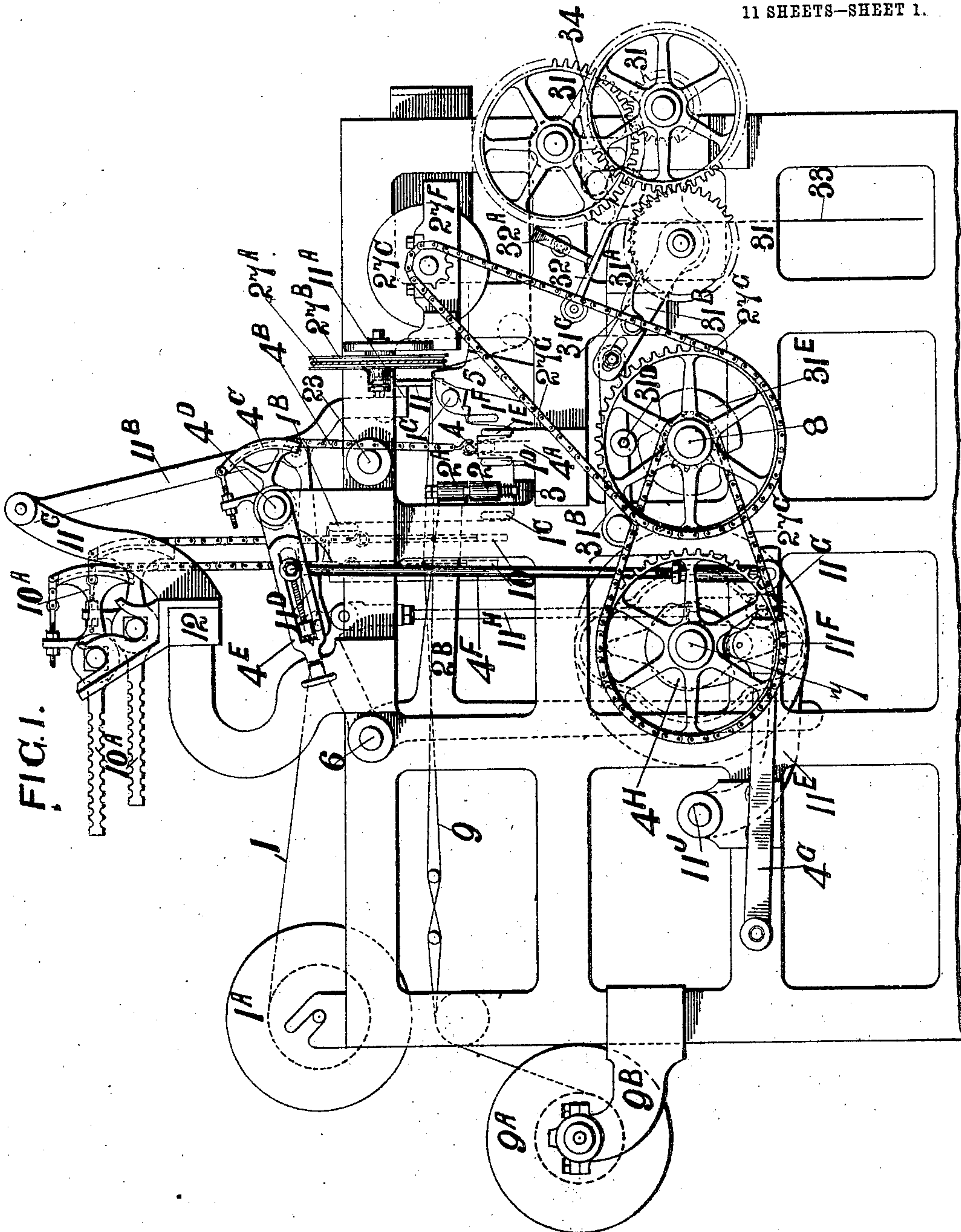


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LOOM FOR WEAVING PILE FABRICS.

APPLICATION FILED DEC. 16, 1903.

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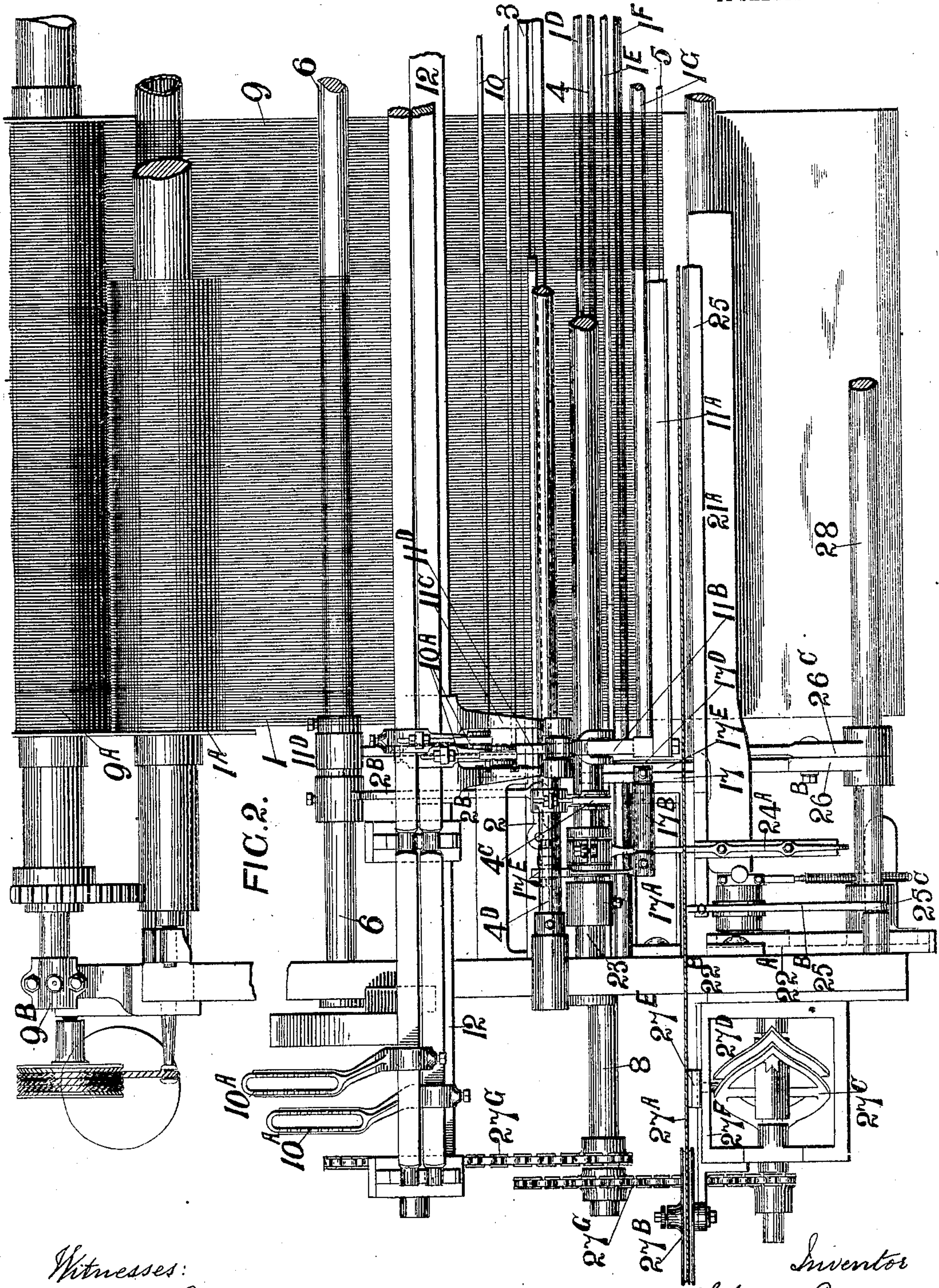
Witnesses:  
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11 SHEETS—SHEET 2.



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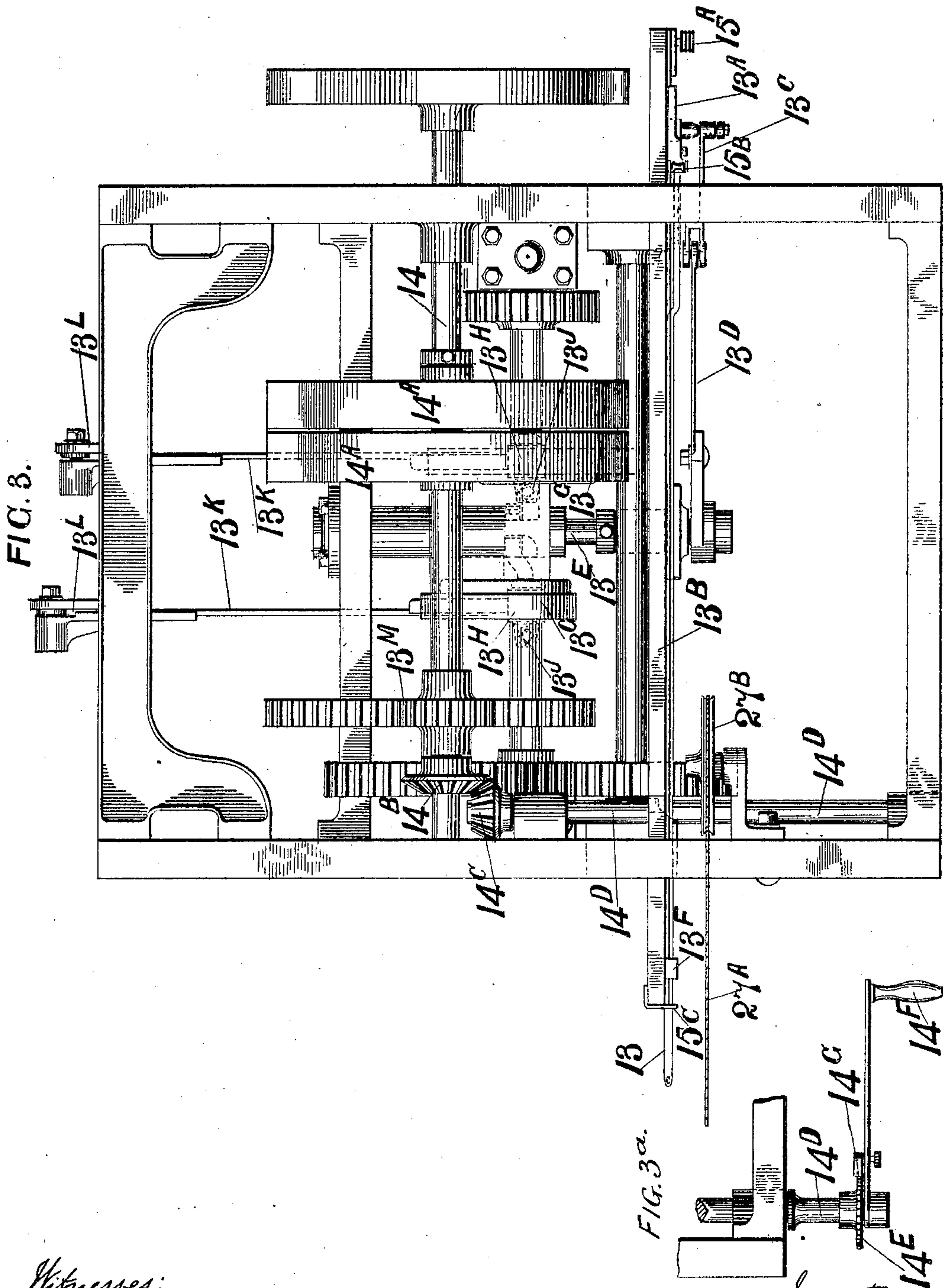
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11 SHEETS—SHEET 3.



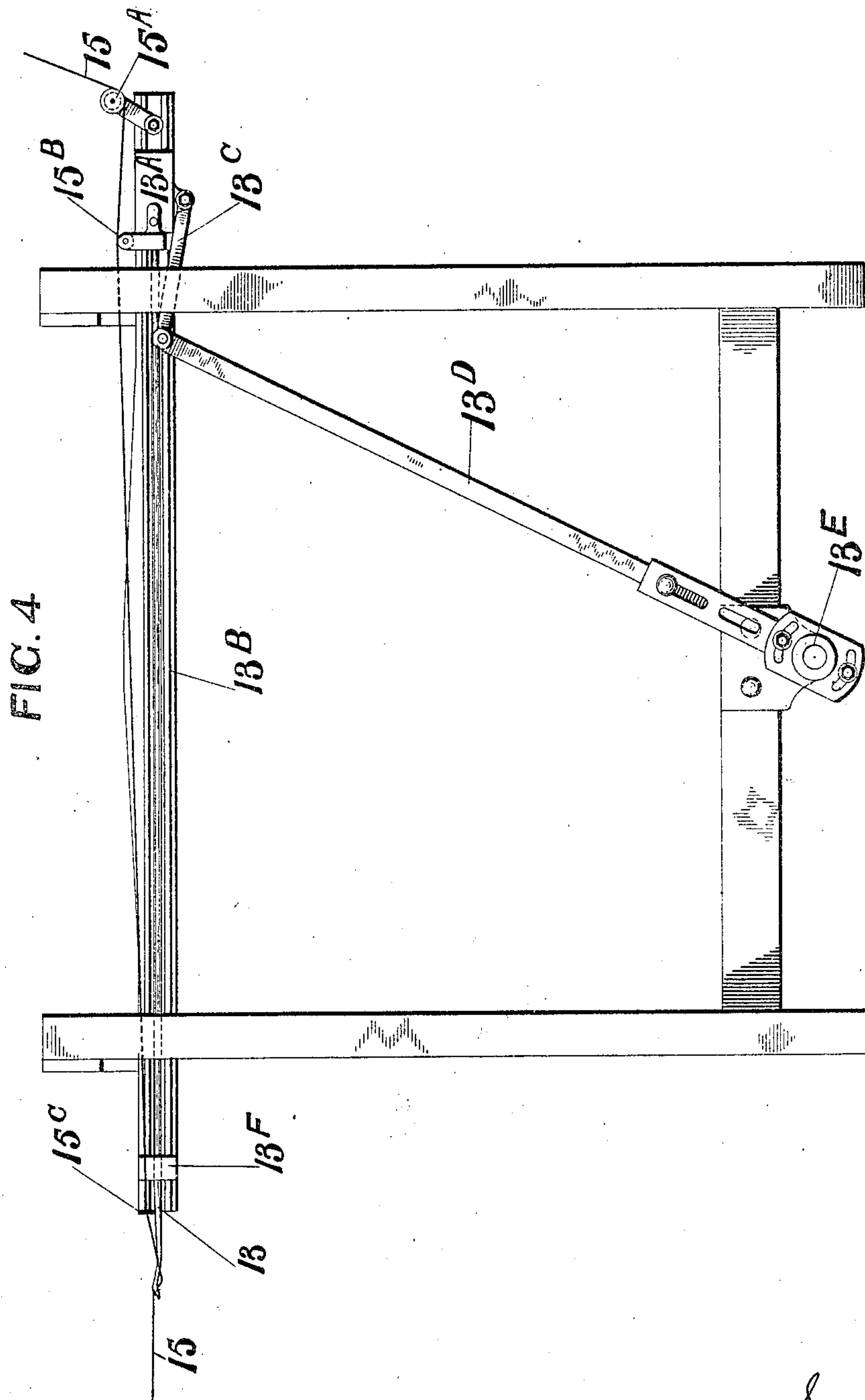
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11 SHEETS—SHEET 4.



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11 SHEETS—SHEET 5.

FIG. 6.

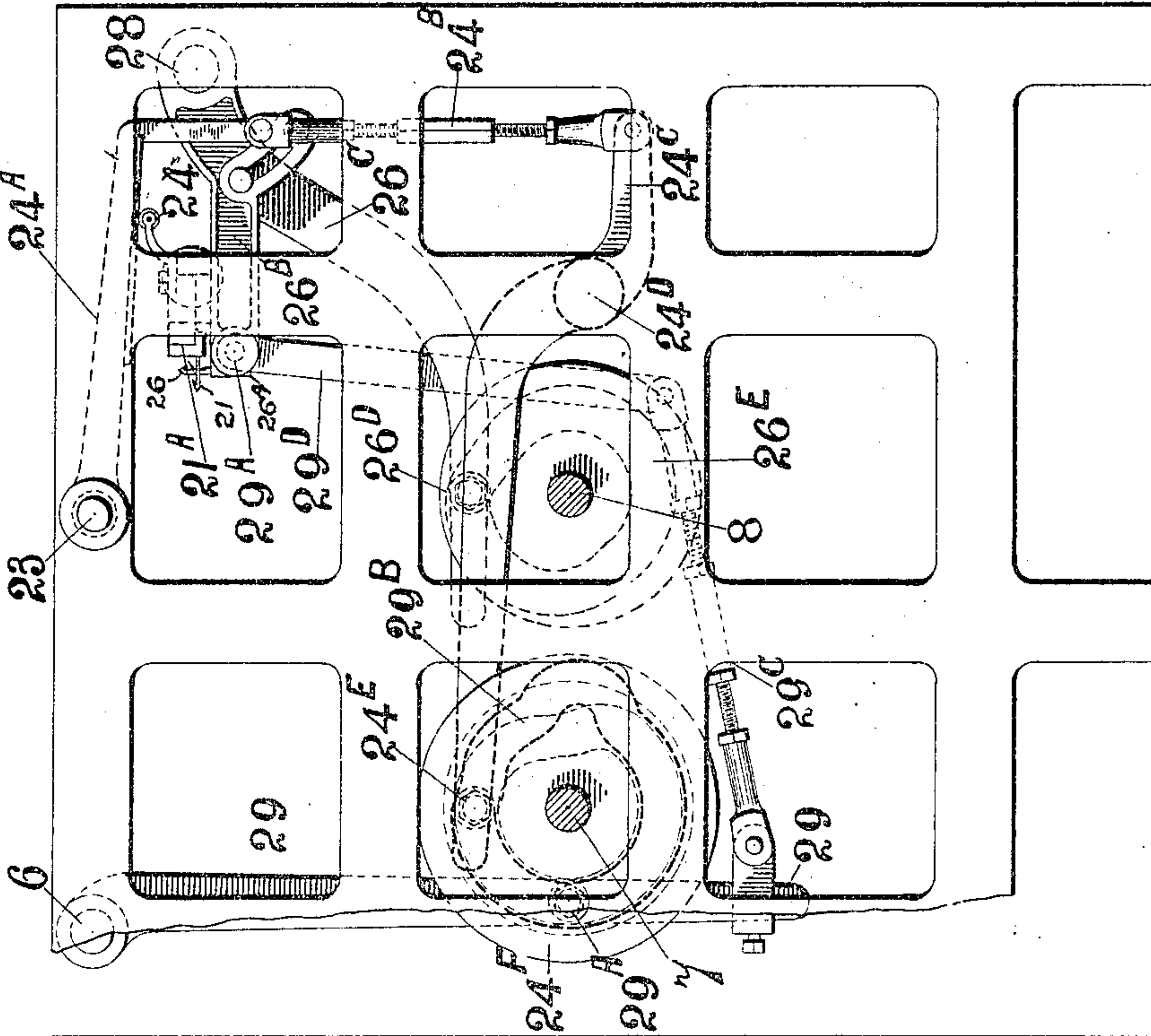
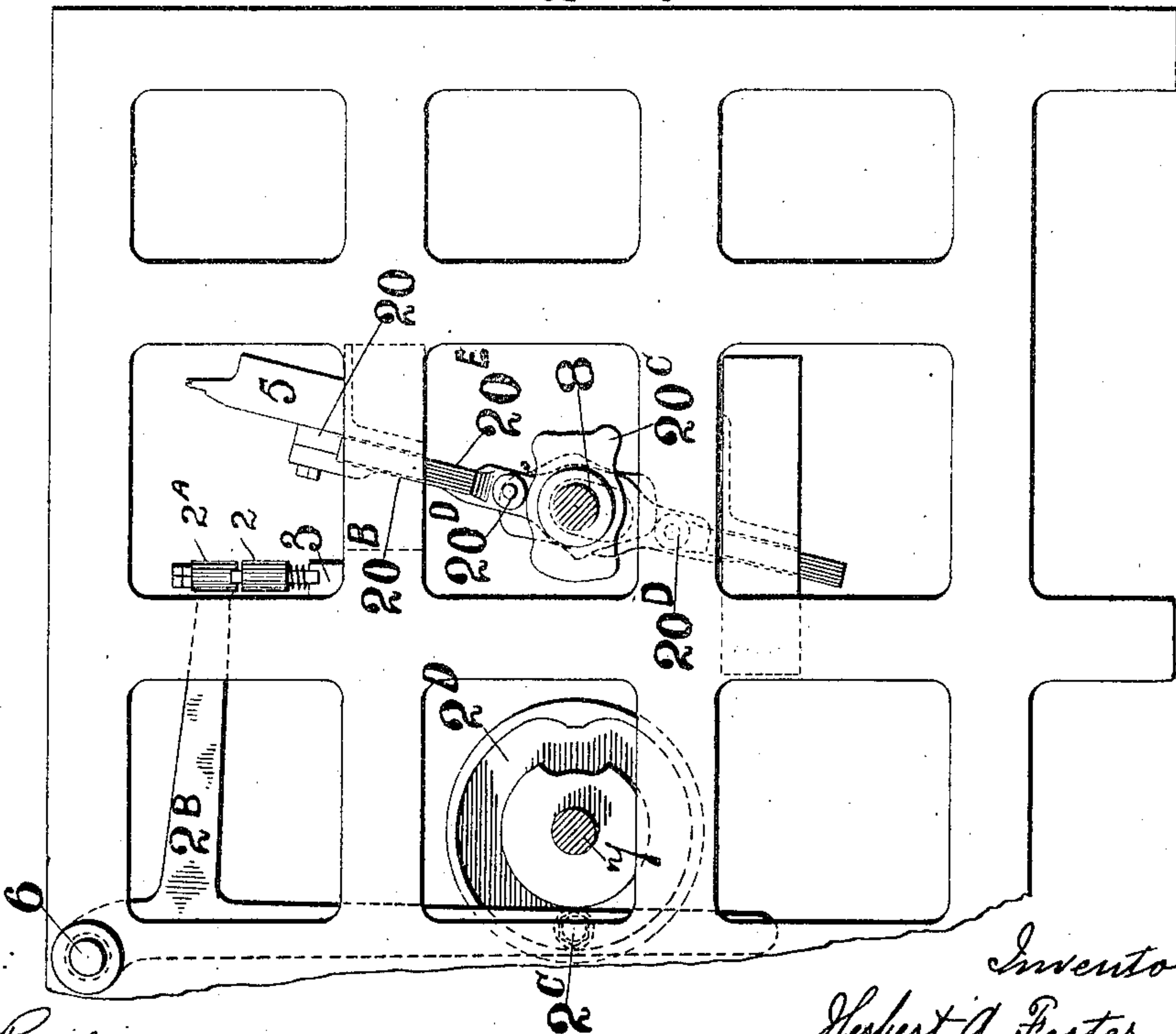


FIG. 5.



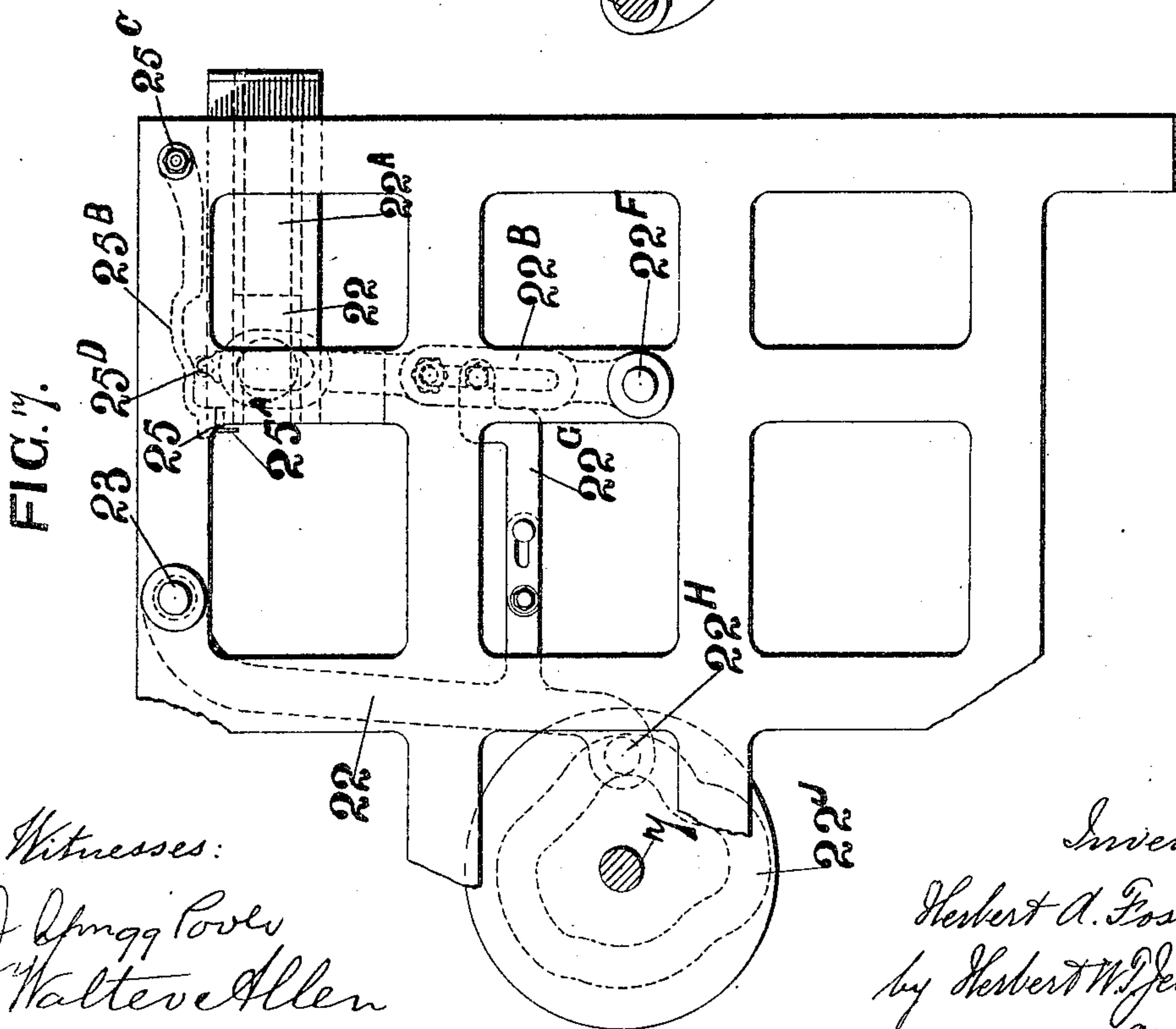
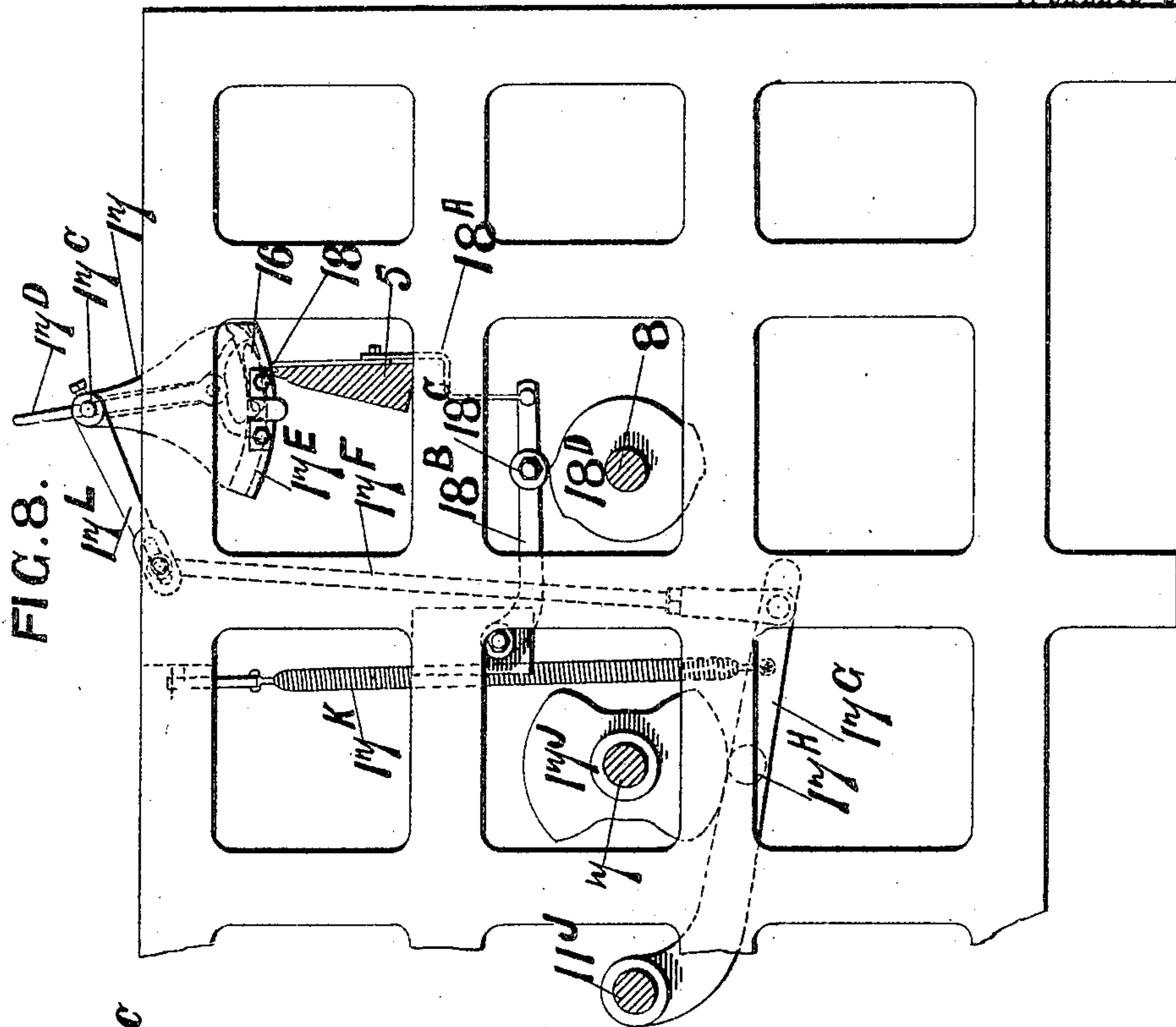
Witnesses:  
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11 SHEETS—SHEET 6.



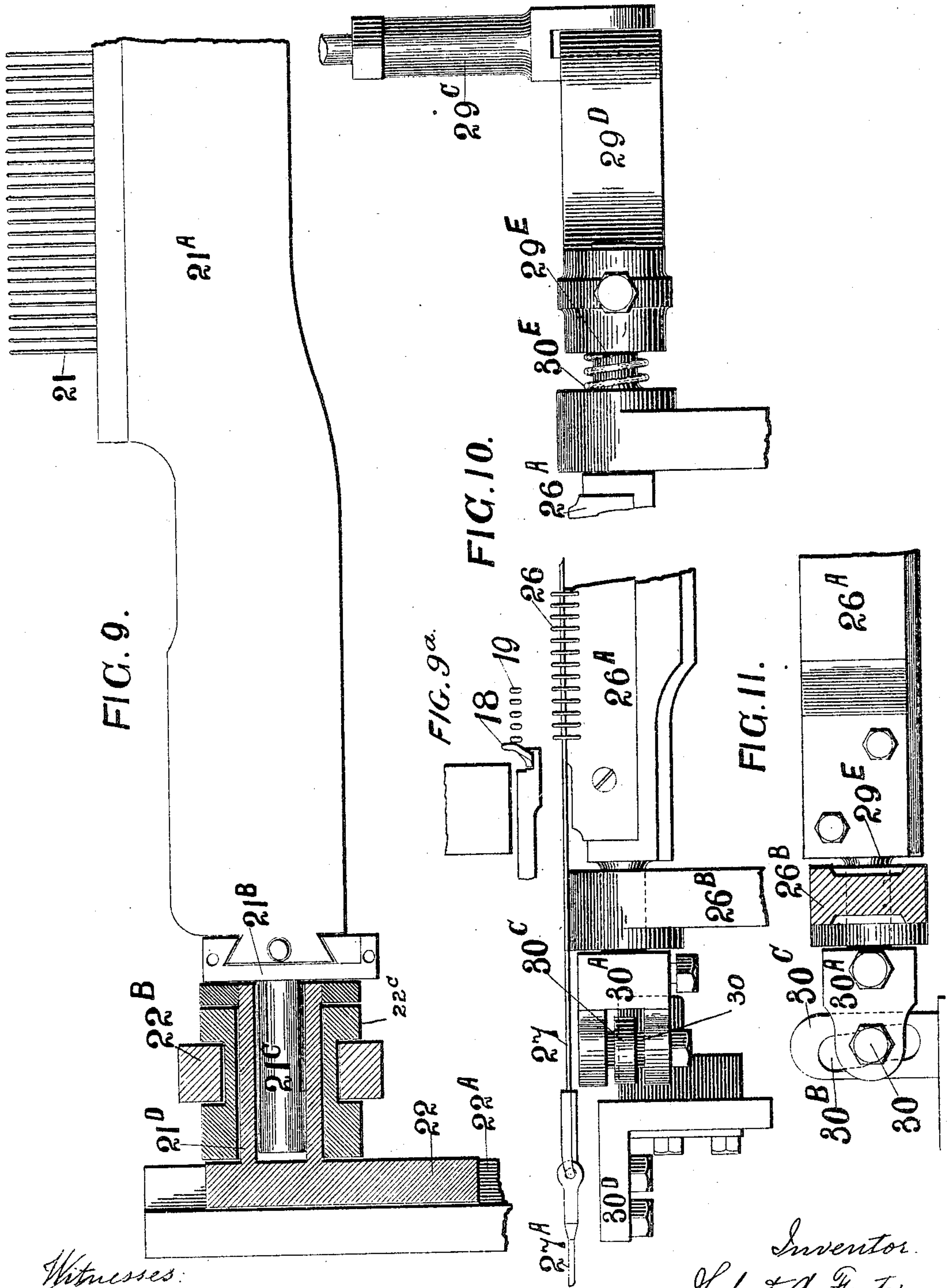
Witnesses:  
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11 SHEETS—SHEET 7.



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11 SHEETS—SHEET 8.

FIG. 12<sup>A</sup>

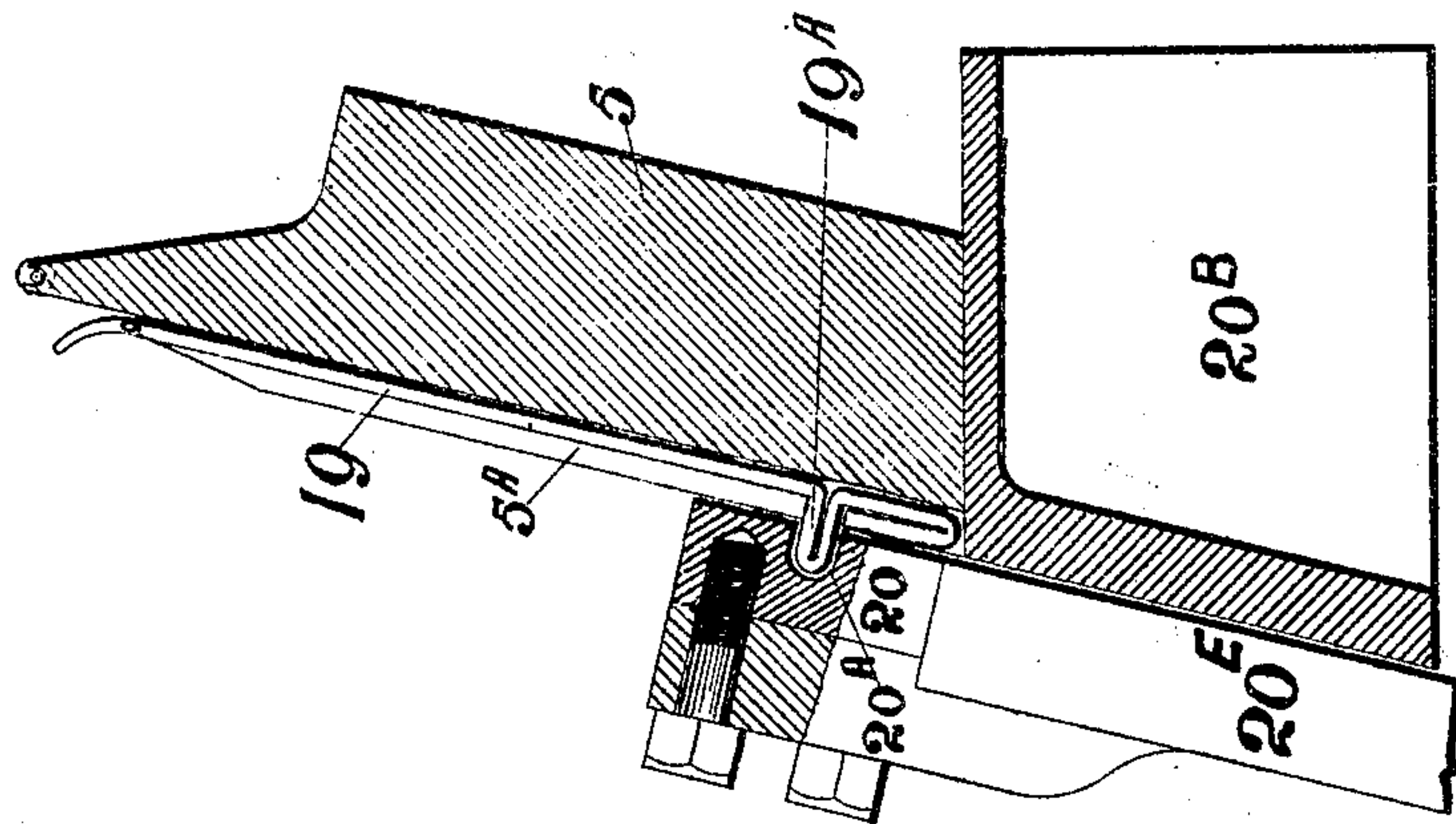
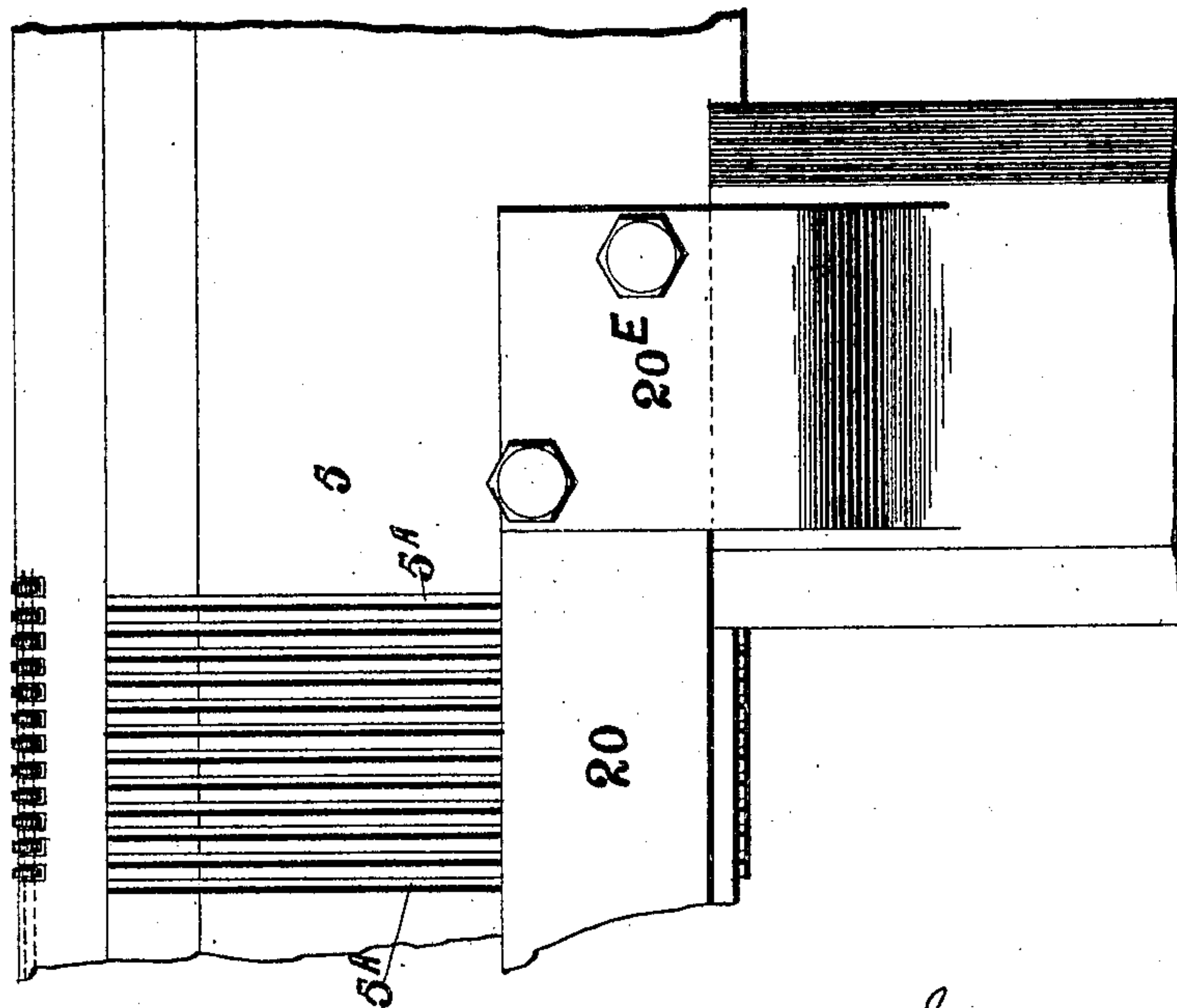


FIG. 12.



Witnesses:  
J. O'Connell  
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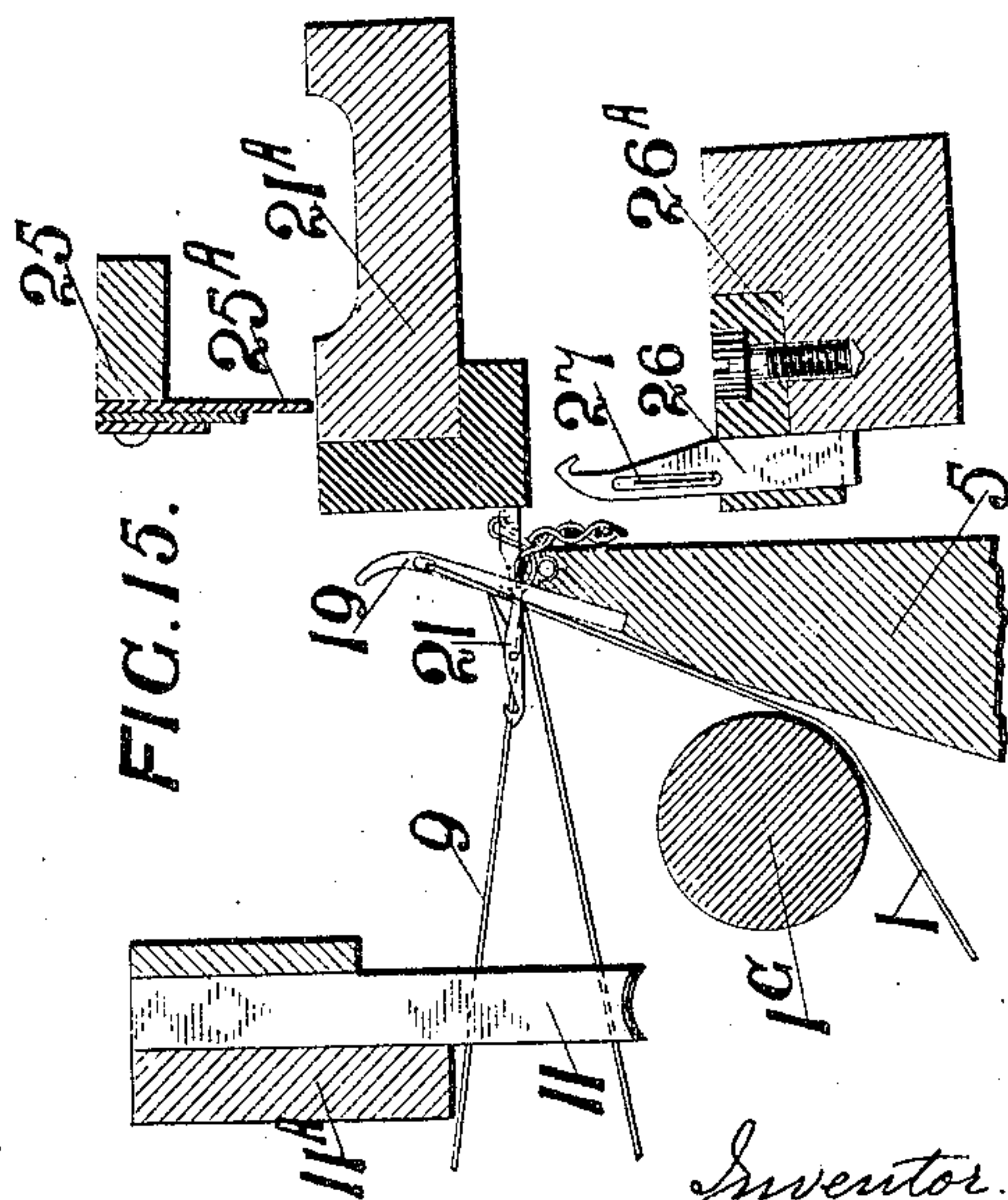
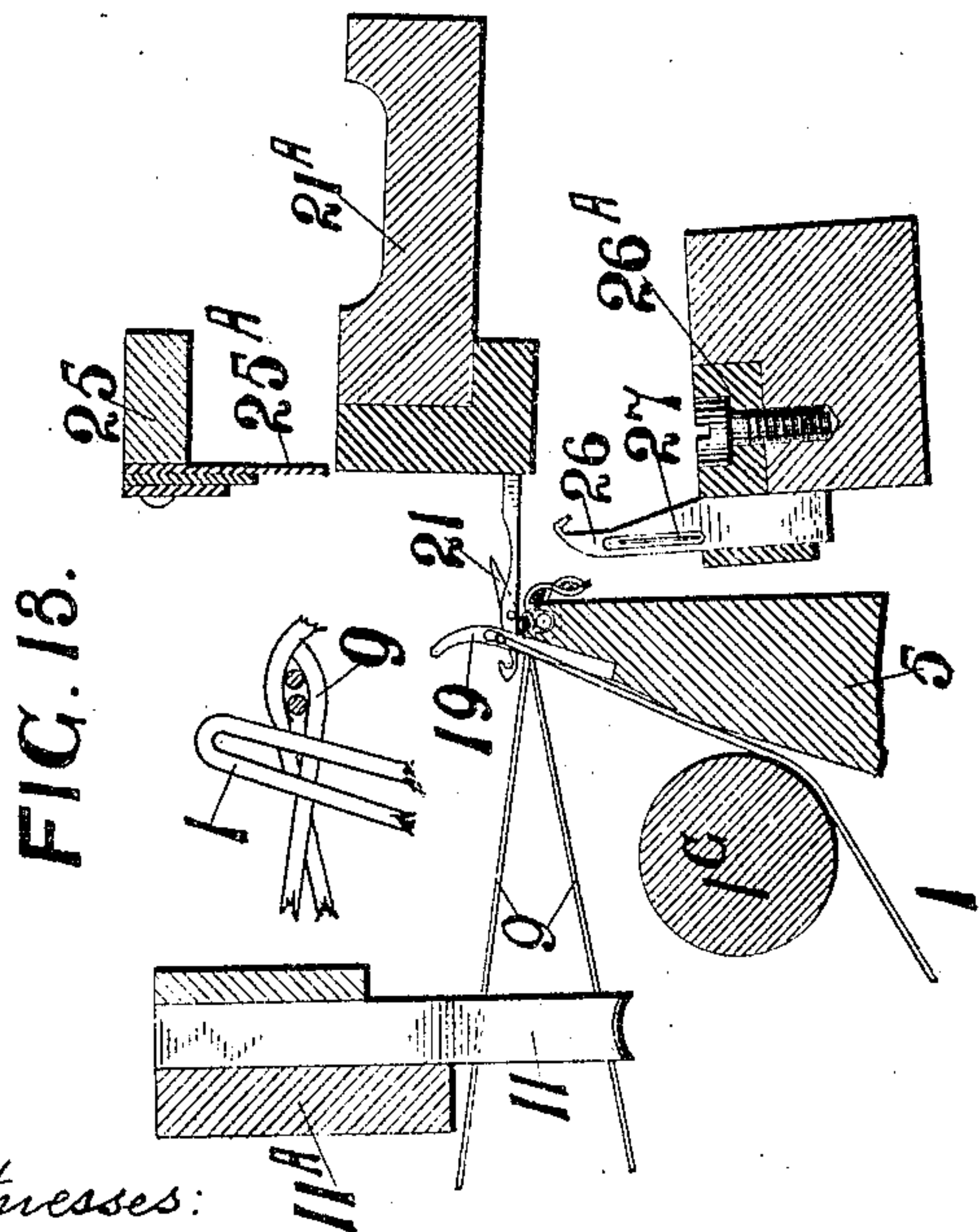
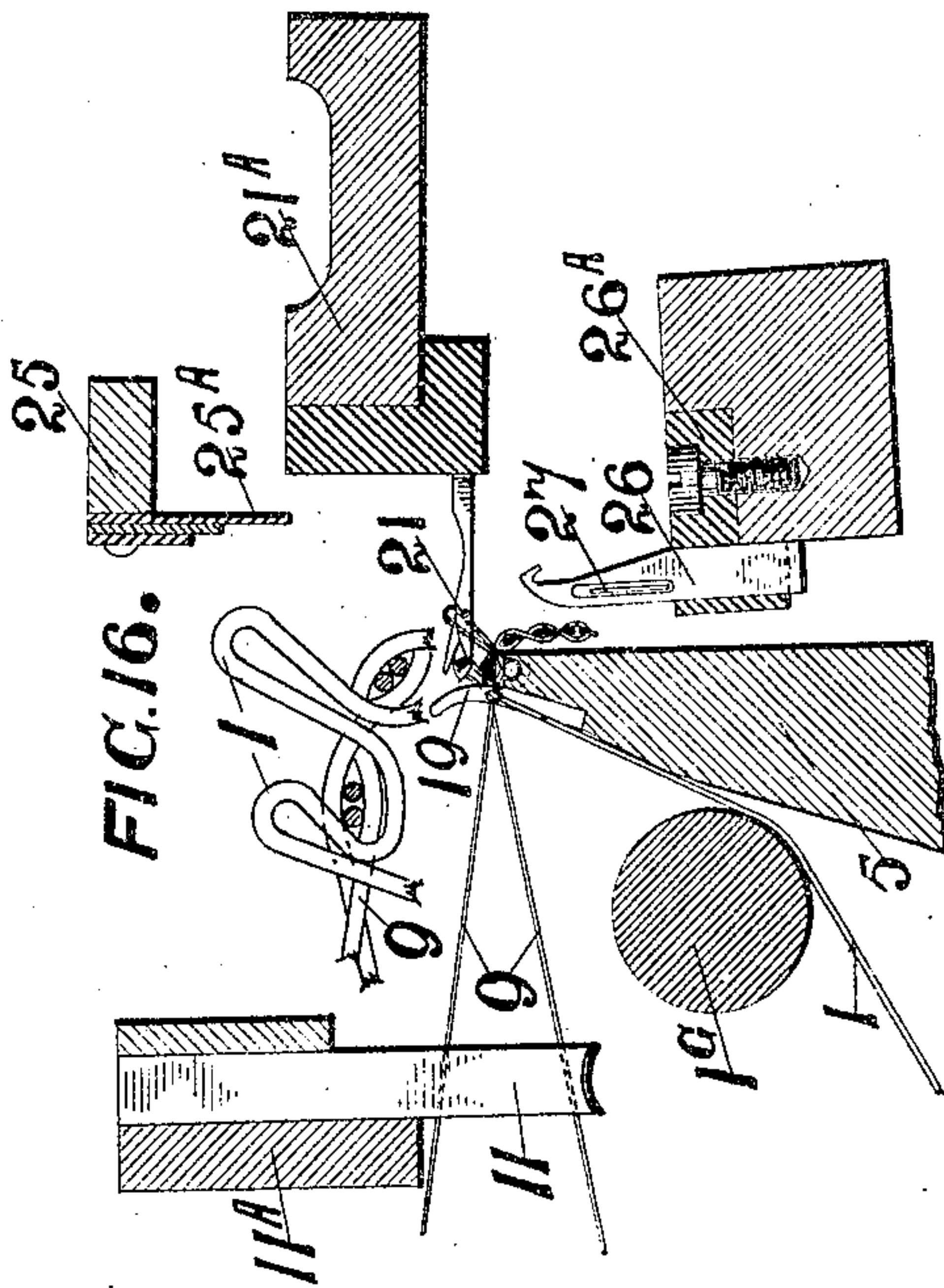
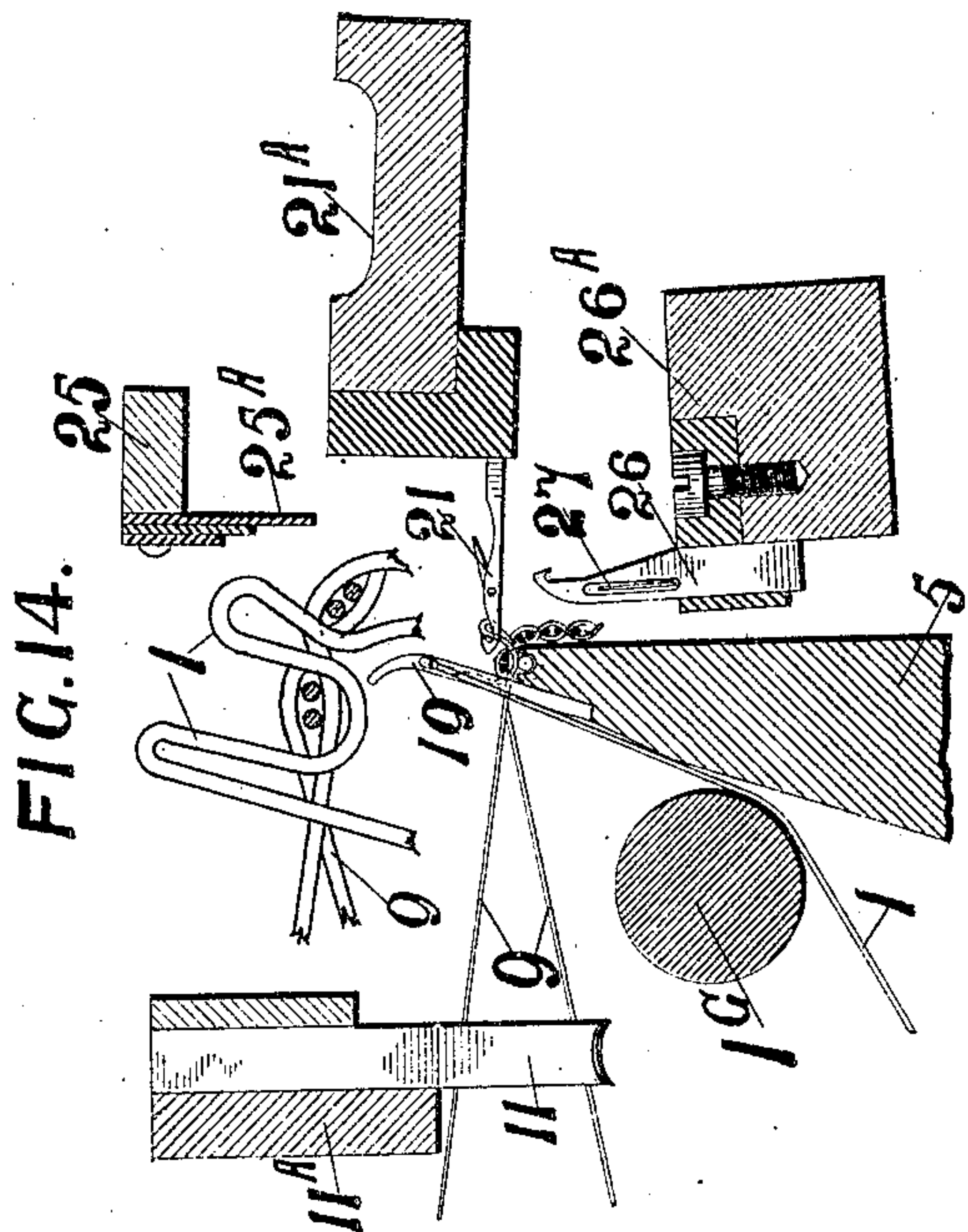
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11 SHEETS—SHEET 9.



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11 SHEETS—SHEET 10.

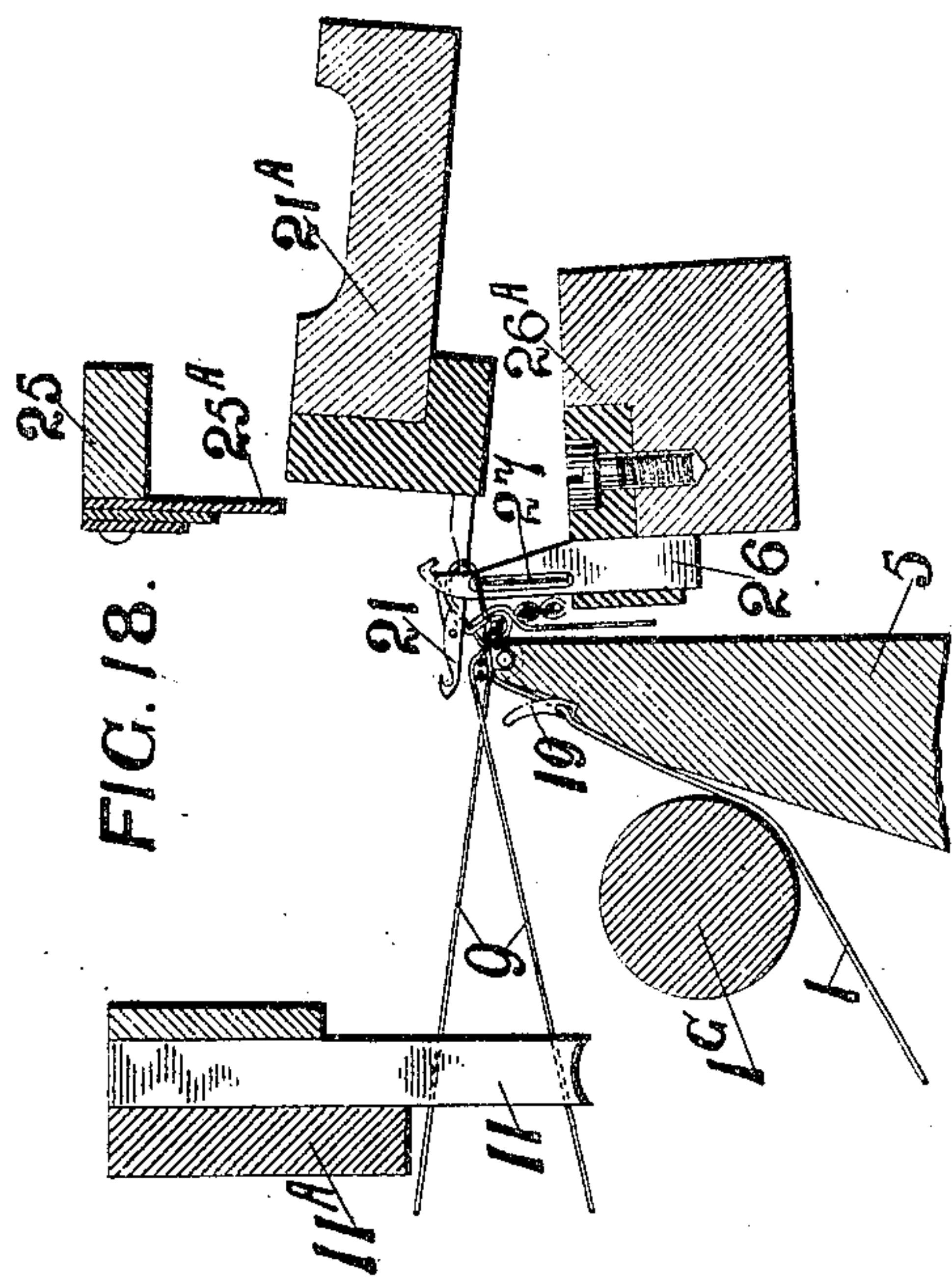


FIG. 18.

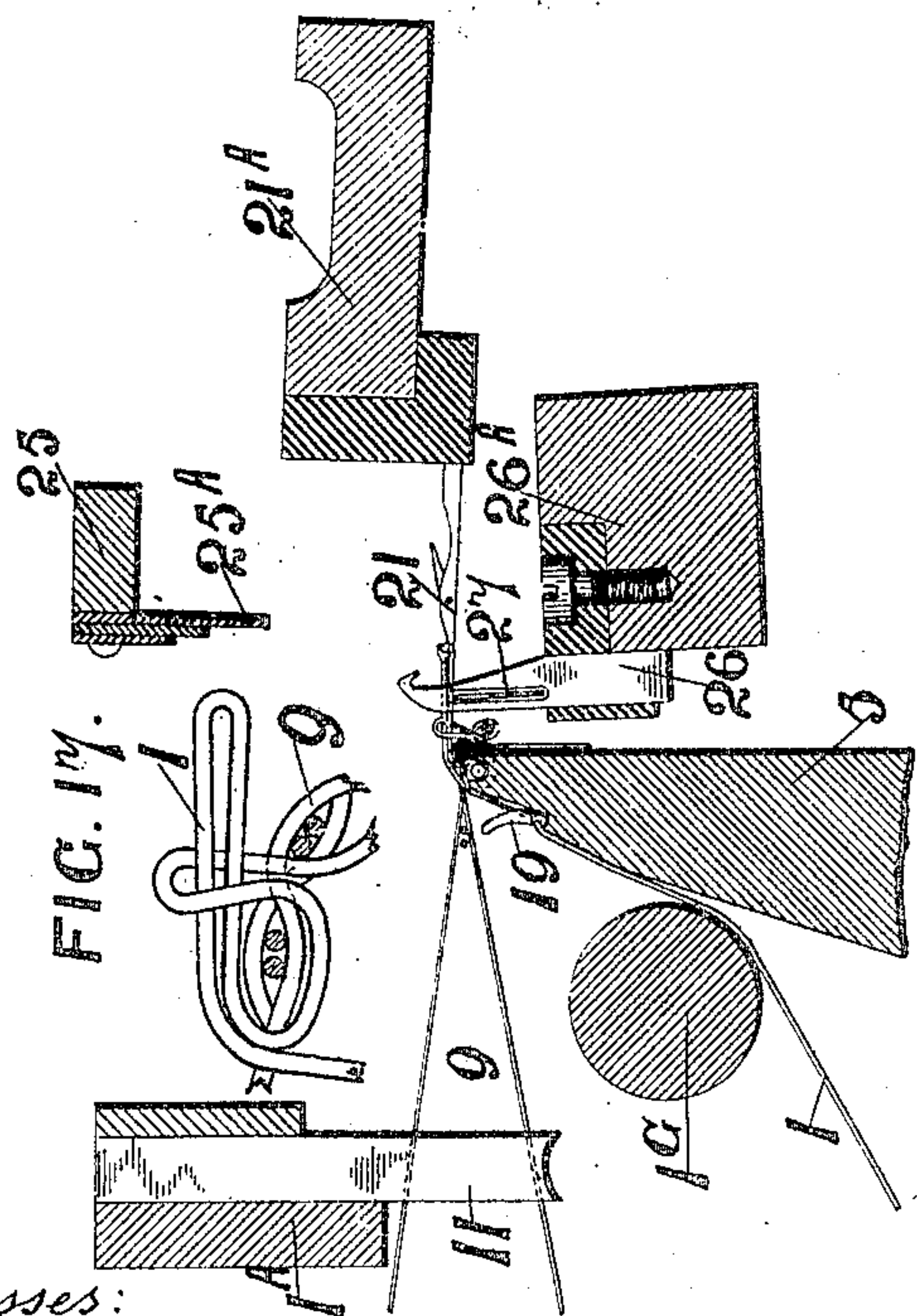


FIG. 17.

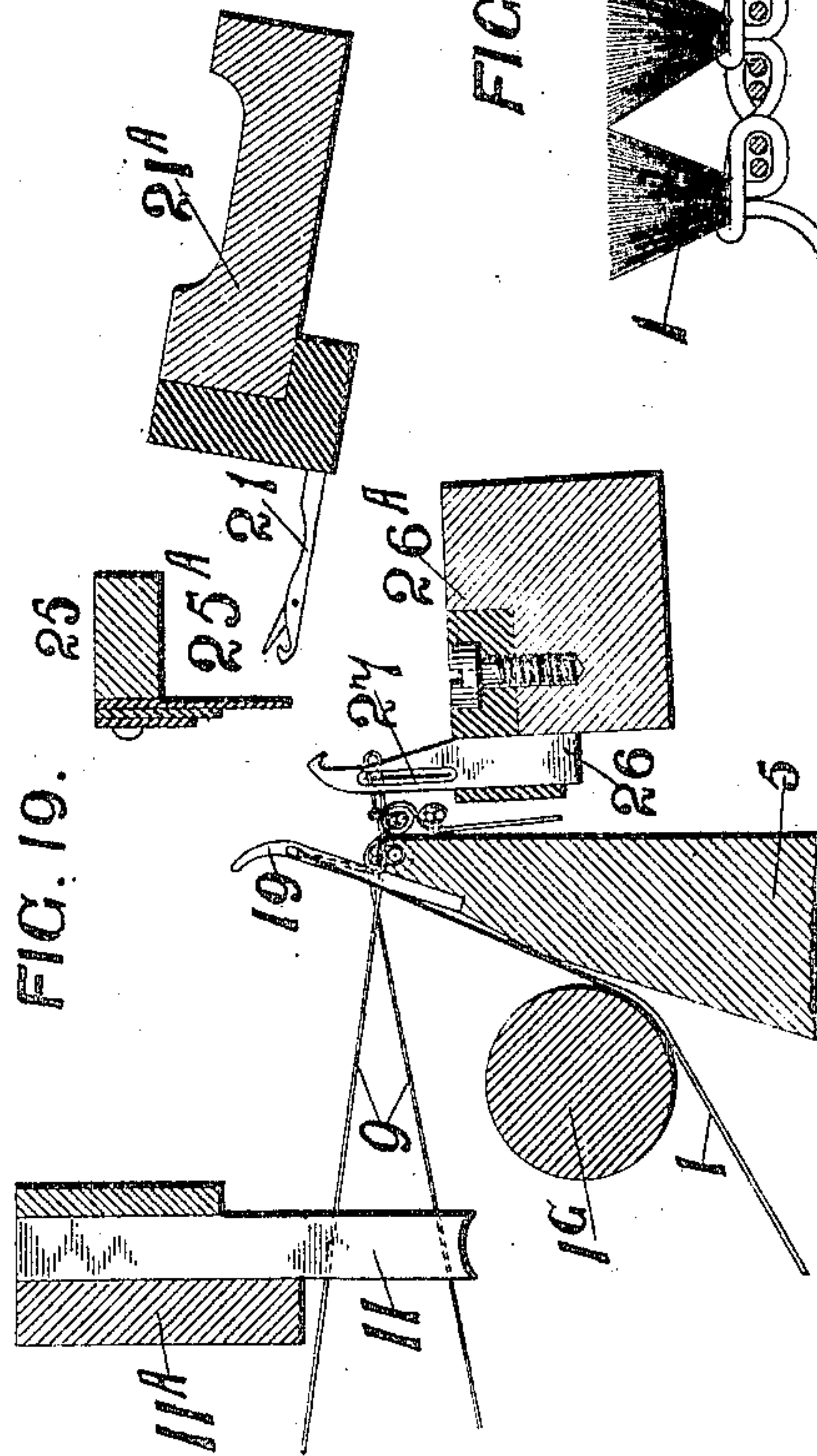
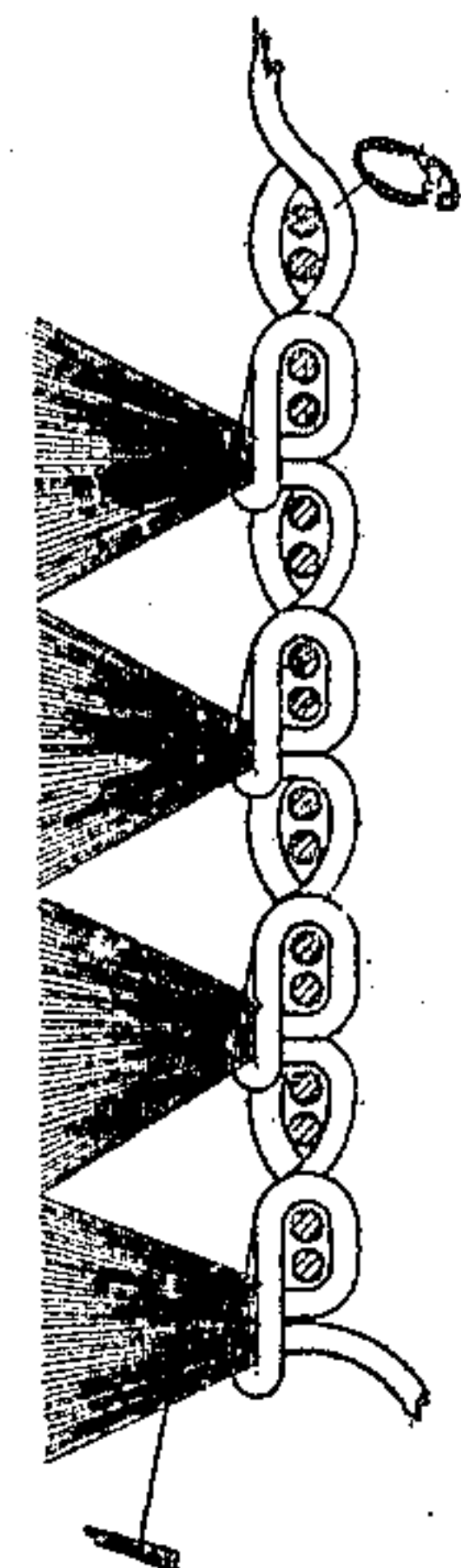


FIG. 19.

FIG. 20.



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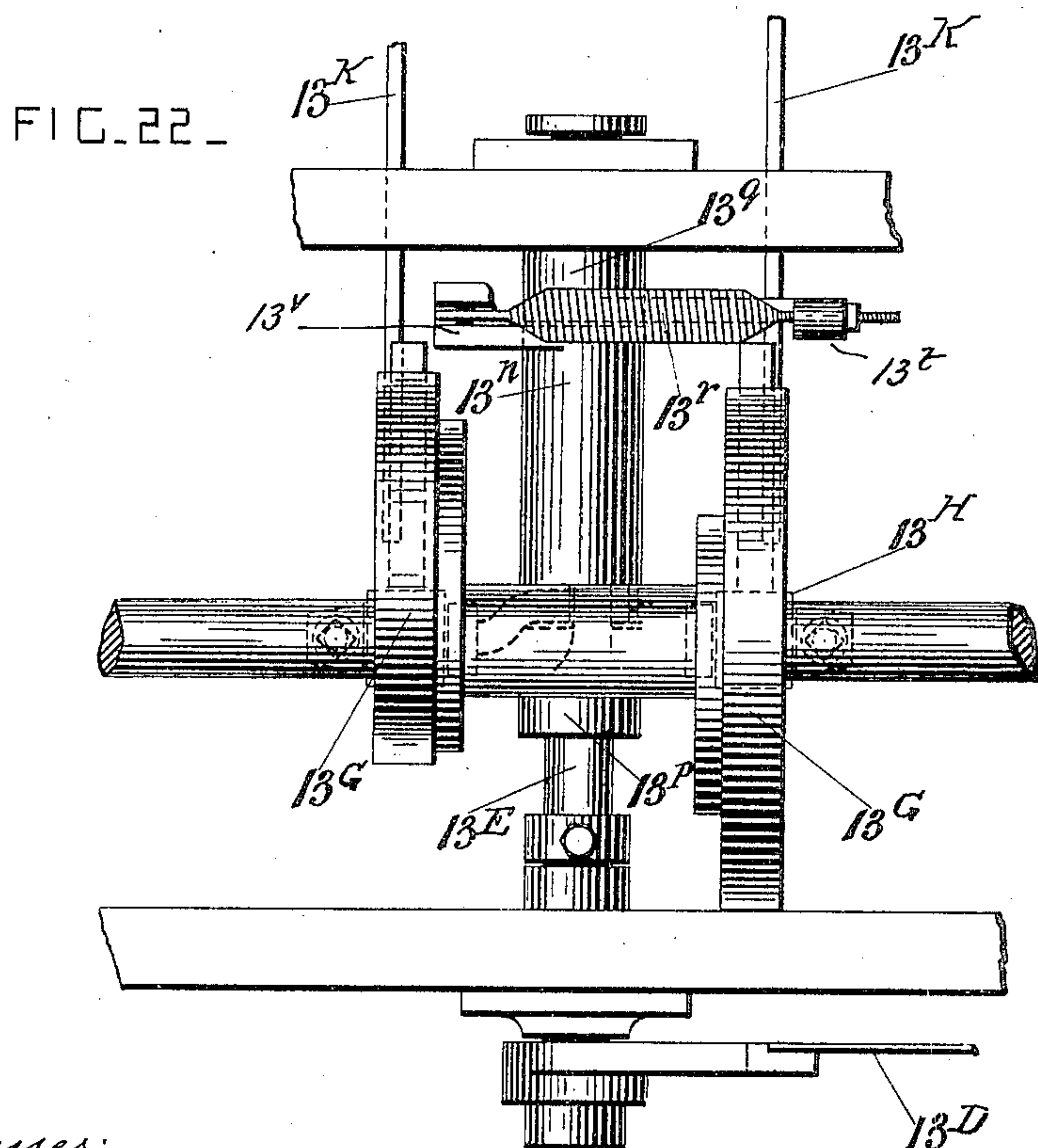
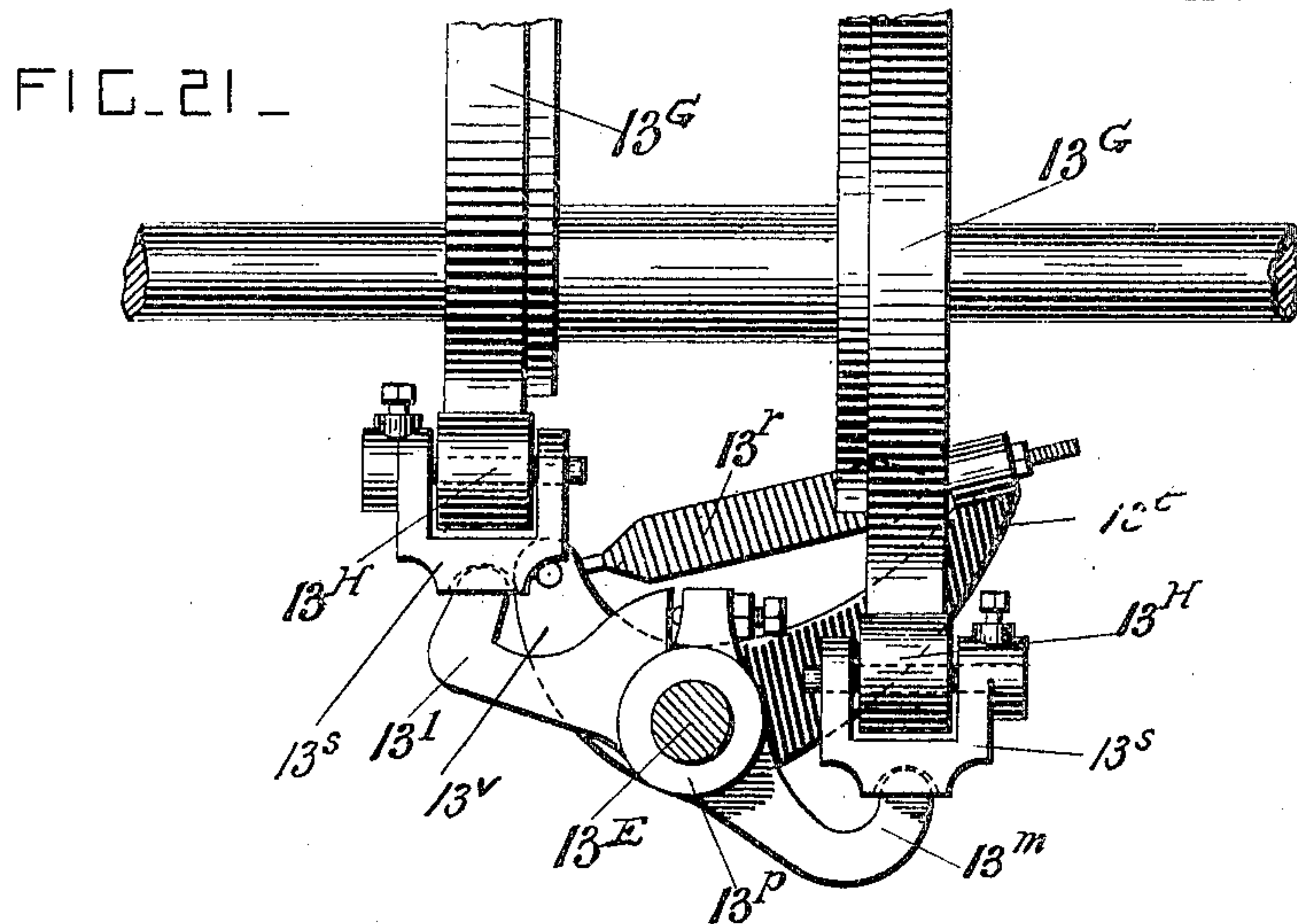
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APPLICATION FILED DEC. 16, 1903.

11 SHEETS—SHEET 11.



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# UNITED STATES PATENT OFFICE.

HERBERT ANDERTON FOSTER, OF QUEENSBURY, ENGLAND.

## LOOM FOR WEAVING PILE FABRICS.

No. 804,309.

Specification of Letters Patent.

Patented Nov. 14, 1905.

Application filed December 16, 1903. Serial No. 185,369.

*To all whom it may concern:*

Be it known that I, HERBERT ANDERTON FOSTER, a subject of the King of Great Britain and Ireland, residing at Queensbury, in the county of York, England, have invented certain new and useful Improvements in Looms for Weaving Pile Fabrics; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of the invention is to produce a cut pile fabric consisting of a backing or foundation with the pile securely tied or knotted therein, the backing or foundation and the pile being formed at one and the same operation.

The improved machinery for producing the above-described fabric comprises a beam carrying the backing or foundation warps and a creel or beam carrying the yarn or yarns for the pile-loops. The warps pass through healds and thence through a reed and over a needle-bar, where the weft is carried across the shed in the form of a double shot by means of a needle or other weft-carrier, the weft being carried across from one edge of the shed to the other, where it is secured by means of a crossing shuttle and yarn or string, the weft being then laid back or shot to the other edge of the shed. The weft is next beaten up by the reed, and as the latter recedes the loop is formed and secured in the foundation by means of needles, loop formers or holders, and knife-needles, over which successive loops are formed and then cut to form the "cut pile" by means of a reciprocating knife working in the knife-needles. The weft carrier or needle is traversed or operated by an arm and link, the former being mounted on a shaft caused to rock or oscillate by means of tappets acting on bowls or runners on a cross rocking shaft. The reed is in the form of a comb between the teeth or prongs of which the warp-threads pass, and this reed is operated so as to alternately beat up and recede by being suspended by arms pivoting on fixed points, the said arms being connected by toggle-joints to a cross-shaft, and the joints are actuated so as to bend or straighten by means of tappets on the main shaft of the machine. The pile-threads are carried through the backing or foundation in the form of loops. Each loop is formed on or held by a hook until removed therefrom by receding needles, and as the bar carrying the hooks can be adjusted

by slotted levers so as to move a greater or less distance the length of pile-loop can be regulated and determined.

Such being the nature and object of the said invention, the following is a complete description of same, reference being had to the annexed drawings, in which—

Figure 1 is an end elevation of the machine: Fig. 2 is a plan view of one end of the machine. Fig. 3 is a plan view of the gearing for driving the machine and of the mechanism for operating the needle-motion. Fig. 3<sup>a</sup> is a broken plan view of one end portion of the shaft 14<sup>D</sup> and its operating-handle. Fig. 4 is a front elevation of the needle-motion mechanism. Fig. 5 is an end elevation of part of the machine, showing the nip-motion and the arrangement of cams for operating the pile-thread needles. Fig. 6 is an end elevation of the mechanism for giving the requisite motion to the knife-needles and for tilting the latch-needles. Fig. 7 is an end elevation of the mechanism for moving the latch-needles backward and forward. Fig. 8 is an end elevation of the shuttle mechanism for securing the weft-threads. Fig. 9 is an enlarged detail of the latch-needle bar, showing its connection with the slotted lever and slide hereinafter referred to. Fig. 9<sup>a</sup> is a broken plan view showing the relative positions of the selvage-hook 18 and the latch-needles 19. Fig. 10 is a detached plan view broken in two and showing the end portions of the knife-needle bar drawn to an enlarged scale. Fig. 11 is a front elevation of one end portion of the knife-needle bar, showing the cam-slots for giving an end-wise motion to the needle-bar. Fig. 12 is a detail, drawn to an enlarged scale, of the back of the needle-bar, showing the grooves in which the needles work. Fig. 12<sup>A</sup> is an enlarged detail showing a sectional elevation of the needle-bar and of the bar which operates the needles. Figs. 13, 14, 15, 16, 17, 18, and 19 show the various positions assumed by the needles during the manufacture of the pile fabric, the latter being further illustrated by enlarged diagrammatical views. Fig. 20 is a sectional elevation of a piece of the finished pile fabric. Fig. 21 is a detail end view, and Fig. 22 is a detail plan view of the devices for operating the lever 13<sup>D</sup> from the cams 13<sup>C</sup>.

According to this invention the pile-yarn 1 is carried on a beam 1<sup>A</sup> and passes therefrom over a guide-bar 1<sup>B</sup>, under a guide-bar 1<sup>C</sup>, between the nip-bar 2 and the block 3, under the guide-beam 1<sup>D</sup>, over the bar 4 of an inter-



mittent letting-off motion, under the guide-bar 1<sup>E</sup>, over the guide-bar 1<sup>F</sup>, and thence under the roller 1<sup>G</sup> to the needle-bar 5. The bars 1<sup>D</sup> and 1<sup>E</sup> constitute a pair of guides under which the pile-yarn passes, and the bar 4 constitutes a letting-off bar which is arranged between the said pair of guides. The above-mentioned guide-bars are preferably provided with pins or are in the form of grids for retaining the warp-threads in their correct position. The nip-bar 2 is provided with screw adjustment 2<sup>A</sup> and extends across the pile-threads and is pressed down onto and raised from the block 3 by the horizontal arm of the lever 2<sup>B</sup>, pivoted on the shaft 6, extending across the machine. The vertical arm of the said lever 2<sup>B</sup> is provided with a bowl or runner 2<sup>C</sup>, which engages with the cam-race in the face-cam 2<sup>D</sup>, fixed on the shaft 7. (See Fig. 5.) The nip-bar above described is for holding the pile-threads while the loops are being formed therein. The bar 4 of the letting-off motion extends across the machine and is suspended in slides 4<sup>A</sup>, (see Fig. 1,) one at each end of the machine, by means of chains or bands 4<sup>B</sup>, which pass over quadrant-sectors 4<sup>C</sup>, fixed on the shaft 4<sup>D</sup>, the latter being provided with a slotted arm 4<sup>E</sup>, connected by the rod 4<sup>F</sup> to the lever 4<sup>G</sup>, pivoted to the frame of the machine and controlled and operated by the tappet 4<sup>H</sup> on the shaft 7. The tappet 4<sup>H</sup> imparts an up-and-down motion to the bar 4, and in its upward motion it withdraws the threads 1 from the beam 1<sup>A</sup>, and in its downward motion it allows the length of threads so drawn off to be taken up as required for forming the loops. The length of thread required for forming the loops may be adjusted by moving the rod 4<sup>F</sup> in the slotted arm 4<sup>E</sup>.

The backing yarn or warp thread 9 is carried by a beam 9<sup>A</sup>, supported between the end frames of the machine by the brackets 9<sup>B</sup>, and passed therefrom to the healds 10, which are operated through the sector-levers 10<sup>A</sup> in the ordinary manner, and thus through the reed 11 to the needle-bar 5. The reed 11 consists of a number of flat metal loops fixed in the bar 11<sup>A</sup>, which extends across the warp-threads. The reed-bar 11<sup>A</sup> is supported at each end thereof by two arms 11<sup>B</sup> swinging from a bracket 11<sup>C</sup>, fixed on the top rail 12 of the machine. The said arms 11<sup>B</sup> are connected by the jointed links 11<sup>D</sup> to the shaft 6, and such links operate in the manner of a toggle-joint through the medium of the connecting-rod 11<sup>E</sup> and lever 11<sup>F</sup>, pivoted on the shaft 11<sup>J</sup> and having a bowl or runner 11<sup>F</sup> engaging with and operated by the face-cam 11<sup>G</sup> on the shaft 7.

By the above-described mechanism the reed-bar 11<sup>A</sup> receives the requisite motion for beating up the double shot of weft which is carried across the shed by the weft-needle 13. (See Figs. 3 and 4.)

The weft-needle 13 is of the usual construc-

tion and fixed at one end to a carriage 13<sup>A</sup>, which is traversed to and fro along the slide-bed 13<sup>B</sup> by means of the link 13<sup>C</sup> and lever 13<sup>D</sup>, fixed on the shaft 13<sup>E</sup>. The needle is supported at the end of the slide-bed by a guide 13<sup>F</sup>. The lever 13<sup>D</sup> is oscillated by the action of the cams 13<sup>G</sup> on the rollers 13<sup>H</sup>, mounted in the double eyes 13<sup>I</sup>, which are carried by the ends of the levers 13<sup>K</sup>, as shown in Figs. 21 and 22. The double eyes 13<sup>I</sup> are supported by the rounded ends of short arms 13<sup>L</sup> and 13<sup>M</sup>, projecting from the loose sleeve 13<sup>N</sup> and fixed boss 13<sup>P</sup> on the shaft 13<sup>E</sup>. The loose sleeve 13<sup>N</sup> is connected to a fixed boss 13<sup>Q</sup> by a spring 13<sup>R</sup>, which provides a means for preventing damage to the needle or the needle motion in the event of an obstruction occurring in the working of the latter. The levers 13<sup>K</sup> are pivoted to brackets 13<sup>L</sup> on the frame, as shown in Fig. 3. The boss 13<sup>Q</sup> is shown in Fig. 22, and it supports one end of the shaft 13<sup>E</sup>. This boss and the sleeve 13<sup>N</sup> have a projecting arm 13<sup>T</sup> and a lug 13<sup>V</sup>, respectively, and the spring 13<sup>R</sup> is arranged between the said arm and lug. The aforesaid levers 13<sup>K</sup> bear against the under side of the tappets 13<sup>J</sup> and are operated thereby. The above-described mechanism is driven by the toothed gearing 13<sup>M</sup> from the main driving-shaft 14, on which are fast and loose pulleys 14<sup>A</sup> and a bevel-wheel 14<sup>B</sup>, gearing with the bevel-wheel 14<sup>C</sup> on the shaft 14<sup>D</sup>, which may be driven by the ratchet-wheel 14<sup>E</sup> and handle 14<sup>F</sup>, carrying the pawl 14<sup>G</sup> from the front of the machine, thus providing means for turning the machinery by hand. The weft-thread 15 comes from a reel or other source and passes around the guide-pulley 15<sup>A</sup> over the pulley 15<sup>B</sup> on the carriage 13<sup>A</sup> and thence through the guide 15<sup>C</sup> at the end of the slide-bed 13<sup>B</sup> through the eye of the needle 13. When the weft-needle 13 has taken a double shot of weft across the shed, it is secured by a shuttle 16, which passes through the loop or bend at the end of the double shot of weft. The shuttle mechanism (see Figs. 2 and 8) consists of a bracket 17, supported by the extension-piece 17<sup>A</sup> from the machine-frame. The bracket is formed with a bearing 17<sup>B</sup> for a shaft 17<sup>C</sup>, carrying a radial arm 17<sup>D</sup>, the lower end of which is forked and provides a holder or carrier for the shuttle 16 as the latter is traversed backward and forward across the race 17<sup>E</sup>, formed in the bottom of the bracket 17. The aforesaid radial arm 17<sup>D</sup> is oscillated by means of the slotted arm 17<sup>L</sup>, connected by the rod 17<sup>F</sup> to the lever 17<sup>G</sup>, pivoted on the shaft 11<sup>J</sup> and having a bowl or runner 17<sup>H</sup>, which is kept in contact with the cam 17<sup>J</sup> by the spring 17<sup>K</sup>.

Working in connection with the selvage warp-thread on each side of the piece is a hook 18. (Shown in plan view in Fig. 9<sup>A</sup> and in elevation in Fig. 8.) The above-mentioned hook slides up and down in the needle-



bar 5 and receives its movement from the connecting-rod 18<sup>A</sup>, lever 18<sup>B</sup>, bowl or runner 18<sup>C</sup>, and cam 18<sup>D</sup>, fixed on the shaft 8. The above-mentioned hooks are employed for taking  
 5 hold of the selvage - thread and the weft-thread at either end of the piece as the needle is being drawn across the shed and prevent the selvage or edge from being drawn in-  
 10 ward by the tension on the weft-thread. The above-mentioned hooks are lifted clear out of the threads when the double shot of weft is being beaten up.

For forming the loops in the pile-threads I employ needles 19, through the eyes of  
 15 which the pile-threads 1 are threaded. These needles are free to slide in a number of grooves 5<sup>A</sup> in the needle-bar 5 and are operated by a cross-bar 20, which is grooved, as  
 20 at 20<sup>A</sup>, for the projections 19<sup>A</sup> of the needles 19. The cross-bar 20 is bolted to a sliding bar 20<sup>E</sup>, working in the slides 20<sup>B</sup> and actuated by the tappet 20<sup>C</sup>, fixed on the shaft 8,  
 25 one on either side of such sliding bar 20<sup>E</sup>, and engaging with the bowl or runner 20<sup>D</sup> on either side of such bar.

When the pile - thread needles 19 pass through the warp-threads 9, taking the pile-threads 1 with them in the form of a number  
 30 of loops, the latter are taken off the pile-thread needles by the latch-needles 21, fixed in the needle-bar 21<sup>A</sup>. (See Figs. 6, 9, and 13.)

The latch-needle bar 21<sup>A</sup> extends across the front of the machine and is provided with a  
 35 slide 21<sup>B</sup> at each end for adjusting the needle-bar vertically. Projecting from such slide is a pin 21<sup>C</sup>, (see Fig. 9,) which enters a hollow boss 21<sup>D</sup> in the slide-piece 22, the latter being  
 40 traversed to and fro along the slide 22<sup>A</sup>, as required, by the slotted lever 22<sup>B</sup>, which engages with a bush 22<sup>C</sup>, fitting on the boss 21<sup>D</sup>. The said lever 22<sup>B</sup> is pivoted at 22<sup>F</sup> and is connected at the slotted portion to the lever 22<sup>G</sup>,  
 45 pivoted on the shaft 23 and having a bowl or runner 22<sup>H</sup>, which engages with the cam-race in the cam 22<sup>J</sup>, fixed on the shaft 7.

The above-mentioned needle-bar is given a tilting motion when required by means of the  
 50 bowl or runner 24 on such bar and bearing against the under side of the lever 24<sup>A</sup>, which is pivoted at one end on the shaft 23 and connected at the other end by the adjustable connecting-rod 24<sup>B</sup> to one end of the lever 24<sup>C</sup>,  
 55 which is pivoted at 24<sup>D</sup>, and carries a bowl or runner 24<sup>E</sup> at its other end, engaging with the cam-race shown by the thick dotted lines in the cam 24<sup>F</sup>, fixed on the shaft 7.

Working in combination with the latch-needles is a latch-opener consisting of a bar  
 60 25, extending over the latch-needles 21, such bar having fixed thereto a flexible pad 25<sup>A</sup> for turning the latches back as the latch-needles 21 come forward. The said bar 25 is connected to two arms 25<sup>B</sup>, mounted on a stud 25<sup>C</sup> on each end frame of the machine, and the re-

quired lifting and lowering motion of the  
 65 latch-opener is obtained through the bowl or runner 25<sup>D</sup> on the end of the slotted lever 22<sup>B</sup>, which moves the latch-needles 21 backward and forward and at the same time travels the  
 70 said bowl or runner along the cam-shaped surface on the under side of the arm 25<sup>B</sup>.

The loops are held while they are being cut on the hooks 26, through which passes a reciprocating knife 27, preferably serrated. The  
 75 knife is connected to a wire cord 27<sup>A</sup>, which passes over two pulleys 27<sup>B</sup>, one on each side of the machine, and is operated by the cam 27<sup>C</sup> engaging with a pin 27<sup>D</sup>, projecting from a carriage 27<sup>E</sup>, which is free to slide on the  
 80 bracket 27<sup>F</sup>, which carries the cam 27<sup>C</sup>, such carriage being secured to the wire cord. The cam is driven by the chain-gearing 27<sup>G</sup> from the shaft 7.

The bar 26<sup>A</sup>, in which the knife-hooks are fixed, as shown in Figs. 6, 10, 11, and 13, is  
 85 supported at each end by the horizontal arm of the lever 26<sup>B</sup>, which is made in two portions 26<sup>B</sup> and 26<sup>C</sup>, as shown in Figs. 2 and 6, so that the position of the knife-hook bar can be ad-  
 90 justed as required. The lever is supported on the cross-shaft 28 and is provided with a bowl or runner 26<sup>D</sup>, which engages with the cam 26<sup>E</sup>, fixed on the shaft 8. A tilting or  
 95 rocking motion is given to the knife-hook bar 26<sup>A</sup> through the lever 29, hanging from the shaft 6 and having a bowl or runner 29<sup>A</sup> engaging with the cam-race in the cam 29<sup>B</sup>, shown by the thin dotted lines on the shaft 7. The  
 100 said lever is connected by an adjustable connecting-rod 29<sup>C</sup> with the lever 29<sup>D</sup>, fixed on the supporting-pin 29<sup>A</sup> of the knife-hook bar 26<sup>A</sup>. (See Fig. 6.)

A slight endwise motion is imparted to the knife-hook bar 26<sup>A</sup>, so as to allow of the latch-  
 105 needles 21 passing between the knife-hooks without colliding with each other. This is effected by a roller 30, supported in the double eye 30<sup>A</sup> on the end of the knife-hook bar. The said roller works in the cam-shaped groove  
 110 30<sup>B</sup> in the lug 30<sup>C</sup>, secured to the needle-bar 5 by the bracket 30<sup>D</sup>, and any shake or play in the above movement is taken up by the spring 30<sup>E</sup> on the opposite end of the knife-hook bar.

Every time a double shot of weft is beaten up the cloth is taken up by the taking-up  
 115 mechanism. (See Fig. 1.) This consists of the toothed gearing 31, operated by means of the ratchet-wheel 31<sup>A</sup> and jointed levers 31<sup>B</sup>, one of which carries a pawl 31<sup>C</sup> for driving such wheel, and the other is provided with a  
 120 bowl or runner 31<sup>D</sup>, which engages with the cam 31<sup>E</sup> on the shaft 8. The ratchet-wheel is prevented from running back by the detent 32 and spring 32<sup>A</sup> in the ordinary manner. The finished piece or fabric 33 passes through  
 125 the cluster of rollers 34, as shown by the thick dotted lines in Fig. 1, and is then conveyed to any desired point. The manufacture of



the pile fabric is effected in the following manner and is illustrated by Figs. 13 to 19, inclusive, of the accompanying drawings.

Fig. 13 shows the pile-thread needles 19 coming through the warp-threads 9 and the latch-needles 21 in their forward position ready for taking the loops of the pile-thread needles. While the needles are in this position the weft-needle takes a double shot of weft across the shed and is traveling back again. The pile-thread needles are now drawn down out of the warp-threads, leaving the loops on the latch-needles, and meanwhile the weft-needle has passed out of the shed and the double shot of weft above mentioned is beaten up by the reed 11. The result of the above operations is shown by the enlarged diagram of the pile and warp threads in Fig. 13. The reed-bar 11<sup>A</sup> now goes back and the pile-thread needles 19 again come up through the warp-threads behind the last-mentioned double shot of weft to the position shown in Fig. 14. This figure shows the latch-needles 21 having gone back slightly and having caught hold of the first-made loop. The result of the above operations is illustrated by the enlarged diagram, which shows a loop on each side of the double shot of weft-thread. In Fig. 15 the weft-needle has again taken a double shot of weft across the shed and the latch-needles have come forward, slipping the loops past the latches. In Fig. 16 the weft-needle has passed out of the shed, the pile-thread needles have been drawn down, reducing the size of the second loop, and the latch-needles are being moved outward and are in the act of slipping the first-made loop over the second one. The form of the loops before they are slipped are shown by the enlarged diagram in Fig. 16. In Fig. 17 the pile-thread needles have gone down to their lowest position clear of the warp-threads. The latch-needles are slightly tilted up as they are moved outward for drawing the second loop through the first one which they have slipped and tightening up the knot thus formed. The last double shot of weft is now beaten up and the knife-hooks 26 are coming up ready for holding the loops while they are cut by the serrated knife 27 reciprocating in such hooks. With reference to the enlarged diagram in Fig. 17 it will be seen that the pile-thread is tied completely around the double shot of weft-thread.

In Fig. 18 the knife-hooks are moved sideways to allow of the latch-needles coming forward between the loops and the hooks until the loops are on the other side of the latches, in which position they are ready for being slipped and left on the knife-hooks. During this operation both the latch-needles and the knife-hooks are tilted in the first case to cause the latches to stand up a little from the needles, so as to insure the latches being turned over, as shown in Fig. 18, by the loops as

they are slipped over the same, and in the second case to insure the knife-hooks taking hold of the loops.

While the above-described movements are taking place the reed-bar is again going back.

In Fig. 19 the latch-needles are drawn outward and are tilted up so that the latches will be turned over by the latch-opener, which is lowered, so as to engage with such latches when the latter are again brought forward. Fig. 19 shows the finished loop left on the knife-hook and waiting to be cut by the knife therein, which operation takes place when five or six loops have been placed on the knife-hooks.

The above-described series of operations is now repeated from Fig. 19 and results in a woven pile fabric similar in section to the view shown in Fig. 20.

Having now particularly described and ascertained the nature and object of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The combination, with a beam for the pile-yarn, and a pair of guides under which the pile-yarn passes; of a letting-off bar arranged under the pile-yarn between the said pair of guides, means for raising the said bar intermittently to draw the yarn off the said beam, and a nipping device arranged between the said pair of guides and beam and operating to hold the pile-yarn while the loops are being formed.

2. The combination, with a beam for the pile-yarn, and a pair of guides under which the pile-yarn passes; of a letting-off bar arranged under the pile-yarn between the said pair of guides, a pivoted lever, a connection between one end of the said lever and the said bar, an operating-rod, means for adjusting the connection of the said rod with the said lever so as to adjust the length of the yarn for forming the loops, means for reciprocating the said rod intermittently, and a nipping device arranged between the said pair of guides and the said beam and operating to hold the pile-yarn while the loops are being formed.

3. The combination, with a beam for the pile-yarn, and a pair of guides under which the pile-yarn passes; of a letting-off bar arranged under the pile-yarn between the said pair of guides, a pivoted lever provided with a longitudinal slot at one end and a sector at the other end, a flexible connection engaging with the said sector and secured to the said bar, an operating-rod, a screw in the said slot for adjusting the connection of the said rod with the said lever, means for reciprocating the said rod intermittently, and a nipping device arranged between the said pair of guides and the said beam.

4. The combination, with a beam for the pile-yarn, and a pair of guides under which the pile-yarn passes; of a letting-off bar ar-



ranged under the pile-yarn between the said pair of guides, means for raising the said bar intermittently to draw the yarn off the said beam, a stationary block under the said yarn between the said beam and the said pair of guides, a nip-bar arranged over the said yarn and block, and means for raising and lowering the said nip-bar intermittently to hold the pile-yarn while the loops are being formed.

5. The combination, with a beam for the warp-threads, healds for the warp-threads, and means for reciprocating the said healds; of weft-inserting mechanism, a reed arranged between the said healds and the said weft-inserting mechanism, pivoted arms supporting the said reed, toggle-levers connected with the said arms, a connecting-rod for operating the said toggle-levers, and driving devices which operate the said rod intermittently.

6. The combination, with a needle-bar, and a series of pile-thread needles slidable crosswise of the said bar and provided with projections; of a grooved cross-bar which engages with the said projections, slidable bars secured one at each end of the said cross-bar, guides for the slidable bars, and revoluble cams for operating the said slidable bars.

7. The combination, with a stationary needle-bar, a series of pile-thread needles arranged crosswise of the said bar, and means for sliding the said needles; of a needle-bar provided with a series of latch-needles, and means for sliding the said latch-needles and their bar crosswise of the said pile-thread needles to take the pile-loops formed by the latter.

8. The combination, with horizontally-arranged guides, slide-pieces in the said guides, and means for reciprocating the said slide-pieces; of pivot-pins engaging with the said slide-pieces, a latch-needle bar provided with latch-needles, and slidable connections between the said bar and the said pins for adjusting the said bar crosswise of the said slide-pieces.

9. The combination, with guides, slide-pieces in the guides, and means for reciprocating the said slide-pieces in the said guides; of a latch-needle bar provided with latch-needles and pivoted to the said slide-pieces, and means for tilting the said bar on its pivots periodically at prearranged points of its travel.

10. The combination, with guides, slide-pieces in the guides, and means for reciprocating the said slide-pieces; of a latch-needle bar provided with latch-needles and pivoted to the said slide-pieces, a pivoted lever, means for operating the said lever intermittently, and a projection on the said bar which is struck by the said lever so that the said bar is tilted on its pivots periodically.

11. The combination, with guides, and reciprocatory slide-pieces movable in the said guides; of a latch-needle bar provided with latch-needles and pivoted in the said slide-pieces, pivoted levers operatively connected

with the said slide-pieces and provided with projections, and a pivoted latch-opener arranged over the said latch-needles and operated by the said projections.

12. The combination, with a pivoted latch-needle bar provided with latch-needles, and means for sliding the said bar horizontally; of a pivoted latch-opener arranged over the said latch-needles, and operating mechanism which tilts the said bar and latch opener on their pivots periodically so that the latches of the needles are brought in contact with the said latch-opener.

13. The combination, with a knife-hooks bar provided with hooks for the pile-loops, of pivoted levers connected to the ends of the said bar and provided with curved slots, cam-levers pivoted concentric with the said levers and provided with pins which engage with the said slots, and revoluble cams for operating the said cam-levers.

14. The combination, with a knife-hooks bar provided with hooks for the pile-loops, of pivoted supporting-levers pivotally connected with the ends of the said bar, a lever secured to one end of the said bar, a pivoted cam-lever, a connecting-rod between the free end portions of the said lever and cam-lever, and a cam which operates the said cam-lever and tilts the said bar periodically on its supporting-pivots.

15. The combination, with a knife-hooks bar provided with hooks for the pile-loops, of pivoted supporting-levers connected to the ends of the said bar and provided with curved slots, cam-levers pivoted concentric with the said levers and provided with pins which engage with the said slots, revoluble cams for operating the said cam-levers, a lever secured to the end of the said bar, a pivoted cam-lever, a connection between the free end portions of the said lever and cam-lever, and a cam which operates the said cam-lever and tilts the said bar periodically.

16. The combination, with a knife-hooks bar provided with hooks for the pile-loops, and means for supporting and oscillating the said bar and hooks; of tappet mechanism which reciprocates the said bar and hooks endwise as the said parts are oscillated.

17. The combination, with pivoted supporting-levers, and means for oscillating them; of a knife-hooks bar pivoted in the free end portions of the said levers and provided with hooks for the pile-loops, a tappet or cam which moves the said bar endwise as it is moved vertically by the said levers, and means for tilting the said bar on its pivots periodically.

18. The combination, with pivoted supporting-levers, and means for oscillating them; of a knife-hooks bar pivoted in the free end portions of the said levers and provided with slotted hooks for the pile-loops, a knife slidable in the slots of the said hooks, a flexible con-



nection secured to the ends of the said knife, stationary sheaves for supporting the said flexible connection, a revoluble cam, and an operating-pin connected to the said flexible  
 5 connection and engaging with the said cam whereby the said knife is reciprocated in the said slots.

19. The combination, with a stationary needle-bar, and a series of pile-thread needles  
 10 slidable crosswise of the said needle-bar; of a latch-needle bar provided with latch-needles, means for oscillating the said latch-needles crosswise of the said pile-thread needles, a  
 15 knife-hooks bar provided with knife-hooks for the pile-loops, and means for oscillating the said knife-hooks crosswise of the said latch-hooks.

20. The combination, with a stationary needle-bar, and a series of pile-thread needles  
 20 slidable crosswise of the said needle-bar; of a latch-needle bar provided with latch-needles, means for oscillating the said latch-needles crosswise of the said pile-thread needles, means  
 25 for tilting the said latch-needles periodically, a pivoted knife-hooks bar provided with knife-hooks for the pile-loops, means for oscillating the said knife-hooks crosswise of the  
 said latch-hooks, and means for tilting the said knife-hooks bar periodically on its pivots.

30 21. The combination, with a beam for the warp-threads, healds for the warp-threads, and means for reciprocating the said healds; of a needle-bar, a beam for the pile-yarn, letting-off mechanism for the pile-yarn, a nip-

ping device for holding the pile-yarn while 35 the pile-loops are being formed, loop-forming mechanism arranged adjacent to the said needle-bar, a weft-needle which forms a double shot across the shed, a shuttle which se- 40 cures the ends of the weft-loops to the warp-selvage, a reed arranged between the said healds and the said needle-bar, and means for reciprocating the said reed after each double shot of the weft.

22. The combination, with a stationary 45 needle-bar, and a series of pile-thread needles slidable crosswise of the said needle-bar; of a latch-needle bar provided with latch-needles, means for oscillating the said latch-needles crosswise of the said pile-thread needles, means 50 for tilting the said latch-needles periodically, a pivoted knife-hooks bar provided with slotted hooks for receiving the pile-loops from the aforesaid needles, a knife slidable in the slots of the said knife-hooks, means for oscil- 55 lating the said knife-hooks in a vertical plane, means for tilting the said knife-hooks bar on its pivots periodically, means for sliding the said knife-hooks bar endwise periodically, and means for sliding the said knife so as to cut 60 the loops after a prearranged number of loops have accumulated on the said knife-hooks.

In testimony whereof I affix my signature in presence of two witnesses.

HERBERT ANDERTON FOSTER.

Witnesses:

J. B. HOWARD,

GERVASE APPLEYARD.