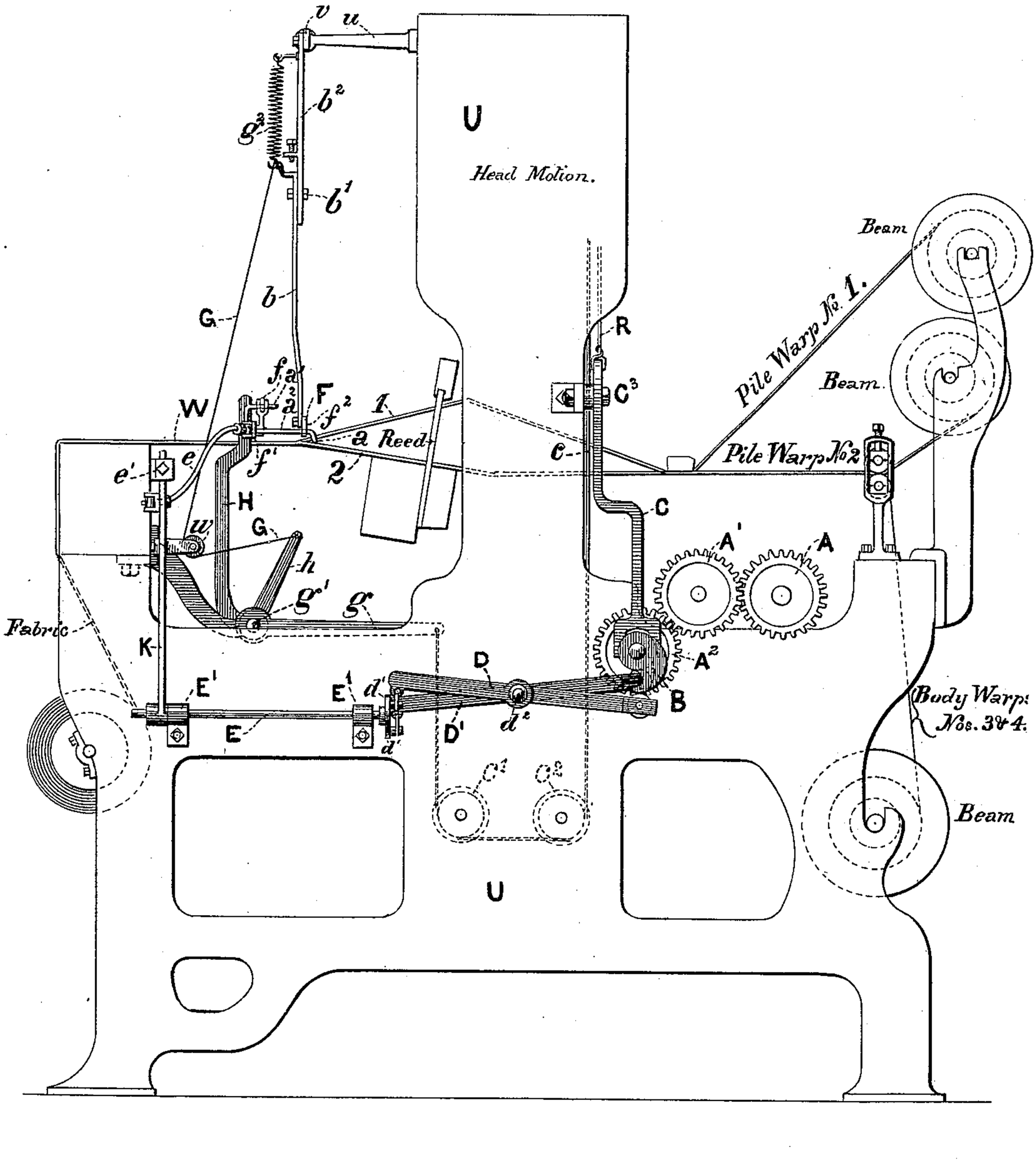
(No Model.) 5 Sheets—Sheet 1

T. HARRISON.

LOOM FOR WEAVING PILE FABRICS.

No. 353,937. Patented Dec. 7, 1886.

FIG. 1.



WITNESSES:

Geo. A. Vaillant.

F. H. West

INVENTOR:

Thomas Harrison,

By Hollingsworth & Haley,

Attorneys.

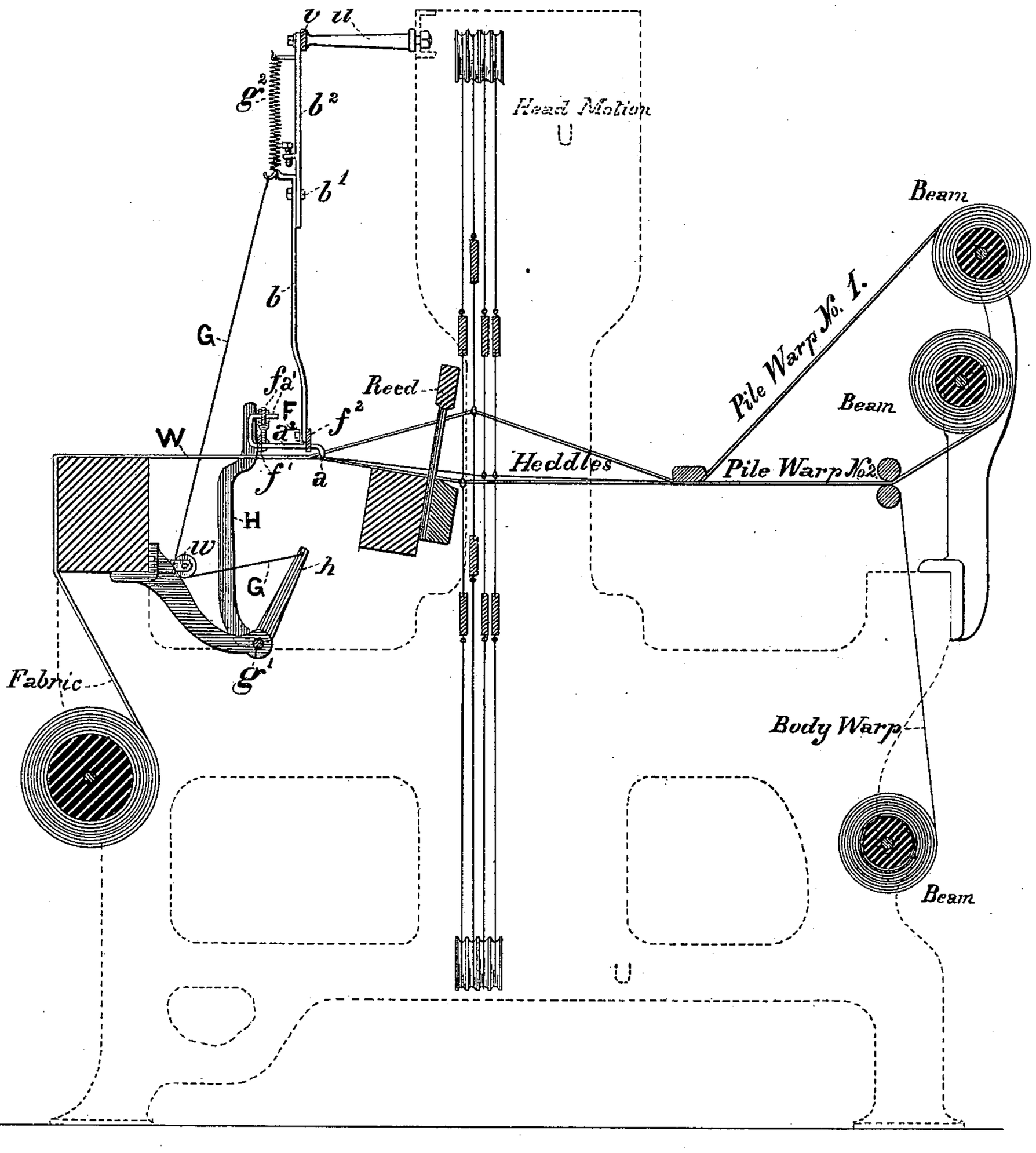
(No Model.) 5 Sheets—Sheet 2.

T. HARRISON.

LOOM FOR WEAVING PILE FABRICS.

No. 353,937. Patented Dec. 7, 1886.

FIG. 2.



WITNESSES:

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(No Model.) 5 Sheets—Sheet 3.

T. HARRISON.

LOOM FOR WEAVING PILE FABRICS.

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FIG. 3.

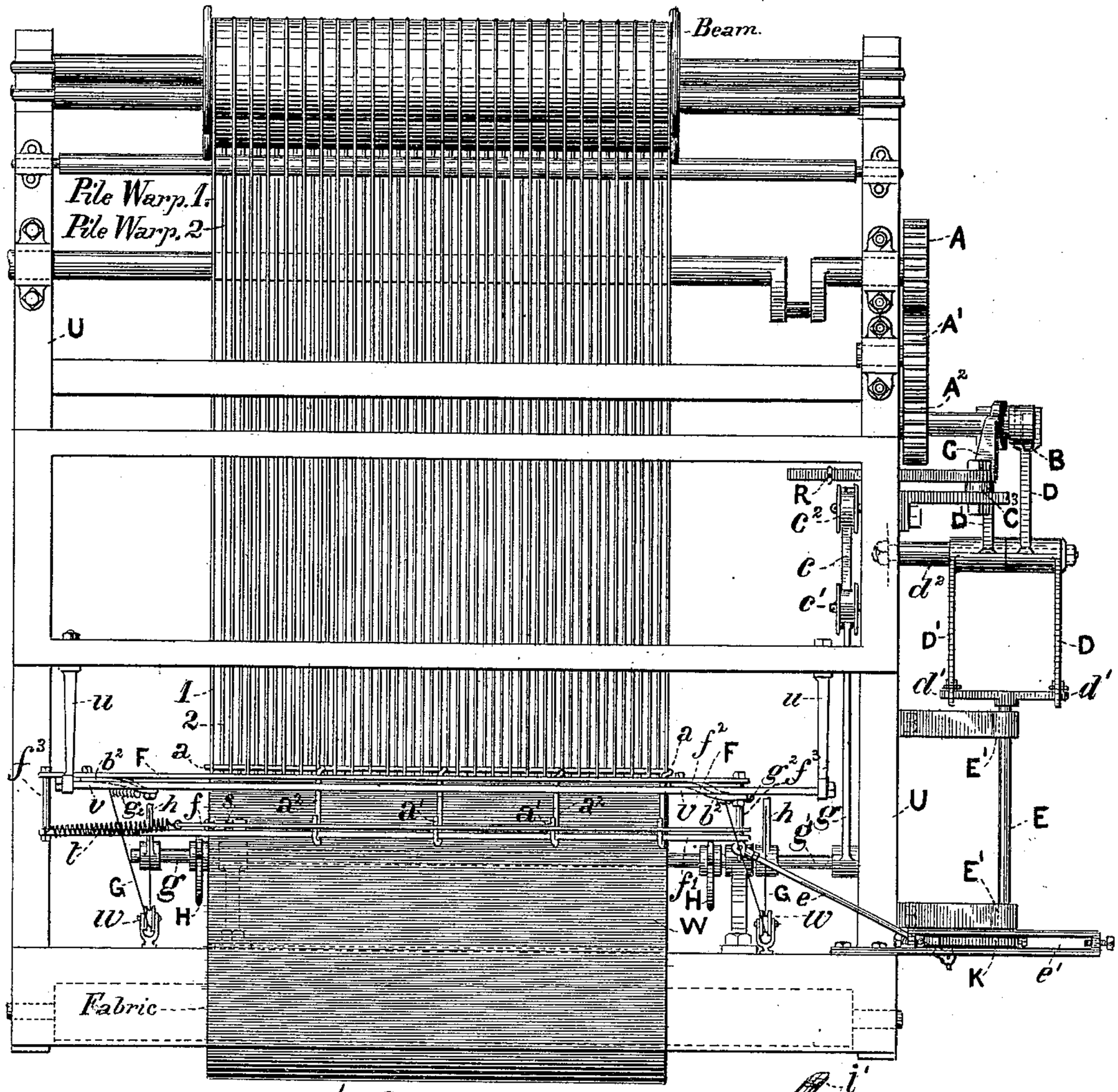
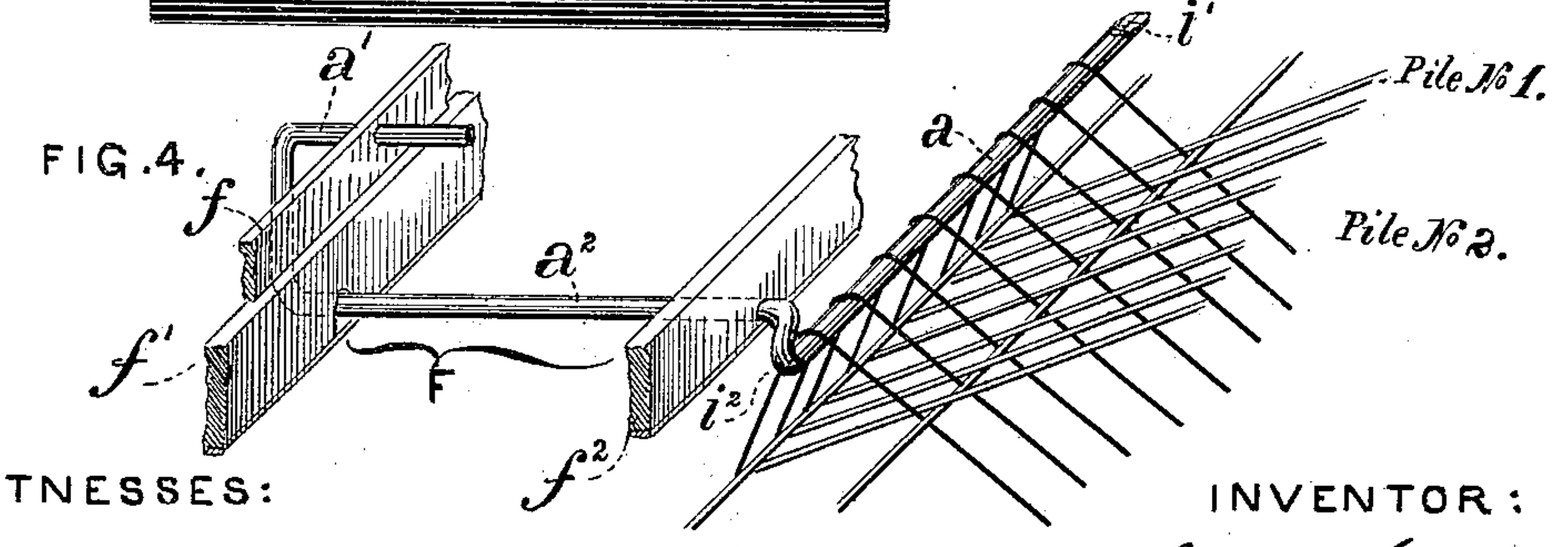


FIG. 4.



WITNESSES:

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(No Model.)

5 Sheets—Sheet 4.

T. HARRISON.

LOOM FOR WEAVING PILE FABRICS.

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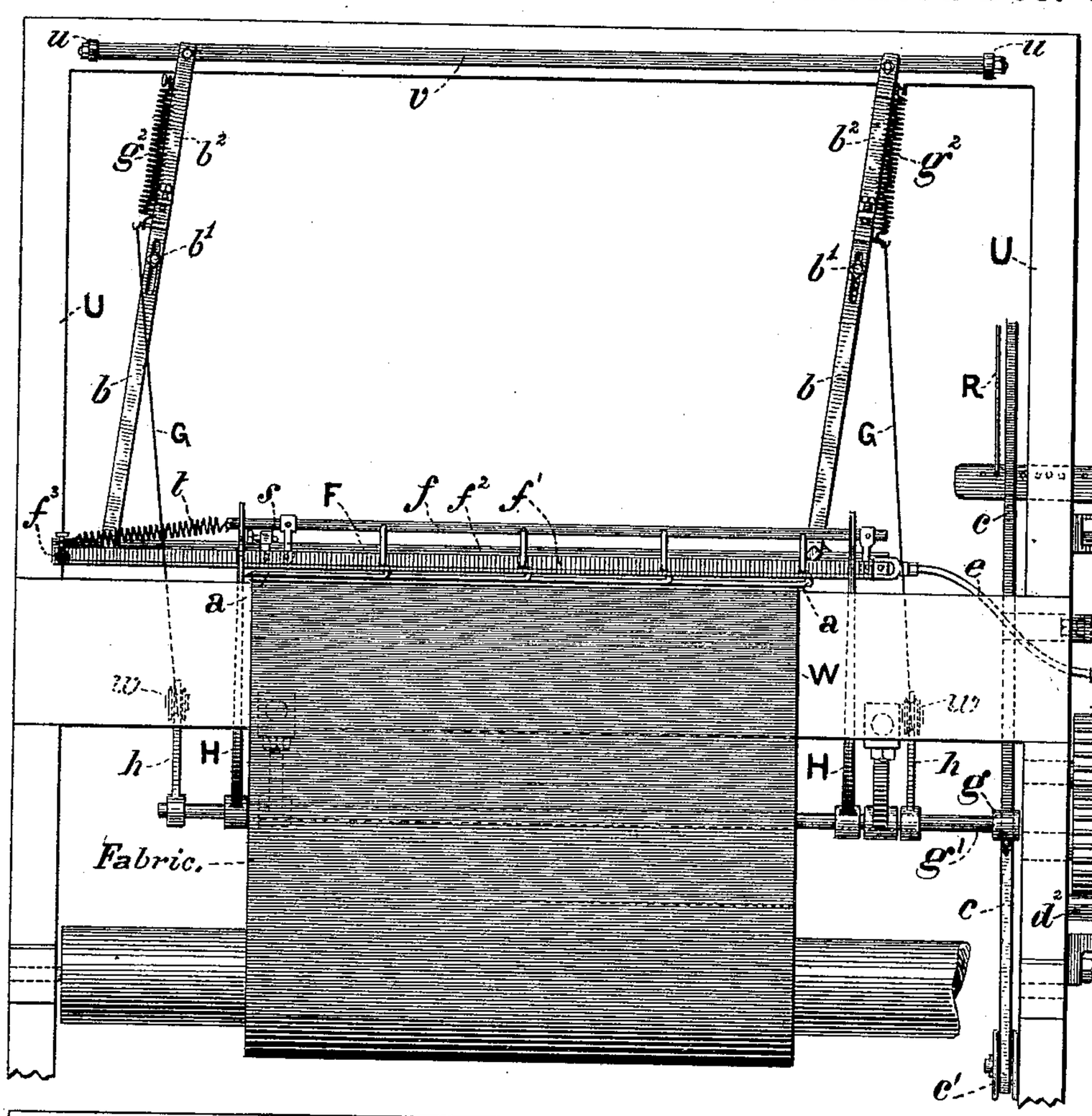

FIG. 5.

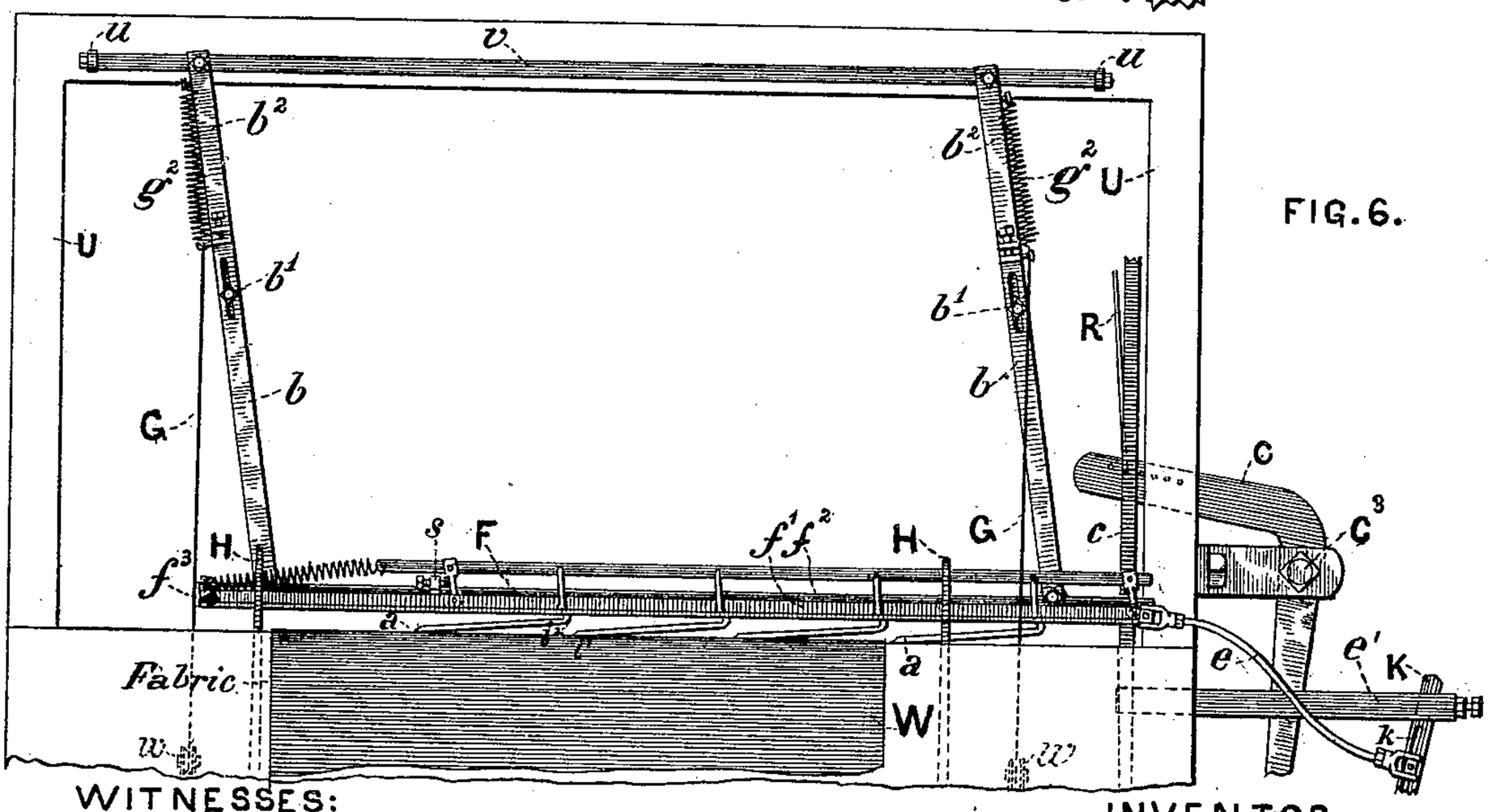

FIG. 6.

WITNESSES:

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(No Model.) 5 Sheets—Sheet 5

T. HARRISON.

LOOM FOR WEAVING PILE FABRICS.

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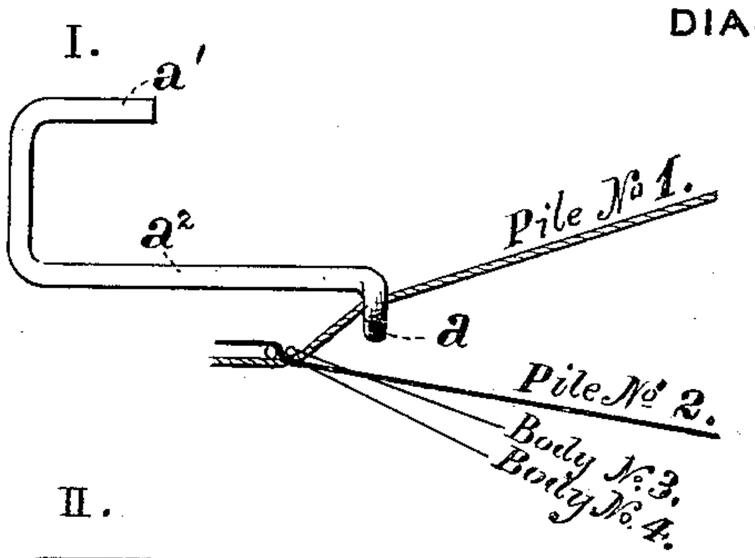
DIAGRAMS

I.



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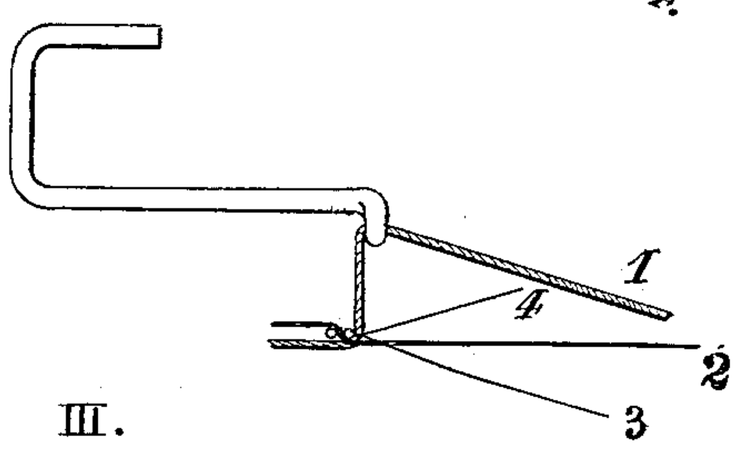

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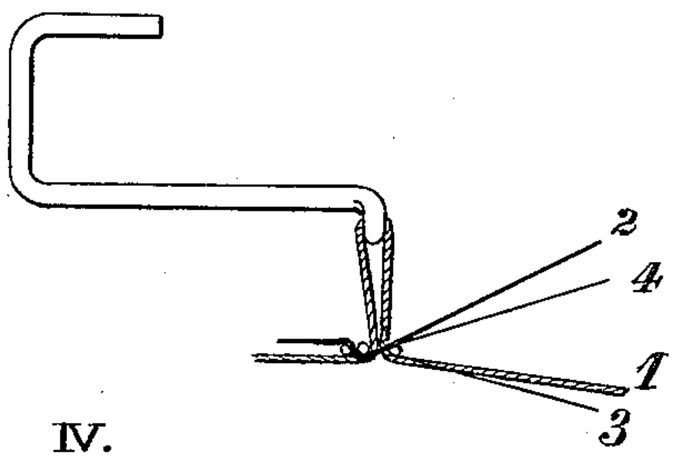

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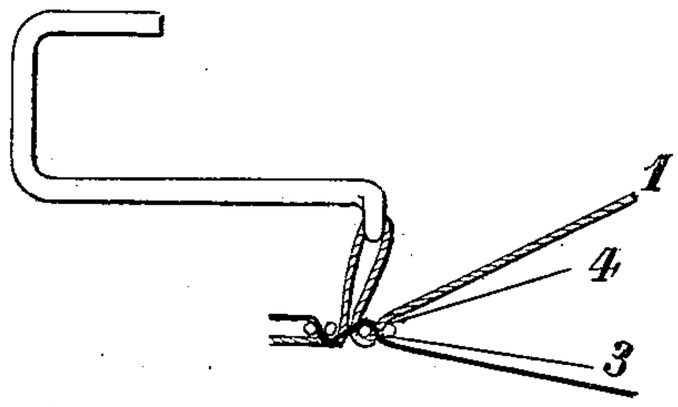

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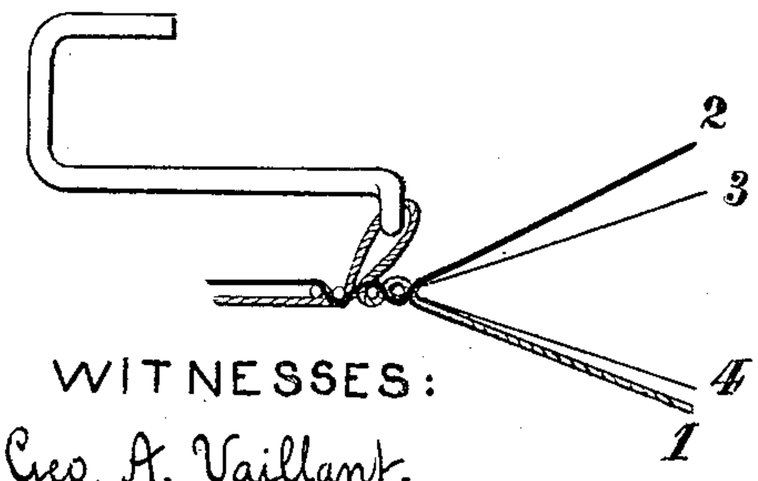
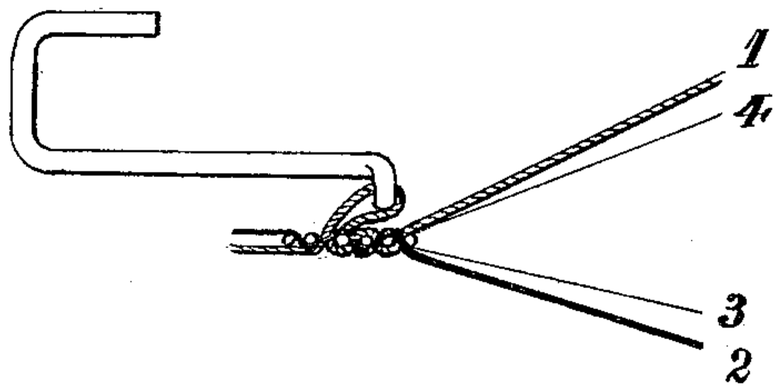
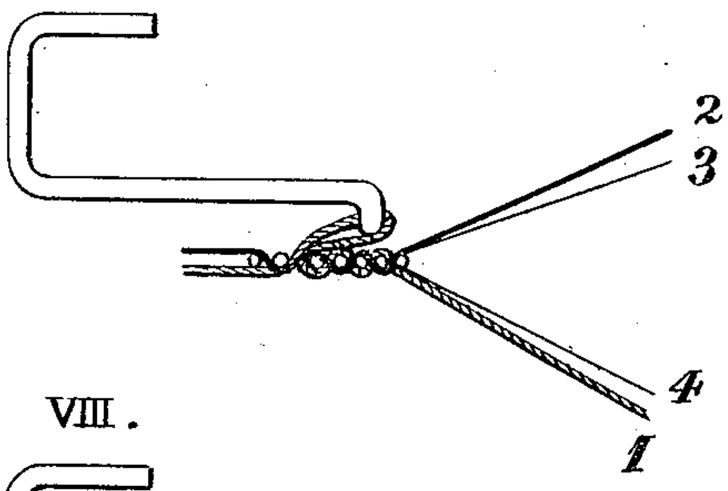


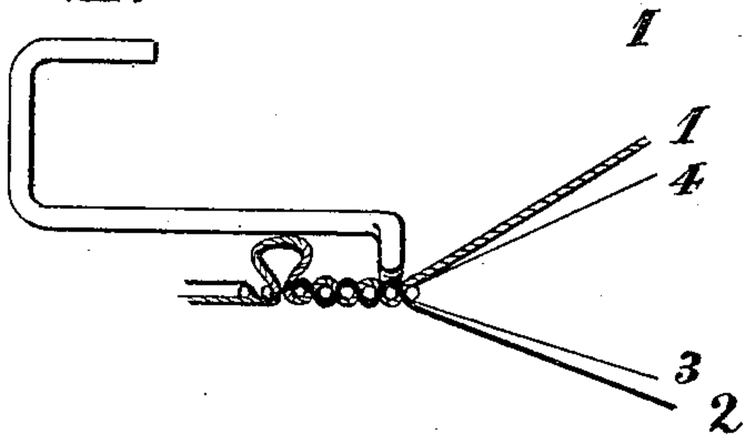
VI.



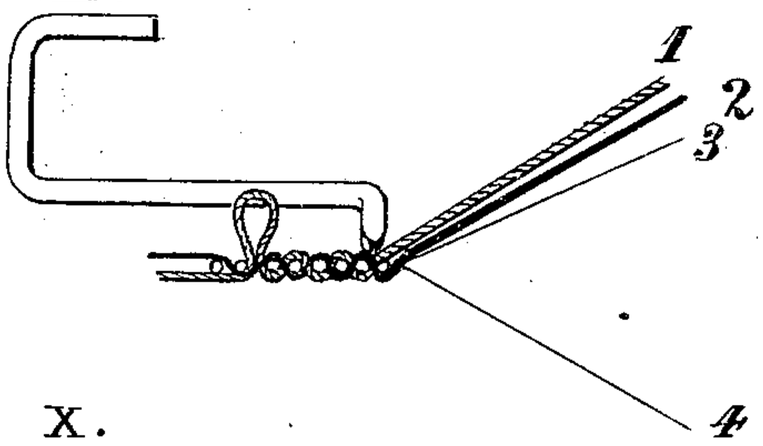
VII.



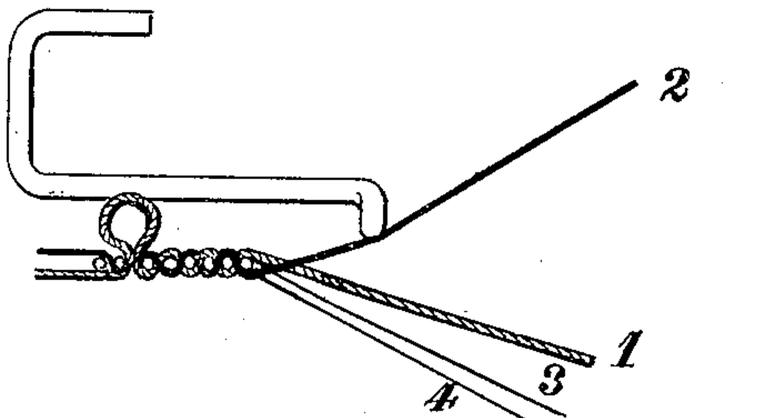
VIII.



IX.



X.



WITNESSES:

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INVENTOR:

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By Hollingsworth & Paley,

Attorneys.

UNITED STATES PATENT OFFICE.

THOMAS HARRISON, OF PHILADELPHIA, PENNSYLVANIA.

LOOM FOR WEAVING PILE FABRICS.

SPECIFICATION forming part of Letters Patent No. 353,937, dated December 7, 1886.

Application filed March 17, 1886. Serial No. 195,589. (No model.)

To all whom it may concern:

Be it known that I, THOMAS HARRISON, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Looms for Weaving Pile Fabrics, whereof the following is a specification.

In the accompanying drawings, Figure 1 represents an exterior side view of a loom embodying my invention, and in this, as in all the remaining general views, those parts of the loom are omitted whose action is well understood and whose insertion in the drawings would tend only to confuse the understanding of the special parts to which my invention relates. Fig. 2 is a vertical longitudinal section through the loom. Fig. 3 is a top or plan view thereof; Fig. 4, a view in detail of a portion of the sectional wire which forms the basis of my invention, showing various parts connected with the portion of the sectional wire which is represented therein and a number of warp and weft threads. Fig. 5 is a front elevation of the loom, showing the working parts in one extreme position; Fig. 6, a partial front view showing said parts in the other extreme position.

The sheet headed "Diagrams," and having on it figures marked with Roman numerals from I to X, inclusive, represents the positions which the threads assume at each stage of the formation of the fabric.

The chief object of my invention is to afford a device which can be applied to any ordinary loom for weaving pile fabrics thereon, which is not limited as to the width of the fabric which it can produce, and which can be arranged so as to form the pile at any desired interval upon the surface of the body fabric, it being especially valuable for weaving what are known as "astrakhan" and similar cloths.

Heretofore the weaving of pile fabrics has been accomplished by the use of a wire, over which the loops of the pile were formed, and which was inserted and withdrawn at intervals; but when such wires are constructed in a single piece the width of the fabric which can be made on them is necessarily limited, since a very long wire cannot be withdrawn and inserted with precision. Furthermore, the means for actuating the wire have been of such a character as to prevent rapid weaving and required a special loom of complicated construction.

To avoid these objections, and to permit a pile fabric of any desired width to be formed with rapidity and precision on an ordinary loom, is the primary object of my invention; and to that end it consists in a movable frame carrying a series of short "wires" upon which the pile-loops can be formed, each wire being pivoted at right angles to the plane of its longitudinal movement and provided with means for depressing its free end at proper intervals, so as to engage beneath the warps which are to form the pile. The wires are, relatively speaking, short, so that each wire is sufficently rigid to prevent uncertain action and to permit a rapid running of the machine.

In the accompanying drawings, U represents the housings of the loom, in which, as before stated, are contained the devices common to all ordinary looms. The position of some of these is indicated by their names, written upon the different sheets; but as their construction is well understood they are omitted from the drawings.

From the upper portions of the housings U is suspended upon projecting arms *u* the device which embodies the main features of my invention, and which will be first described, the description of its actuating mechanism being reserved until the device itself is understood. Said arms *u* support a cross-bar, *v*, Fig. 5, to which are pivoted strips b^2, provided near their lower ends with screw-studs *b'*, which project through slots in strips *b*, so as to form two swinging supports, each of which is capable of a limited longitudinal extension and shortening, and both of which are elastic or yielding, so as to not only be capable of swinging upon their respective pivots, but of moving slightly in a plane at right angles to that in which they so swing. The two sections of each support are further connected by spiral springs g^2, one end of which is attached to the upper and the other to the lower piece, the normal tendency of said springs being to hold the lower piece, *b*, up in its highest position. Cords G extend from suitable attachments upon the lower strips, *b*, around pulleys *w*, to rock-arms *h*, by whose oscillation said cords are alternately pulled and released at proper

intervals, so as to raise or depress the strips *b*, and therefore the frame F, which is supported at their lower ends. This frame F is a composite structure, made up of the parallel bars f' f^2, connected by braces f^3, and carrying a series of wires, *a*, also parallel to the bars f' f^2, but having shanks a^2, bent at right angles thereto. These shanks a^2 pass through openings in the bars f' f^2, and are journaled therein. A third strip, *f*, which is free to move relatively to the strips f' f^2, engages with a return-bend, a', at the end of the shank a^2. It will thus be seen that each wire *a* is capable of an individual oscillating movement upon the shank a^2 as a center, such oscillating movement being necessarily produced by a longitudinal movement of the bar *f* relatively to the bar f', and that the frame as a whole may reciprocate in three planes at right angles to one another—or, in other words, may move in the direction of the shuttle-motion, the warp-motion, and the reed-motion.

Figs. 5 and 6 illustrate two positions of the frame F itself and of the individual wires. Thus in Fig. 5 the frame is at its extreme left-hand position, and also its extreme downward position, and each member of the series of wires *a* is horizontal, being supported upon the warp-threads of the body of the fabric. In Fig. 6 the frame is at its extreme right-hand and uppermost position, and the individual wires *a*, being no longer supported from beneath, are each turned down at an angle to the frame. The frame therefore oscillates laterally, longitudinally, and vertically, but is always parallel to the plane of the cloth, (indicated by W,) while the individual wires *a* are at one time parallel to the cloth and at another time inclined thereto.

The bar *f*, which actuates the individual wires *a*, has a spring, *t*, at one end, whose tension normally draws said bar into the position indicated in Fig. 6, so as to depress the ends of the individual wires *a* when no longer supported from beneath by the warp-threads of the body of the fabric, its motion, however, being limited by the adjustaole stop *s*, the same consisting of a screw passing through a lug formed upon the bar f'. Each wire *a* preferably has the configuration indicated in Fig. 4, so that its free end i' shall fit snugly against the curve i^2 of the next wire, and thus make practically a continnous single (though in reality sectional) wire. This method of construction prevents the occurrence of lines or marks, which might otherwise be formed in the pile were there a gap between two wires.

The movements of the swinging frame F are effected in the following manner: A gear, A, upon a driving shaft rotates the gears A' and A^2, the latter of which has upon its shaft a cam, B, which is capable of being shifted to different positions lengthwise on said shaft. A lever, C, having a forked lower end, engages with said cam B in such a manner as to be capable by movement in one direction or the other of shifting said cam longitudinally upon the shaft. Said lever C is pivoted at C^3, Fig. 5, and its bent upper end is connected by a cord, R, to the "head-motion" of the loom. As is well known, this head-motion is capable of great variation, and therefore the movements of the lever C can be varied so as to shift the cam B at any desired intervals. Said cam in one of its positions acts upon the end of a lever, D, and in its other position on the end of a similar lever, D'. These levers, though separate, are pivoted upon a shaft, d^2, and lead to transverse rock-arms d', which are secured to a rock-shaft, E, working in bearings E', which project laterally from the housings. To the other end of this rock-shaft E is attached a lever, K, whose upper free end is inclosed within a slotted guide-piece, e', and has connected with it a bent toggle-arm, *e*, the other end of which is connected with the frame F. The attachments between the toggle-arm *e*, frame F, and lever K are by universal joints, and that upon the lever K is mounted in a longitudinal slot, *k*, therein, (see Fig. 5,) so as to admit a considerable range of adjustment in the throw of the frame F. Tracing up the movements of this part of the apparatus, it will be seen that when the cam B in rotating strikes the lever D and depresses one end thereof the other will rise, carrying with it the rock-arm d', and rocking the shaft E in such a manner as to throw the lever-arm K toward the loom, and thus push the frame F toward the left, as shown in Fig. 5. The shifting of the cam B (by the action of the head-motion through the lever C) will cause it to leave this lever D and strike the end of the other lever, D', which, acting in a similar manner upon the rock-arm d' and shaft E, will throw the lever K to the right, carrying the frame F, therefore, in that direction, as shown in Fig. 6. The rising and falling movements of said frame F are produced in the following manner: A cord, *c*, is attached to the head-motion and leads down around the pulleys c' c^2 to the end of a lever, *g*, rigidly attached to the rock-shaft g', which shaft carries two upwardly-projecting lever-arms, *h*. From the upper end of these levers *h* cords G lead around pulleys *w w*, and thence to suitable attachments at the top of the sliding strips *b*, on which the frame is suspended. At each pull upon the cord *c* the lever-arm *g* will descend, throwing the arms *h* to the right in Fig. 1, and hence pulling the cords G in such a manner as to depress the pieces *b* and lower the frame F bodily. When the pull upon the cord *c* ceases, the tension of the springs g^2 raises the strips *b* to their original position, and of course pulls the cords G, so as to restore the lever-arms *h* and *g* to their original position likewise.

The backward and forward movements of the frame F are effected by means of two arms, H, rigidly secured to the rock-shaft g', which is actuated by means of the cord *c*, before referred to. Upon the turning of the rock-shaft g' to the right in Fig. 1, said arms H throw

the frame to the right also, and upon the cessation of the pull upon the cord *c* the elasticity of the pieces *b b*² restores the frame to its original position. This last movement of the frame F (which is in the direction of the reed-motion) accompanies the movement which depresses the frame, and of course may, by varying the attachment of the cord *c* to the head-motion, be effected at any desired interval. Assuming that the intervals of all these movements are arranged in a given series in consonance with the movements of the harness and the reed, I will now, by reference to the sheet marked "Diagrams," describe the formation of the loops by means of the sectional wires *a*.

Two pile-warps may be used, which are indicated respectively by 1 and 2. These warps are carried in the usual manner from the beams through the heddles and reed, as shown in Fig. 2. The body-warps 3 and 4 of the fabric are brought from a separate beam, through the heddles and reed, and the weaving is commenced in the ordinary manner. To form a row of loops with the pile-warp 1, the operation commences, as shown in Diagram I—that is to say, the points of the wires *a* are all depressed, and the frame is at the extreme right-hand position shown in Fig. 6. Each wire *a* thereupon enters beneath a number of warp-threads and raises them slightly above the plane of the fabric. An empty shuttle is then shot through, after which the body-warp 4 rises and the pile-warp 1 descends, as shown in Diagram II. The pile-warp 2 rises and a pick of the shuttle follows, and the action of the reed throws the filling-thread toward the wire *a*, so as to close the row of pile-loops thereon, as indicated in Diagram III. The weaving then continues, as indicated from IV to VII, inclusive, by means of both pile-warps and both body-warps, the shuttle operating in the ordinary manner. During all this period the taking up of the cloth has drawn over the bottom of the pile-loop somewhat to the left in the diagrams, (where, however, this action, as well as the height of the loop, is much exaggerated for the purpose of illustration,) and as soon as a sufficient number of picks have been made to securely lock the pile-loops the frame F and the wires *a* are thrown to the right of Fig. 5, or toward the observer from the point of view in the diagrams. This disengages the wires from the loops which they have theretofore supported, and leaves them as shown in Diagram VIII. So long as the wires have been surrounded by the loops and have rested upon the body of the fabric they have been maintained in a horizontal position; but upon their being withdrawn from the loops and upon the rise of the frame bodily this support ceases and the ends of the wires *a* dip downward by the tension of spring *t*. This position immediately follows upon their withdrawal, and occurs when the frame is at the extreme right-hand position, (shown in Fig. 6,) or, in other words, is ready to engage with a fresh set of pile-warps.

Returning now to the Diagram IX, it will be seen that both the pile-warps are up; but in the Diagram X the pile-warp 1 (which has just formed the first series of loops) is down, and with it the body-warps 3 and 4 have descended, leaving only the pile-warp 2 up and ready to be engaged by the wires *a*, whereupon a repetition of the ten positions indicated will occur with said pile-warp 2, and so on throughout the weaving operation, the rows of pile-loops alternating from the warps 1 and 2.

In the method illustrated in the diagrams six picks of filling are represented between the rows of pile-loops; but of course this number can be varied indefinitely by varying the frequency of movements of the frame F and wires relatively to the picks of the shuttle, and in many cases a much less number of picks will be found sufficient to lock the pile-loops, so as to prevent them from pulling out.

As is well known, a great variety of movements may be taken from the head-motion of a loom, and therefore the movements of the swinging frame and wires can be varied not merely in frequency, but in grouping, so as to produce many different dispositions or patterns of pile-loops upon the face of the fabric. It is not, however, deemed necessary to further specify these possible variations, since they will be obvious to any one skilled in the use of looms, and are, moreover, almost infinite in number.

It will be seen from the foregoing description that the frame F and its sectional wires can be applied to almost any well-known form of loom without interfering with the general arrangement thereof, and that by merely increasing the number of wires *a* the fabric may be produced of as great width as the loom is capable of weaving. In the drawings the number of wires has been arbitrarily reduced and their individual proportions exaggerated, in order to more clearly show their construction; but in practice for making astrakhan I have obtained good results with wires of one-eighth of an inch gage, each about four inches long. Wires of any gage may, however, be used, according to the fineness of pile which it is desired to produce, the only limit being in the stiffness of the wire, which of course may be relatively increased by diminishing the length of the individual sections.

I do not desire to limit my claim to the use of any given number of wires *a*, and for the purpose of including any plural number of wires I term the group of said wires a "sectional wire," and while I have specified the composite frame F as the best device now known to me for carrying said sectional wire I do not limit my claim to such particular carrying device, nor to the specific actuating mechanism of the frame and sections of wire.

I am aware that the use of a sectional wire is not, broadly speaking, new; and I am also

aware that heretofore a series of "spurs" or hooks mounted upon carrying-wires has been employed for making pile, and that in the latter case the wires, which carried the spurs were provided with bent shanks, so that by turning the shank each spur could be rotated, with the carrying-wire as an axis. These devices, however, differ from my invention in the following particulars: The sectional wire, as heretofore constructed, was not only incapable of motion in the direction of the warp-motion, but the individual sections were not pivoted so as to turn and depress their ends for insertion between the warp threads. This capacity for individual rotation is essential to the proper operation of the device, since without it there can be no certainty that the wires will engage with all, or, indeed, any, of the warp-threads. Where the independently-journaled spurs have been used, their carrying-wires were inserted through the dents of the reed. This method of construction not only prevented their longitudinal movement in the direction of the shuttle-motion, but necessitated the use of a separate spur for each warp-thread, since the withdrawal of the spur from the loop could only be effected by the rotary movement of the spur upon its axis, and if the spur were long enough to engage with any substantial number of threads it would be prevented from turning by the threads themselves and by the body-fabric. Furthermore, the suspension of the spurs upon carrying-wires sufficiently long to project through the openings in the reed rendered it necessary to provide a supplemental device for supporting the outer or free ends of the wires, so that the structure was highly complicated. The essential difference of my invention from these devices lies in its effecting all the movements specified—viz., the oscillation of the individual sections, the lateral movement of the wire as a whole in the direction of the reed-motion and the warp-motion, (these movements being respectively in horizontal and vertical planes,) and the longitudinal movement of the wire as a whole in the direction of the shuttle-motion. This system permits the use of sections sufficiently long to avoid great multiplication of parts, and at the same time has the advantages due to the employment of a sectional wire, instead of a continuous one.

I claim—

1. The combination of a sectional wire, each section of which is journaled, as described, and capable of individual oscillation, and means, substantially as described, whereby said wire as a whole is reciprocated in the direction of the reed-motion, the warp-motion, and the shuttle-motion, and each section thereof is oscillated at stated intervals in the weaving operation, substantially as set forth.

2. In combination, a frame arranged above but adjacent to the line of travel of the shuttle, means, substantially as described, whereby said frame is suspended and made capable of motion in the direction of the shuttle-motion, the reed-motion, and the warp-motion, a series of wires, *a*, journaled in said frame and having bent shanks, a strip engaging with the bent shanks of said wires and free to move relatively to the frame, and means, substantially as described, whereby at proper intervals the frame as a whole and the said strip individually are actuated, substantially in the manner and for the purpose set forth.

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Witnesses:

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