching or registry of the pattern in looms of those classes that employ pile or other pattern warps is secured, and I intend to claim this invention broadly without limiting myself to the specific mechanism shown for attaining that result.

What I claim is—

1. The combination with a loom, of a pattern-matching mechanism, substantially as described.

2. The combination with a loom, of a pattern-matching mechanism having a member moved by the pattern-warp and means for controlling the matching mechanism by the movement of said member, substantially as described.

3. The combination with a loom, of a pattern-matching mechanism having a roll rotated by the pattern-warp and means actuated by said roll for controlling the matching mechanism, substantially as described.

4. The combination with a loom, of means controlled by the pattern-warp for varying

the tension of the pattern-warp to correct the registry of the pattern, substantially as described.

5 5. The combination with a loom, of a tension-bar for the pattern-warp, a member moved by the pattern-warp, and means controlled by said member for adjusting the pressure on said bar to vary the tension of the pattern-warp, substantially as described.

10 6. The combination with a loom, of a tension-bar for the pattern-warp, a roll over which the pattern-warp passes and which is rotated by the pattern-warp, and means controlled by said roll for adjusting the pressure
15 on said bar to vary the tension of the pattern-warp, substantially as described.

7. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting on said bar and adjustable to vary the tension
20 of the pattern-warp, and means controlled by the pattern-warp for adjusting said weight, substantially as described.

8. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting
25 on said bar and adjustable to vary the tension of the pattern-warp, a member moved by the pattern-warp, and means controlled by said member for adjusting the weight, substantially as described.

30 9. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting on said bar and adjustable to vary the tension of the pattern-warp, a screw for adjusting said weight, mechanism for rotating said screw in
35 opposite directions, a member moved by the pattern-warp and means for controlling said mechanism by said member, substantially as described.

40 10. The combination with a loom, of a tension-bar for the pattern-warp, a screw controlling the pressure on said bar, normally-disconnected driving mechanism for rotating said screw in opposite directions to vary the
45 tension of the warp, and means controlled by the pattern-warp for connecting said mechanism to rotate the screw in one direction or the other, substantially as described.

50 11. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting on said bar and adjustable to vary the tension of the pattern-warp, a screw for adjusting said weight, ratchet-and-pawl mechanism for rotating said screw in opposite directions, means
55 for holding said pawls normally disengaged from the ratchets, and means controlled by the pattern-warp for engaging the pawls for the rotation of the screw in one or the other direction, substantially as described.

60 12. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting on said bar and adjustable to vary the tension of the pattern-warp, a screw for adjusting said weight, ratchet-and-pawl mechanism for rotating said screw in opposite directions, levers
65 normally holding the pawls disengaged from the ratchets, a movable member actuated by the warp, and means controlled by the posi-

tion of said member for rocking said levers for the connection of one or the other of the pawls with its ratchet to rotate the screw in
70 one direction or the other, substantially as described.

13. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting on said bar and adjustable to vary the tension
75 of the pattern-warp, a screw for adjusting said weight, normally-disconnected driving mechanism for rotating said screw in opposite directions, a movable frame carrying members, means controlled by said members for con-
80 necting and disconnecting said mechanism, a roll rotated by the pattern-warp, and a disk carrying one or more pins or projections and rotated by said roll, said members crossing the path of said pins on the movement of the
85 frame and arranged to pass a pin on the movement of the frame when the speed of the disk is normal and to engage and be actuated by a pin when the disk is slow or fast for the connection of the driving mechanism, substan-
90 tially as described.

14. The combination with a loom, of a tension-bar for the pattern-warp, a weight acting on said bar and adjustable to vary the tension of the pattern-warp, a screw for adjusting said
95 weight, normally-disconnected driving mechanism for rotating said screw in opposite directions, a movable frame carrying members, means controlled by said members for connecting and disconnecting said mechanism,
100 a roll rotated by the pattern-warp, and a disk carrying one or more pins or projections and rotated by said roll, said members crossing the path of said pins on the movement of the frame and arranged to pass a pin on the move-
105 ment of the frame when the speed of the disk is normal and to engage and be actuated by a pin when the disk is slow or fast for the connection of the driving mechanism, and means for moving said members in the plane of move-
110 ment of the pin after one of the members has been actuated and in the direction required to aid in securing the free passage of the members past the pins on the next movement of the frame, substantially as described.
115

15. The combination with a loom, of a roll rotated by the pattern-warp, a member actuated by said roll, a movable frame carrying members one or the other of which is adapted to engage the member actuated by the roll on
120 the movement of said frame past said member if the pattern is out of register, and means controlled by the members on said frame for increasing or diminishing the tension of the pattern-warp to correct the registry, substan-
125 tially as described.

16. The combination with a loom, of a roll rotated by the pattern-warp, a member actuated by said roll a movable frame carrying members one or the other of which is adapted
130 to engage the member actuated by the roll on the movement of said frame past said member if the pattern is out of register, and means controlled by the members on said frame for

increasing or diminishing the tension of the pattern-warp to correct the registry, means for moving the members carried by the frame in the plane of movement of the member actuated by the roll after one of the members on the frame has been actuated and in the direction required to aid in securing the free passage of the actuated member on the next movement of the frame, substantially as described.

17. The combination with the movable frame *d*, carrying sleeves *e, e'* having arms *f, f'* and *g, g'*, of roll *a* rotated by the pattern-warp, disk *c* actuated by said roll and provided with one or more pins 2, and means for adjusting the tension of the pattern-warp controlled by arms *g, g'*, substantially as described.

18. The combination with the longitudinally-movable shaft 24, carrying loose sleeves *e, e'* having arms *f, f'*, and *g, g'*, of longitudinally-movable shaft 25 having a cam-groove 4 engaging a fixed pin 5 to move the shaft longitudinally when the shaft 25 is rotated, connections between shaft 25 and sleeves *e, e'* and shaft 24, whereby shaft 25 is rotated by

said sleeves and shaft 24 moved longitudinally by shaft 25, of roll *a* rotated by the pattern-warp, disk *c* actuated by said roll and provided with one or more pins 2, and means for adjusting the tension of the pattern-warp controlled by arms *g, g'*, substantially as described.

19. The combination with the movable frame *d* carrying arms *g, g'*, of roll *a* rotated by the pattern-warp, disk *c* actuated by said roll and provided with one or more pins 2, connections for actuating said arms *g, g'* by a pin 2 on the movement of the frame if the pattern is out of registry, and means for holding arm *g* in position when actuated by a pin 2 to secure the adjustment of the tension although the arm is released by the pin, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALEXANDER CLAPPERTON.

Witnesses:

ALEX. SMITH COCHRAN,
ARTHUR LAND.