

(No Model.)

7 Sheets—Sheet 1.

S. C. LISTER & J. REIXACH.

LOOM FOR WEAVING DOUBLE PILE FABRICS.

No. 292,664.

Patented Jan. 29, 1884.

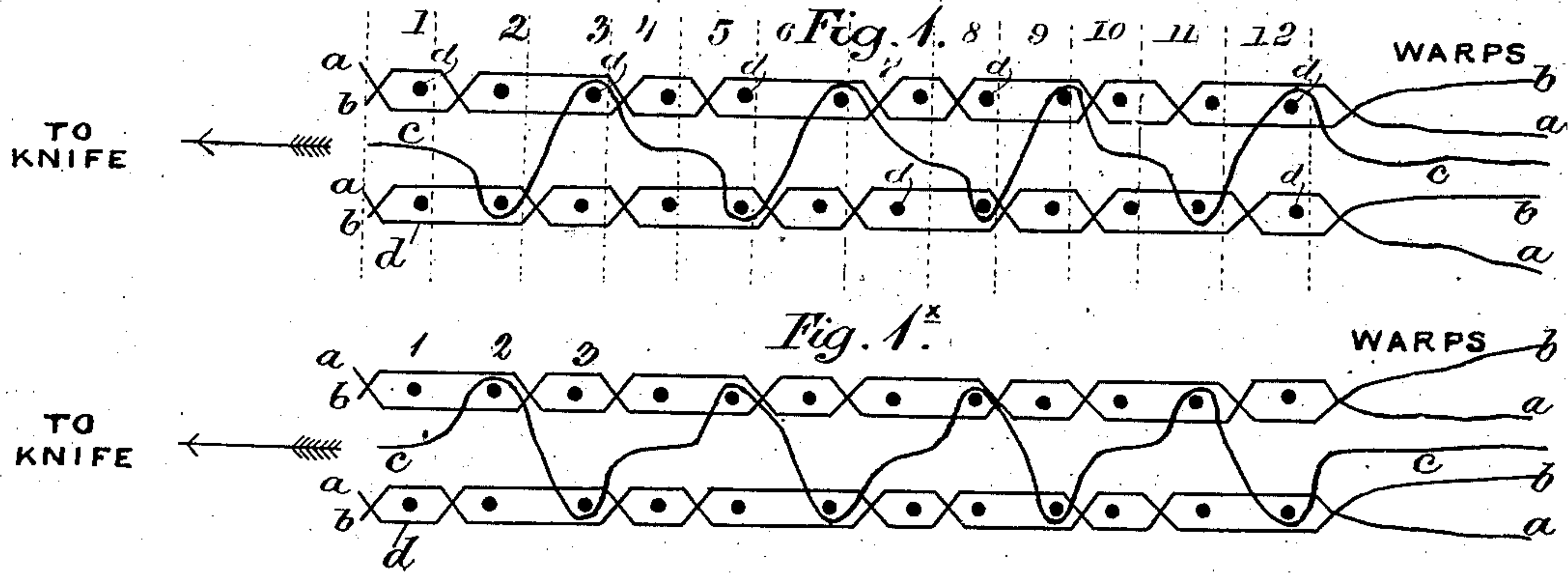
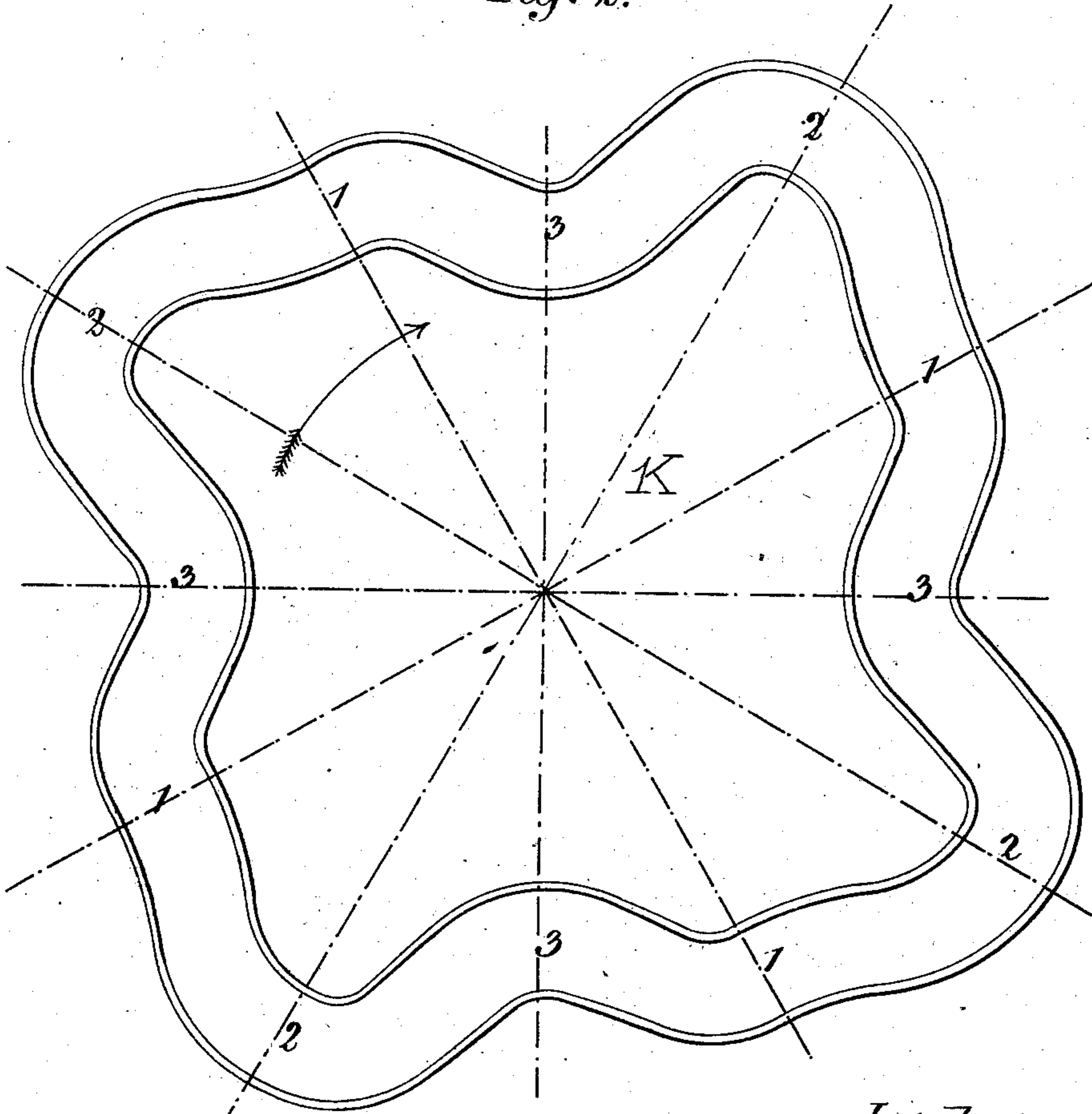


Fig. 2.



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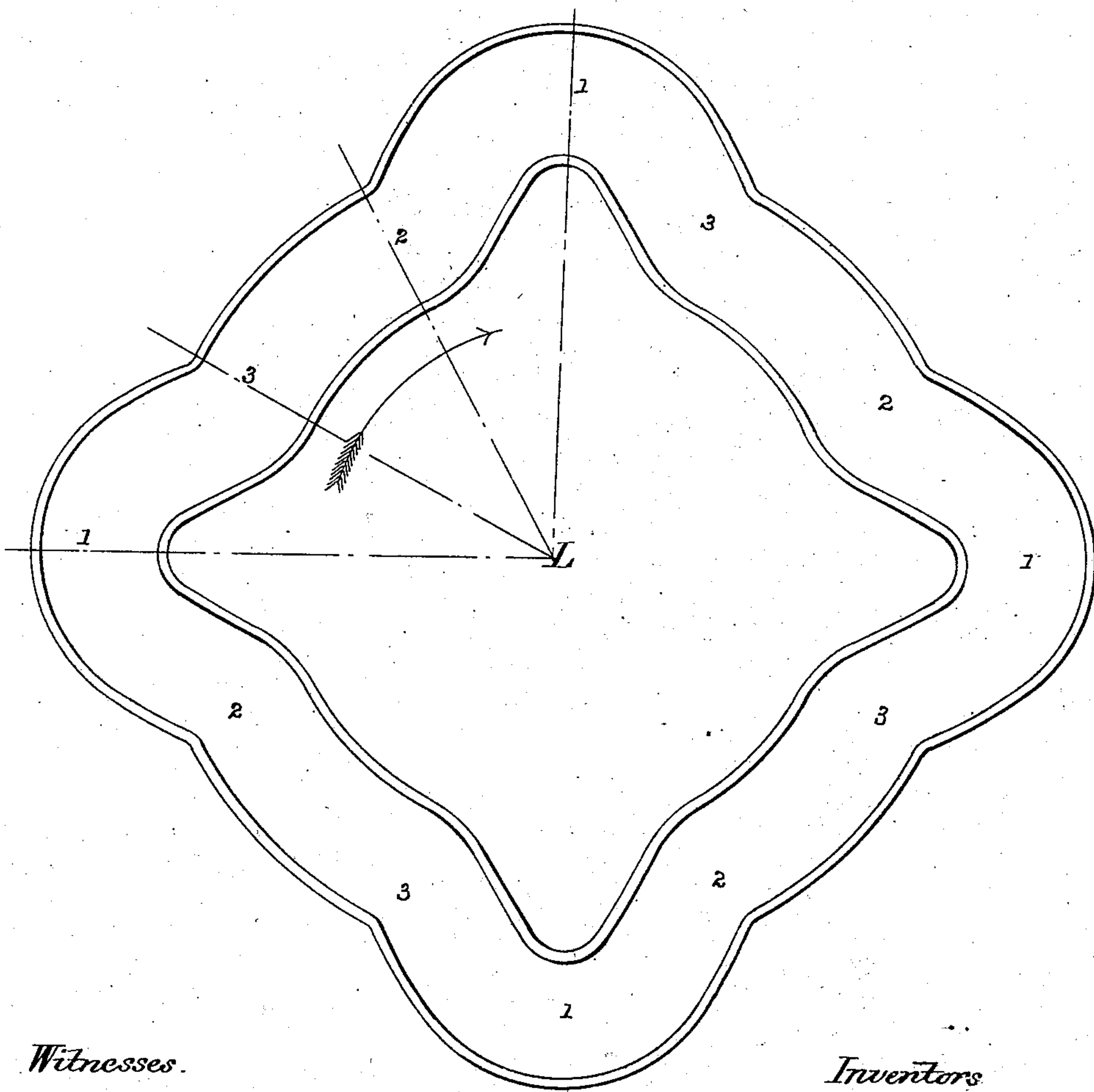
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Fig. 3.



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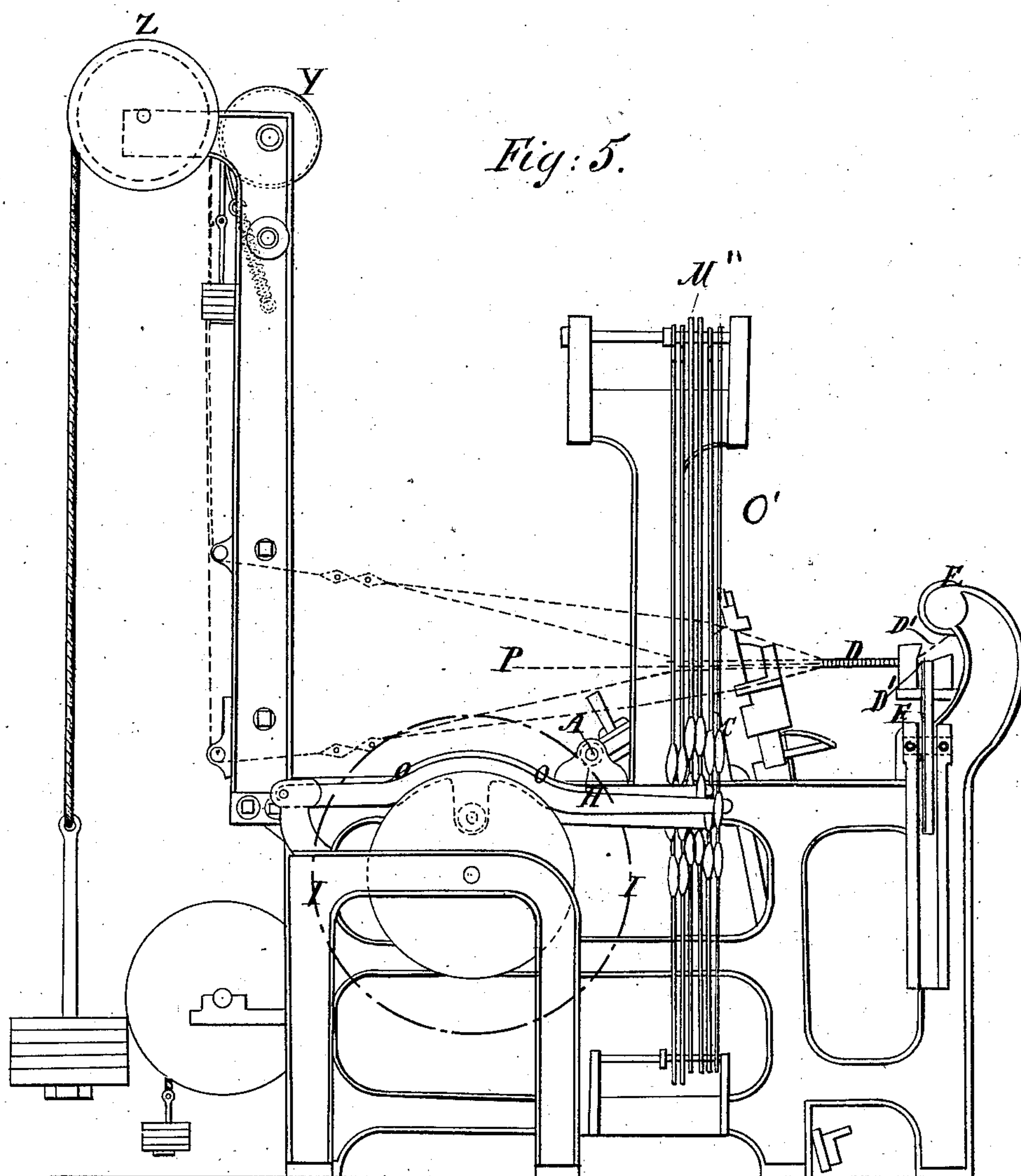
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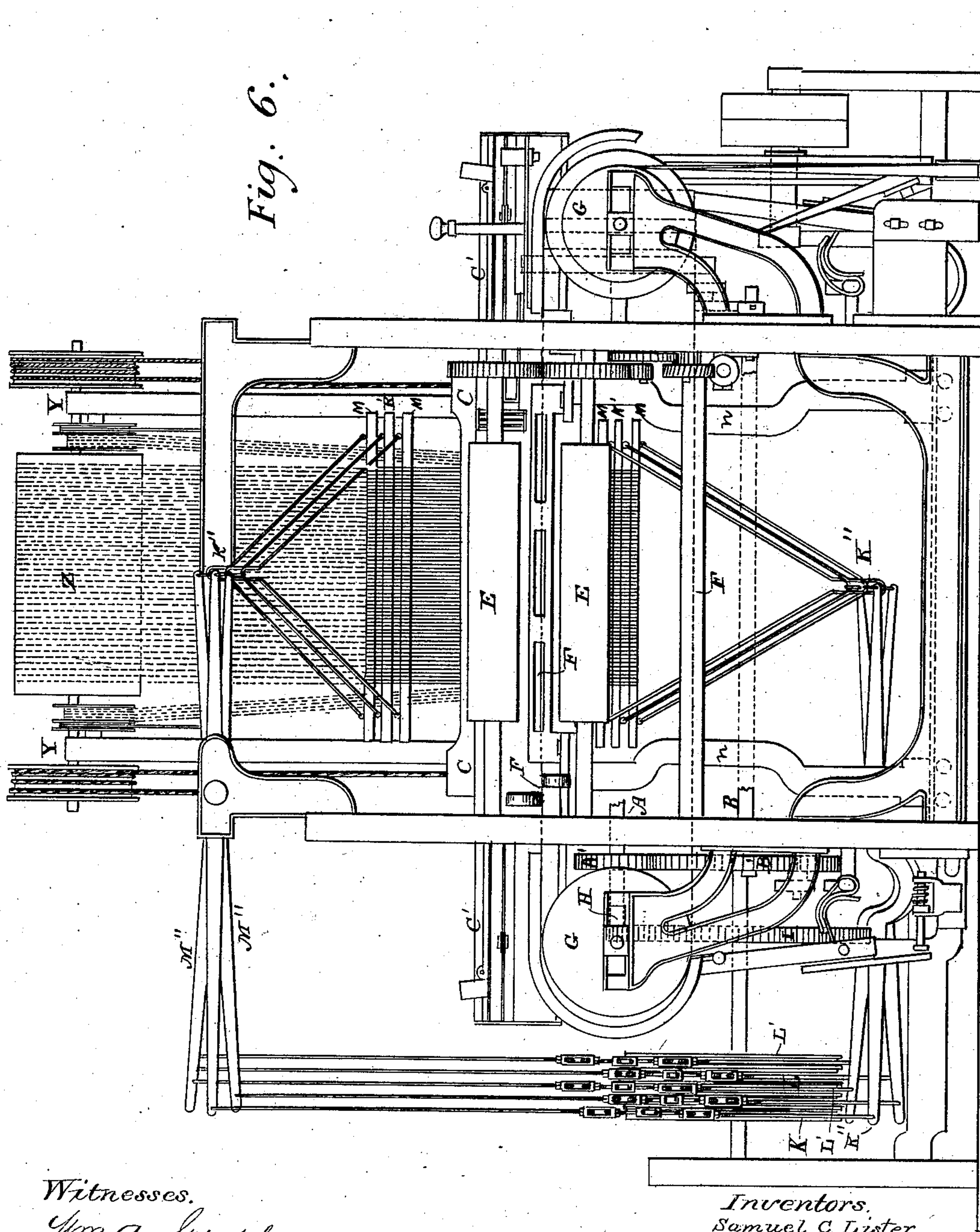
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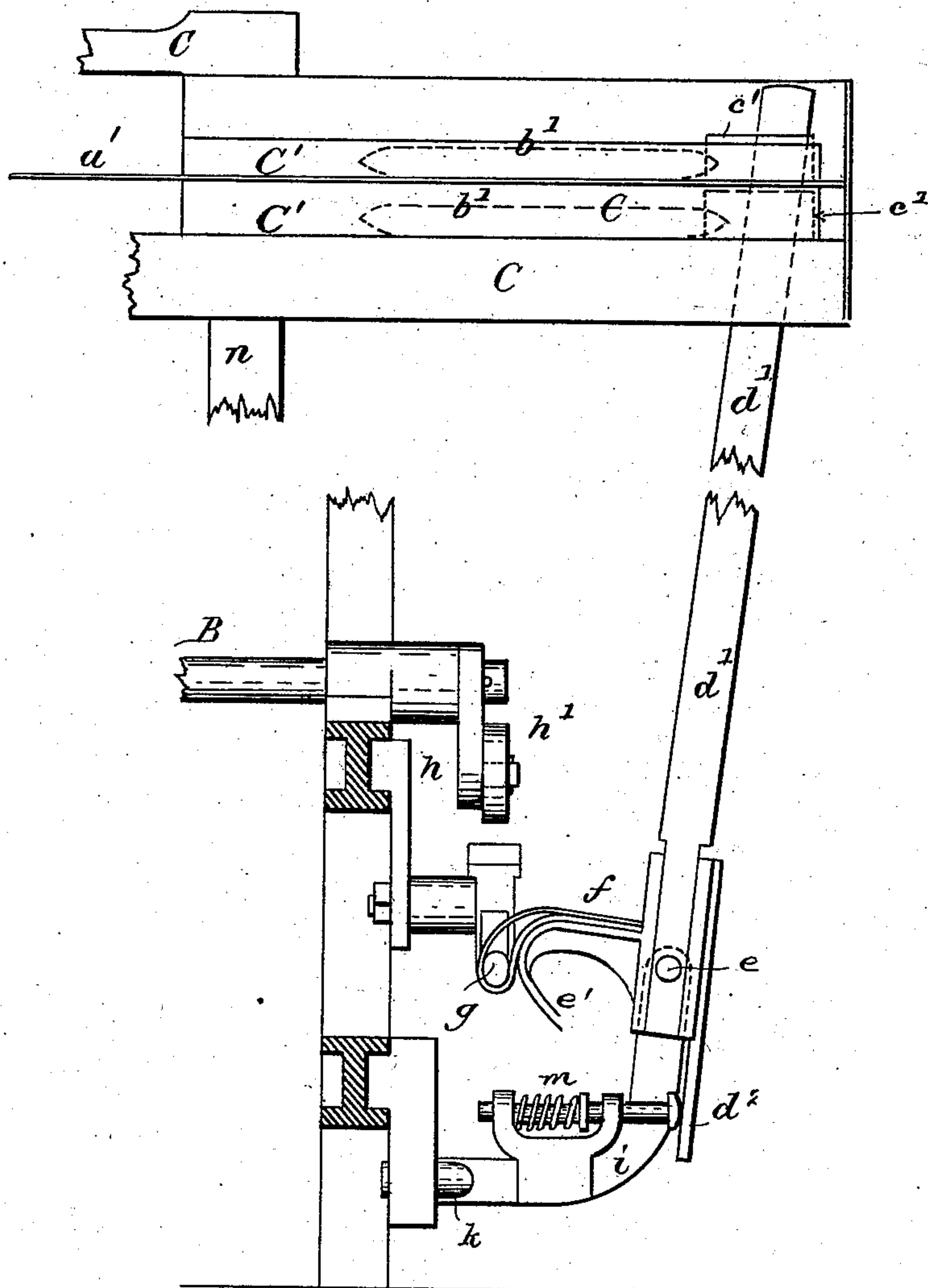
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Fig. 7.



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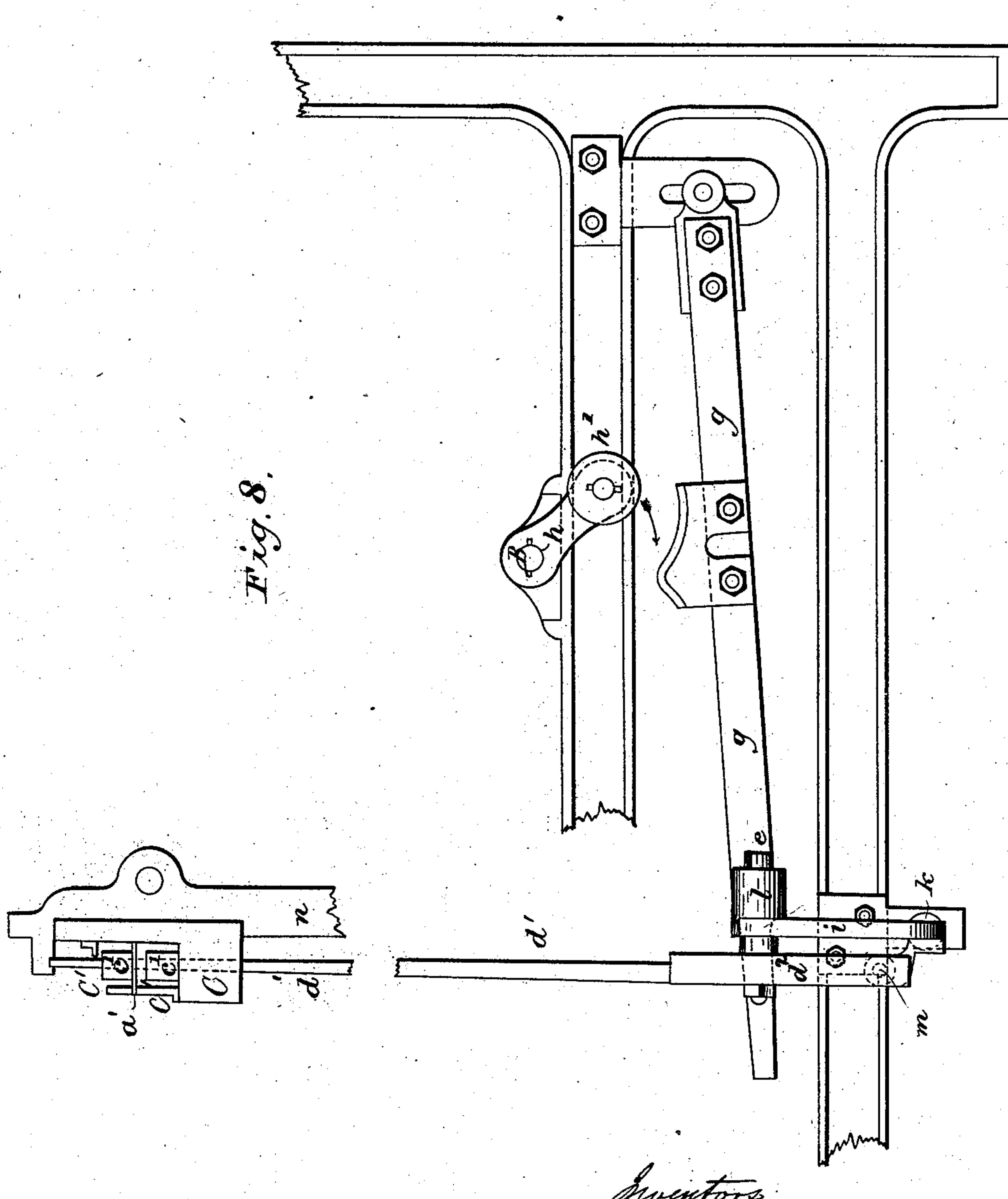
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UNITED STATES PATENT OFFICE.

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LOOM FOR WEAVING DOUBLE PILE FABRIC.

SPECIFICATION forming part of Letters Patent No. 292,664, dated January 29, 1884.

Application filed November 28, 1881. (No model.) Patented in England August 23, 1878, No. 3,327; in France March 13, 1879, No. 129,564, and in Germany March 25, 1879, No. 10,163.

To all whom it may concern:

Be it known that we, SAMUEL CUNLIFFE LISTER and JOSÉ REIXACH, subjects of the Queen of Great Britain, residing at Manningham, near Bradford, in the county of York, England, have invented certain new and useful Improvements in Looms for Weaving Double Pile Fabrics, (for which we have received Letters Patent in England, No. 3,327, dated August 23, 1878; in France, No. 129,564, dated March 13, 1879, and in Germany, No. 10,163, dated March 25, 1879,) of which the following is a specification.

The object of this invention is to cheapen and improve the manufacture of double pile fabrics—that is, fabrics composed of two distinct cloths connected by pile-threads which have to be severed to produce two pile fabrics. The main object is to use up as small an amount as may be of the pile-warp, while at the same time giving to the cloths a sufficiently well covered pile-surface, and to construct the loom in as simple a manner as may be to effect these objects.

The fabric made is shown by the diagram view Figure 1 of the drawings hereunto annexed. The lines *a b* represent the two divisions of the ground-warps for the top and bottom cloths. The line *c* represents the pile-warp, and the dots *d* represent the shoots of weft. It will be seen that the pile-warp *c* is tied into each cloth by every third shoot of weft put into such cloth, and that the ground-warps *a b* of each cloth are crossed alternately after a single shoot, *d*, of weft, and after two successive shoots, *d d*, of weft; also, that the pile-warp *c* passes around the second of the two successive shoots *d d* of weft. If the pile-warp were passed around the single pick of weft, it would not be held firmly. If it were passed around the first of the two successive picks of weft, the fabric made would be irregular, as, when the second of the two picks was thrown and it was beaten up by the batten, this second pick would often be driven in front of the first pick, and there would be no certainty as to what position the two picks of weft would occupy in the completed fabric.

The object of our invention is, therefore, to manufacture the fabric precisely as shown by the drawings. The diagram Fig. 1^x shows the same fabric. It is simply the diagram Fig. 1 inverted. The same cams, with but slight alteration, make the fabric either by the series of movements indicated by diagram Fig. 1 or by diagram Fig. 1^x.

For forming the fabric, three forms of cam only are required for working the healds—one cam of the form shown at Fig. 2 for the pile-warp heald, and two each of the cams shown at Figs. 3 and 4 for the healds for the ground-warps of the two cloths.

At Figs. 5 and 6 we have shown a two-shuttle pile-fabric power-loom with the healds worked by a set of cams of the above form acting in unison to produce the fabric shown at Fig. 1. Fig. 5 is a side view of the loom, showing the way in which the cams give motion to the healds. Fig. 6 is a front view of the loom.

Fig. 7 is a face view, and Fig. 8 a side elevation, of some of the parts at one end of the loom, showing well-known apparatus used for throwing the shuttles from the two shuttle-boxes, which are at each end of the batten. A is the crank or driving-shaft of the loom, which, by means of a toothed wheel, A', upon it, (see Fig. 6,) drives a toothed wheel, B', on the picking-shaft B, as is usual. C is the batten, worked to and fro by the crank-shaft. C' C' are two fixed shuttle-boxes, one above the other, at each end of this batten. D is the uncut double pile fabric. (See Fig. 5.) D' are the two fabrics after being cut. E are rollers, over and under which the two fabrics are led away. In the loom shown in these drawings the severing of the pile is effected by means of the cutting-edge of an endless band of steel, F, kept distended between pulleys G, and caused to revolve continuously while the loom is at work. No claim is made to the use of an endless band of steel for severing the pile. It is a suitable arrangement for the purpose; but other suitable arrangements of mechanism for severing the pile may be adopted. The picking-shaft B (see Fig. 6) gives motion to picker-staffs, one for each pair of shuttle-

boxes C' at each end of the batten C, in the ordinary well-known manner, and by these the shuttles are thrown to and fro across the loom.

Well-known shuttle-actuating mechanism is shown in Figs. 7 and 8. In these figures, *a'* is a horizontal plate dividing the upper from the lower shuttle-box. It extends nearly to the side of the warps. *b', b'* are the shuttles. *c', c'* are the pickers, both actuated by one picker-staff, *d'*. The picker-staff at its lower end is fixed to a short axis, *e*, which can turn in a bearing on the bracket *i*. The lower end of the picker-staff has also an arm, *e'*, extending from it. A leather strap, *f*, formed into a loop, is fixed to and lies above the top of the arm. The end of a lever, *g*, enters this loop of leather. The lever *g* is acted upon by a roller, *h'*, on a crank-arm, *h*, at the end of the picking-shaft B. When the roller is, by the revolution of the picking-shaft, made to strike against the lever *g*, it depresses the lever, so turning the picker-staff upon its axis *e* and throwing the two shuttles. The bracket *i* can turn on a horizontal joint, *k*, which is at right angles to the axis *e*. This permits the picker-staff to rock backward and forward with the batten as the batten is rocked backward and forward, in the ordinary manner. After the picker-staff has been made to throw the shuttles, it is brought back by a coiled spring contained in a box, *l*, which forms part of the bracket *i*. One end of the spring is fixed to the interior of the box, the other to the axis *e*. *m* is a spring-stop for a downward prolongation, *d''*, of the picker-staff to strike against when the picker-staff is thrown back by the coiled spring. *n* shows part of one of the swords which carry the batten.

Any suitable arrangement of mechanism for controlling the delivery of pile-warp may be employed. We have not, therefore, thought it necessary to show any arrangement of parts for effecting this object. The arrangement of mechanism described in our United States Letters Patent for improvements in looms for weaving double pile fabrics, No. 268,250, of November 28, 1882, is very suitable for the purpose; but other arrangements of mechanism may be used.

The dotted line P, Fig. 5, shows the pile-warp.

The ground-warps are carried by a beam, Z, which is prevented from turning too easily by a friction-cord wound around its end. One end of the cord is attached to a spring, and the other holds in suspension a weight, as is common in ordinary looms, and the warps are drawn off from the beam by the forward movement of the double cloth as it is woven.

Y are beams for carrying the warps for the side selvages. The warps are drawn off from these beams and have the requisite tension put upon them in a way just described in treating of the warp-beam Z.

The healds for working the selvage-warps

are not shown, as they would tend to confuse the drawings, and illustration of them is not necessary here, they being of ordinary construction, and worked just like the other healds from cams on the shaft which carries the other cams used for working the other healds. This cam-shaft has fast upon it a toothed wheel, I, (see Figs. 5 and 6,) which is driven by a pinion, H, on the main crank-shaft A.

The cam K, Figs. 1 and 6, is for working the heald K', by which the pile-warp is lifted and lowered.

Two healds M are used for raising and lowering the ground-warps of the top fabric, and two other healds, M, for raising and lowering the ground-warps of the bottom fabric. One of each pair of healds M is worked by means of a cam, L, and the other by means of a cam, L'. The cam L is shown at Fig. 3 and the cam L' at Fig. 4. The pair of cams L L' for operating the ground-warps of bottom fabric are set one-twelfth of a circle in advance of the exactly similar cams L L' for working the ground-warps of the top fabric. Each cam acts upon a truck or roller on a lever, O, which at its end is attached to a rod, O', which connects together the top and bottom levers, M' K', of the healds, as is usual, and as is shown at Figs. 5 and 6. The crank-shaft A of the loom makes twelve revolutions for each revolution of the axis of the cams K, L, and L'. The four quarters of each cam are formed alike, and three picks of weft are thrown during the time that the cams make a quarter-turn. By means of one of the cams shown at Fig. 3, one half of the ground-warps of the upper cloth is held down while one pick of weft is thrown, and is then held up while two picks of weft are thrown, and by means of one of the cams shown at Fig. 4, the other half of the ground-warps of the upper cloth is held up while a single pick of weft is thrown, and down while the two picks are thrown. One of the cams shown at Fig. 3 and another of the cams shown at Fig. 4 are similarly used for working the ground-warps of the lower cloth. When radial line 1 of cam L (see Fig. 3) is vertical, the heald which it works is down, the shed is open, and a pick of weft is thrown. When line 2 comes into vertical position, the heald is up and another pick of weft is thrown. When line 3 comes into vertical position the heald remains up and another pick of weft is thrown. Cam L' (see Fig. 4) is just the reverse of cam L. When radial line 1 is vertical, the heald which it works is up. When the line 2 is vertical, the heald is down, and when line 3 is vertical the heald remains down. By means of the cam K the pile-warp is for every quarter-turn of the cam lowered, so as to be caught by a shoot of weft into the bottom cloth, lifted so as to be caught by a shoot of weft into the top cloth, and then held at rest between the two cloths when the next pick of weft is thrown. When

radial line 1 of cam K is vertical, the pile-warp heald is central and the pile-warp out of both sheds. When line 2 is vertical, the heald is down and the pile-warp in the bottom shed, and when line 3 is vertical the heald is up and the pile-warp in the top shed.

To effect the movements of the various warps in the way shown by the diagram, Fig. 1, the cams will be in the following positions for every three picks of weft: For pick 1, the line 1 of cam K will be vertical, and also the lines 1 of cams L L' for top cloth and lines 2 of cams L L' for bottom cloth; for pick 2, the line 2 of cam K, lines 2 of cams L L' for top cloth, and lines 3 of cams L L' for bottom cloth will be vertical; for pick 3, the line 3 of cam K, lines 3 of cams L L' for top cloth, and lines 1 of cams L L' for bottom cloth will be vertical. The cams are all fixed upon the cam-shaft in such manner that line 1 of cam K, lines 1 of cams L L' for top cloth, and lines 2 of cams L L' for bottom cloth are in a line with one another.

To make the fabric by the series of movements shown by diagram Fig. 1^x, the position of the cams L L' for operating the ground-warps of the top and bottom fabrics, respectively, would be reversed, and cam K would be made exactly the reverse of that shown at Fig. 2.

In order to show the importance of adjusting the cams in the particular relation to each other described, and to render still clearer the operation of the cams, the following explanation may be given with reference to diagram Fig. 1:

It has been already stated that the ground-warps for the top cloth are divided into two equal divisions, (indicated by lines *a b* in the diagram,) and that the ground-warps for the bottom cloth are also divided into two equal divisions, (indicated by lines *a b*;) also, that the pile-warps are indicated by the line *c*, and that the dots marked *d* indicate weft-threads; also, that one weft-thread *d* is thrown between the two divisions of the warps which form the top cloth and another weft-thread between the two divisions of the warps that form the bottom cloth for each one-twelfth of a revolution of the cams, by which the crossing of the warps is controlled; also, that the throwing of the weft-threads into the two cloths is effected simultaneously; also, that there is one pair of cams for actuating the two equal divisions of the warps forming the top cloth and another pair of cams for actuating the two equal divisions of the warps forming the bottom cloth—that is, that every alternate warp-thread, say, of the top cloth, is controlled by a heald actuated by one cam of the pair of cams and the other alternate warp-threads of the top cloth by a heald actuated by the other cam of the pair of cams. Just in the same way the alternate warp-threads of the bottom cloth are controlled by a heald actuated by one cam and the other alternate warp-threads by another cam.

It has also been stated that the pile-warp *c* is controlled by a heald actuated by a separate

cam, and that the operating parts of all the cams are divided in twelve equal divisions; also, that the several warp-threads have only to be brought into three different positions by the action of the several cams; therefore each quarter of the circumference of the cam-groove of each cam gives the three movements to the warps which it actuates, and all the four quarters of any one cam are simply repetitions the one of the other. Now, remembering that all the cams are fixed on one axis, and are therefore all revolved at the same speed, and that, as before stated, a pick of weft is thrown into the top cloth and a pick of weft into the bottom cloth for every one-twelfth of a revolution of the several cams, it will be seen, aided by the vertical lines across the diagram, dividing it into twelve divisions, marked with numbers 1 to 12 inclusive, what happens at each one-twelfth of a revolution of the cams. The entire twelve divisions show what takes place during one complete revolution of the cams. In the division marked 1 it will be seen that the two sets of warps of the top cloth are made to cross; also, that the two sets of warps of the bottom cloth are made to cross, and that a shoot of weft is thrown between the two sets of top warps and another between the two sets of bottom warps, and that the pile-warp is held central between the two cloths and is not caught into either of them. In the next division (marked 2) the warps of the top cloth are crossed, but not the warps of the bottom cloth, and the pile-warp is carried down so as to be caught into the bottom cloth, and a weft-thread is thrown into each cloth, as before. In the next division (marked 3) the warps of the top cloth are not crossed and those of the bottom cloth are crossed, and the pile-warp is lifted up into the top cloth, to be caught into it, a weft-thread being again thrown into each cloth. In the next division (marked 4) the movements described with reference to division 1 are repeated. Division 5 is a repetition of division 2, and division 6 of division 3; and so the movements described with reference to the first three divisions are continuously repeated. Now, looking at the diagram, it will at once be seen that the ground-warps of the top cloth have given to them precisely the same series of consecutive movements as the ground-warps of the bottom cloth, but that the movements of the ground-warps of the bottom cloth precede the corresponding movements of the warps of the top cloth by one division—that is, by one-twelfth of a revolution of the cams.

We do not herein claim the method above disclosed, the right being reserved to claim such method in another application.

We claim as of our own invention—

1. The combination of means for supplying two sets of ground-warps, one above the other, for forming a top fabric and a bottom fabric; mechanism for passing a weft-thread between the warps of top fabric when crossed, and for

simultaneously passing a weft-thread between the warps of bottom fabric when they are likewise crossed; mechanism for causing the crossing of the ground-warps of the top fabric alternately after one pick of weft has been passed into that fabric, and then after two consecutive picks of weft have been put into it, and then, again, after a single pick of weft has been put into it, and so on; mechanism for causing the ground-warps of the bottom fabric to make corresponding crossings, but to make them either one pick before or one pick after the like crossings of the warps of the top fabric; means for supplying a set of pile-warps; mechanism for raising and lowering these warps, arranged to first (when a pick of weft is simultaneously thrown into both fabrics) cause the pile-warps to be caught into one fabric by the second of the two consecutive picks of weft that have to be put into that fabric, then at the next pick of weft to cause the pile-warps to be caught into the other fabric, (similarly by the second of the two consecutive picks of weft that have to be put into that fabric,) and afterward, at the next pick of weft, to cause the pile-warps to be held centrally between the two fabrics, so as not to be caught into either of them, and so on in succession; a batten for beating up the weft-threads, and take-up mechanism for taking up the cloth as it is woven, substantially as hereinbefore set forth.

2. The combination of the batten, the two shuttle-boxes, one above the other, at each end of the batten, shuttle-actuating mechanism, two healds operating upon the ground-warps of the top fabric, their two actuating-cams, two healds operating upon the ground-warps of the bottom fabric, the two cams for actuating them, similar in construction to the cams for working the ground-warps of the top fabric, a heald operating upon the pile-warp, the single cam for actuating this heald, and the levers and connecting-rods interposed between the respective cams and healds, the several cams being shaped and set upon the cam-shaft, as described, to cause the ground-warps of the top fabric to be crossed alternately after one pick of weft has been put into that fabric and after two consecutive picks of weft have been put into it, and to cause the ground-warps of the bottom fabric to make corresponding crossings, but to make them either one pick in advance of or one pick after the like crossings of the top warps, and to cause the pile-warp to be caught into each fabric by the second only of the two consecutive picks of weft put into that fabric, substantially as hereinbefore described.

3. The combination of the batten, the two shuttle-boxes, one above the other, at each end of the batten, shuttle-actuating mechanism, the two healds and their two actuating-cams

for operating the ground-warps of the top fabric, said cams being formed so as to cross these warps alternately after one pick of weft has been put into that fabric and after two consecutive picks of weft have been put into it, the two healds and their pair of actuating-cams for operating the ground-warps of the bottom fabric, the said cams corresponding with those for operating the ground-warps of the top fabric, but so set upon the cam-shaft as to produce the corresponding crossings of the warps either one pick in advance of or one pick after the like crossings of the warps of the top fabric, the single heald and its cam for operating upon the pile-warp, so formed and set upon the cam-shaft as to cause the pile-warp first to be caught into one fabric by the second of the two consecutive picks of weft put into that fabric, then to be caught into the other fabric by the second of the two consecutive picks of weft put into that fabric, and next to be held centrally between the warps of the two fabrics, so as not to be caught into either of the fabrics when a pick of weft is put into each of them, and the levers and connecting-rods interposed between the respective cams and healds, substantially as and for the purpose hereinbefore set forth.

4. The combination of the two healds for raising and lowering the ground-warps of the top fabric, the two healds for raising and lowering the ground-warps of the bottom fabric, the two corresponding pairs of cams, L L', one pair for each two healds, each pair formed so as to raise one heald and lower the other during one-twelfth of a revolution, then during the next one-twelfth of a revolution to retain the healds at rest, then during the next one-twelfth of a revolution to reverse the movement formerly given to the healds, and so on in succession, and with one pair of cams set one-twelfth of a revolution in advance of the other pair upon the cam-shaft, the heald for raising and lowering the pile-warp, its cam formed to raise the heald during one-twelfth of a revolution, lower it during the next twelfth of a revolution, and hold it in a central position during the next twelfth of a revolution, the connecting-rods and levers interposed between the cams and the healds, the shaft upon which the cams are mounted, the driving-shaft, and the gearing connecting said shafts, substantially as and for the purpose hereinafter set forth.

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