No. 818,743. PATENTED APR. 24, 1906.

P. CASSIDY & A. A. ST. LAURENT.

HARNESS CONTROLLING MECHANISM FOR LOOMS.

APPLICATION FILED JUNE 20, 1905.

3 SHEETS—SHEET 1.

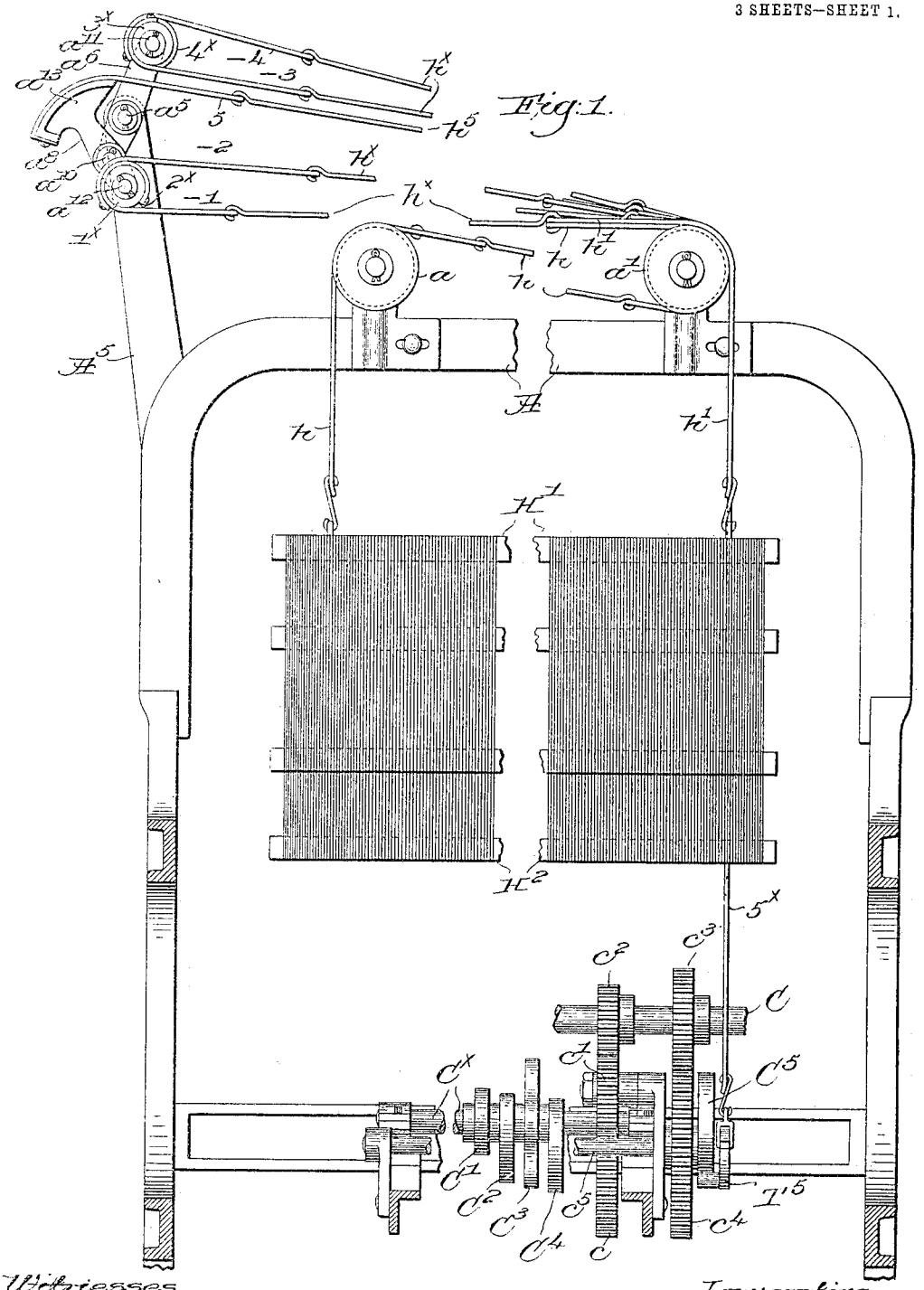


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

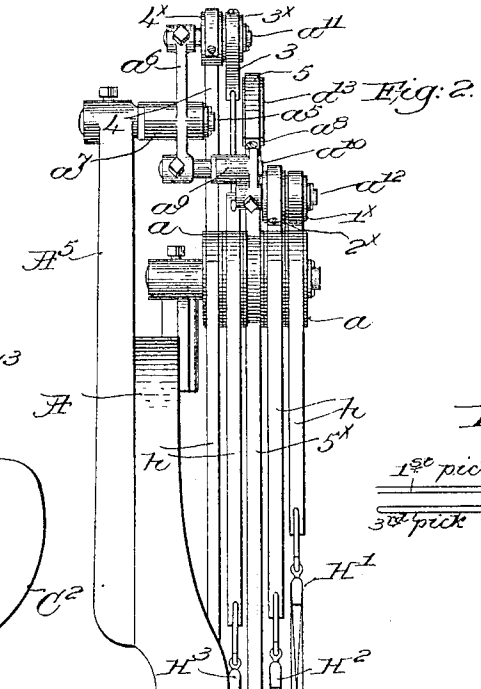


Fig. 3.

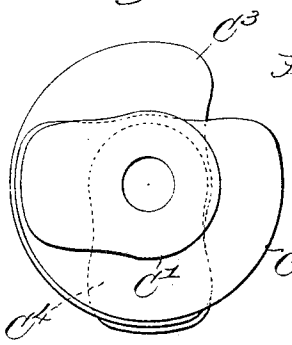
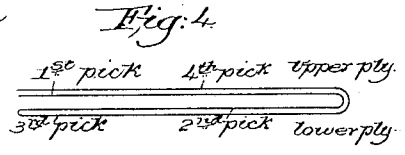
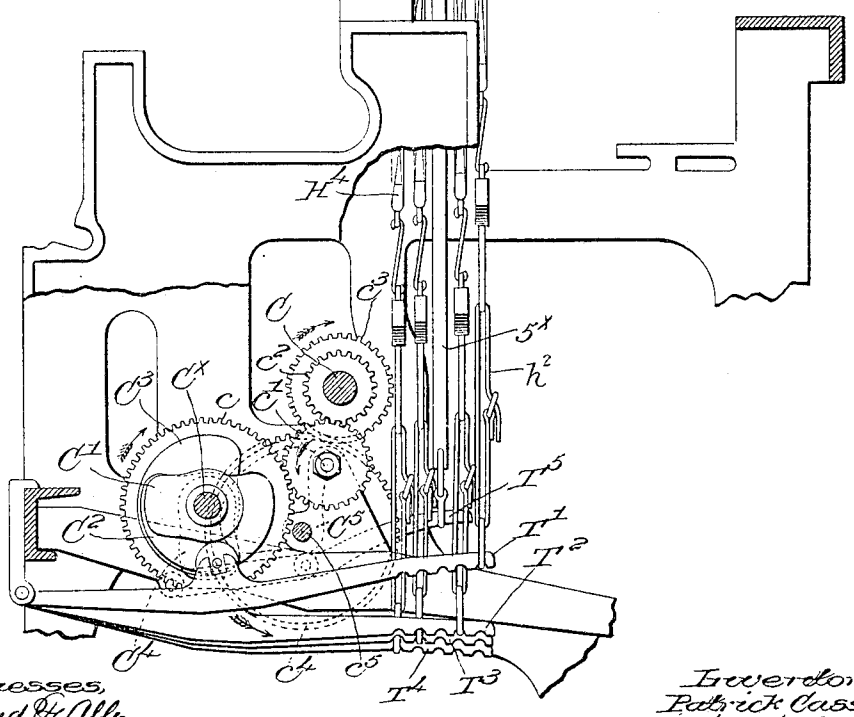


Fig. 4.





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3 SHEETS—SHEET 3.

Fig. 5.

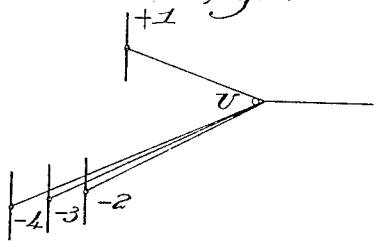


Fig. 5a.

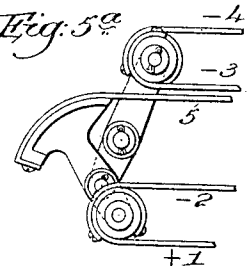


Fig. 6.

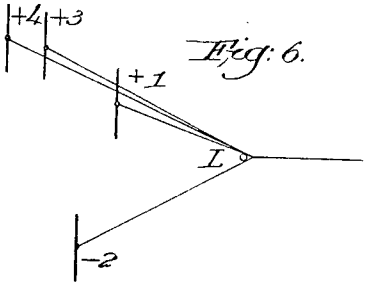


Fig. 6a.

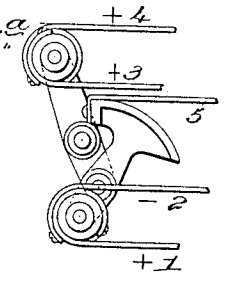


Fig. 7.

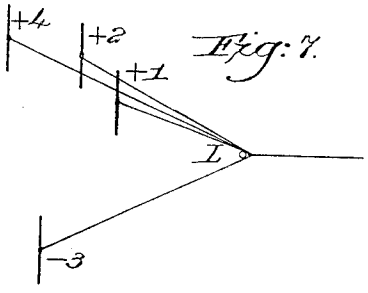


Fig. 7a.

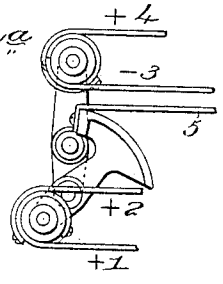


Fig. 8.

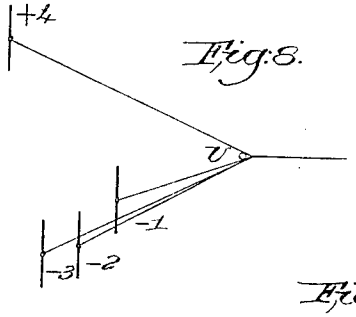


Fig. 8a.

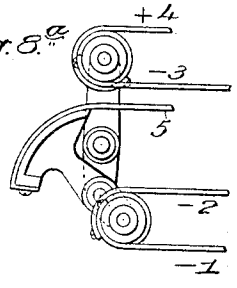


Fig. 9.



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UNITED STATES PATENT OFFICE.

PATRICK CASSIDY AND AIMÉ A. ST. LAURENT, OF SALEM, MASSACHUSETTS, ASSIGNORS TO DRAPER COMPANY, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE.

HARNESS-CONTROLLING MECHANISM FOR LOOMS.

No. 818,743. Specification of Letters Patent. Patented April 24, 1906.

Application filed June 20, 1905. Serial No. 266,109.

To all whom it may concern:

Be it known that we, PATRICK CASSIDY and AIMÉ A. ST. LAURENT, citizens of the United States, and residents of Salem, county of Essex, State of Massachusetts, have invented an Improvement in Harness-Controlling Mechanism for Looms, of which the following desciption, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to multiple-harness looms—*i. e.*, wherein more than two harness-frames are used and operated by cams or other equivalent means in such manner that while one harness-frame is up or down a plurality of harness-frames will be down or up, as the case may be, and the invention has more particular reference to a four-harness motion designed for weaving a two-ply fabric, such as is often used in making bags.

In the present embodiment of the invention the construction and arrangement are such that the two plies of cloth are joined at one selvage only, as will appear more fully hereinafter; and the invention has for its particular object the production of a simple and effective and positively-acting compensating connection between and controlling the harness-frames without the use of springs or similar devices.

The harness-frames are connected in pairs by flexible overhead connections, each harness-frame being operatively connected with an actuating-cam. The flexible connections pass upward from the frames over stationary guide-sheaves and thence around sheaves or pulleys mounted on a compensating device of peculiar construction, the movement whereof is positively governed by a separate cam.

In weaving the double fabric hereinbefore referred to the shuttle is first picked through the shed for the upper ply, for instance, and returns through the shed for the lower ply, after which the lower shed is changed and the third pick is made, laying the filling in the lower ply. The shed for the upper ply is then changed and the fourth pick returns the shuttle therethrough to the starting-point, the filling being laid in the two plies thus: upper, lower, lower, upper, so that the plies are joined only at one edge. This requires with the four harness-frames such a harness-motion that referring to the frames for the four picks is expressed as follows: 1 up, 3 down; 3 up, 1 down; 3 up, 1 down; 1 up, 3 down, and repeat, the harness-frames changing, of course, as will be described hereinafter.

In the arrangement herein illustrated the first and second frames are connected, counting from the front, and the third and fourth frames, and as the order called for by the cams requires the connected pair to be at times in either the upper or the lower shed and at other times to be in different sheds—*i. e.*, one up and the other down—the compensating device is called into play to effect or make possible such variation in the position of the frames, but without a complicated top motion or overhead connection, and obviating the use of a spring or other variable device for controlling the compensating device.

The novel features of the invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a front elevation, centrally broken out, of a sufficient portion of a loom to be understood with one embodiment of this invention applied thereto. Fig. 2 is a left-hand side elevation thereof, the nearer loom side being broken away to show the harness-operating cams and the connections between them and the respective harness-frames. Fig. 3 is an enlarged detail showing the operating-cams and their relative position. Fig. 4 is a diagrammatic view showing the manner in which the filling is laid in the two plies during a cycle of four picks. Figs. 5, 6, 7, and 8 are diagrammatic views showing the relative positions of the harness-frames for the four picks of the cycle. Figs. 5^a, 6^a, 7^a, and 8^a show substantially the corresponding positions of the compensating device and the connector-sheaves or pulleys when the harness-frames are positioned as shown in Figs. 5, 6, 7, and 8, respectively; and Fig. 9 is a separate view of the compensating cam.

The arch A of the loom has mounted upon it two sets of guide-sheaves *a a'*, Fig. 1, the set *a* having only four sheaves in use in the present arrangement, one for each harness-

frame, and the set a' having five sheaves all in use, the fifth sheave being for a purpose to be described, the harness-frames being indicated in Fig. 2 at H′, H², H³, and H⁴. From the top of each frame lead two straps or bands $h\,h'$, the straps h passing up over the sheaves a and across and under the sheaves a' and up around them, while the straps h' pass up directly to and around the sheaves a', and both straps of each frame are connected with a hooked link $h^{\times}$—that is, considering the two bands h and h' of each harness as primary bands, they are connected at their free ends with one end of a link $h^{\times}$, and to the other ends of the links secondary straps or bands are connected, such secondary bands being shown at 1, 2, 3, and 4, Fig. 1, corresponding to the frames H′, H², H³, and H⁴, respectively. Each harness-frame is connected at its lower end by a suitable connection, as h^2, Fig. 2, with its corresponding treadle, the four treadles or harness-levers being indicated at T′, T², T³, and T⁴ in Fig. 2.

The treadles are provided with usual rolls, with which coöperate the several operating-cams C′, C², C³, and C⁴ (shown separately in Fig. 3) and all mounted on a cam-shaft C×, Fig. 2, having fast upon it a gear c in mesh with an intermediate pinion c', which meshes in turn with a pinion c^2 on the main driving-shaft C or pick-shaft. A larger pinion c^3 on this shaft meshes with a gear c^4, fast on an auxiliary shaft c^5, on which is mounted the compensating cam C⁵, to be referred to, said cam acting upon a treadle T⁵, as shown in Fig. 2. The cam-shaft C× makes one revolution for each four picks in the present arrangement, and the auxiliary shaft c^5 rotates in synchronism therewith or one revolution for each four picks, but in the opposite direction.

By reference to Fig. 3 it will be seen that the harness-cams C′ and C⁴ have substantially the same contour, and C² and C³ are similar, the difference in the throw of the cams being provided to give the proper shed-opening, inasmuch as the harness-frames have to be given an increasing throw, as they are farther back from the front harness-frame, this being a well-known expedient in loom construction. For convenience in following out the positions of the several harness-frames throughout the cycle the + sign is used on the drawings to indicate a raised harness-frame or one in the upper plane of the shed and the − sign to indicate a lowered frame, or in the lower plane of the shed. (See Figs. 1, 5, 6, 7, and 8.)

Referring to Figs. 1 and 2, the arch A has at one side, herein shown at the left, an upright stand A⁵, provided with a forwardly-extended horizontal stud a^5, which forms the fixed fulcrum for the compensating device, the latter comprehending a lever a^6, whose hub a^7, Fig. 2, is mounted to rock on the stud a^5, and a second lever a^8, having a hub a^9, fulcrumed on a stud a^{10} on the lower end of lever a^6. At the upper end of lever a^6 a stud a^{11} has mounted upon it two connected rolls or sheaves 3× and 4×, the latter being of larger diameter, because a greater throw must be given to the rearmost harness-frame H⁴ than to the next frame H³ in front, and the secondary straps or bands 3 and 4 are wrapped around sheaves 3× and 4× in opposite directions and fixedly secured thereto. The said secondary bands or connectors thus form a flexible connection between the harness-frames H³ and H⁴, the connected sheaves constituting a support for the connection and being mounted on one member a^6 of the compensating device. The distance from stud a^{11} to the fixed fulcrum a^5 is greater than that between said fulcrum and the movable fulcrum a^{10}, which pivotally connects the main and auxiliary members a^6 and a^8 of the compensating device. On the lower end of the member a^8 a stud a^{12} rotatably supports two connected sheaves 1× and 2×, the former being of less diameter than the latter, so as to give the greater throw to the harness-frame H², and the secondary straps or bands 1 and 2 are wrapped around said sheaves in opposite directions and fixedly secured thereto, so that the harness-frames H′ and H² are flexibly connected overhead, having the bearing-sheaves mounted on the member a^8 of the compensating device. Said member a^8 has its upper and longer lever-arm shaped to form a segment a^{13}, over which passes a strap 5, its adjacent end being secured to the segment and its opposite end to a link h^5, the latter being connected in turn with a strap or band 5×, which passes over the fifth sheave of the set a' and thence downward to the treadle T⁵, Fig. 2. The cam C⁵, acting through the described connection, governs the operation of the compensating device in a manner to be described, but positively, and by or through such device the connected pair of harness-frames may be in the same plane of the shed or in different planes, as called for. The harness-frames which control the warps for the upper ply of the fabric are herein the frames H′ and H⁴, while the frames H² and H³ operate in a similar manner for the lower ply, and in the arrangement herein shown and described one harness-frame is up and three down for the first pick, three up and one down for the second pick, three up and one down for the third pick, (but not the same frames,) and one up and three down for the fourth and last pick of the cycle.

The harness-frame positions of Figs. 1, 2, and 5 agree with H′, or No. 1 up and the other three frames down, and the shuttle is thrown on the first pick—say from left to right, viewing the diagram Fig. 4—and at such time the compensating device is positioned as shown in Figs. 1 and 5ª, the filling

being laid in the shed for the upper ply, as U, Fig. 5. The shed is then changed by raising Nos. 3 and 4 harness-frames from the lower to the upper plane of the shed, Nos. 1 and 2 remaining as before, and to make such change the compensating device is brought into action, so that Nos. 3 and 4 can be raised. When the cam-shaft $C^{\times}$ is turned one-quarter of a revolution, so as to change the positions of the harness-cams, the cam C^5 is also turned one-quarter of a revolution and depresses its treadle, thereby exerting a pull on the flexible connection between it and the lever a^8. This pull acts through lever a^8 upon the lever a^6 to rock it on the fixed fulcrum a^5 into substantially the position shown in Fig. 6^a, throwing the upper end of lever a^6 to the left to lift Nos. 3 and 4 harness-frames—*i. e.*, H^3 and H^4—as their cams then permit such rise, the lever a^8 practically swinging about the stud a^{12} as a center, no change being called for in the positions of Nos. 1 and 2 harness-frames. The second or return pick is then made, laying the filling in the lower ply, as at L, Fig. 6, and again the shed is changed, Nos. 1 and 4 harness-frames remaining raised while No. 3 must be depressed to the lower plane of the shed and No. 2 must be raised to the upper plane, as in Fig. 7. In order to permit No. 3 to descend, due to the depressing action of cam C^3 upon the treadle T^3, while No. 4 remains up, the lever a^6 must swing about its fulcrum a^5 into about the position shown in Fig. 7^a, the cam C^5 still keeping a pull on the connection between its treadle and the upper end of lever a^8, and as the connection a^{10} between the compensating levers moves to the left from the position shown in Fig. 6^a the position of the sheaves $1^{\times}$ and $2^{\times}$ is changed, they being moved far enough to the left to compensate for the rise of No. 2 harness-frame from the lower to the upper plane of the shed.

The harness-frames being positioned as shown in Fig. 7, the third pick is made, laying the filling again in the lower ply, but from left to right, viewing Fig. 4, and as the fourth pick—the last of the cycle—is laid in the upper ply, from right to left, the original shed-opening for the first pick must be changed prior to such pick to lower No. 1 harness-frame, while No. 4 remains up. At the same time No. 2 frame must be depressed to bring the frames into the relative positions shown in Fig. 8. The position of the compensating lever a^6 is not materially changed from that shown in Fig. 7^a, as Nos. 3 and 4 do not now change; but as Nos. 1 and 2 were both up they must both be depressed by their respective cams, and to permit this a low part of the cam C^5 now coöperates with its treadle, permitting the latter to rise, and as the connection between the treadle and lever a^8 is thereby let off or slackened said lever swings on a^{10} as a fulcrum into the position shown in Fig. 8^a. This permits the connected sheaves $1^{\times}$ and $2^{\times}$ to move inward or to the right, viewing Fig. 7^a, and allows the cams C' and C^2 to lower the corresponding harness-frames, after which the shuttle is picked, laying the filling in the upper ply, as at U, Fig. 8. The cycle is now completed, two picks having been laid in each of the plies in this sequence, upper, lower, lower, upper, and the next change brings the parts back into the position shown in Figs. 1, 5, 5^a, with No. 1 harness-frame up and the other three down.

From an examination of the diagram Figs. 5 to 8, inclusive, it will be obvious that the first and fourth picks of filling are laid in sheds formed by Nos. 1 and 4 harness-frames, but that their positions are reversed in the fourth pick, and that the second and third picks are laid in sheds formed by Nos. 2 and 3 harness-frames, but with their positions reversed for the two picks. It will also be manifest that were it not for the compensating device there would be nothing to lift either harness-frame of a connected pair were its fellow frame down, nor could the two connected frames be raised together, as hereinbefore described. As shown most clearly in Fig. 9, the compensating cam C^5 has two high and two low portions, the cam being shown as symmetrical in shape and so timed with relation to the harness-cams that it exerts a positive pull on the compensating member a^8 at the proper times and at other times permits said lever to move in the opposite direction. The compensating device is thus positively acting, simple, and effective. By a slight change in the position of the harness-cams, setting them all quartering, with C' and C^4 opposite each other, and C^2 opposite to C^3, a tubular fabric may be woven, the harness-frames then being moved in this sequence: 1 up, 2, 3, and 4 down; 1, 2, and 4 up, 3 down; 4 up, 1, 2, 3 down; 1, 3, and 4 up, 2 down. When this arrangement is used, the cam C^5 must be rotated at twice the speed for the arrangement illustrated to coöperate properly with the harness-cams, and the two plies will be connected at each edge, forming a tube.

The invention is not restricted to the precise construction and arangement shown and described, as the same may be varied or modified in detail by those skilled in the art without departing from the spirit and scope of the invention.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a loom-harness mechanism, four vertically-movable harness-frames, means, including four flexible connectors arranged in pairs, to connect said frames in pairs, and a controlling-cam for and operatively connected with each harness-frame, combined with

a compensating device comprising a main lever having a fixed fulcrum, an auxiliary lever pivotally mounted on the main lever below its fulcrum, a pair of coaxial, connected sheaves rotatably mounted on the upper end of the main lever, and a similar pair of sheaves rotatably mounted on the lower end of the auxiliary lever, the two pairs of connectors being oppositely wrapped around and fastened to the pairs of sheaves, respectively, and positively-acting controlling means for said compensating device connected with the auxiliary lever above its pivotal connection with the main lever.

2. In a loom-harness mechanism, four vertically-movable harness-frames, a flexible overhead connection between each pair of said frames, and a controlling-cam for and operatively connected with each harness-frame, combined with a compensating device comprising pivotally-connected main and auxiliary members each having a pair of connected, axial sheaves rotatably mounted upon it to support respectively the two overhead connections, and a fixed fulcrum for the main member, located between the sheaves thereon and the point of connection with the auxiliary member, and positively-acting controlling means for said compensating device, operatively connected with the auxiliary member at a point above the fixed fulcrum.

3. In a loom-harness mechanism, four vertically-movable harness-frames flexibly connected in pairs overhead, and a controlling-cam for and operatively connected with each frame, combined with a compensating device comprising two pivotally-connected levers, a rotatable double sheave on each lever, each sheave coöperating with one of the overhead connections of the pairs of harness-frames, a fixed fulcrum for one of said levers, and positively-acting controlling means for the compensating device, including a cam operatively connected with the other of said levers.

4. In a loom-harness mechanism, four vertically-movable harness-frames flexibly connected in pairs overhead, a controlling-cam and a coöperating treadle connected with the bottom of each harness-frame, combined with a compensating device comprising main and auxiliary, pivotally-connected levers, a fixed fulcrum for the main lever, a double sheave on the latter above the fulcrum, cooperating with one of the flexible overhead connections, a similar double sheave on the auxiliary lever below its pivot, and coöperating with the other flexible overhead connection, and a controlling-cam positively connected with the upper end of the auxiliary lever and governing the operation of the compensating device.

5. In a loom-harness mechanism, four vertically-movable harness-frames flexibly connected overhead in pairs, and a controlling-cam for and operatively connected with each frame, combined with a compensating device coöperating with the overhead flexible connections, said compensating device including two pivotally-connected levers, each connected with the overhead connection of a pair of frames, and positively-acting controlling means connected with one of said levers and governing the operation of the compensating device, whereby the harness-frames of a pair may be simultaneously in the same or in different planes of the shed.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

PATRICK CASSIDY.
AIMÉ A. ST. LAURENT.

Witnesses:
PETER J. KIERAN,
JOSEPH C. LERESQUE.