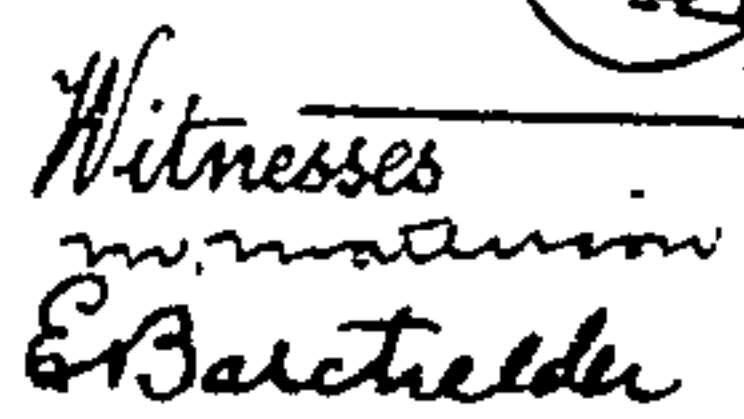


APPARATUS FOR THE PRODUCTION OF LENO FABRICS.

946.137.

6 SHEETS—SHEET 1.



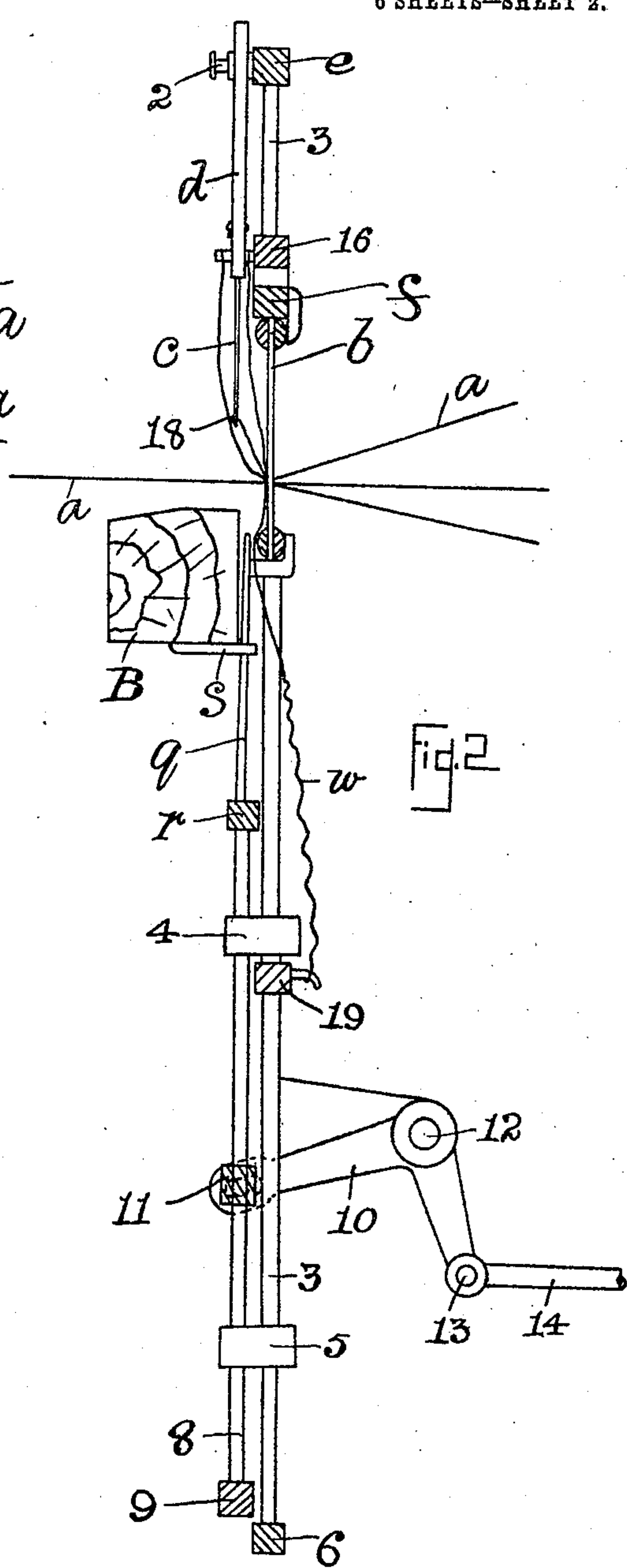
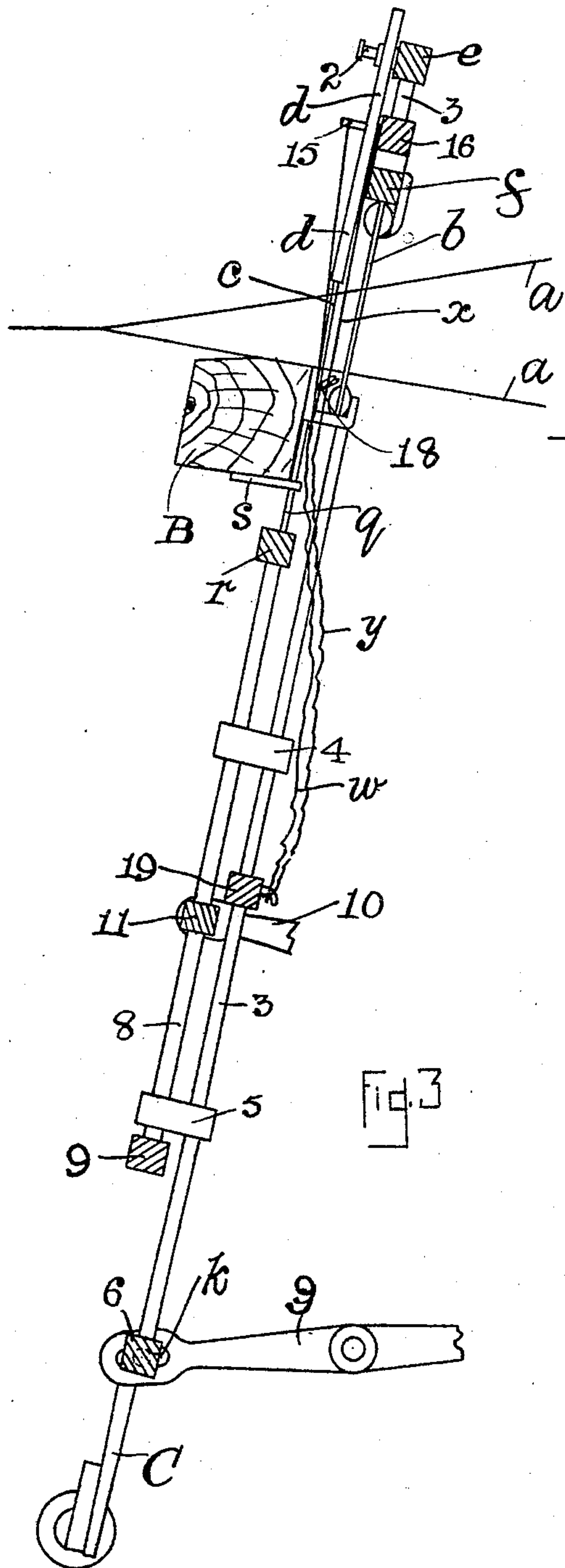
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 APPARATUS FOR THE PRODUCTION OF LENO FABRICS.  
 APPLICATION FILED DEC. 31, 1907.

946,137.

Patented Jan. 11, 1910.

6 SHEETS—SHEET 2.



Witnesses  
 in testimony  
 E. B. Batcher

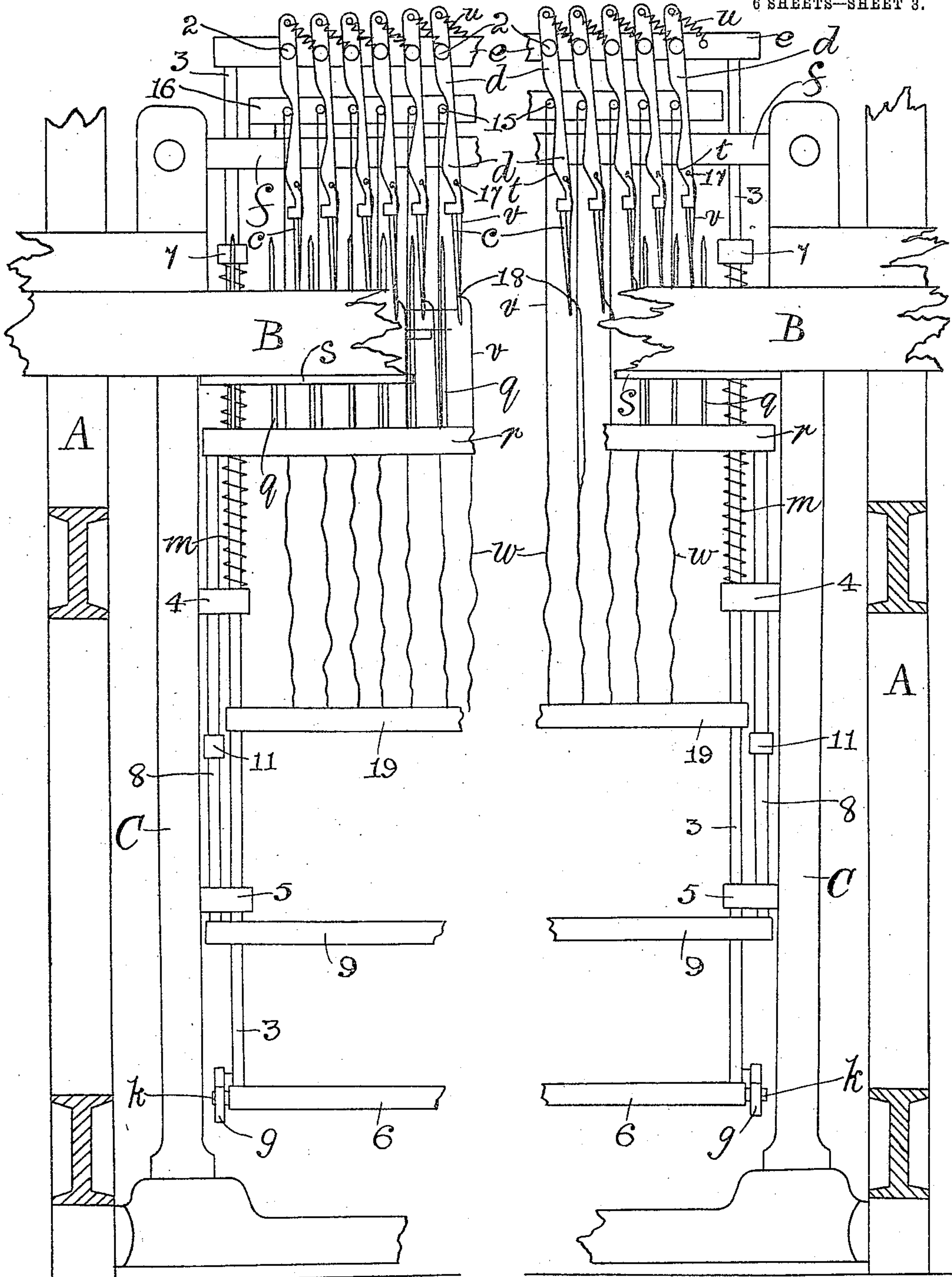
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6 SHEETS—SHEET 3.



Witnesses  
 Wm. H. H. H.  
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Fig. 4

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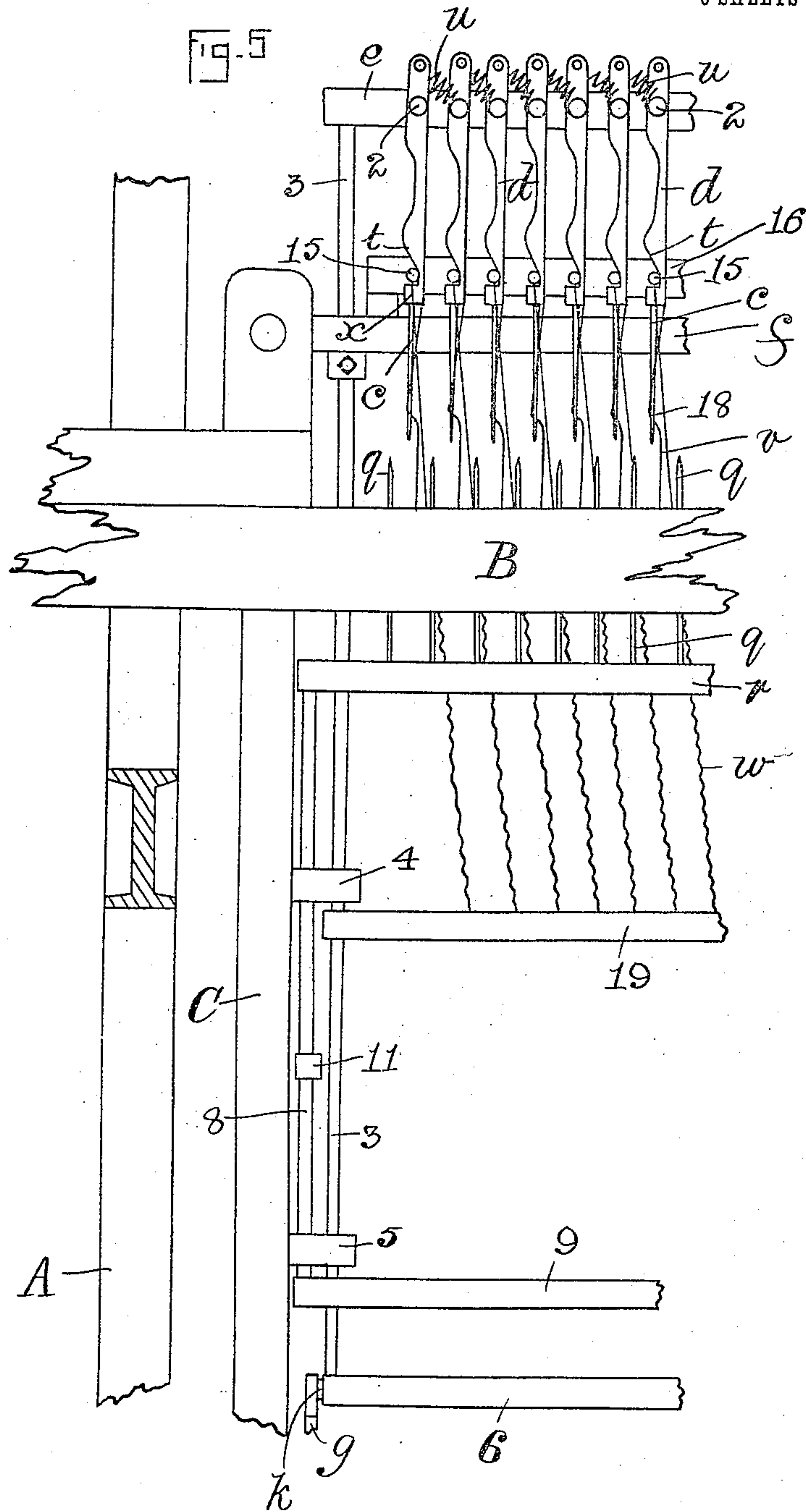


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6 SHEETS—SHEET 4.



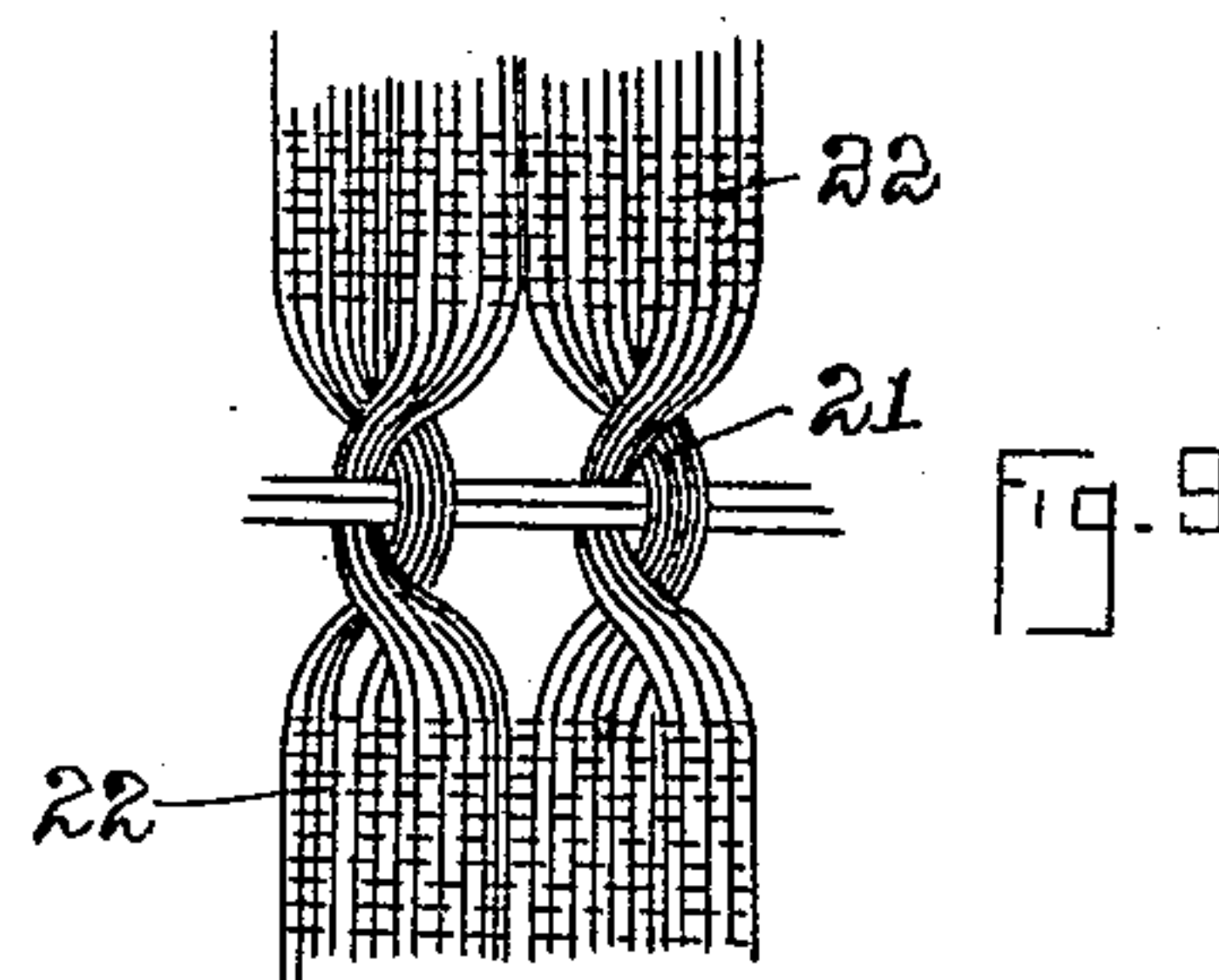
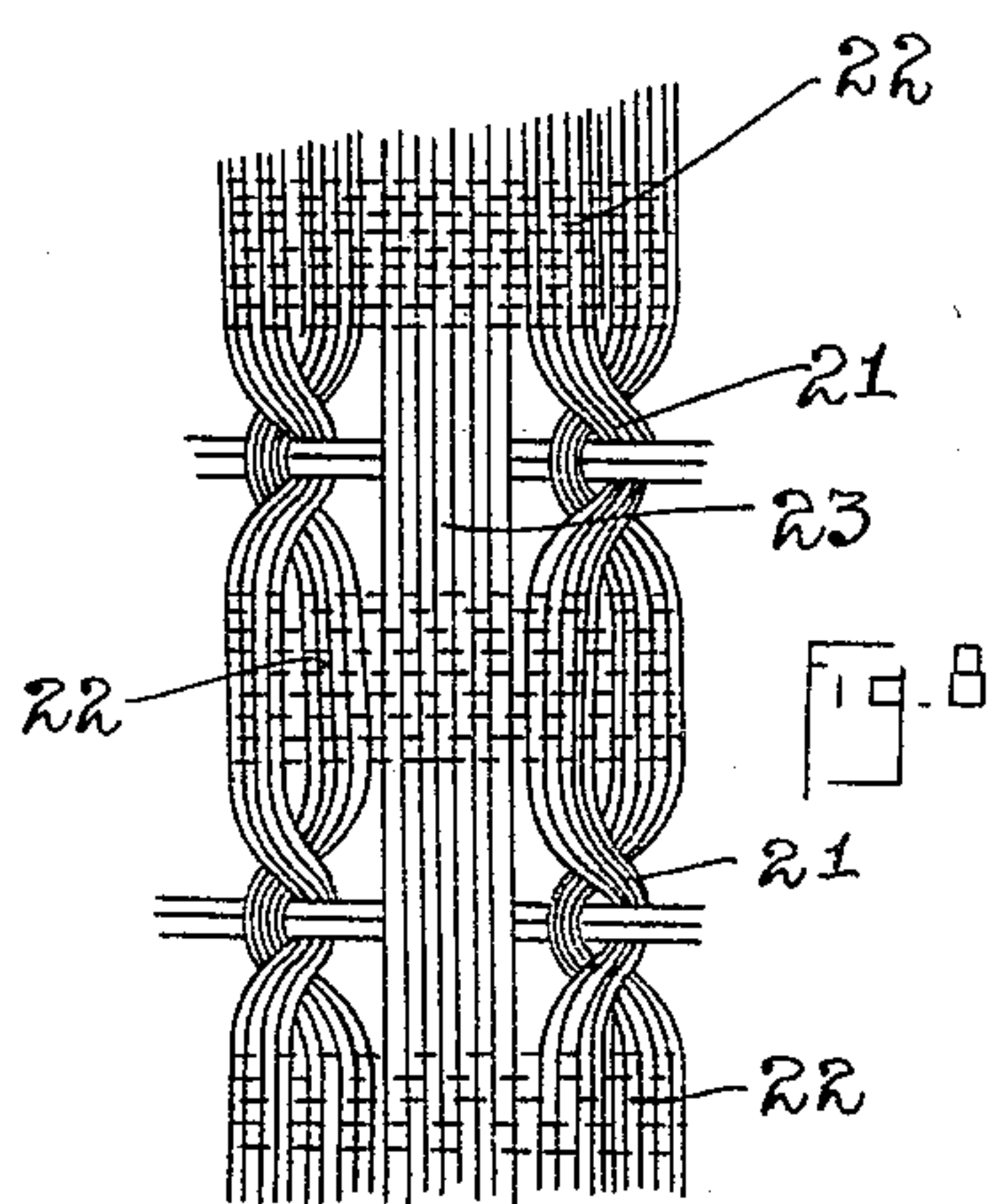
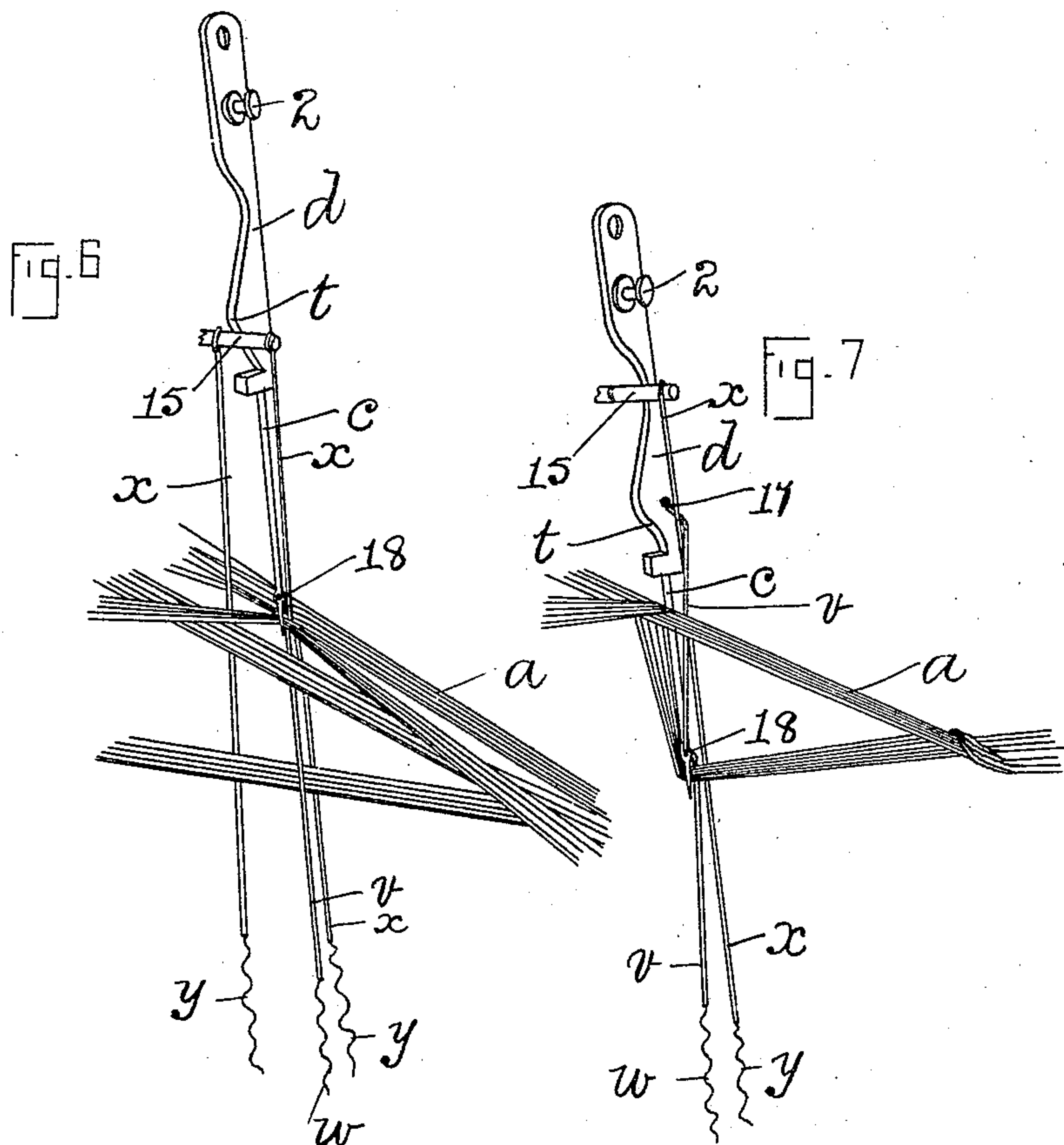
Witnesses  
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 E. Batchelder

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 APPLICATION FILED DEC. 31, 1907.

946,137.

Patented Jan. 11, 1910.  
 6 SHEETS—SHEET 5.



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 APPLICATION FILED DEC. 31, 1907.

946,137.

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6 SHEETS—SHEET 6.

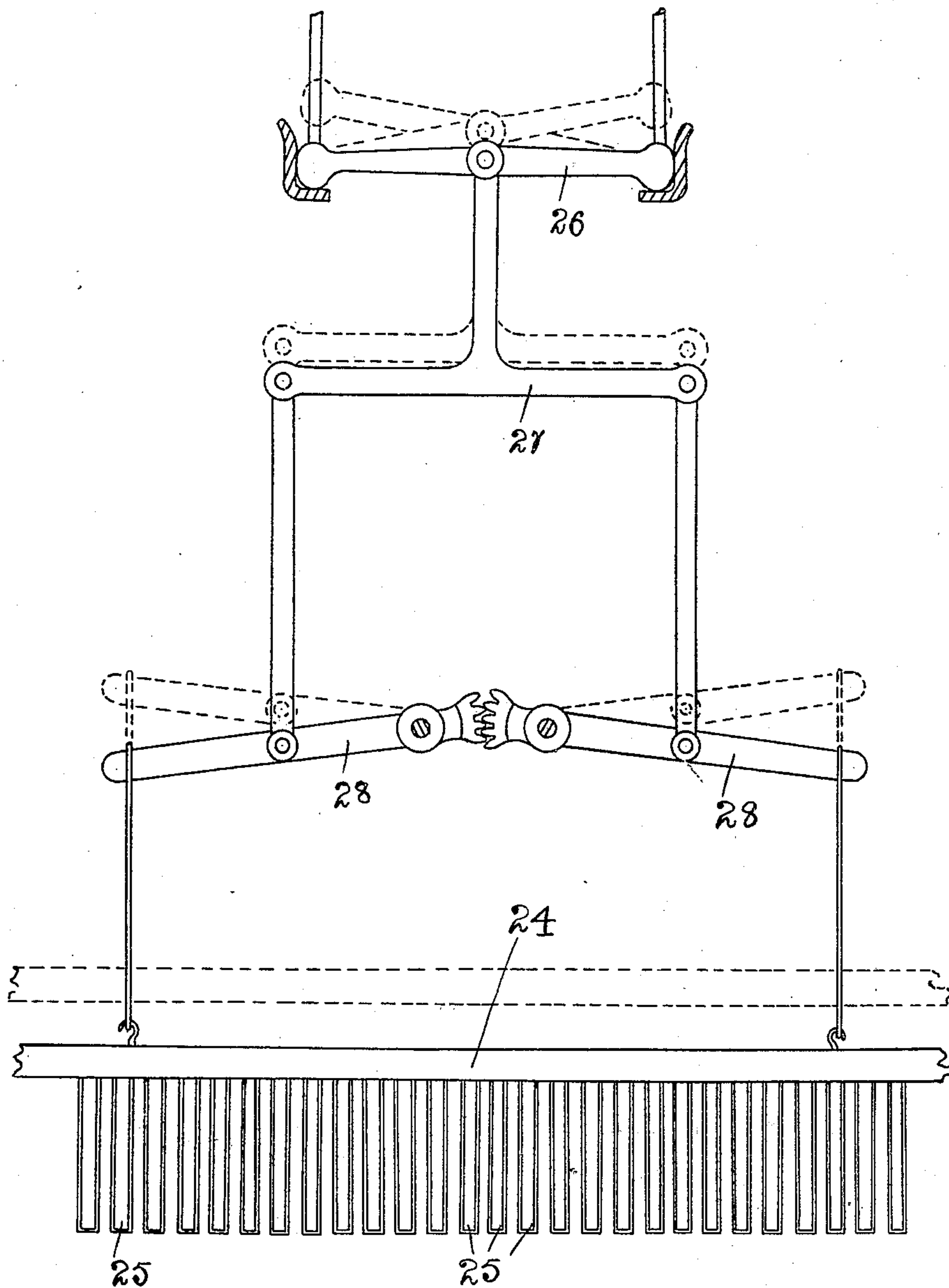


Fig. 10

Witnesses  
 nomination  
 E. Balchelder

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# UNITED STATES PATENT OFFICE.

JOSEPH KING, OF KEIGHLEY, ENGLAND.

APPARATUS FOR THE PRODUCTION OF LENO FABRICS.

946,137.

Specification of Letters Patent.

Patented Jan. 11, 1910.

Application filed December 31, 1907. Serial No. 408,807.

*To all whom it may concern:*

Be it known that I, JOSEPH KING, a subject of the King of Great Britain, and resident of No. 65 Cliffe street, Keighley, in the county of York, England, have invented certain new and useful Improvements in Apparatus for the Production of Leno Fabrics, of which the following description, together with the accompanying sheets of drawings, is a specification.

My invention relates to the production of that class of leno fabrics wherein a comparatively large number of warp threads are made to cross over at intervals another greater, less or equal number of adjoining threads and yet allow both lots or series of said threads to be interwoven with their weft threads in the ordinary manner in the intervals between said crossings.

My invention consists in the application of devices or means to a power loom so that the production of the class of fabric described, may be automatically carried into effect in unison with the other motions of the loom as it is operated in the usual manner.

In the accompanying sheets of drawings which are illustrative of my invention:— Figure 1 is a sectional end elevation of sufficient of a loom to illustrate the application thereto of my improved parts. The relative positions of the parts as shown are those which they assume during the passage of the shuttle. Fig. 2 is a similar view to Fig. 1 but shows only such parts of same as are necessary to illustrate my improved devices in other positions than those which they are shown to occupy by said Fig. 1, said altered position being that in which the parts are situated when beating up the weft. Fig. 3 is a similar view to Fig. 2 but illustrates the parts in certain positions hereinafter explained. Fig. 4 is a front elevation of the parts shown by Fig. 1, but shows certain of the parts in the position they occupy as illustrated by Fig. 3. Fig. 5 is a similar view to Fig. 4 but illustrates the parts in the positions they occupy as shown by Fig. 1. Figs. 6 and 7 are perspective views showing certain of my improved devices in the respective positions of having laid-hold-of the threads to be crossed and of having depressed them to form the opening for the passage of the shuttle. Figs. 8 and 9 illustrate the crossing of the warp threads in fabrics produced by my improved appa-

ratus. Fig. 10 is a drawing in detail showing a means whereby my improved parts may be actuated by a common jacquard.

Similar letters and figures of reference indicate similar parts throughout the several views.

A indicates the ordinary framework of the loom, B the lay or slayboard, and C the lay-sword.

In carrying my invention into effect, I arrange the warp threads *a* to pass or be connected through the reed *b* in the usual manner, as well as to be conducted in the ordinary way through the usual heddles or harness which actuate them during ordinary weaving operations. However I set-back or mount the reed *b* to the rear of the shuttle race on the lay B sufficiently to afford space for pendent needles *c* to pass between these parts to operate the warp threads *a* as hereinafter described. These needles *c* are fixed to levers *d* which are pivoted at 2 to the cross bar *e*. This bar *e* is fixed upon the upper ends of the rods 3, which pass through the bar *f* (which secures the reed *b* and acts as the usual and well known hand rail) which acts as a guide for same, while their lower extremities pass through guides 4 and 5 secured to the laysword C. The lower ends of these rods 3, are fixed to the cross bar 6 which acts as a binding stay to same and to the upper bar *e*. Motion is transmitted to this bar *e* by the loom dobby or shedding mechanism raising the rear ends of the levers *g* (to which it is coupled by cords *h*) and depressing the front ends of said levers *g* thus forcing down said upper bar *e* by said levers *g* being coupled to the vertical rods 3, at *k*. The return or ascending motion of the bar *e* is effected by the springs *m* which take over the rods 3 and rest upon the guides 4 at one end while their upper extremities press upon hoops 7 secured to said rods 3.

The levers *g* which effect the descending motion of the bar *e* and its levers *d*, are coupled to, or so as to be actuated simultaneously with, those jack levers, or other parts of the dobby or jacquard machine, which are arranged to actuate the levers *n* for slackening the warp threads which pass over the usual leno slacking bar, *p*, thus whenever the levers *g* are moved so also is the slackening bar or "slackener" *p*.

Since, in accordance with the arrange-



ments of my improved parts as above described, the reed *b* is moved out of position for acting as a guide for the shuttle as heretofore, I now mount projecting pins *q* upon  
 5 a bar *r* which extends across the loom to carry the number of pins *q* required for the whole width. These pins *q* extend from  
 10 said bar *r* and pass through openings made in a guide *s* fixed to the under surface of the slayboard B, and they are caused to ascend during the passage of the shuttle so that their upper extremities reach above the shuttle race as shown by Figs. 1, 4 and 5, while  
 15 during the beating up of the weft by the reed *b* these pins *q* are withdrawn or moved to occupy a position below said shuttle race as shown by Fig. 2.

The bar *r* is fixed upon the upper ends of the rods 8 which pass through openings in  
 20 the guides 4 and 5 so that by another bar or stay-piece 9 being secured to their lower extremities, they may be actuated by the levers 10, spanning projecting parts 11 carried by them, as said levers 10 are moved.  
 25 These levers 10 are pivoted at 12 to bearings secured to the layswords C, while their pendent arms are coupled at 13 to rods 14 which are held from longitudinal movement by being coupled to the bracket 14<sup>a</sup> fixed to  
 30 the framework A. As the layswords C oscillate or move backward and forward to beat up the weft and recede to allow such weft to be thrown between the threads of warp, the levers 10 are carried with them  
 35 and by the rods 14 being held against movement in the same directions, said levers 10 are caused to oscillate and so actuate the pins *q* as desired.

The levers *d* which carry the pendent  
 40 needles *c*, have inclined or cam surfaces *t* formed on their edges to contact with projections 15 fixed to a cross-bar 16 secured to the hand rail *f*. These levers *d* are retracted by springs *u* (which may be of metal  
 45 although india-rubber bands are preferably employed since their retracting force can be more readily increased or decreased by simply winding extra coils upon or unwinding them from their retaining parts formed  
 50 by extensions of the pivotal pins 2) so that they are always kept in contact with the projections 15 by which means as said levers are caused to descend from their position shown by Figs. 1, 2 and 5 into the positions shown  
 55 by Figs. 3 and 4 the actions of their inclined surfaces *t* upon the projections 15 cause said levers *d* to move laterally. Cords or bands *v* are fixed at 17 to the levers *d* and are made to extend through eyes 18  
 60 approaching the pointed and extending ends of the needles *c*, and down to the springs (preferably of india rubber) *w* which are secured to hooks on a bar 19 fixed to, so as to move with, the rods 3 and the  
 65 bar *e* and consequently with the needle *c*

and levers *d*. These rubber bands *w* are to keep the cords *v* in a state of tension and yet allow them to yield as occasion may require.

To each of the projections 15 are fixed two strings *x*, one occupying a position be-  
 70 hind the needle *c* and the other a position in front of same. These strings *x* extend to be coupled to springs (preferably of india-rubber) *y* which reach down to be secured to hooks on the bar 19 so that as  
 75 this bar 19 descends with the parts that carry the needles *c* said cords *x* are stretched and held in a state of tension thus causing the threads of warp adjoining them to be pulled laterally to form an opening or leave a  
 80 space for the needles *c* to pass through as hereinafter explained. The front string *x* also keeps the last shot of weft from falling or remaining in the path of motion of said  
 85 needles when they descend as stated.

The threads of warp *a* which have to be crossed over the adjoining threads, are raised by their heddles or harness to a higher level than are said adjoining threads in order to enable the points of the needles *c*  
 90 to lay-hold-of or press them laterally without said points of the needles coming into contact with said adjoining threads.

When the devices are constructed, arranged and mounted in position as above  
 95 described and the other parts of the loom are adjusted in the well known manner ready for the process of weaving to be carried out, on the loom being started the usual weaving operations are performed  
 100 until the position is reached when the warp threads have to be crossed over to form the leno desired. At this time the heddle or harness operating mechanism causes the  
 105 needles *c* to descend for their points to pass below and to one side of the warp threads they have to actuate while their cords *v* will pass down the other side of them.

As the needles *c* commence to descend the actions of the cam surface *t* upon the pro-  
 110 jections 15 cause said needles to move over the top of the threads of warp which are lower than those threads which the needles *c* are forcing laterally somewhat as shown by Fig. 6, so that they are thereby carried be-  
 115 yond same in order that as the needles continue to descend the threads which they actuate are gathered together between the points of said needles and their cords *v* by which they are carried and caused to de-  
 120 scend on the opposite sides of the adjoining threads somewhat as shown by Fig. 7 thus the opening for the insertion of the weft between these threads is formed and on such  
 125 insertion being completed the several needles and parts return to their normal positions and for the other or ordinary weaving operations to be continued leaving the leno effect produced in the fabric as desired.

Since all the threads of warp are entirely  
 130



free from the parts which produce the crossing-over or leno effect, as shown at 21 Figs. 8 and 9 they may be operated to produce plain fabric as the part 22 between such crossing-over effects 21, or other ordinary leno effects or designs may also be produced in addition to those hereinbefore described and in the same piece of fabric. When the threads of warp cross over all the adjoining threads as shown by Fig. 7 then the rear string  $x$  may be dispensed with since the lateral pull of each needle  $c$  upon its warp threads will form an opening or clear space for its neighboring needle. However the front string  $x$  is retained to keep the weft clear of the needles as described.

Although only one series of needles  $c$  is herein shown and described it is obvious that I may employ two or more series of such needles and have them operated by their respective parts as and when desired. It is also clear that if the spaces between the needles as above arranged are too large for the pattern desired, then other and additional needles with their levers mounted on the same pivotal pins 2 may be employed in which case said additional needles  $c$  or their levers  $d$  would be bent or shaped to fall or occupy positions in vertical planes adjoining the other series of needles.

Although the needles  $c$  are hereinbefore described as acting, and are shown by the accompanying drawings to act by descending from positions above the warp, I would have it understood that I am aware that it is possible for such needles to be arranged to operate beneath the warp-threads in which case they would rise from their positions and bring their cords  $v$  so as to cross the threads beneath those adjoining.

In the production of leno fabrics in accordance with my present invention, when pattern or designs of fabrics are required which necessitate the employment of a jacquard machine, in order to enable such jacquard machine to retain the crossing threads of warp in their raised positions during the period of their crossing actions, although this may be for several shots of weft to be inserted, I arrange a shaft 24 carrying a series of metal loops 25 to support such threads as are to be raised and this shaft 24 I arrange to be retained by being coupled to levers 28 which are actuated by the lever 26 through the medium of the T piece 27. This lever 26 is operated by two or more needles in the jacquard, half of which are coupled to one end thereof, and the other half to the other end. The needles in the jacquard machine which are coupled to either end may raise said lever 26 at such end, thus lifting the piece 27 and levers 28 while when such raised end is descending by or with its actuating needles then if the lever 26 is desired to be retained in its highest

position, the needles at the other end thereof are raised so that the central part of the lever 26 neither descends nor ascends at such time; thus the shaft is retained as desired.

Such being the nature and object of my invention, what I claim is:—

1. An apparatus for use in the production of leno fabrics including an approximately straight cord or band, a needle engaging said cord or band intermediate the ends thereof, a support for one end of said cord or band, and means engaging the other end of said cord or band to exert a tension thereon.

2. In apparatus for use in the production of leno fabrics, needles mounted on pivoted levers, framework carrying said levers, means for actuating said framework, cords or bands mounted to act in conjunction with said needles and means for otherwise actuating the threads of warp to produce the ordinary openings or passage for the insertion of the weft substantially as herein specified.

3. Apparatus for use in the production of leno fabrics in power looms, comprising a series of needles, levers to which such needles are secured, framework for supporting and actuating said levers, means for moving said needles in a lateral direction, cords being arranged in front of the reed in the loom, guiding pins or projections to keep the shuttle in its path upon the lay, means for actuating said pins or projections and means for operating the warp threads to form a passage for the shuttle substantially as herein specified.

4. In apparatus for use in the production of leno fabrics of the class described, series of needles, means for transmitting vertical and lateral motion to such needles cords or bands actuated by said needles, retracting springs secured to such cords or bands, strings for separating the warp threads so that a passage is made for the insertion of the needles, means for stretching and releasing such strings, means for actuating the warp threads for enabling the insertion of weft, and means for beating up such weft substantially as herein specified.

5. In apparatus for use in the production of leno fabrics, a series of needles having cord extensions, levers to which said needles are secured, constructed with cam surfaces as described, retracting springs for actuating said levers, projections against which said springs cause said levers to press their cam surfaces, framework for supporting said levers, means for actuating said framework, means for operating the threads of warp for allowing the insertion of the weft and means for beating up such weft substantially as herein specified.

6. In apparatus for use in the production



of leno fabrics, a series of needles, levers to which said needles are secured, a framework carrying said needles, means for oscillating said levers relatively to the framework, cords  
5 arranged to act in conjunction with said needles to enable them to carry the threads of warp as described, means for actuating the framework carrying the needles and levers, and means whereby the slackening of  
10 the warp may be effected simultaneously with the actuating of the said needles substantially as herein specified.

7. In apparatus for use in the production of leno fabrics, a series of pendent needles  
15 having cord extensions and means for exerting tension on said cord extensions, means for supporting said needles and moving them laterally and vertically, the lay or slay-board of the loom formed to allow the oper-  
20 ation of said needles, bearings or supports for the reed to keep same at a distance from the shuttle race, guiding pins for guiding the

shuttle in its course across the lay, lever devices and parts for actuating said guiding pins in unison with the motion of the lay 25 and other devices for actuating the warp threads substantially as herein specified.

8. In apparatus for the production of leno fabrics, a series of pendent needles having cord extensions and means for exerting ten- 30 sion on said cord extensions, means for supporting and actuating same, jacquard mechanism arranged to operate a shaft carrying metal loops for raising the threads of warp which are to be crossed over the other threads 35 and said shaft with its metal loops substantially as herein specified.

In testimony whereof I have hereunto affixed my signature in presence of two witnesses.

JOSEPH KING.

Witnesses:

JOHN WHITEHEAD,  
FRED HAMMOND.