

No. 822,564.

PATENTED JUNE 5, 1906.

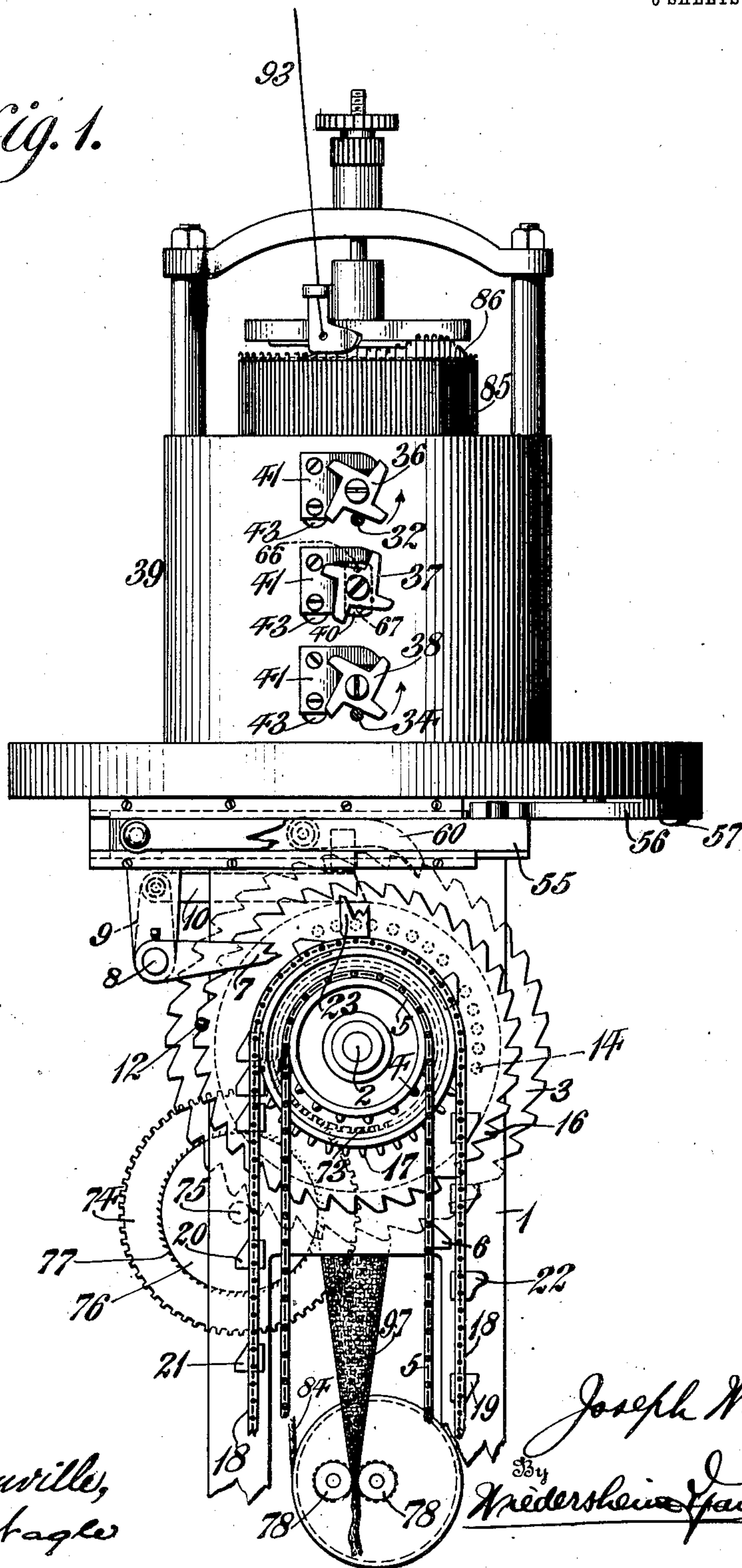
J. WHEELER.

CIRCULAR INDEPENDENT NEEDLE KNITTING MACHINE.

APPLICATION FILED MAR. 6, 1905.

6 SHEETS—SHEET 1.

fig. 1.



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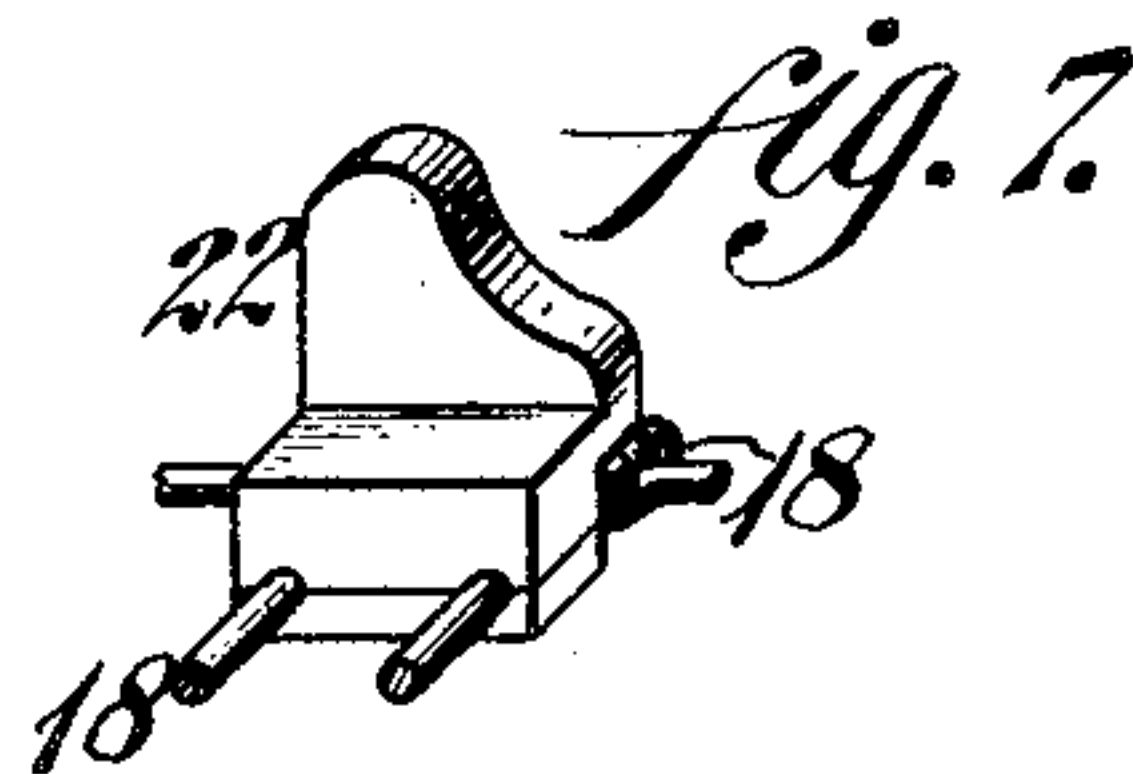
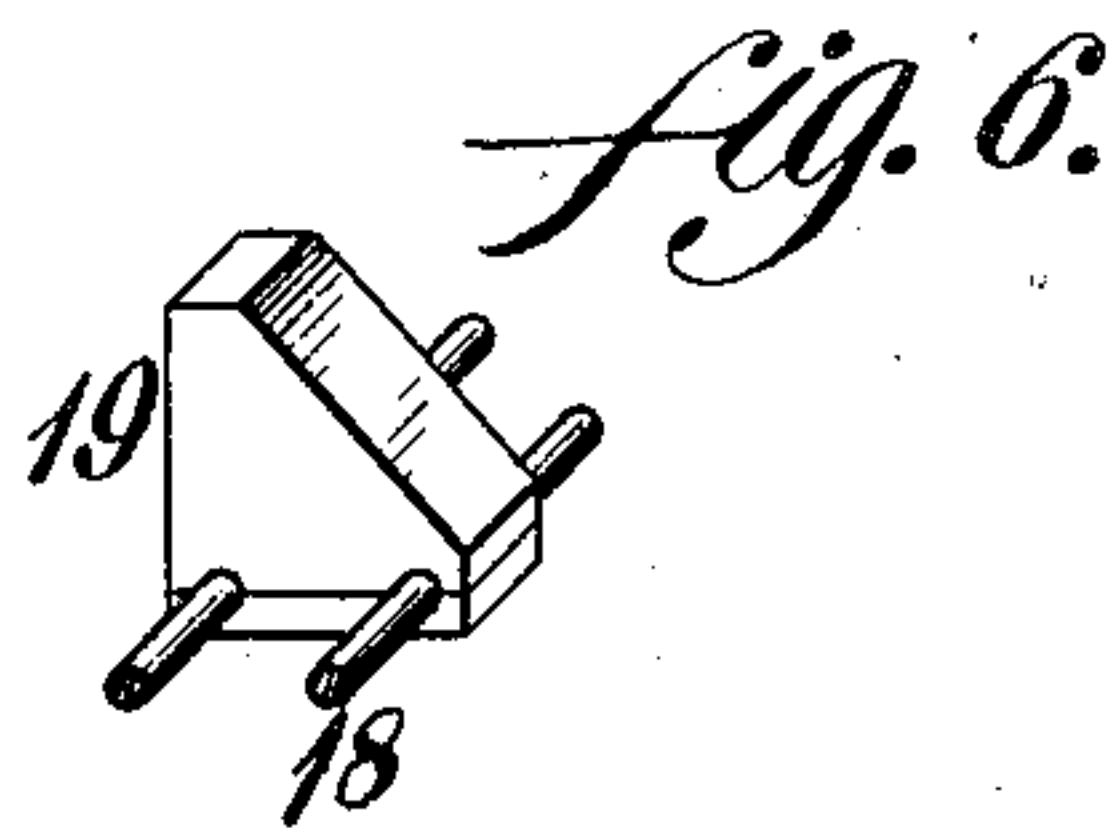
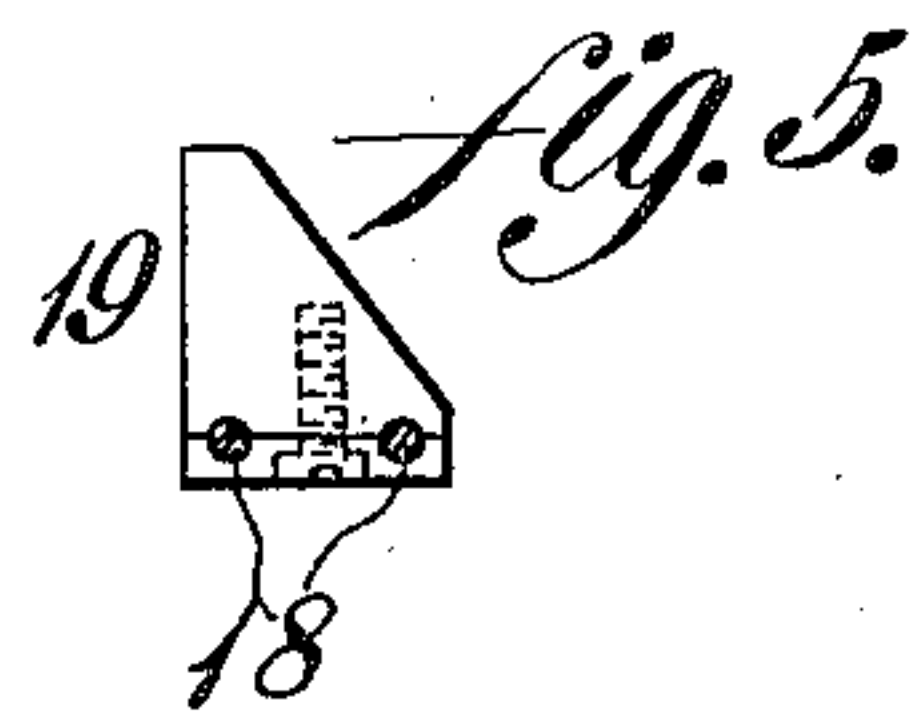
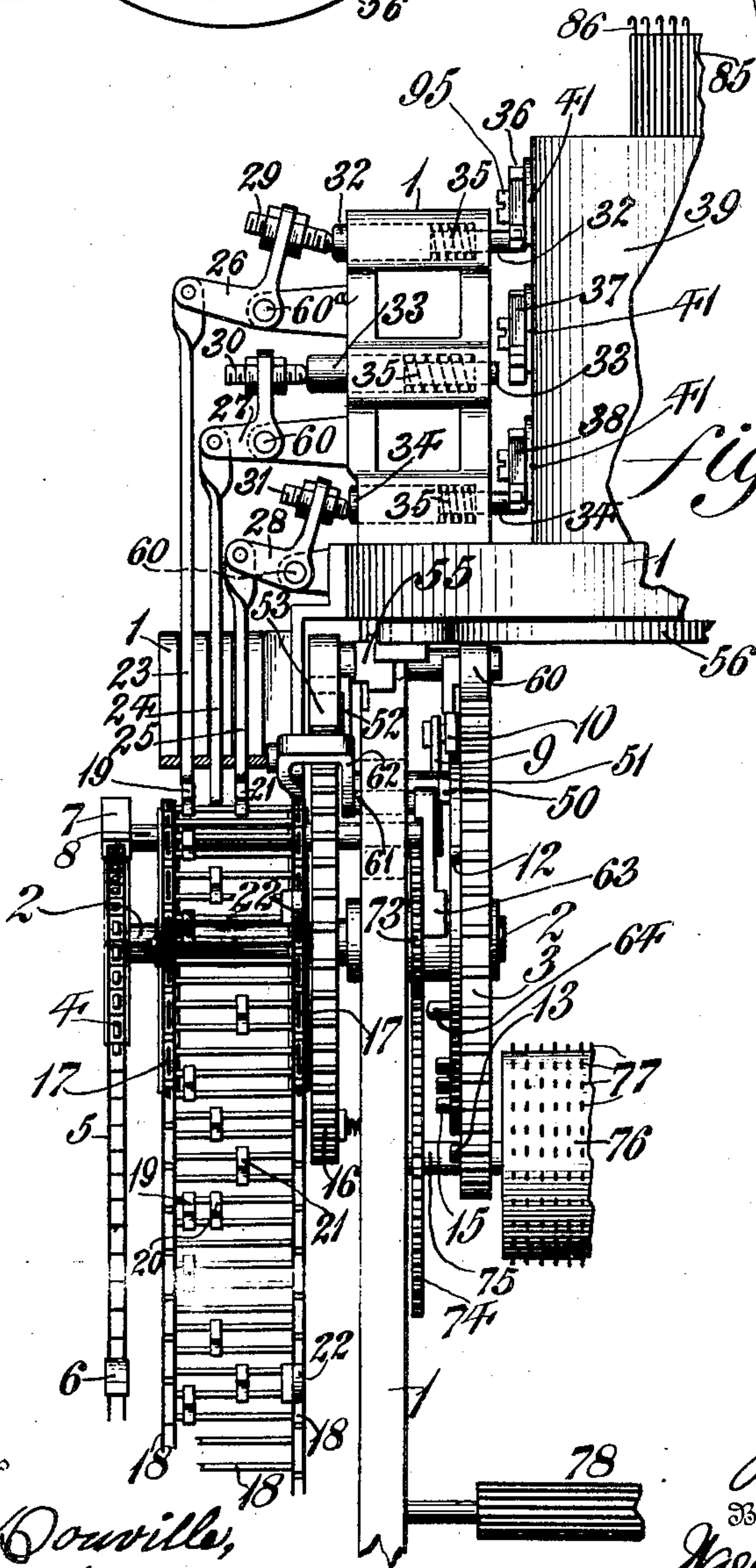
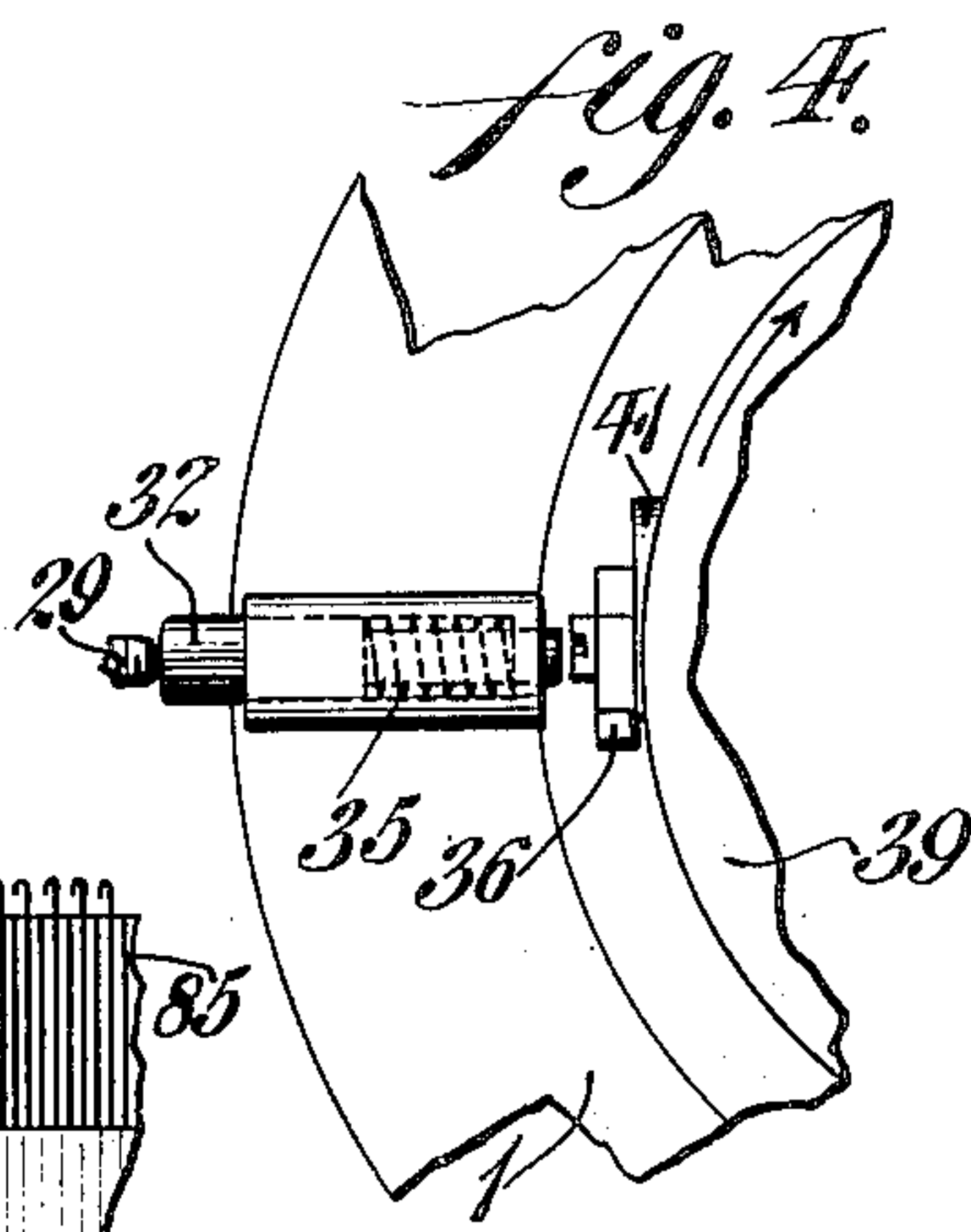
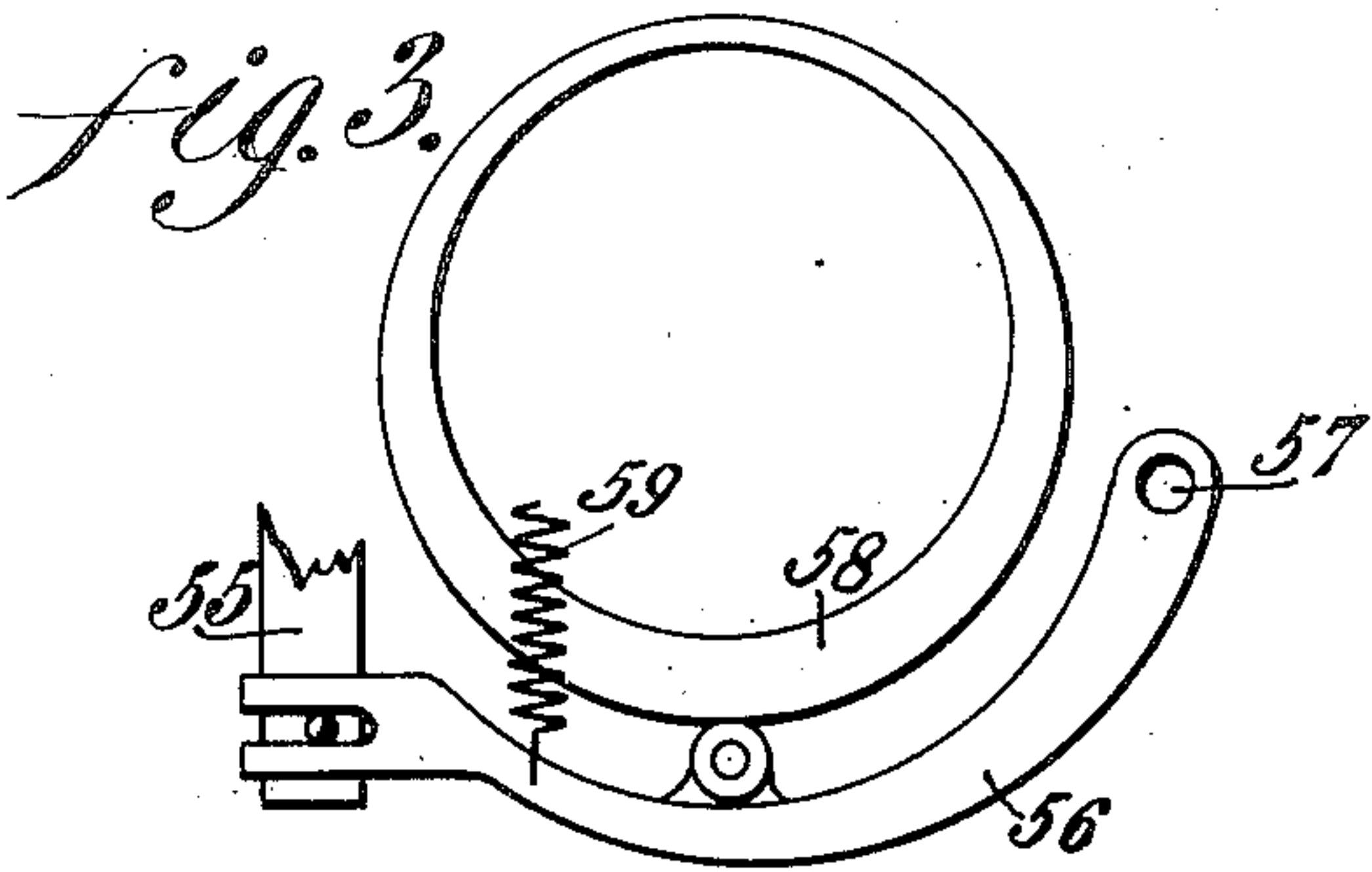
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6 SHEETS—SHEET 2.



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6 SHEETS—SHEET 3.

fig. 8.

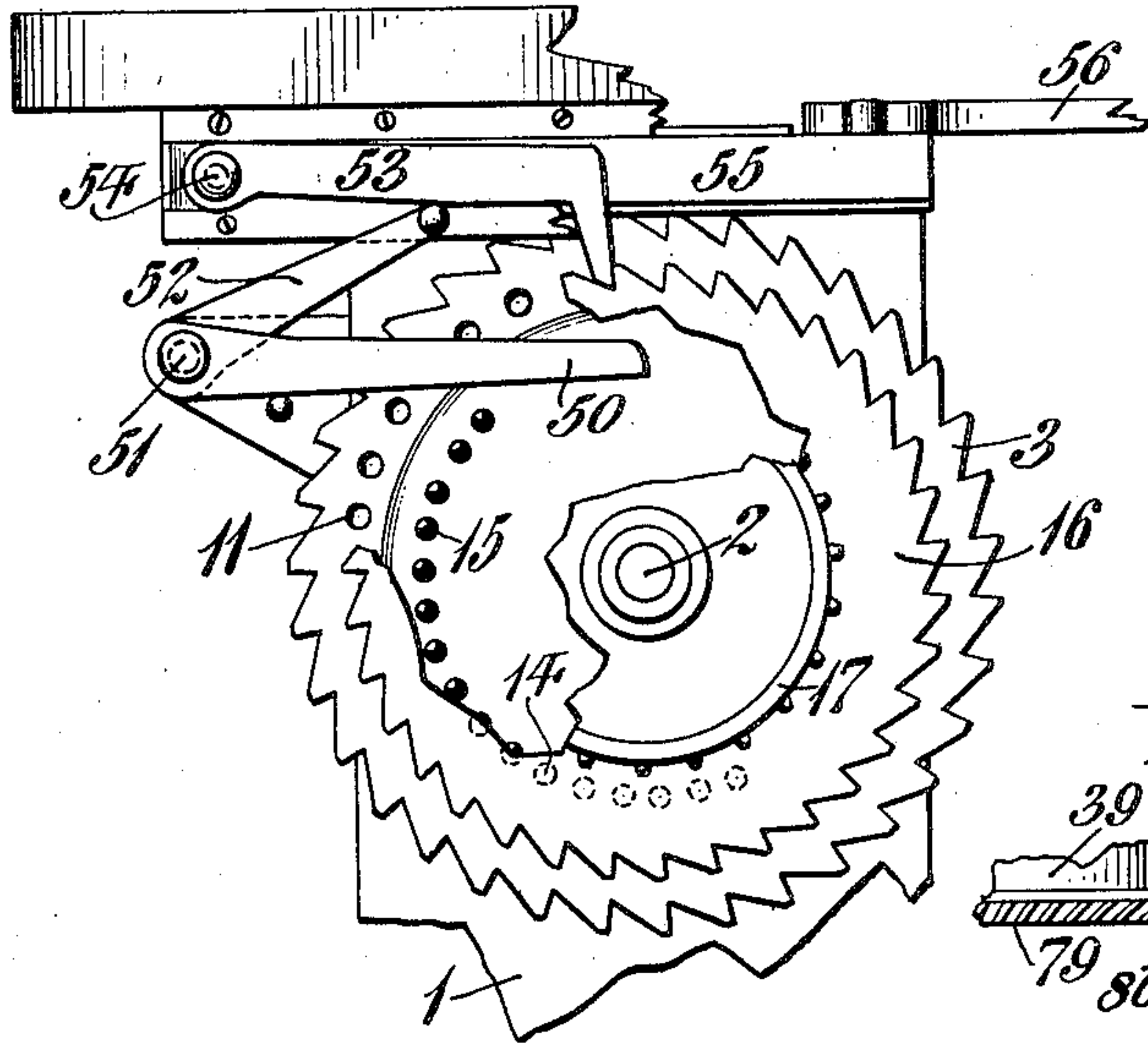


fig. 9.

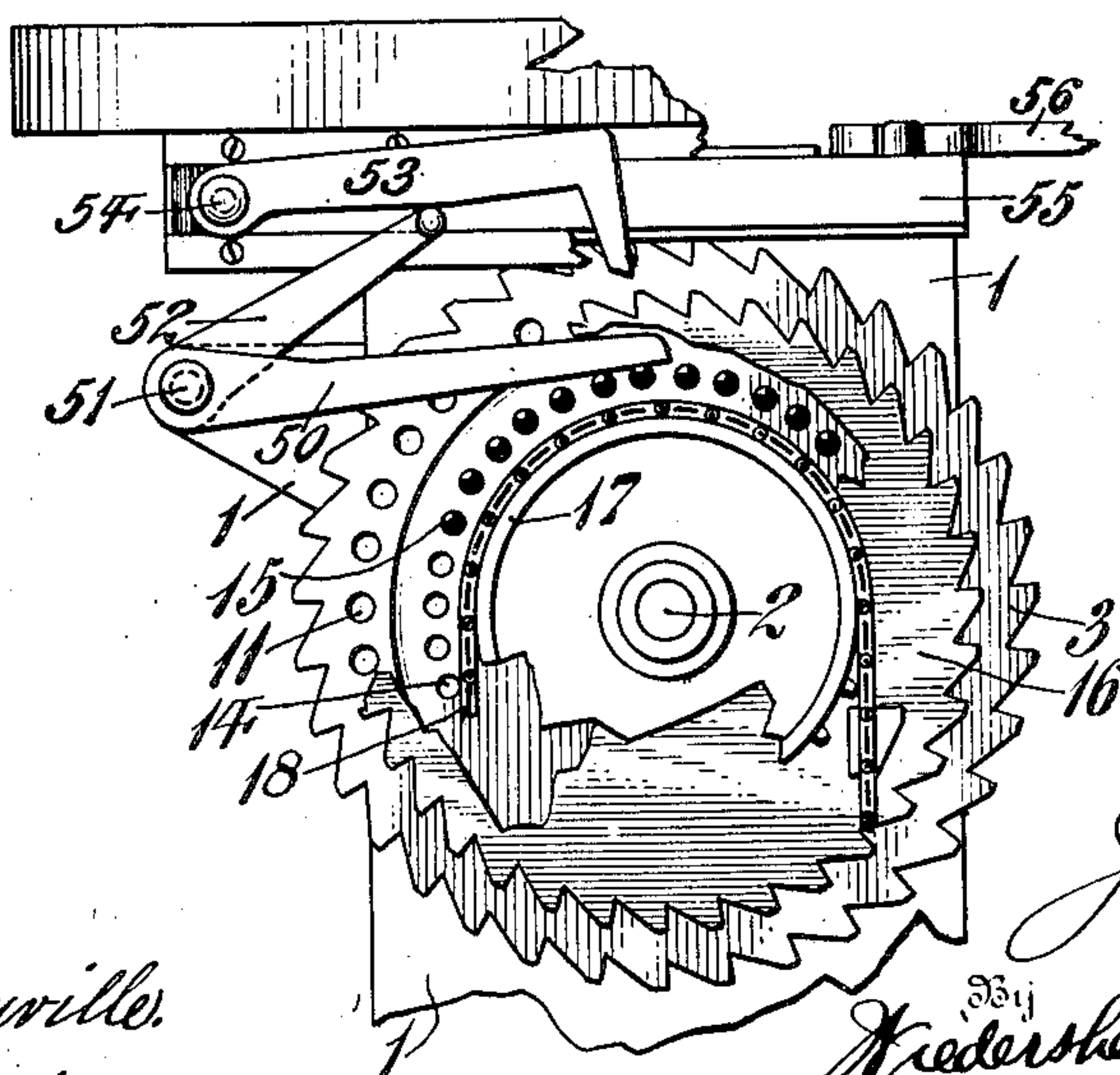
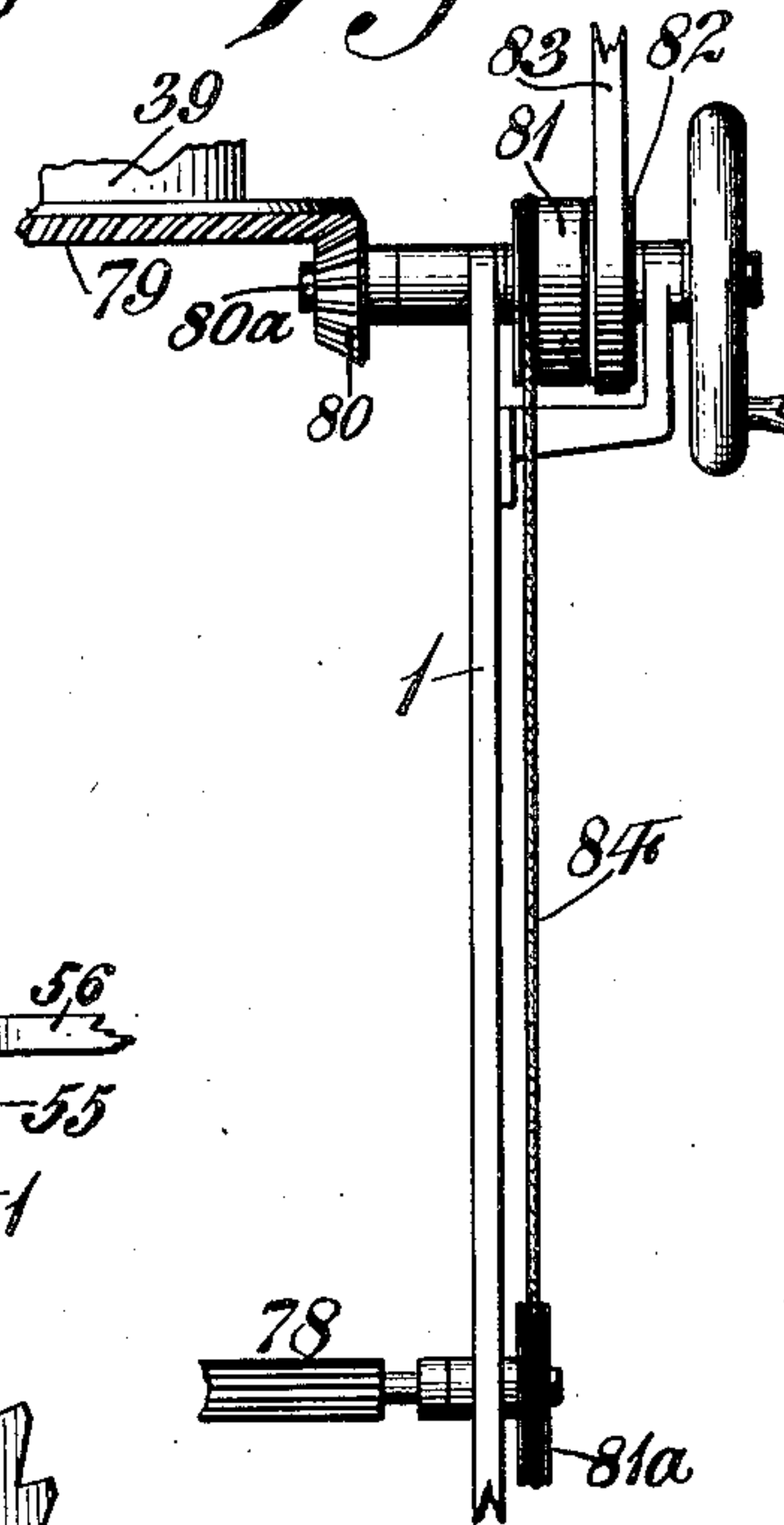


fig. 10.



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6 SHEETS—SHEET 4.

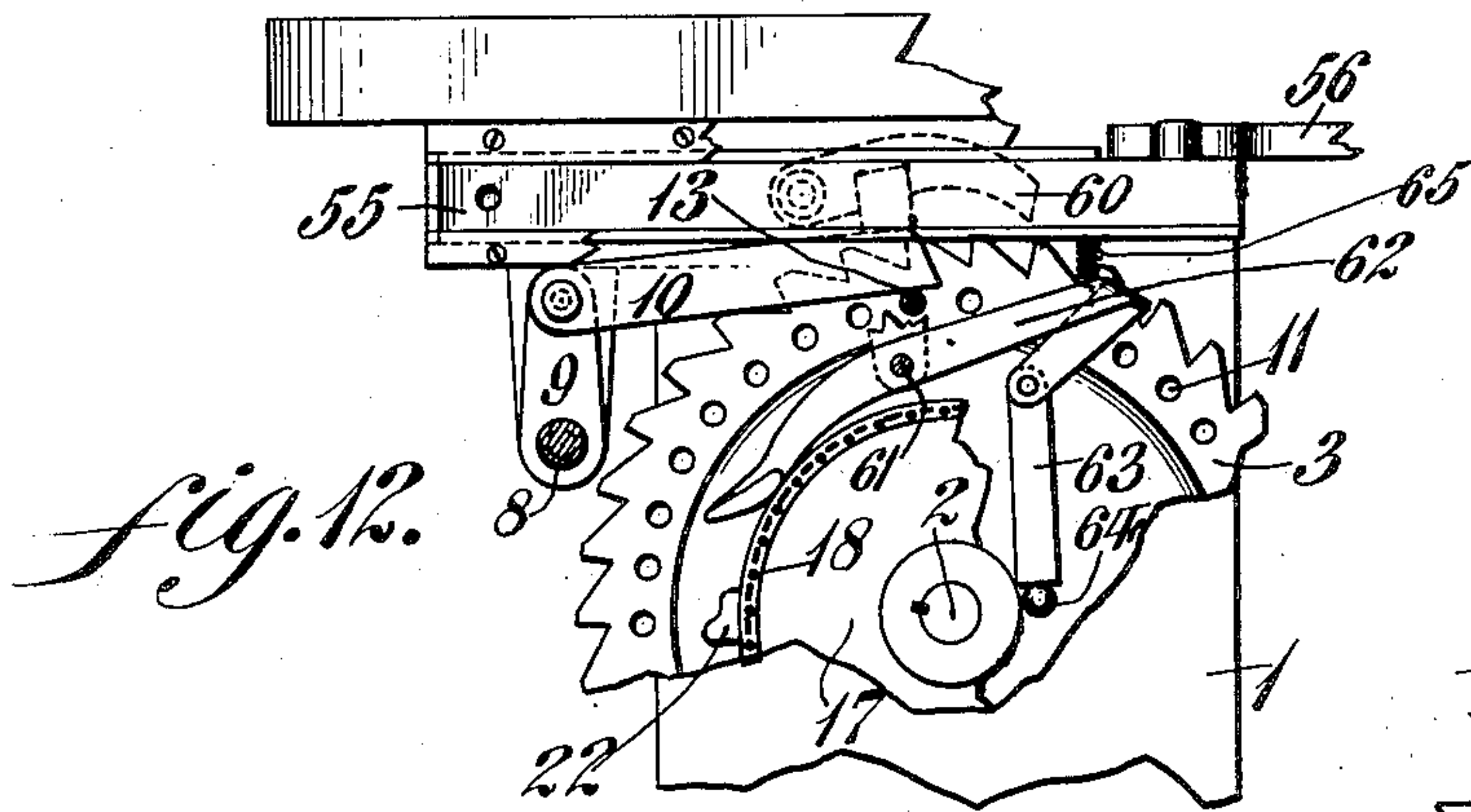
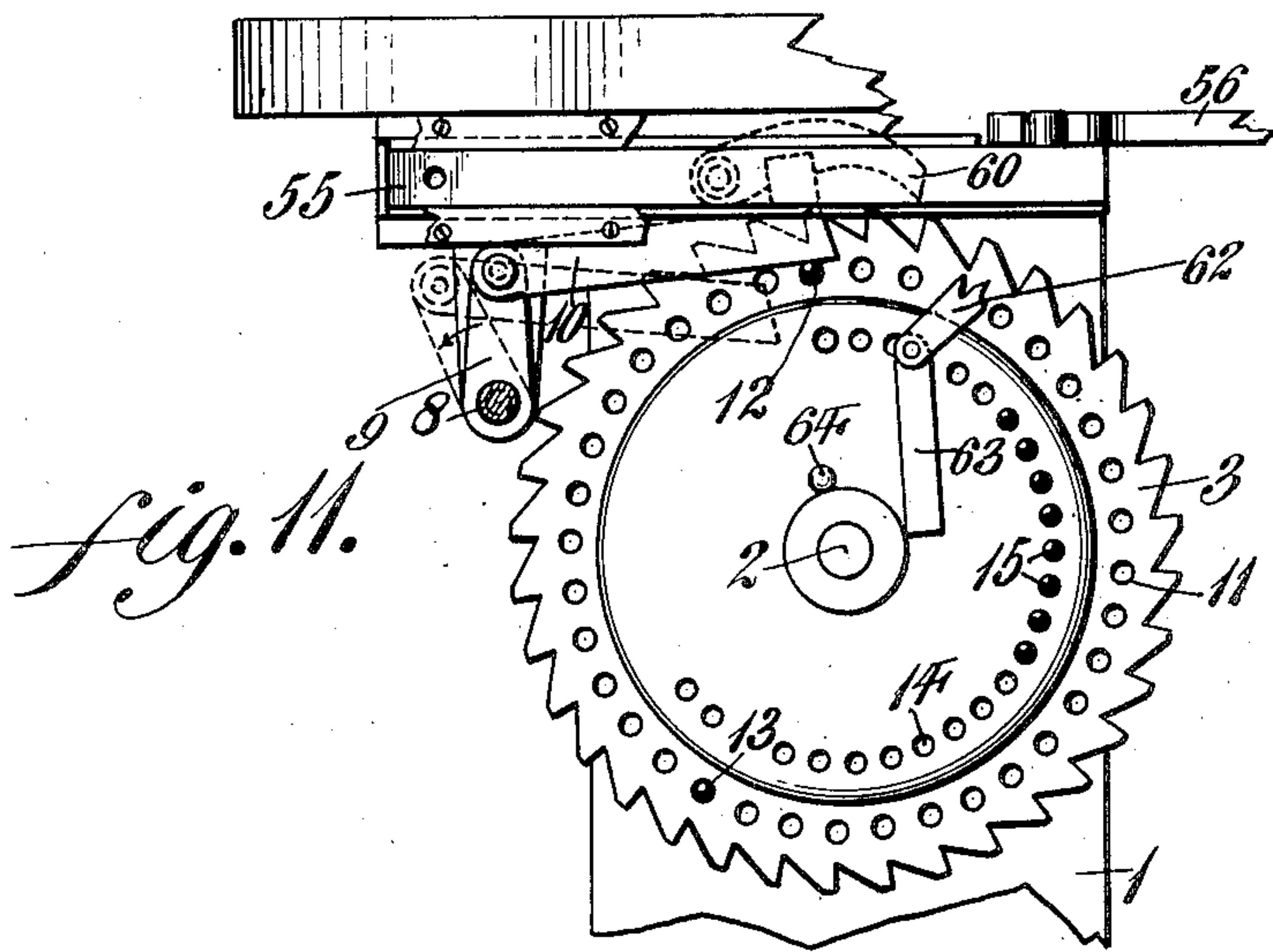
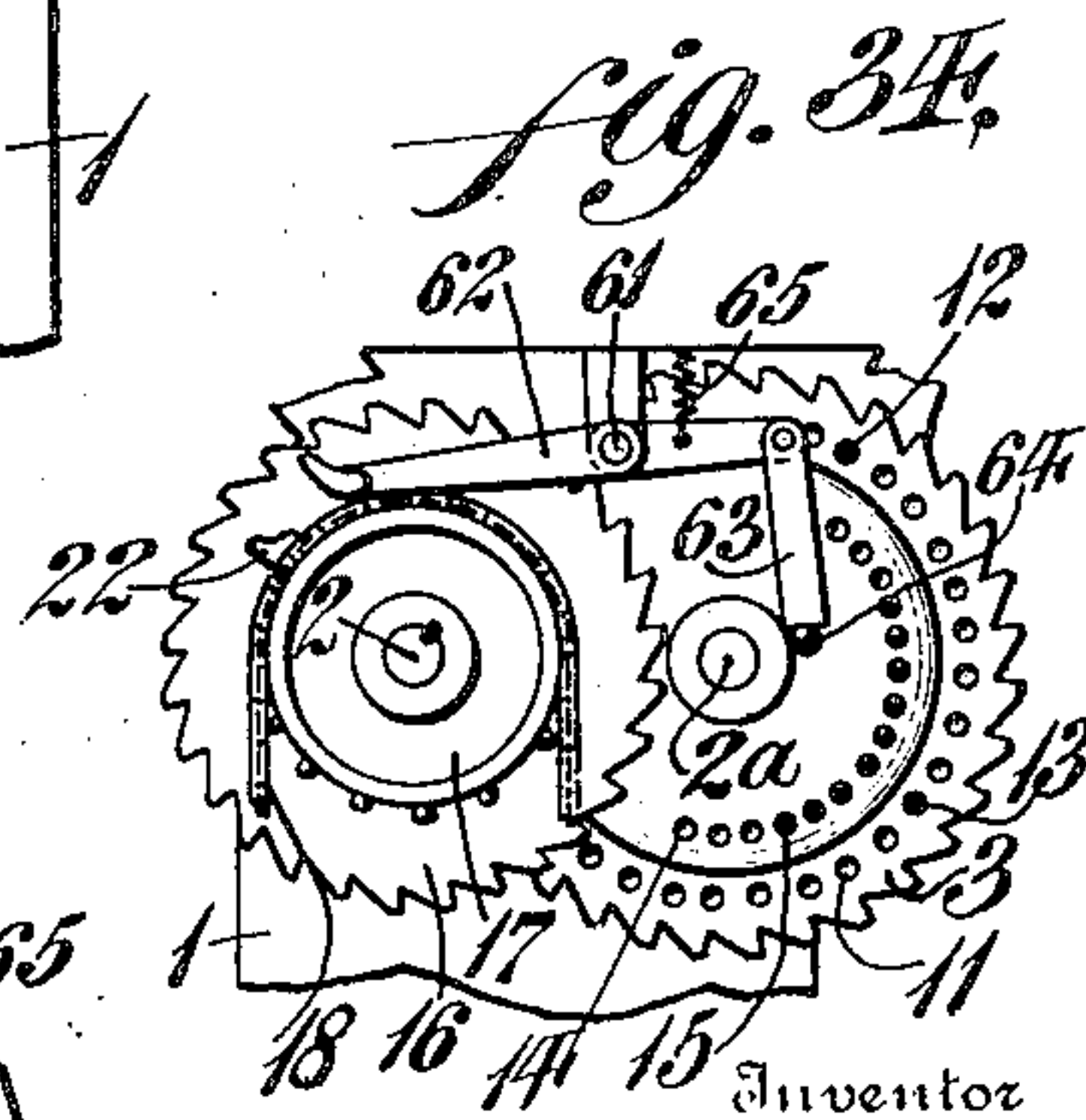
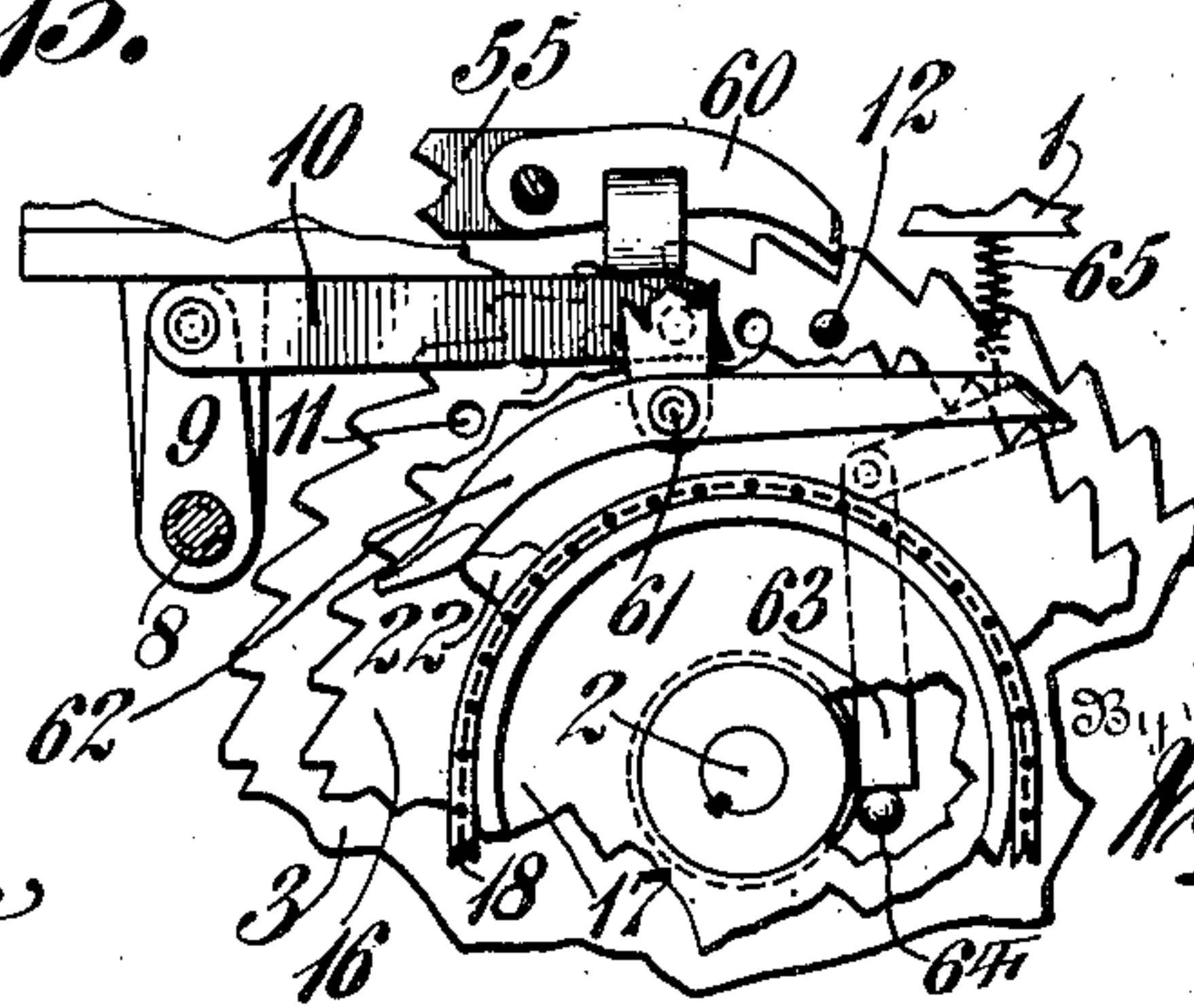


fig. 13.



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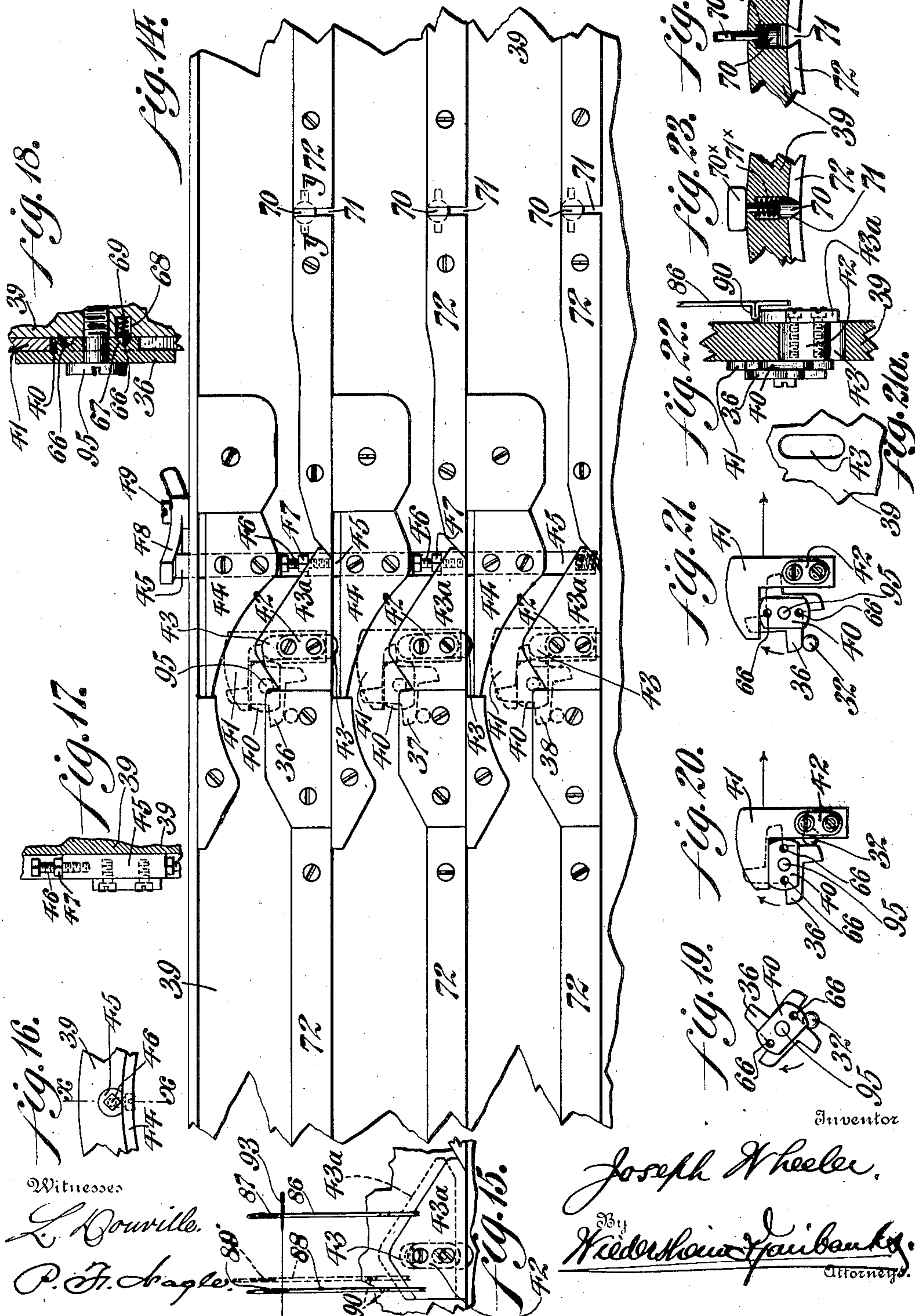
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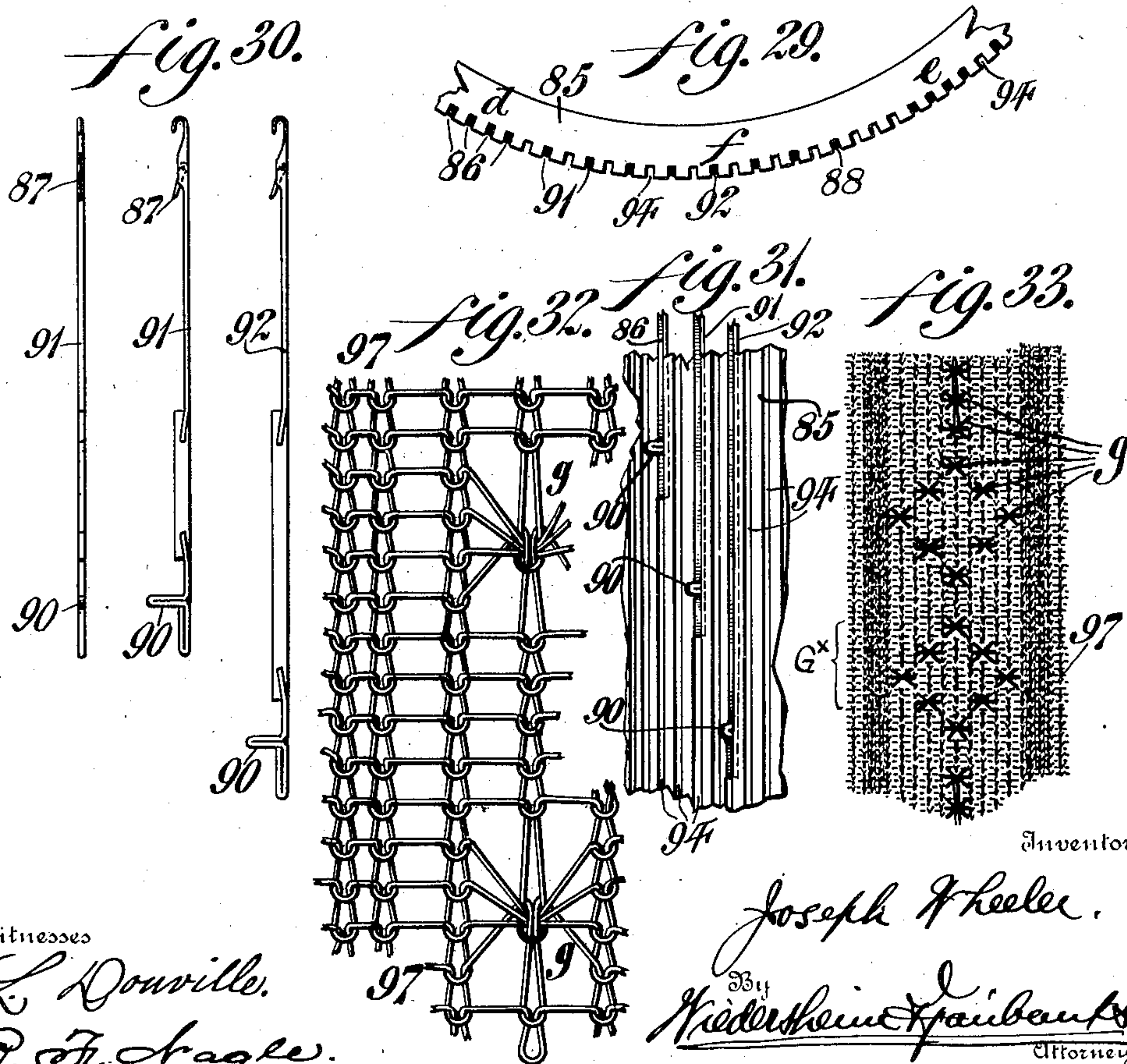
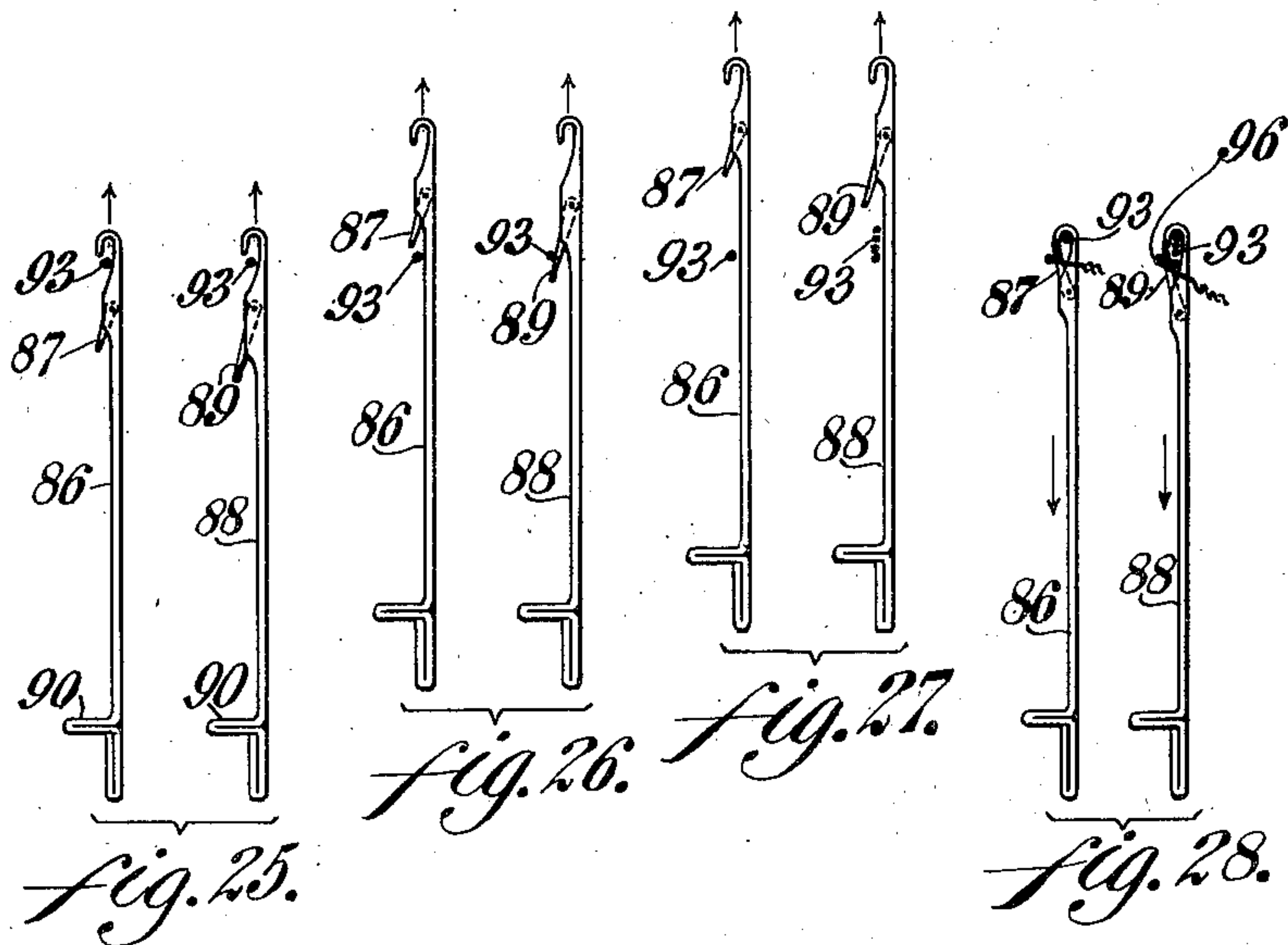
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APPLICATION FILED MAR. 6, 1905.

6 SHEETS—SHEET 6.



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UNITED STATES PATENT OFFICE.

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CIRCULAR INDEPENDENT-NEEDLE KNITTING-MACHINE.

No. 822,564.

Specification of Letters Patent.

Patented June , 1906.

Application filed March 6, 1905. Serial No. 248,463.

To all whom it may concern:

Be it known that I, JOSEPH WHEELER, a subject of the King of Great Britain, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a certain new and useful Circular Independent-Needle Knitting-Machine, of which the following is a specification.

My invention relates to a novel construction of a knitting-machine; and it consists of means for raising and lowering any desired number of tucking-cams either simultaneously or independently of each other, so as to produce knitted fabrics having lace effects.

It also broadly consists of means for adjusting the draw or stitch cams relatively to each other and also of means whereby the needles may be easily inserted and also removed from the needle-cylinder at pleasure.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

Figure 1 represents an end elevation of a portion of a knitting-machine having certain parts of my invention applied thereto. Fig. 2 represents a side elevation at a right angle to that in Fig. 1 of a portion of a knitting-machine with parts of my invention applied thereto. Figs. 3 and 4 represent plan views of certain detached portions of the machine. Fig. 5 represents an elevation of a lug employed. Fig. 6 represents a perspective view of the lug seen in Fig. 5. Fig. 7 represents a perspective view of another form of lug employed. Figs. 8 and 9 represent end elevations of certain portions of the machine. Fig. 10 represents a front elevation of a portion of the machine on a reduced scale. Figs. 11, 12, and 13 represent end elevations of certain parts of the machine and some of which are seen in different positions. Figs. 14 and 15 represent front elevations of a portion of the interior of the cam-cylinder opened out or developed, so as to clearly illustrate the cams therein. Fig. 16 represents a plan view of a portion of the machine. Fig. 17 represents a vertical section on line $x x$, Fig. 16. Fig. 18 represents a vertical section of certain detached portions of the device. Figs. 19 to 21^a, both inclusive, represent front elevations of certain detached portions of the device. Fig. 22 represents a partial end elevation and partial vertical section of some detached portions of the device. Figs. 23

and 24 represent horizontal sections on line $y y$, Fig. 14, and with certain parts in different positions. Figs. 25 to 28, both inclusive, represent needles in various positions. Fig. 29 represents a plan view of a portion of the needle-cylinder. Fig. 30 represents a view of needles of different lengths. Fig. 31 represents an elevation of a portion of the needle-cylinder with needles of different lengths placed therein. Fig. 32 represents an elevation of a fabric which may be produced by my device. Fig. 33 represents an elevation of the fabric seen in Fig. 32, on a reduced scale, and illustrates a diamond effect of design. Fig. 34 represents an elevation of a modification.

Similar characters of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates the frame of the machine, in which is journaled the shaft 2, having loosely mounted thereon a ratchet-wheel 3 and a sprocket-wheel 4, the latter being keyed or otherwise secured to said shaft and is provided with a sprocket-chain 5, which has secured thereon a stud 6, adapted to operate the arm 7, so as to rock the shaft 8, and consequently the arm 9, secured thereto, and thus impart motion to the stop-rod 10.

The ratchet-wheel 3 is provided with openings 11, in which are inserted the studs 12 and 13, and also with openings 14, adapted to receive studs 15, the object of all of which is hereinafter described.

Secured to the shaft 2 is a gear-wheel 73, which meshes with the gear-wheel 74, secured to a shaft 75, on which is a drum 76, provided with spurs 77 for a purpose hereinafter described.

The shaft 2 has loosely fitted thereon the ratchet-wheel 16, which has secured thereto the sprocket-wheel 17, around which is passed the pattern-chain 18, which is provided with studs 19, 20, 21, and 22.

Secured to the shaft 51, journaled in the frame 1, are the arms 50 and 52, the latter being in contact with the pawl 53, pivoted at 54 to the slide 55, guided in the frames 1 and to which a reciprocating motion is imparted by the lever 56, fulcrumed at 57 in the frame 1. The lever 56 has a rocking motion imparted thereto by the eccentric ring 58, (see Fig. 3,) which may be secured to the cam-cylinder 39, so as to rotate therewith. The

lever 56 is held in contact with the ring 58 by a spring 59, one end of which is secured to the lever 56, while its opposite end is secured to a convenient fixed point in the frame 1. The slide 55 is provided with a pawl 60, which engages with the ratchet-wheel 3, so as to impart motion thereto. Fulcrumed at 61 in the frame 1 is a lever 62, which is operated by the pattern-chain 18. Pivoted to the lever 62 is a bar 63, which engages at certain times with a stud 64 on the ratchet-wheel 3, the lever 62 being held in its normal position by the spring 65.

Guided in the frame 1 are the bars 23, 24, and 25, which actuate, respectively, the bell-crank levers 26, 27, and 28, which are pivoted at 60^a in the frame 1 and are provided, respectively, with screws 29, 30, and 31, which are adjustably fitted therein.

Guided in the frame 1 are the plungers 32, 33, and 34, whose outer ends abut against the screws 29, 30, and 31, respectively, it being noted that each of said plungers is provided with a spring 35 for a purpose herein-after described.

The cam-cylinder 39 is provided with star-wheels 36, 37, and 38, and each of said wheels is provided with a cam 40, upon which rests a slide 41, connected with a lug 42, which is placed in its respective opening 43 in the cam-cylinder 39, it being noted that each lug 42 has secured thereto a tucking-cam 43^a and is raised and lowered by its cam 40. In the present instance there are three tucking-cams employed, although any desired number of such cams may be used.

The cam-cylinder 39 is provided with draw-cams 44, each of which is secured to a block 45, fitted in the cam-cylinder 39, so as to be vertically adjusted therein, said blocks 45 being provided with adjusting-screws 46 and jam-nuts 47, there being as many draw-cams employed as there are tucking-cams used. The draw-cams are held in their adjusted positions by the lever 48, fulcrumed at 49 in the cam-cylinder 39. The lever 48 is for the purpose of lowering the stitch-cams 44, so as to form a slack or loose stitch at the end of the stocking near the foot and denotes where the foot of the stocking is to be knitted on, it being understood that a certain amount of plain knitting follows this slack, so as to allow for raveling and trimming.

Each cam 40 is provided with sockets 66, adapted to receive at certain times a ball 67, which is located in a socket 68 in the cam-cylinder 39 and is pushed forward by a spring 69 for a purpose hereinafter described. The cam-cylinder 39 is provided with plugs 70, adapted to open and close the passages 71 in the run 72 to permit needles to be either inserted in the needle-cylinder 85 or removed therefrom, as desired. 70^x designates a thumb-piece, and 71^x designates a spring for the plug 70. Journaled in the frame 1 are

take-up rollers 78, to which motion may be imparted from the fixed pulley 81 by the belt 84.

The cam-cylinder 39 may be driven in the usual manner, as illustrated in Fig. 10, and which consists of the bevel gear-wheels 79 and 80, the latter being mounted on the main driving-shaft 80^a, journaled in the frame 1 and provided with the fast and loose pulleys 81 and 82, respectively, and a driving-belt 83.

Motion may be imparted to the take-up rollers 78 by a belt 84, led from the pulley 81 to the pulley 81^a, fast on the shaft of one of the feed-rollers 78.

85 designates the needle-cylinder, which is of sufficient length to receive the needles, which in the present instance are of three different lengths.

86 designates a needle with short latch 87, and 88 designates a needle with a long latch 89, it being understood that there are as many different length of needles as there are tucking-cams employed and that said needles are provided with butts 90, as usual.

The needles 91 in the modification shown in Fig. 30 are longer than the needles 86 and 88, while the needles 92 are longer than the needles 91, which two latter sets consist of long and short latches similar to those seen in Fig. 25.

The short-latch needles take a stitch every revolution of the machine, and the long-latch needles take a stitch only when the tucking-cams are raised, and when the said tucking-cams are lowered the long-latch needles gather in the threads, thus forming the ordinary tuck-stitch.

93 designates the yarn, which is fed to the needles in the cylinder 85 in the usual manner.

The operation is as follows: The needles 86, 88, 91, and 92 are placed in the needle-cylinder 85, arranged in three sets according to their lengths, one set working with each of the three sets of cam-grooves and are so arranged therein as to produce a fabric of predetermined design. For instance, they may be placed in groups, as at *d* and *e* in Fig. 29, and in alternate needle-grooves, as at *f*, and when desired several grooves 94 may be left devoid of needles, the arrangement depending upon the design of the fabric. The lugs 19, 20, 21, and 22 are placed on the pattern-chain 18 in such positions relatively to each other that they work in harmony with the needles. The yarn 93 is fed to the needles in the usual manner. The number of reeds employed depends entirely upon the number of series of draw and tucking cams employed, it being apparent that the greater the number of series of said cams the larger the number of feeds which will be necessary to produce the desired result. When the machine is started, the cam-cylinder 39 is rotated, and

with it the eccentric ring 58, and imparts a rocking motion to the lever 56, which causes the slide 55 to reciprocate, so as to move the pawls 53 and 60 to and fro. Assuming the ratchet-wheel 16 to have rotated by reason of the forward movement of the pawl 53 and that the pawl 60 and ratchet-wheel 3 are in the positions seen in Fig. 12, it is apparent that while the ratchet-wheel 16 is rotating the wheel 3 is at rest and remains so until the link 6 actuates the lever 7, which causes the bar 10 to be drawn back and released from its engagement with the stop 12, which will permit the pawl 60 to drop and engage the ratchet-wheel 3 and move the same into the position seen in Fig. 12, at which time the stud 13 will have engaged the lever 10 and caused the pawl 60 to be released from its engagement with the ratchet-wheel 3. On the further rotation of the ratchet-wheel 16 the lug 22 on the chain 18 will engage the lever 62. This causes the lever 62 to turn on its fulcrum 61, so as to depress the bar 63, which by reason of its contact with the stud 64 causes the ratchet-wheel 3 to rotate sufficiently to remove the stud 13 from beneath the lever 10. (Compare Figs. 12 and 13.) When the stud 12 leaves the lever 10, the latter drops and permits the pawl 60 to engage with the ratchet-wheel 3 and impart motion thereto.

When the ratchet-wheel 3 is at rest, the lace fabric is being made, and when the ratchet-wheel 3 is rotating the plain fabric is being made. As the ratchet-wheel 3 rotates it throws the pawl 53 out of action by means of the studs 15 in the holes 14, said studs engaging the lever 50, thus throwing out of action the ratchet-wheel 16 and bringing the pattern-chain to rest. When the parts are in the position seen in Fig. 11, the lug 6 on the length chain 5 causes the ratchet-wheel 3 to rotate, bringing it to the position seen in Fig. 12. The lug 22 on a chain 18 then raises the lever 62, which depresses the stud 64 on the ratchet 3 and causes said ratchet-wheel 3 to rotate, as seen in Fig. 13, said wheels continuing to rotate until brought to rest. This stopping of the ratchet-wheel 3 is caused by the stud 12 engaging the stop-rod 10, which latter causes the pawl to be disengaged from the ratchet-wheel 3, at which time the parts will be in the position as seen in Fig. 11. When a stud 22 has left the lever 62, the latter is returned to its normal position, as in Fig. 12, by the spring 65. The ratchet-wheel 3 in turning causes the studs 15, which are inserted in the ratchet-wheel 3, to engage the lever 50 and turn the shaft 51, (see Figs. 8 and 9,) thereby causing the lever 52 to remove the pawl 53 from its engagement with the ratchet-wheel 16, so as to cause the latter to remain stationary until the last stud 15 leaves the lever 50, when the latter drops and

permits the pawl 53 to again engage the ratchet-wheel 16 and turn the same.

It is obvious that the number of studs 15 inserted in the wheel 3 determines the duration of the stationary period in each revolution of the wheel 16, and the number of studs 15 also denotes the length of the plain section of the fabric. During any desired period in the plain stitch the slack course above described may be made in any part of the plain section of the fabric, which latter is regulated by the studs 15.

The ratchet-wheel 16 imparts motion to the sprocket-wheels 17, and consequently to the pattern-chain 18, and as these wheels and chain move as one it is apparent that when the wheel 16 comes to a standstill the chain 18 will likewise come to a stop.

When a stud 19 is brought under the bar 23, (see Fig. 2,) it lifts said bar and turns the lever 26 on its fulcrum 60, thereby causing the screw 29 to advance the plunger 32 so that the latter is brought in the path of the star-wheel 41, which is in alinement therewith, so that said wheel 41 has a quarter of a revolution imparted thereto by reason of its contact with the plunger 32 due to the revolution of the cam-cylinder 39.

When the cams 43^a are in the positions seen in Fig. 14, the short-latch needles are raised sufficiently to bring their latches above the yarn 93, as seen in Fig. 26, so that when said needles are lowered they draw said yarn through the loops thereon and produce plain knitting. The needles 88 are also lifted by the cams 43^a, but being provided with long latches 89 the latter do not pass above the yarn 93, (see Fig. 26,) and consequently retain said yarn under their hooks, which receive one additional strand at each revolution of the cam-cylinder 39. When the uppermost cam 43^a is in the position seen in Fig. 14, the cam 40 is in the position seen in Fig. 20, so that when the star-wheel 36 is brought against the plunger 32 it is gradually turned on its axis 95 during the rotation of the cam-cylinder 39, which carries said star-wheel. In Fig. 20 the star-wheel 36 is represented as just brought in contact with the plunger 32, while in Fig. 19 said star-wheel 36 is in a position it occupies when a partial rotation is imparted thereto, its axis 95 being now almost directly above the plunger 32, and when said wheel leaves the plunger 32 it is in the position seen in Fig. 21, it having had a quarter of a revolution imparted thereto by its contact with said plunger 32, and the cam 40 has been turned from the position seen in Fig. 20 to that seen in Fig. 21, whereupon the cam 43^a, secured to the slide 41, is lifted from its lowermost position (seen in Fig. 14 and in full lines in Fig. 15) to the position seen in dotted lines in said Fig. 15, so that when the needles with long latches

ride up this cam 43^a in its elevated position said needles are raised sufficiently to bring their latches 89 above the yarn 93, as seen in Fig. 27, so that when said needles are lowered they draw the several strands of yarn 93 through the loops 96 thereon, as seen in Fig. 28, thereby casting off the tuck-stitches and producing the star effect at *g* in the fabric 97. (Seen in Figs. 32 and 33.)

When a cam 40 is in the position seen in Fig. 20, said cam is prevented from improper rotation by reason of its position relatively to the slide 41; but when said cams 40 are in the position seen in Fig. 21 the same might turn beyond the desired point. So to avoid this the ball-and-socket device seen in Fig. 18 is employed, it being understood that a ball 67 is forced into a socket 68 when a star-wheel is turning.

When a stud 19 leaves the bar 23, the latter drops and turns the lever 26, whereupon the screw 29 releases its pressure on the plunger 32 and permits it to return to its normal position, which is one similar to that of the plunger 33 in Fig. 2, it being apparent that when said plungers 32, 33, and 34 are in their normal positions they are out of the path of their respective star-wheels 36, 37, and 38, so that when a cam 43^a is either in its uppermost or its lowermost position it remains so until its plunger is again advanced, so as to turn its star-wheel.

In Fig. 4 the plunger 32 is in its normal position and permits the star-wheel 36 to pass without contacting therewith, thereby permitting its cam 40 to remain in the position in which it was left when last turned by the star-wheel 36 and remain in this position until again turned by the star-wheel 36 and plunger 32, as hereinbefore described.

The object of the plungers 33 and 34 and the star-wheels 37 and 38 being to raise and lower their respective cams 43^a in the same manner as described in connection with the plunger 32 and star-wheel 36 and for a similar purpose, it is deemed unnecessary to describe the operation of these, since it is similar to that hereinbefore described.

It is to be understood that the several cams 43^a may be raised and lowered simultaneously or else independently of each other according to requirements.

When the fabric 97 is being drawn between the take-up rollers 78, it causes the drum 76 to rotate by its contact therewith, and thus impart motion to the gear-wheels 73 and 74, so as to turn the sprocket-wheel 4 and operate the chain 5, so that the link 6 thereon may be brought in contact with the lever 7, so as to rock the shaft 8, and thereby cause the arm 9 to remove the stop-rod 10 from the stud 13 and permit the pawl 60 to engage the ratchet-wheel 3, and thus rotate the same, said lug 6 being brought in contact with the arm 7 when a predetermined length of the

fabric is begun and continuing to travel until said length is completed, when said lug is again brought in contact with the arm 7, so as to cause the stop-rod 10 to permit the pawl 60 to again operate the ratchet-wheel 3, as hereinbefore described.

By the provision of three separate cam-grooves each having an automatically-adjustable tucking-cam and draw-cam I am enabled to produce in the fabric a pattern containing a wide and easily-varied pattern unit which may be varied at will. The provision of only two cam-grooves would prevent the making of a variable pattern unit sufficiently wide to be very noticeable—that is to say, I can make a diagonal square, such as G^x in Fig. 33, having eight gathered (tucked) spots. By the use of two variable cams I could produce a figure of this kind having only four such spots, which would scarcely be noticeable in a garment such as a stocking.

It will be evident that various changes may be made by those skilled in the art which will come within the scope of my invention, and I do not, therefore, desire to be limited in every instance to the exact construction herein shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a knitting-machine, the combination of three sets of needles, a similar number of cam-grooves, each containing a tucking-cam, coöperating with said needles, means for operating each of said tucking-cams, and pattern means controlling the order of operation of the said cams.

2. In a knitting-machine, the combination of three sets of needles, a similar number of cam-grooves, each containing a tucking-cam coöperating with said needles, an adjustable draw-cam in each set of cam-grooves, means for simultaneously adjusting said draw-cams, independent means for operating each of said tucking-cams and pattern means for controlling the order of operation of each of said tucking-cams.

3. In a knitting-machine, the combination of three sets of needles, a similar number of cam-grooves, each containing a tucking-cam and an adjustable draw-cam coöperating with said needles, means for operating each of said tucking-cams and pattern means controlling the order of operation of said tucking-cams.

4. In a knitting-machine, a cam-cylinder, three or more sets of tucking-cams arranged in different planes, a plurality of star-wheels adapted to coact with said cams, a plurality of spring-pressed plungers adapted to coact with said star-wheels, a plurality of bell-crank levers adapted to coact with said plungers, and means for actuating said levers.

5. In a knitting-machine, a cam-cylinder,

three or more numbers of tucking-cams arranged in different planes, a similar number of star-wheels adapted to coact with said cams, a similar number of spring-pressed plungers adapted to coact with said star-wheels, a similar number of bell-crank levers adapted to coact with said plungers, a plurality of bars adapted to coact with said bell-crank levers, and means for actuating said bars.

6. In a knitting-machine, a cam-cylinder, three or more sets of tucking-cams arranged in different planes, a similar number of star-wheels adapted to coact with said cams, a similar number of spring-pressed plungers adapted to coact with said star-wheels, a similar number of bell-crank levers adapted to coact with said plungers, a similar number of bars adapted to coact with said bell-crank levers, a pattern-chain, a similar number of lugs thereon adapted to actuate said bars, and means for actuating said chain.

7. In a knitting-machine, a cam-cylinder, three or more sets of tucking-cams arranged in different planes, a similar number of star-wheels adapted to coact with said cams, a similar number of spring-pressed plungers adapted to coact with said star-wheels, a similar number of bell-crank levers adapted to coact with said plungers, a similar number of bars adapted to coact with said bell-crank levers, a pattern-chain, lugs thereon adapted to actuate said bars, a sprocket-wheel about which said chain passes, a ratchet-wheel secured to said sprocket-wheel, and means for actuating said ratchet-wheel.

8. In a knitting-machine, a cam-cylinder, three or more sets of tucking-cams arranged in different planes, a similar number of star-wheels adapted to coact with said cams, a similar number of spring-pressed plungers adapted to coact with said star-wheels, a similar number of bell-crank levers adapted to coact with said plungers, a similar number of bars adapted to coact with said bell-crank levers, a pattern-chain, lugs thereon adapted to actuate said bars, a sprocket-wheel about which said chain passes, a ratchet-wheel secured to said sprocket-wheel, a pawl adapted to coact with said ratchet-wheel, a slide to which said pawl is secured, devices for engaging and disengaging said pawl with said ratchet-wheel, and means for actuating said slide.

9. In a knitting-machine, a cam-cylinder, three or more sets of tucking-cams arranged in different planes, a similar number of star-wheels adapted to coact with said cams, a similar number of spring-pressed plungers adapted to coact with said star-wheels, a similar number of bell-crank levers adapted to coact with said plungers, a similar number of bars adapted to coact with said bell-crank levers, a pattern-chain, a plurality of lugs thereon adapted to actuate said bars, a sprocket-wheel about which said chain passes,

a ratchet-wheel secured to said sprocket-wheel, a pawl adapted to coact with said ratchet-wheel, a slide to which said pawl is secured, devices for engaging and disengaging said pawl with said ratchet-wheel, a lever to which said slide is secured, and means for actuating said lever.

10. In a knitting-machine, a cam-cylinder having a recess therein, a plurality of blocks located one above the other in said recess, a screw adjustably carried by each lower block and on which the next upper block is supported, a jam-nut for each screw, a spring interposed between the lowermost block and the bottom of said recess, a draw-cam carried by each block, and a lever engaging the uppermost block for simultaneously actuating said draw-cams.

11. In a knitting-machine, a cam-cylinder, three draw and tucking cams thereon arranged in series and in different planes, means for independently adjusting said draw-cams relatively to each other and means for simultaneously actuating said draw-cams.

12. In a knitting-machine, a cam-cylinder, a plurality of draw and tucking cams arranged one above the other, a plurality of star-wheels adapted to coact with said tucking-cams, a plurality of spring-pressed plungers adapted to coact with said star-wheels, a plurality of bell-crank levers adapted to coact with said plungers, a plurality of bars adapted to coact with said bell-crank levers, a pattern-chain, a plurality of lugs thereon adapted to actuate said bars, a sprocket-wheel around which said chain passes, a ratchet-wheel to which said sprocket is secured, a pawl adapted to coact with said ratchet-wheel, a shaft on which said wheels are mounted, a second ratchet-wheel loosely mounted thereon, a sprocket-wheel fixedly mounted thereon, a stop mechanism operated by said sprocket-wheel, a slide adapted to coact with said pawl, and means for actuating said slide.

13. In a knitting-machine, a cam-cylinder, three or more sets of draw and tucking cams arranged one above the other, a similar number of star-wheels adapted to coact with said tucking-cams, a similar number of plungers adapted to coact with said star-wheels, a similar number of bell-crank levers adapted to coact with said plungers, means for adjusting said levers relatively to said plungers and means for actuating said bell-crank levers.

14. In a knitting-machine, a needle-cylinder, needles of different lengths carried thereby, a cam-cylinder, three or more series of draw and tucking cams secured thereto in different planes and actuating said needles on the rotation of said cam-cylinder, means for actuating said tucking-cams, and means for simultaneously actuating said draw-cams.

15. In a knitting-machine, a needle-cylinder,

der, needles carried thereby, a cam-cylinder, three or more series of draw and tucking cams secured thereon in different planes for actuating said needles and means for independently adjusting said series of draw-cams, and means for simultaneously actuating said draw-cams.

16. In a knitting-machine, a cam-cylinder, a plurality of draw and tucking cams arranged thereon in different planes, a driving-shaft for rotating said cam-cylinder, an eccentric actuated by the rotation of the latter, a pawl actuated by said eccentric, a ratchet-wheel adapted to coact with said pawl, a sprocket-wheel secured to said ratchet-wheel, a chain adapted to coact with said sprocket-wheel, a stop-rod adapted to coact with said ratchet-wheel, a stud on the latter, a lever adapted to coact with said stud and normally held out of contact therewith, and a lug on said chain adapted to coact with said lever, and thus permit said pawl to actuate said ratchet-wheel.

17. In a knitting-machine, a cam-cylinder, a plurality of draw and tucking cams arranged thereon in different planes, a driving-shaft for rotating said cam-cylinder, an eccentric actuated by the rotation of the latter, a plurality of pawls adapted to be actuated by said eccentric, ratchet-wheels adapted to coact with said pawls, a stud on one of said ratchet-wheels, a lever adapted to coact therewith to begin the rotation of said ratchet-wheel, a stop-rod adapted to hold said pawl out of engagement with said ratchet-wheel and means on the latter for regulating the duration of said engagement.

18. In a knitting-machine, a cam-cylinder, three or more series of draw and tucking cams arranged thereon in different planes, a driving-shaft for rotating said cam-cylinder, an eccentric adapted to be actuated by the latter, a plurality of pawls adapted to be actuated by said eccentric, ratchet-wheels adapted to coact with said pawls, studs adjustably located on said ratchet-wheels, a plurality of levers adapted to coact with said pawls and said studs, a pattern-surface, lugs thereon, and means coacting with said lugs to actuate said tucking-cams.

19. In a knitting-machine, a cam-cylinder, a plurality of draw and tucking cams arranged thereon in different planes, a driving-shaft for rotating said cam-cylinder, an eccentric actuated by the rotation of the latter, a plurality of pawls adapted to be actuated by said eccentric, ratchet-wheels adapted to coact with said pawls, levers adapted to cause said pawls to engage with and be disengaged from said ratchet-wheels and adjustable means carried by the latter to regulate the duration of such engagement, a pattern-sur-

face, lugs thereon, and means coacting with said lugs to actuate said tucking-cams.

20. In a knitting-machine, a needle-cylinder, needles carried thereby, a cam-cylinder for actuating said needles, a passage in said cam-cylinder through which the needles may be inserted in said needle-cylinder and removed therefrom, said passage having its inner end beveled, a spring-pressed plug having a beveled end which engages said recess bevel and a thumb-piece for actuating said plug.

21. In a measuring device for knitting-machines, the combination of three or more tucking-cams, arranged in different planes, pattern means for controlling the tucking-cams, a drum rotated by its engagement with the fabric, a length-chain actuated by said drum, a lug on said chain, a lever actuated thereby and means coacting with said lever for controlling said pattern means.

22. In a knitting-machine, three or more tucking-cams arranged in different planes, a pattern-chain suitably actuated and adapted to operate the tucking-cams, a drum rotated by its contact with the fabric, gear-wheels to which the motion of said drum is imparted, a length-chain actuated thereby, a lug on said length-chain, a lever actuated thereby, a shaft rocked by said lever, a lever-arm actuated by said shaft, and a stop mechanism for controlling the movement of said pattern-chain, actuated by said arm.

23. The combination, in a knitting-machine, of tucking-needles movable either to the tucking or clearing position, pattern mechanism governing such movement of said tucking-needles, a pattern-wheel having a ratchet formation, a pawl for actuating said ratchet, means on the pattern-wheel for moving said pawl out of active position at successive points in the movement of the wheel, and means under control of the needle-governing pattern mechanism for starting movement of the pattern-wheel after it has been stopped by the action of such controlling devices.

24. A knitting-machine having three sets of tucking-needles with butts in different horizontal planes, and a corresponding set of lift-cams likewise disposed in different horizontal planes.

25. A knitting-machine having three sets of tucking-needles with butts in different horizontal planes, and a corresponding set of lift-cams likewise disposed in different horizontal planes and means for moving said lift-cams independently of each other.

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Witnesses:

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