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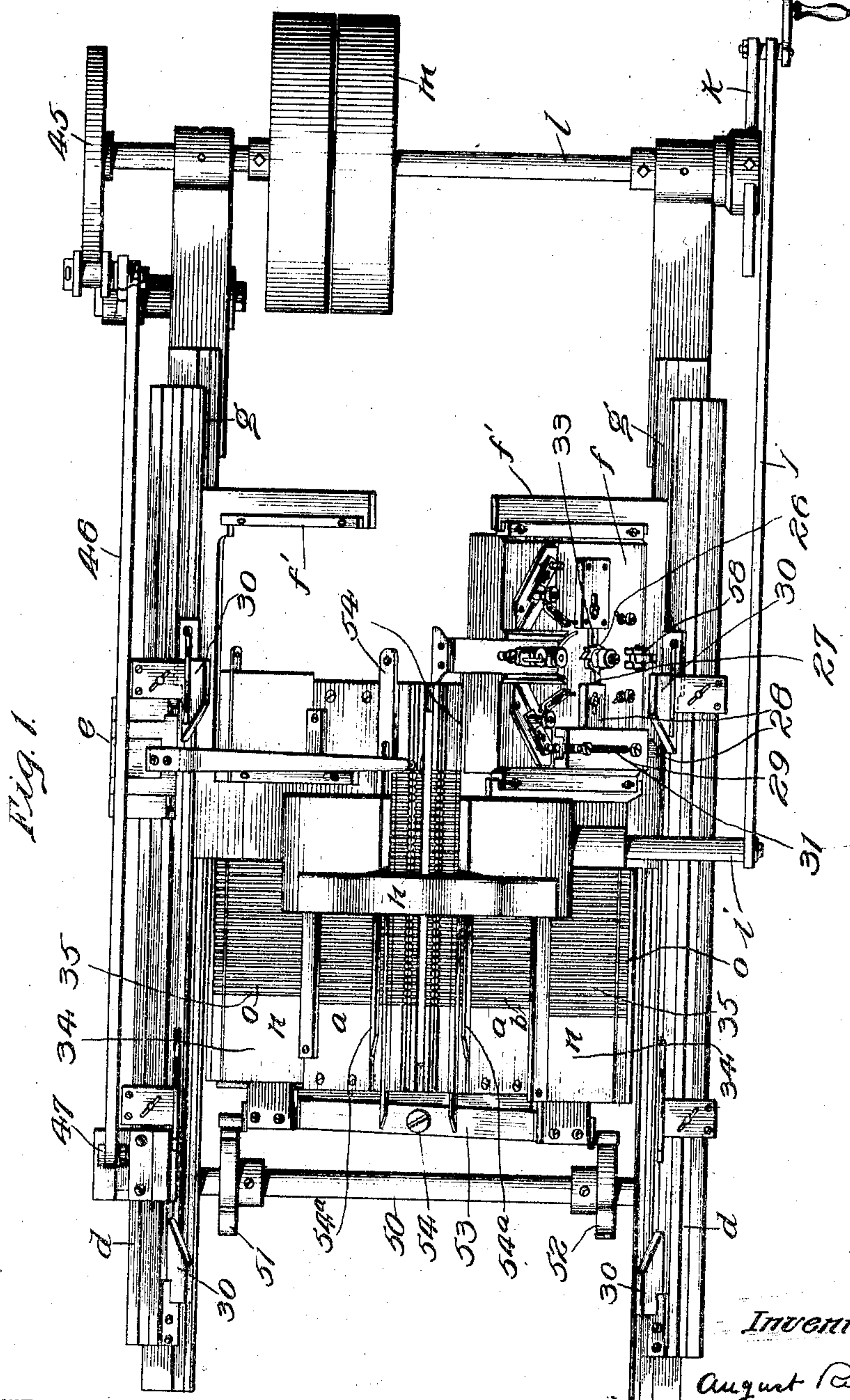
PATENTED APR. 16, 1907.

A. RIEFFEL & E. ITTERSHAGEN.

KNITTING MACHINE.

APPLICATION FILED JUNE 24, 1903.

7 SHEETS—SHEET 1.



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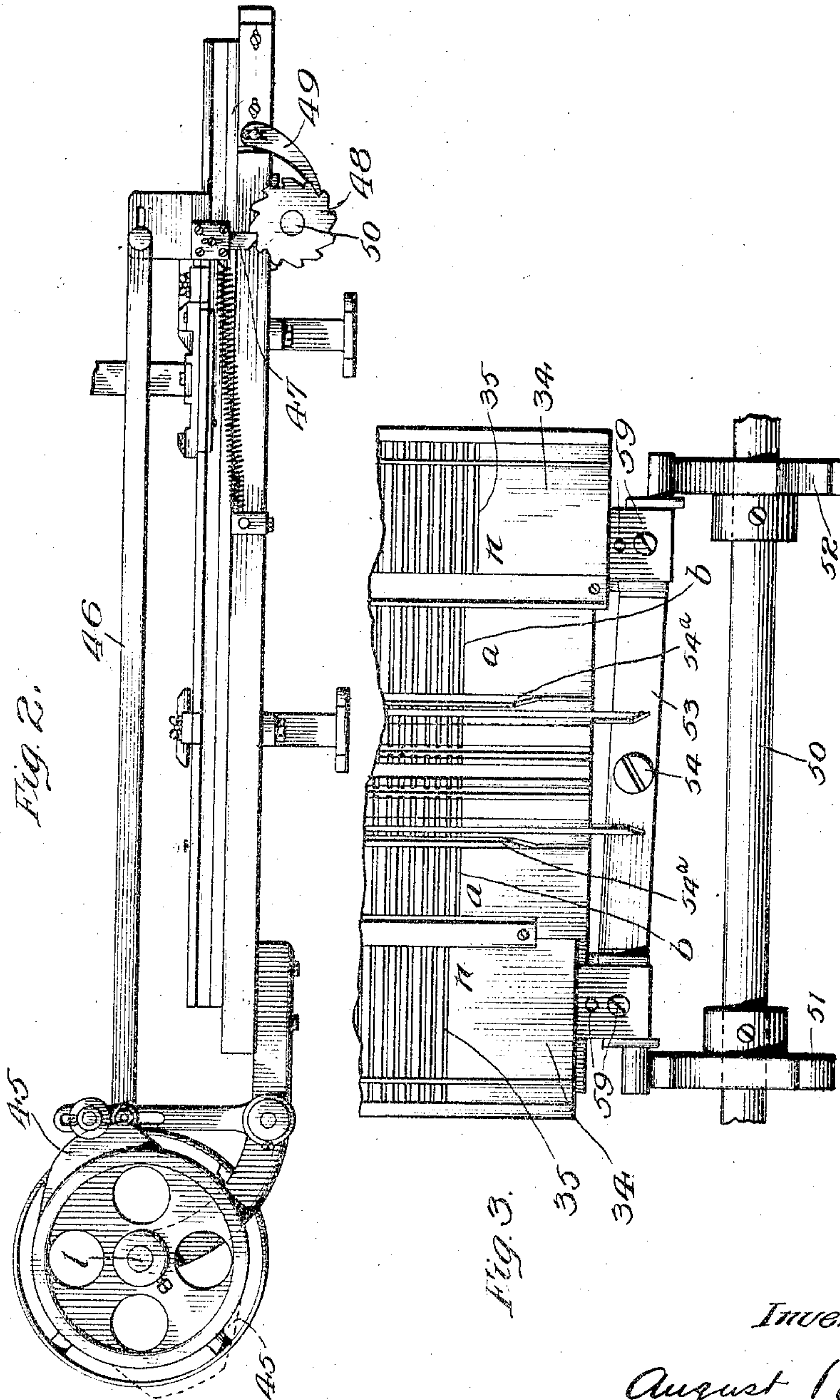
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7 SHEETS—SHEET 2.



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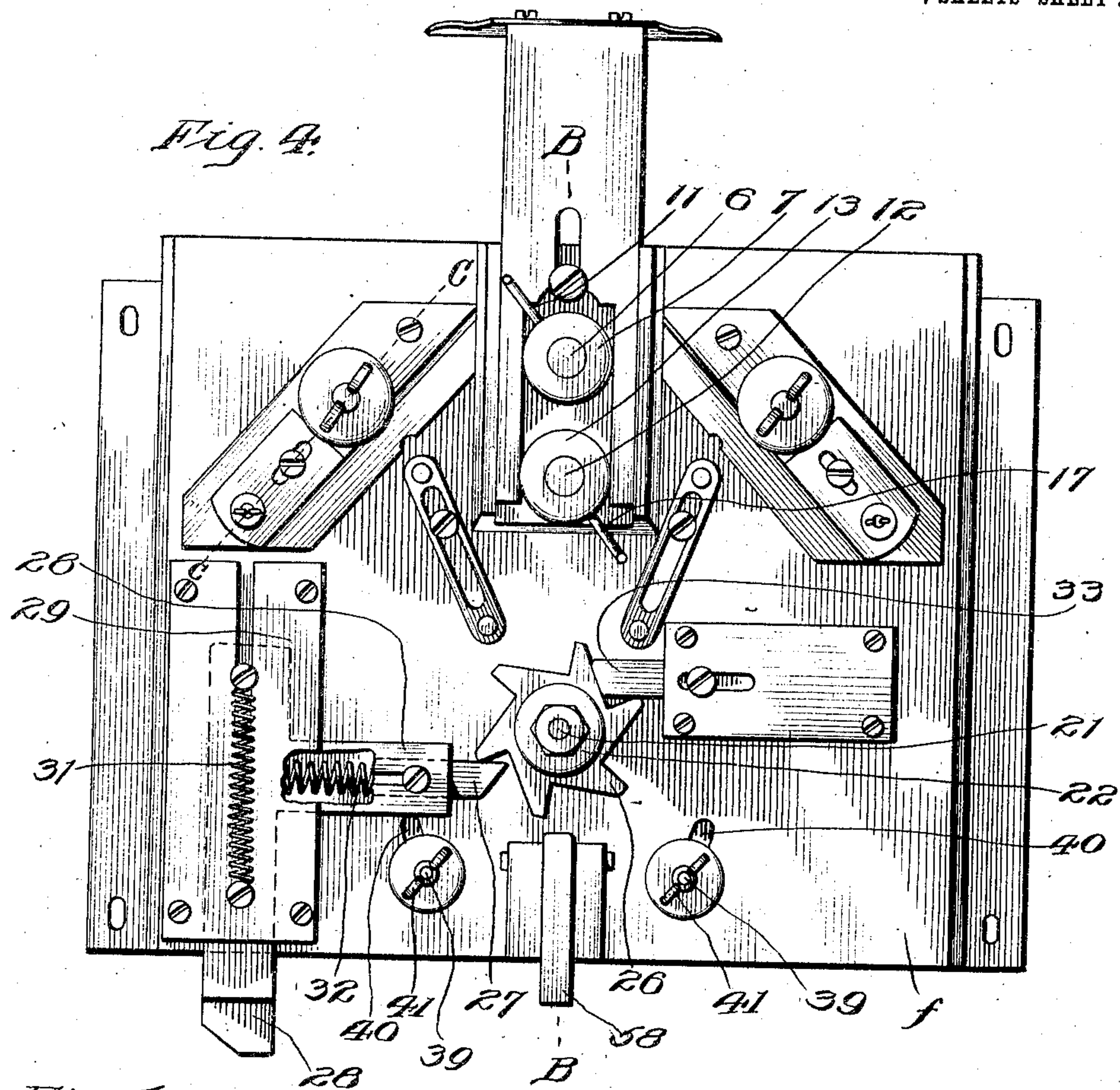
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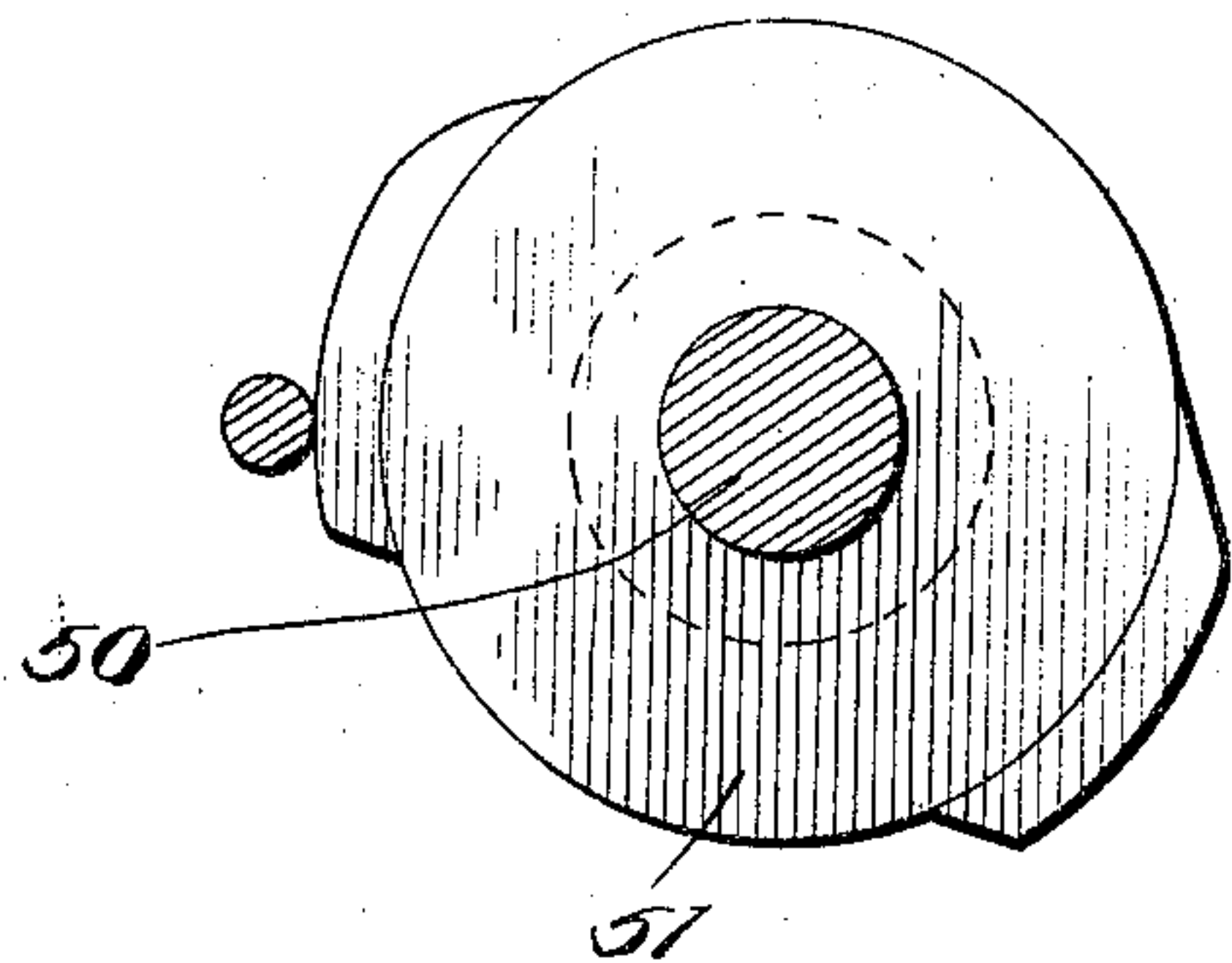
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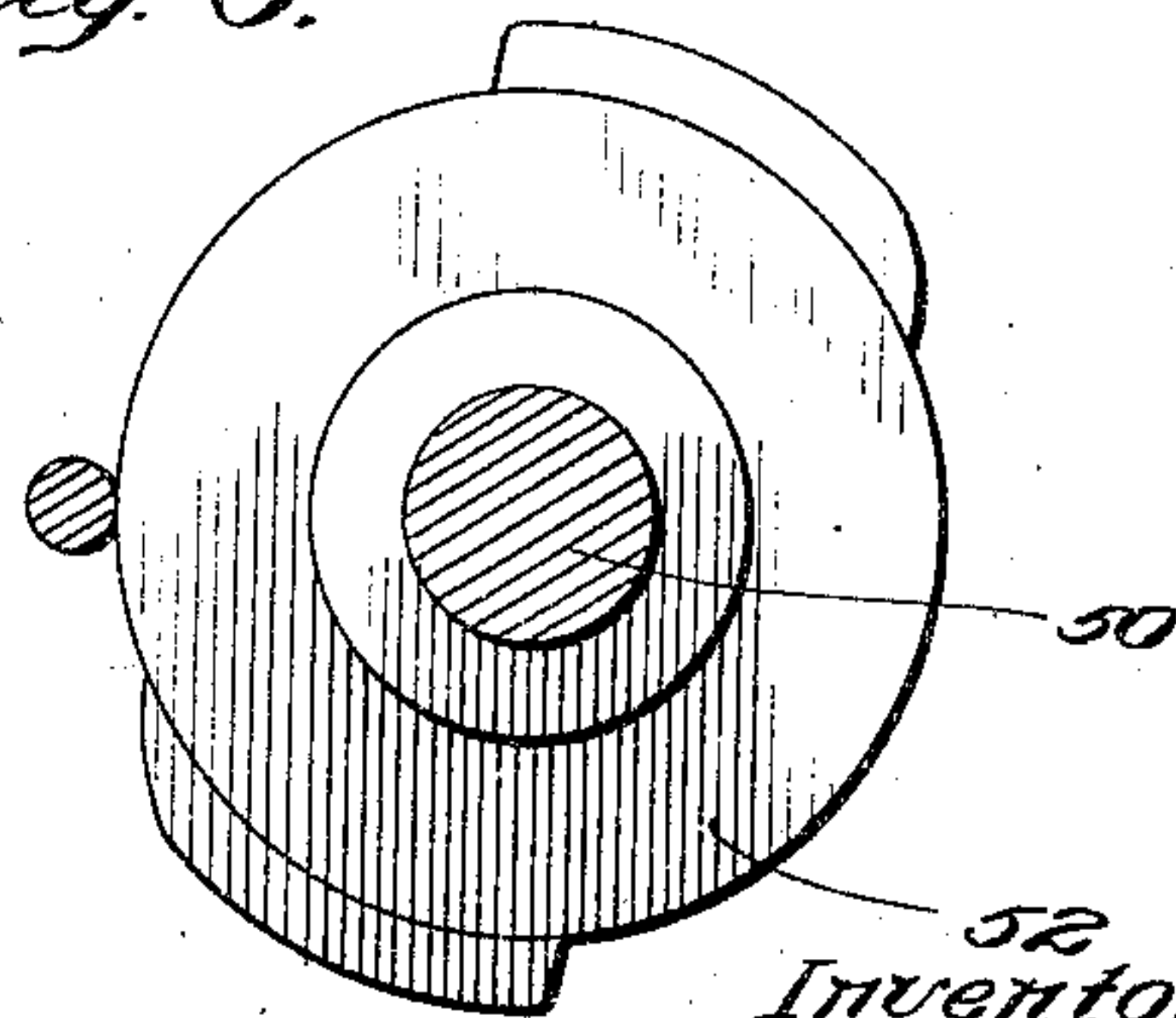
7 SHEETS—SHEET 3.



*Fig. 5.*



*Fig. 6.*



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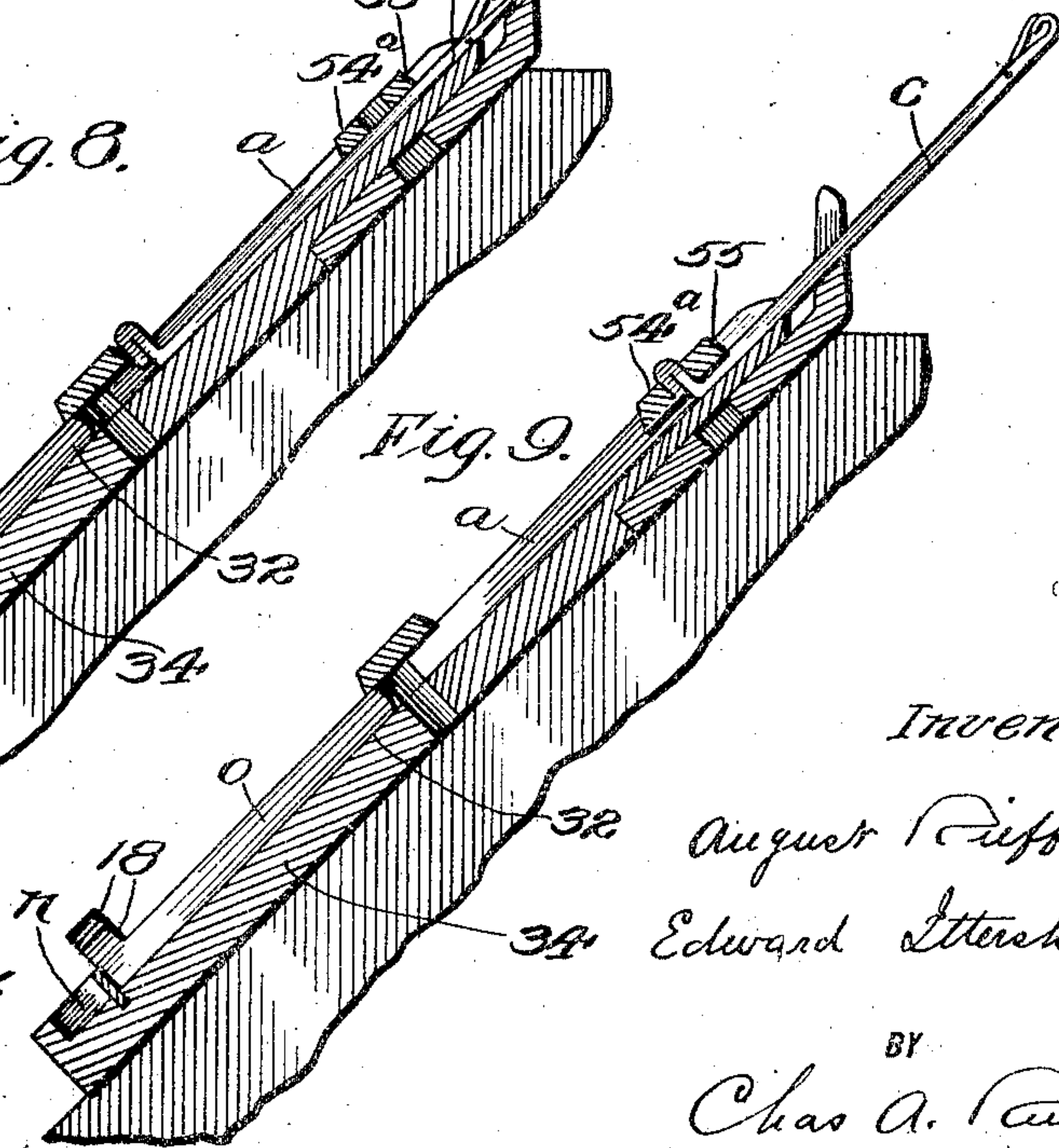
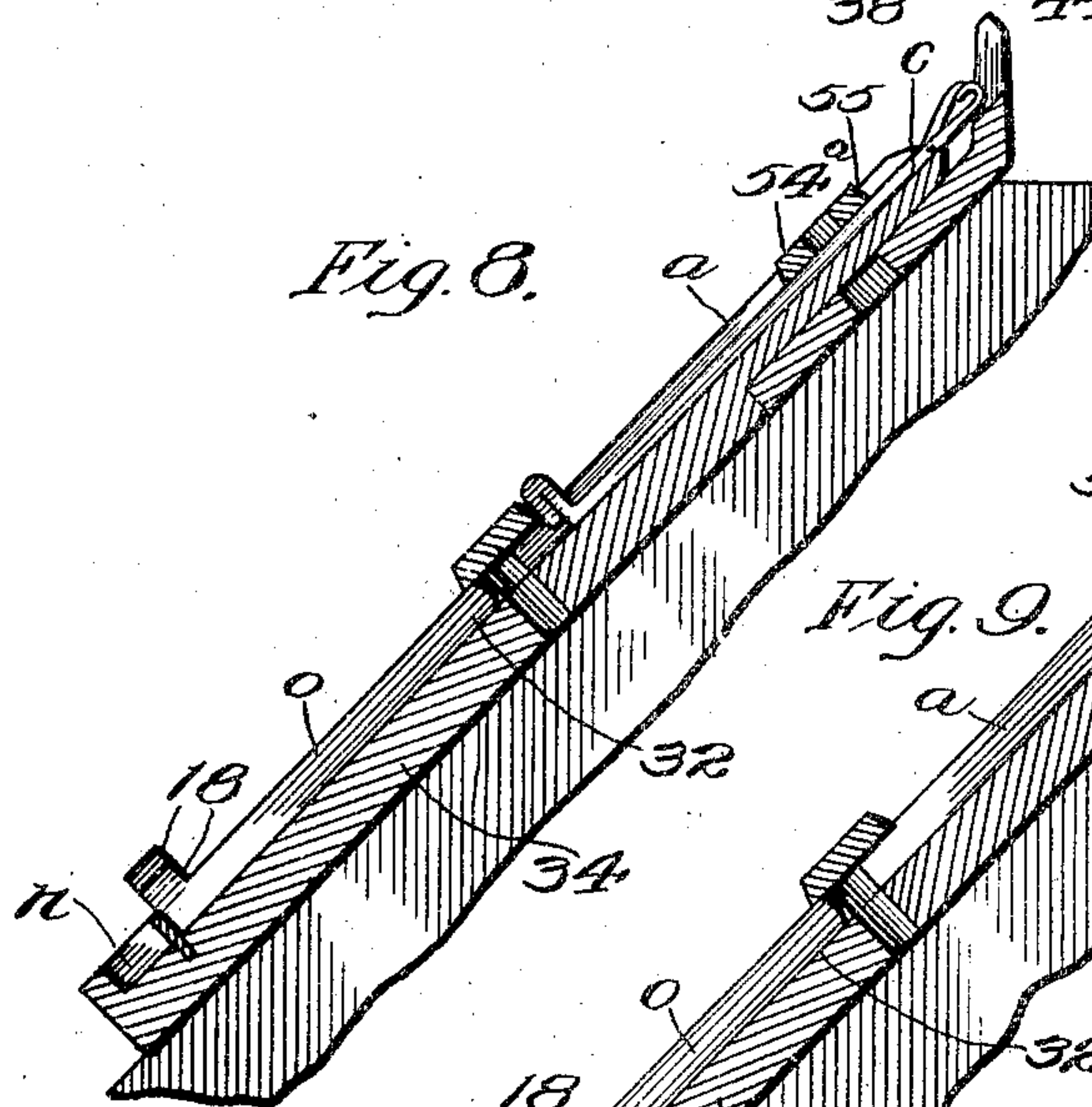
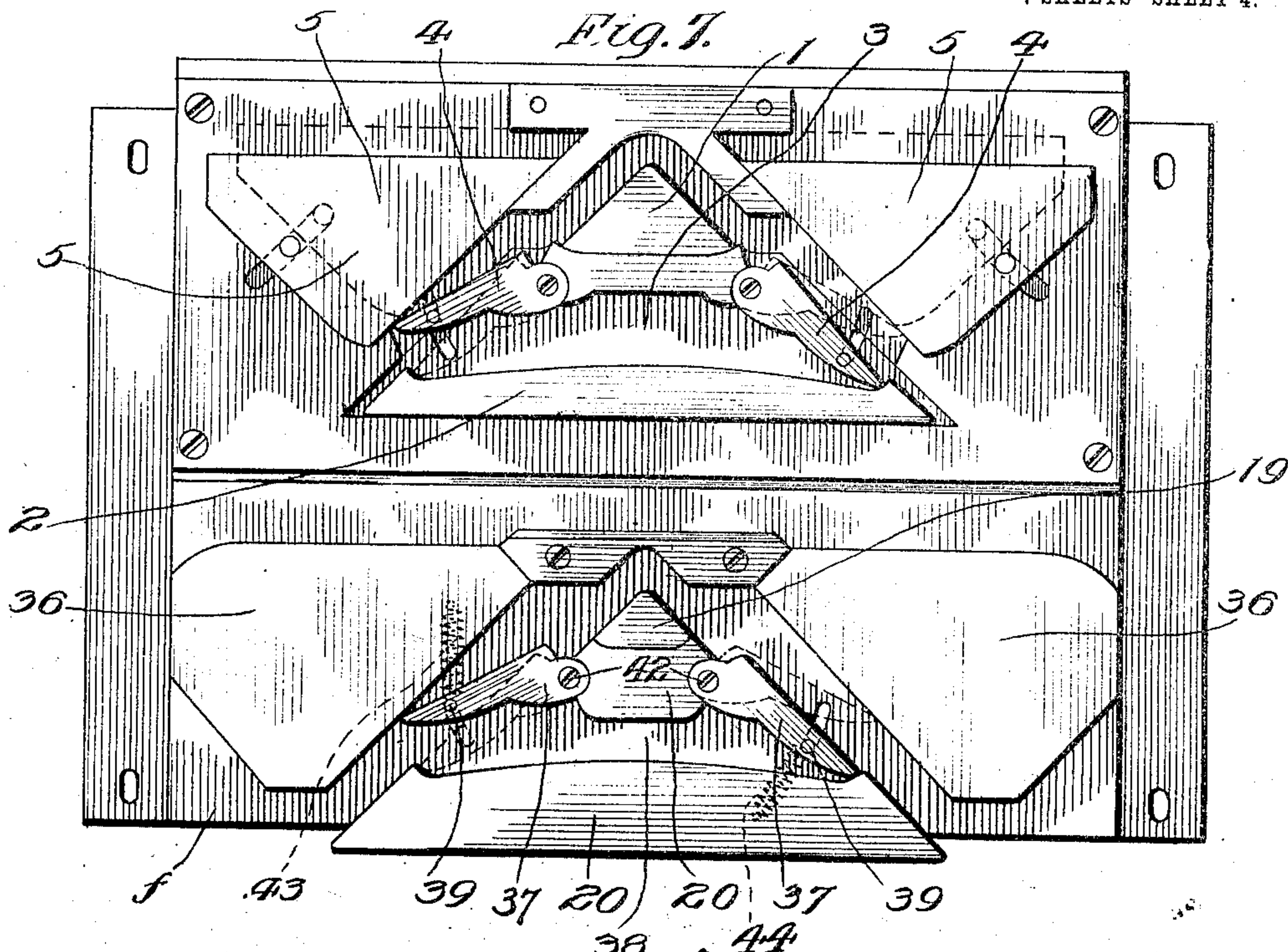
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7 SHEETS—SHEET 5.

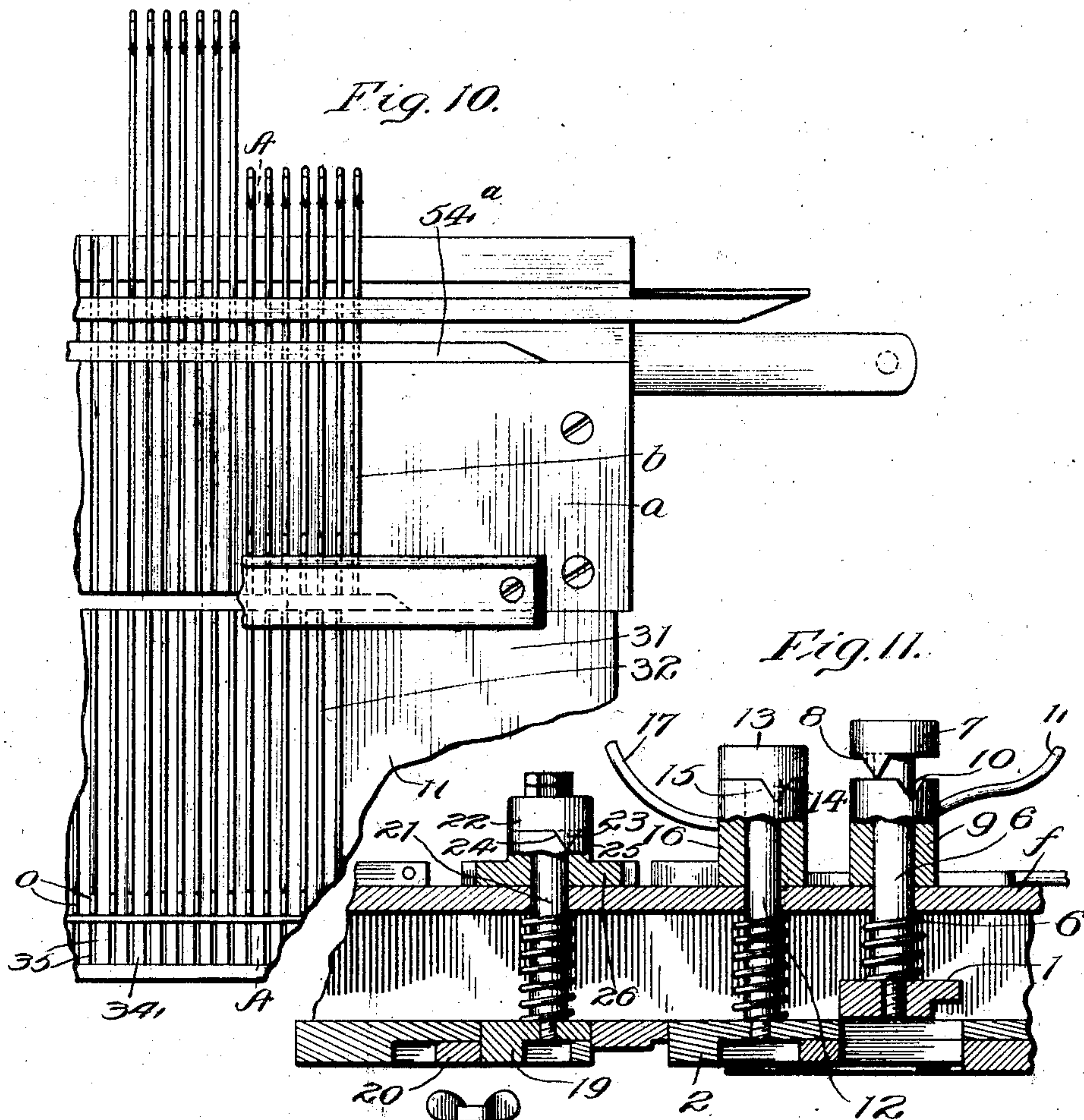


Fig. 12.

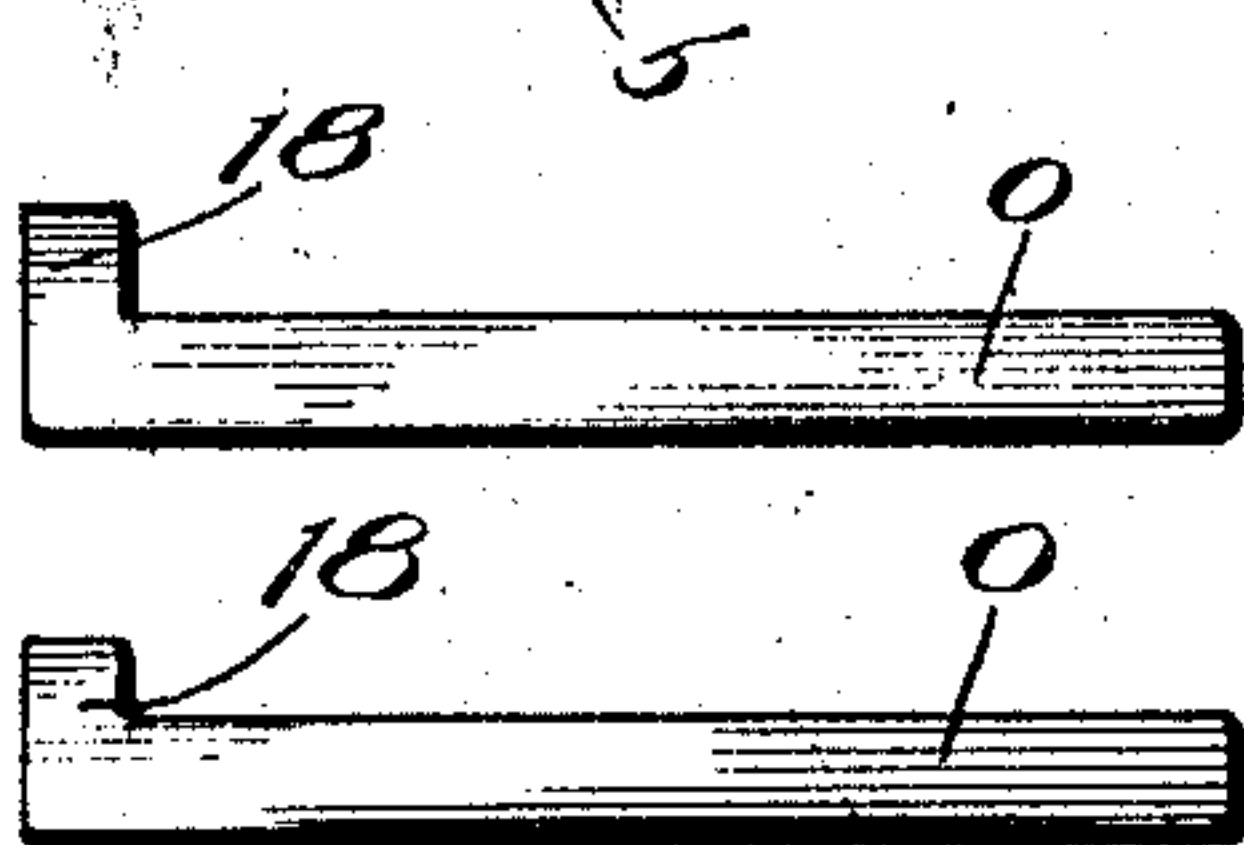
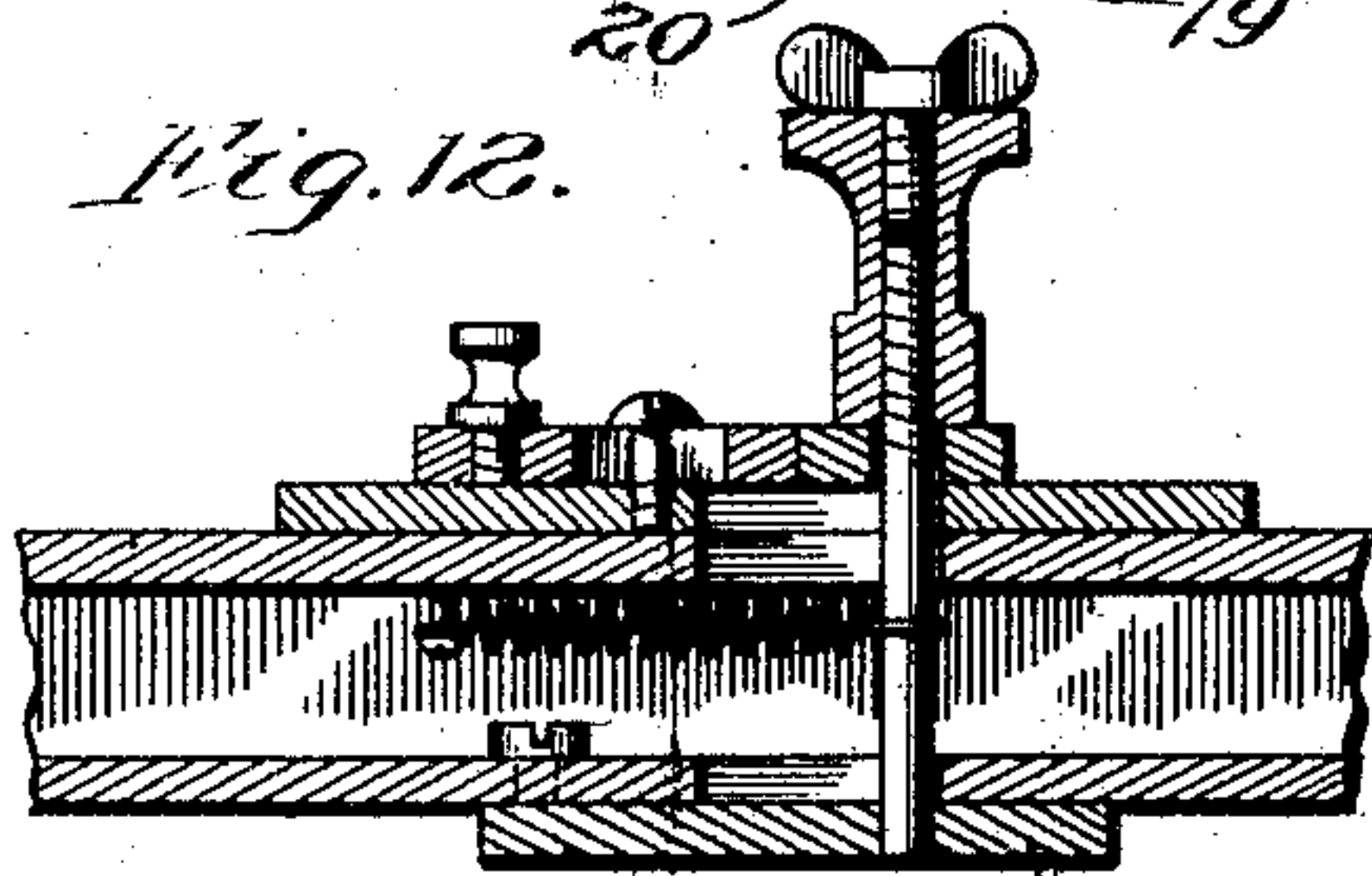


Fig. 13

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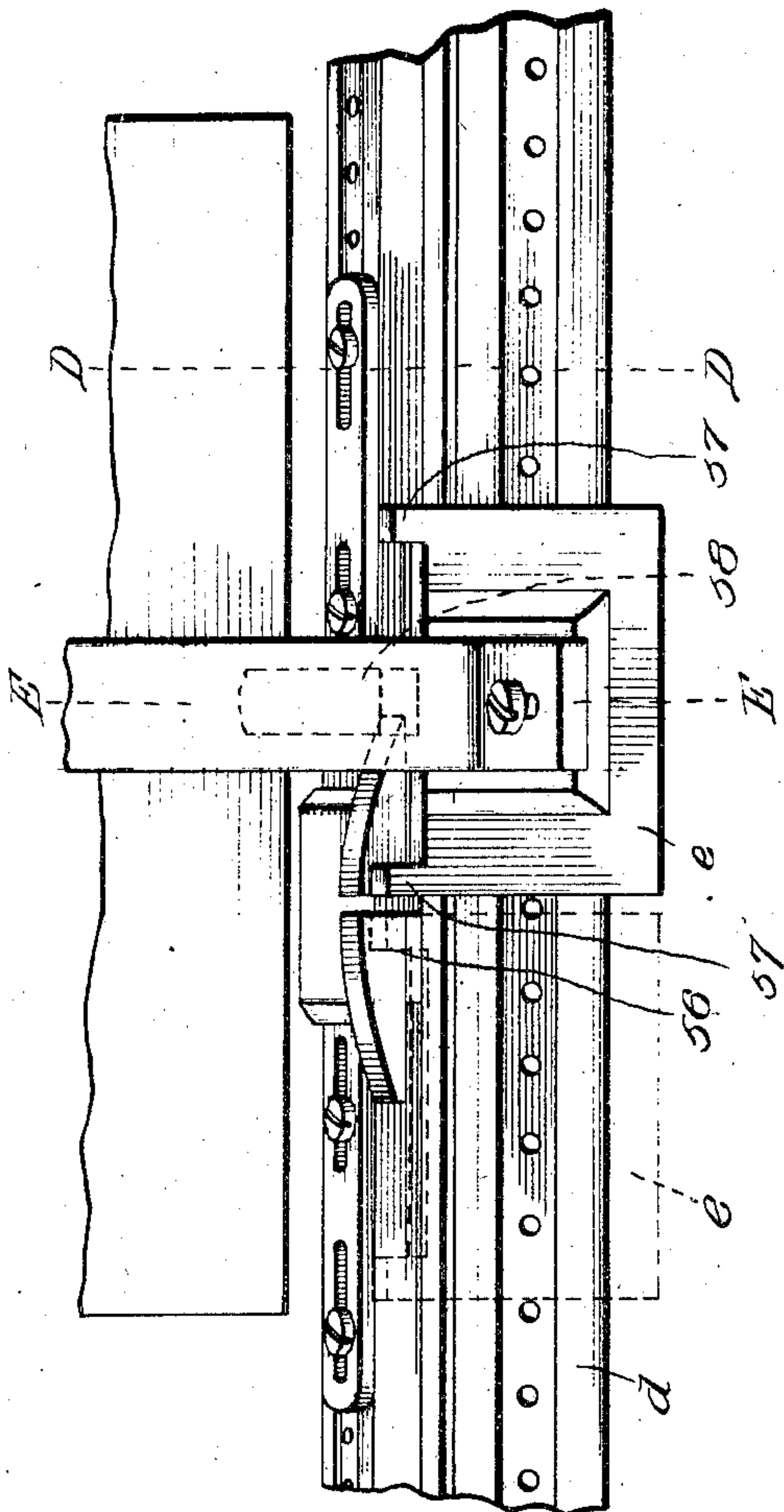
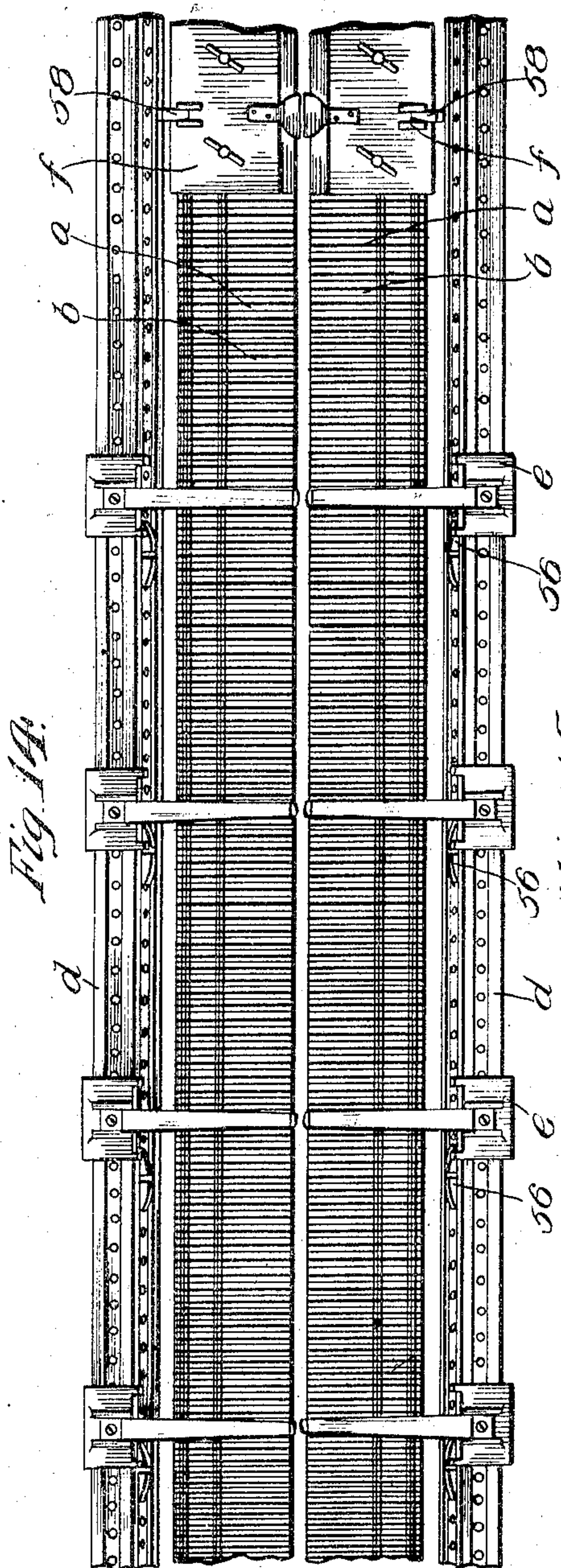
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APPLICATION FILED JUNE 24, 1903.

7 SHEETS—SHEET 8.



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7 SHEETS—SHEET 7.

Fig. 16

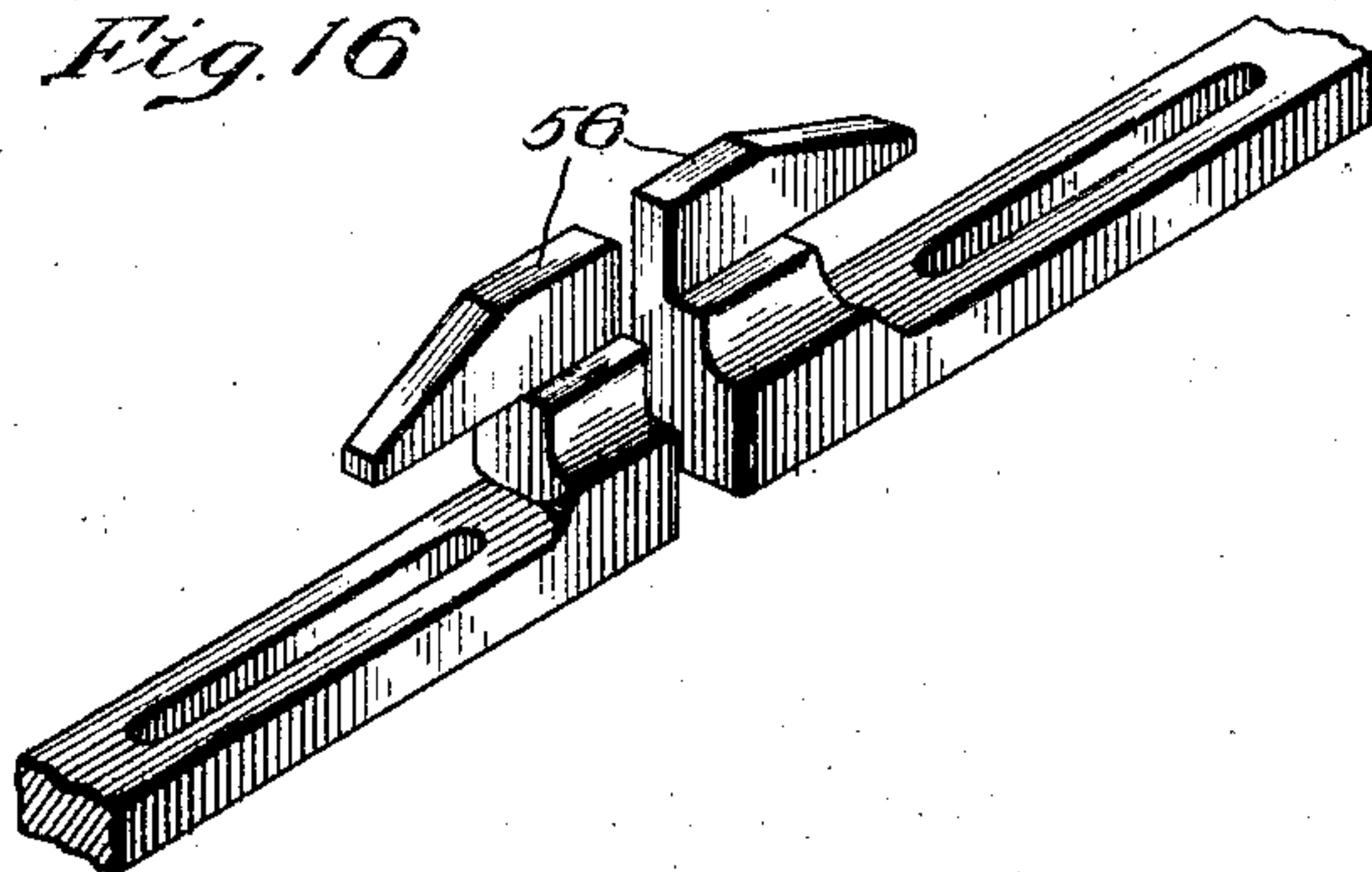


Fig. 17.

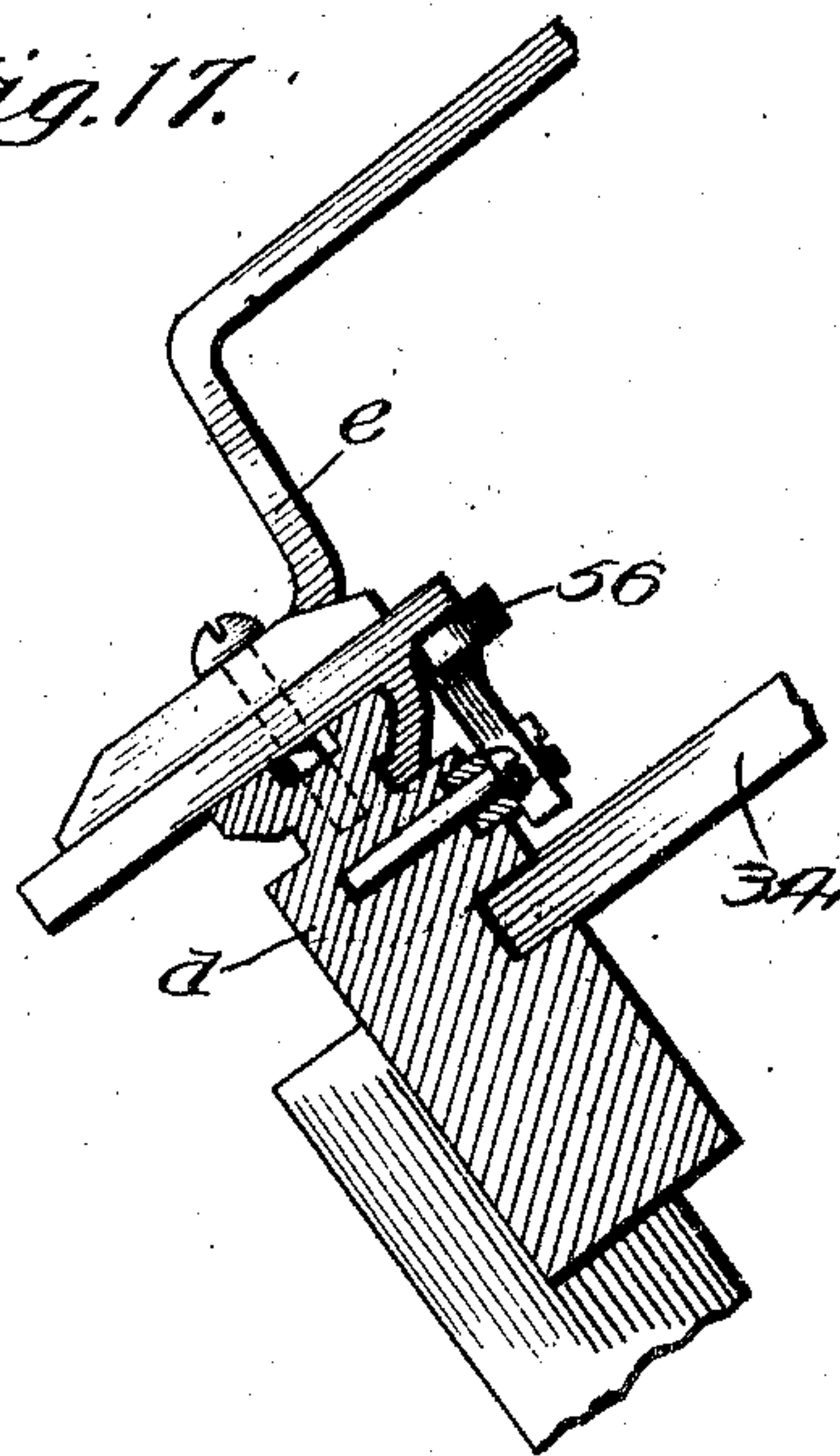
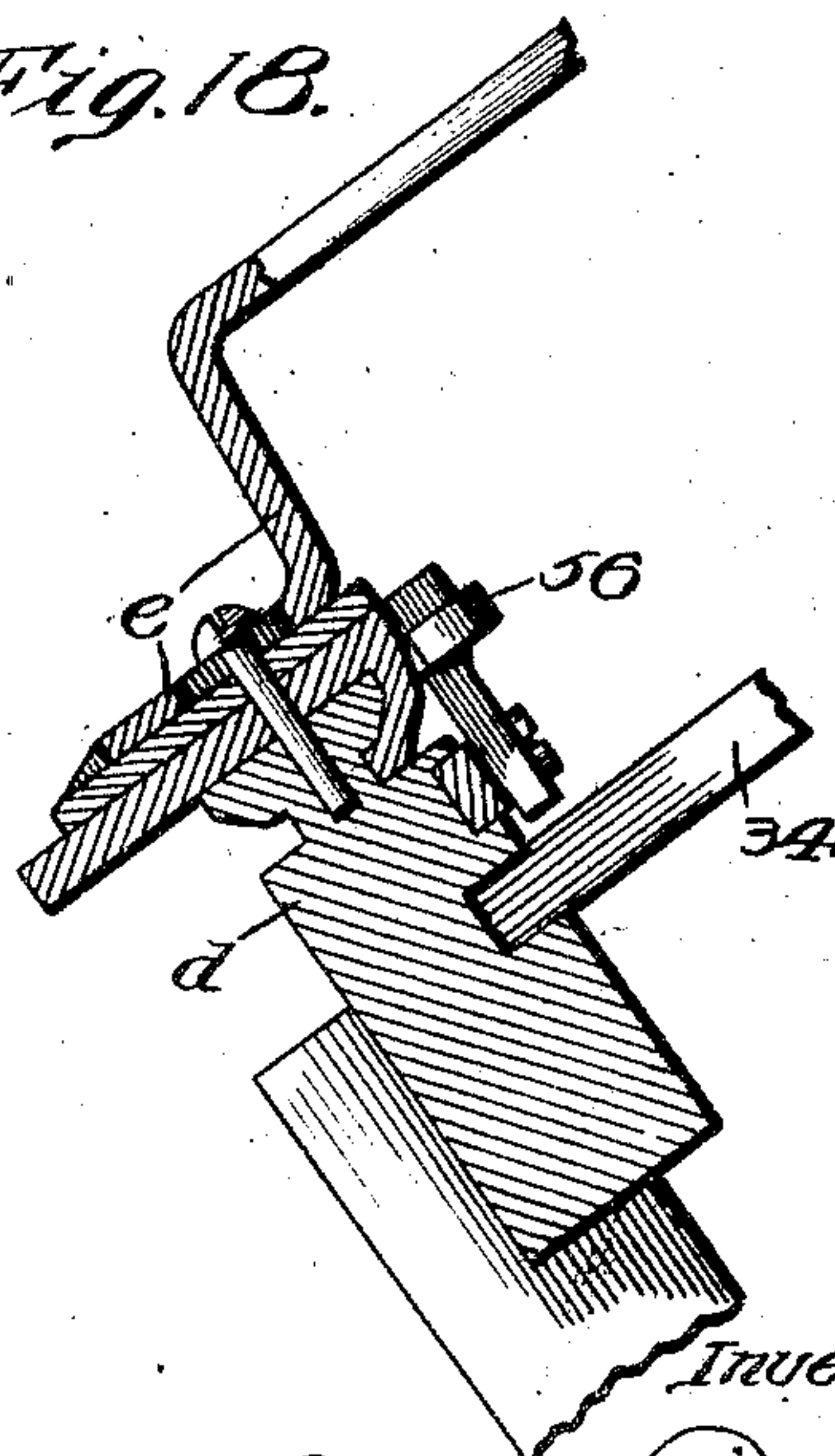


Fig. 18.



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# UNITED STATES PATENT OFFICE.

AUGUST RIEFFEL AND EDUARD ITTERSCHAGEN, OF PHILADELPHIA, PENNSYLVANIA; SAID ITTERSCHAGEN ASSIGNOR TO SAID RIEFFEL.

## KNITTING-MACHINE.

No. 850,786.

Specification of Letters Patent.

Patented April 16, 1907.

Application filed June 24, 1903. Serial No. 162,891.

*To all whom it may concern:*

Be it known that we, AUGUST RIEFFEL and EDUARD ITTERSCHAGEN, citizens of the United States, and residents of the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a specification.

Our invention relates to improvements in knitting-machines, and more particularly to improvements in double-plate or Lamb type knitting-machines; and the object of our invention is to furnish certain improvements in the construction and operation of such machines, as more fully described hereinafter.

In the accompanying drawings, forming part of this specification, and in which similar letters of reference indicate similar parts throughout the several views, Figure 1 is a plan of a knitting-machine embodying our improvements; Fig. 2, a side elevation of Fig. 1; Fig. 3, a plan, upon an enlarged scale, of part of the left end of Fig. 1; Fig. 4, a plan of the top of one of the reciprocating needle-cam-carrying plates; Figs. 5 and 6, side elevations of cams for operating the movable needle-jack-carrying plates; Fig. 7, a plan of the bottom of the reciprocating needle-cam-carrying plates, showing the cams; Figs. 8 and 9, a section through the needle and needle-operating-jack-carrying beds on line A A, Fig. 10, the former showing the needle withdrawn and the latter the needle extended; Fig. 10, an enlarged plan showing parts of the needle and jack beds and means for holding certain of the needles out of operative action; Fig. 11, a section of Fig. 4 on line B B; Fig. 12, a section of Fig. 4 on line C C; Fig. 13, side elevations of jacks with long and short heels; Fig. 14, a plan showing the machine arranged in multiple—that is, a long plate or a number of short plates placed end to end, each section of which forms a separate operative machine having its own yarn-carriers, all of the sections or machines having one common cam-carrying plate; Fig. 15, an enlarged plan of part of frame, showing improved arrangement of cams for operating stop that operates thread-carriers; Fig. 16, a perspective view of cams for operating thread-carrier-actuating stop; Figs. 17 and 18, sections of Fig. 15, the former on line D D, the latter on line E E.

*a* are the needle-beds of a double-plate knitting-machine, which are furnished with the usual transverse slots *b* for carrying the needles *c*.

*d d* are parallel guides for carrying the thread-carrier slides *e* and thread-carriers, also of the usual construction. In Fig. 1 but one thread-carrier guide and thread-carrier is shown in order to promote clearness.

*f* are cam-carrying plates carried by frames *f'*, which travel in suitable guides *g* on or forming part of guides *d d*.

*h* is an arch or connection joining the upper ends of frames *f'*. But one plate *f* is shown in Fig. 1. Either one or both of the cam-carrying plates *f* carry a stud *i*, Fig. 1, to which one end of a connecting-rod *j* is attached, the other end of this rod being carried by a crank *k*, which is carried by a shaft *l*, which may be driven by pulleys *m* or otherwise from any convenient source of power. The revolutions of shaft *l*, through the connections shown, cause the cam-plates and the parts connected therewith to reciprocate across the needle-beds *a*.

*n* are longitudinally-movable jack-beds carrying needle-operating jacks *o*, which are movable transversely of beds *n* and which are adapted to elevate the needles *c*, as presently described.

The cam-carrying plates *f* are furnished with two sets of cams, one for operating the needles *c* directly, the other for operating the needles through the jacks *o*. The needle-operating cams may be thrown into or out of action at will, and the same may be done with the jack-operating cams, although when the latter are in use the cam or cams of the needle-operating set that serve to draw the needles into the beds are used in connection with them, the jacks operating only to elevate the needles. In Figs. 4, 7, 11, and 12 the cam-plates and details thereof are shown.

The needle elevating, rising, or central part of the cam, Fig. 7, is constructed of an upper portion 1 and a lower portion 2. These parts are together or independently movable into and out of the plane of the needle-butts. When in operative position or lowered, they engage the heels of the needles, elevating them. When raised, they pass over without engaging the needles. If the upper portion 1 be alone raised, the needles



will be only partially raised, forming a tuck instead of a full stitch. The lower part 2 of the rising cam is furnished with a passage 3, Fig. 7, the ends of which can be closed by latches 4. By opening one of these latches the needles will make a full stitch upon one side only upon one pass of the cam-plate, the needles passing through the passage 3 upon the opposite pass, making no stitch. When the opposite latch upon the other cam-plate is opened, this action will be reversed and the machine will knit a round fabric. When both latches are opened on one cam-plate, the needles upon that side of the machine will remain idle and a flat fabric will be knitted by the other side of the machine.

5 are stitch-cams, which can be moved in or out as may be necessary to lengthen or shorten the stitch. The means for carrying these cams is shown in Fig. 12. They are well known and will not need detailed description. The upper part 1 of the rising cam is carried upon a stem 6, Figs. 4 and 11, which passes up through the cam-plate *f* and the top of which carries a collar 7, which is furnished with a lug or tooth 8.

9 is a sleeve surrounding stud 6 below collar 7, furnished with a notch 10, into which tooth 8 can pass.

11, Fig. 4, is a thumb-piece or lever by means of which collar 9 may be turned to cause the notch 10 to engage or disengage tooth 8 to lower or lift stem 6 to place the part 1 of the cam into or out of operative position. When cam 1 is lifted, the needles will form a tuck-stitch. When this cam is lowered, they will form a full stitch, as before stated.

The part 2 of the cam is carried upon a stem 12, passing through plate *f*, which is furnished with a collar 13, carrying a tooth 14, adapted to engage a notch 15 in a sleeve 16, which can be turned by a thumb-piece or lever 17, Figs. 4 and 11, to raise the stem and the piece 2 precisely as the piece 1 is raised. The piece 2 being raised, the rising cam can be reciprocated back and forth without in any way affecting or operating the needles. Before raising the piece 2 the latches 4 are thrown up against the part 5 and are held in this position until the piece 2 is lowered.

The jacks *o* are operated by cams carried by the lower end of the plate *f*. The needles are lifted for full and tuck stitches by the jacks passing over the entire raising-cam or over only a portion of this cam, the top or point of the cam being adapted to be moved up, so that it will be out of contact with the heels on the jacks, or at least with certain of the heels that are shorter than others. Side elevations of the jacks are shown in Fig. 13, the heel 18 upon one of the jacks being only about one-half the height of the heel 18 upon the other one.

The jack rising cam is constructed in two

pieces—a movable piece 19, Figs. 7 and 11, and a stationary piece 20, shown in the same figures. The piece 19 is carried by a stem 21, Fig. 11, passing up through plate *f* and carrying upon its top a collar 22, which is furnished with downwardly-projecting teeth 23, adapted when the cam is down to rest in corresponding notches 24 in the hub 25 of a ratchet-wheel 26. The collar 22 is fast upon stem 21, and upon the rotation of the ratchet-wheel the stem and the upper part 19 of the rising cam are lifted or lowered, depending upon whether the tooth 23 rests upon the top of the hub 25 or in the notch 24 in the hub.

The ratchet-wheel 26, attached to hub 25, is rotated automatically by a pawl 27, Fig. 4, which is carried by an arm 28, which is carried by and is longitudinally movable in a case 29, carried by the cam-plate *f*. The arm 28 is adapted upon the movement of the cam-plate to engage a cam or cams 30, Fig. 1, which are carried by the guides or frame *d* of the machine. One or more cams 30 may be used, placed upon the guides *d* so as to engage arm 28 at or near the ends of the stroke of the cam-plate *f*. When the arm 28 engages a cam 30, it is raised, the pawl 27 engaging one of the teeth of ratchet 26, rotating it one step. 31 is a spring for returning arm 28 and connected parts to their normal or lowered position. The pawl 27 is normally held in engagement with ratchet 26 by a spring 32, Fig. 4, which permits the retraction of the pawl 27 upon the lowering of arm 28; but any other of the well-known arrangements for a fast and loose pawl may be used. 33 is a detent arranged in any well-known manner to prevent a backward movement of ratchet 26.

As the cam-plate *f* is reciprocated back and forth across the needle-bed the arm 28 is engaged and lifted by cams 30. Each time that it is lifted it causes pawl 27 to engage and move the ratchet-wheel one step, and as this wheel is rotated it causes the notches 24 to engage or disengage the teeth 23. The engagement or disengagement of the teeth 23 and notches 24 causes the upper part 19 of the jack rising cam to be raised or lowered, and the number of times that the arm is lifted, the amount that the ratchet 26 is turned, or the number of notches 24 that the hub 25 carries determines the number of times that the part 19 will be raised and lowered during a given movement of the cam-plate.

The jacks *o*, operated by cam 19 20, work in a bed *n*, which is furnished with grooves 35, which are spaced as are the grooves *b* in the needle-bed *a*. The upper ends of the jacks *o* are adapted when operated by rising cam 19 20 to engage and elevate the needles *c* as would the needle rising cam 1 2. It will be understood that when the jack-cam 19 20 is in operation that the needle-cam 1 2 is preferably out of action, and vice versa.

The heels 18 upon the jacks *o* are some of



one height and some of another. When the part 19 of the jack-raising cam is lowered, all of the heels of the jacks, both long and short ones, will pass completely over cam 19 20, elevating the needles *c* to their full height; but when the part 19 is raised the jacks with long heels only will be engaged by both the parts 19 20 of the rising-cam, the jacks with short heels being raised by the part 20 of the cam only, passing across the top of this part and over the part 19 without engaging it. It will thus be seen that by means of the long and short heeled jacks and the movable cams and latches tuck-stitches can be made on either round or flat work by each reciprocation of the cam-plate.

36, Fig. 7, are the cams for returning the jacks to their lowest positions after having been elevated by cam 19 20. The jacks are not attached to the needles, and these latter are at all times lowered by the cams 5 of the upper set of cams.

The jack-operating cam 19 20 carries latches 37, either one or both of which may be opened. If both latches 37 be opened, the heels of the jacks will pass upon both strokes of the cam-plate through the passage 38, and the jacks will be inoperative. If but one of the latches be open, the jacks will upon one stroke of the cam-plate be elevated and upon the other stroke will pass through passage 38 without being elevated. The latches 37 are carried upon stems 39, Fig. 4, which pass through slots 40 in cam carrying-plate *f*. 41 are nuts by means of which stems 39 may be locked at the upper or lower end of slots 40, as may be necessary to hold latches 37 opened or closed. The latches 37 are pivotally secured at 42. 43 is a spring for normally holding one of the latches 37 open, and 44 a spring for holding the other latch normally closed. The latches may be used with or without these springs, or the operations of the springs may be reversed so as to hold the latch shown closed open and that shown open closed. When arranged as shown in the drawings, the jacks are operated upon one pass of the cams and are idle upon the opposite pass.

The jack-beds 34 are longitudinally movable with respect to the needle-beds *a*, and by a different arrangement of the jacks with long and short heels by arranging the cams 19 20 to make full, tuck, or miss stitches and by moving the jack-bed in or out, so that the jacks will at different times engage different needles, the machine will work different patterns, as may have been predetermined. The jack-beds are operated by an automatic device, as follows: 45, Figs. 1 and 2, is a cam upon the driving-shaft 1 of the machine, which upon its revolution engages and moves an arm 46, upon the far end of which is a pawl 47, which engages with a ratchet-wheel 48, furnished with a detent 49 to prevent a

backward movement. Upon the shaft 50 of ratchet-wheel 48 are cams 51 52, Figs. 1, 3, 5, and 6, which are adapted to engage one end of a lever 53, the other the other end of this lever, which is itself pivoted at its center 54. The ends of the lever 53 are attached one to the needle-jack-carrying bed upon one side of the machine, the other to the needle-jack-carrying bed upon the other side of the machine, and as the cams 51 52 alternately move the opposite ends of the lever 53 in and out the jack-beds are moved in and out with them. The device may be adjusted so as to move the jack-beds one or more spaces. If moved one space, the same jacks will operate first one needle and then the next needle; if two spaces, first one needle and then the next needle but one, and so on. The movement of the jack-beds is timed to take place when the cam-plate is at the end of its stroke and the cams out of contact with the needles or jacks. The cams or jacks may be arranged to cause the needles upon each side of the machine to knit the same or different patterns. One jack-bed may remain idle while the other works. The jack-operating cams may raise the needles upon one side of the machine and the needle-cams the needles upon the other side of the machine, or the needles upon both sides may be all operated by the jacks and jack-cams or all by the needle-cams, thus permitting a great number of patterns to be made upon the machine by simply adjusting the operating-cams or the throw of the jack-bed, or both. The jack-beds 34 are secured to the rocking lever 53 by screws 59. By removing these screws the jack-beds upon one or both sides of the machine may be thrown out of action.

54<sup>a</sup>, Figs. 1, 3, 8, 9, and 10, is a bifurcated slide carried in a groove 55 in the upper part of the needle-beds *a* and at right angles to the grooves which carry the needles. If certain of the needles are not required in knitting a fabric, they are moved up in their grooves in the needle-bed until their heels are opposite the groove 55; but prior to this moving the slide 54<sup>a</sup> has been withdrawn from the groove 55. The heels of all of the needles that are to be out of action being opposite the groove 55, the slide 54<sup>a</sup> is pushed back in the slide, whereupon the heels of the needles will pass up through the bifurcation in the slide, as shown in Fig. 9, and the needles thus engaged will be held in an inoperative position until the slide is withdrawn to release them.

The machine is adapted for knitting either a straight or a round, or a wide, or a narrow fabric, or a combination of these fabrics—for instance, the hand of a glove and the fingers. The cams upon one side of the machine may be arranged to knit a fancy and upon the other side a plain fabric, as might be required for the back and inside part of a glove. In fact, an almost endless number of combi-



nations may be made by using the several cams and movable jack-carrying bed. If the needle and jack beds be made of great length, as shown in skeleton in Fig. 14, and furnished with a number of thread-carriers *e*, a single pair of cam-carrying plates *ff* may be reciprocated across the beds, and a number of articles can be knitted at one time.

In constructions of this nature it has heretofore been the practice to have stationary stops upon the tops of the side rails *d d* for limiting the travel of the thread-carrier guides *e*, which slide upon the rails, and in long machines the aggregate of these stops each being necessarily of some width restricts the production of the machine. In order to overcome this objection, we secure the thread-carrier guides to the rails *d*, so that they will slide freely thereon, but will have at the same time sufficient friction to bring them to an immediate stop when the actuating power is relieved. Hence no permanent or separate stop is required and the slides can travel until they engage each other, thus increasing the capacity of the machine by the aggregate width of the several permanent stops usually used.

The thread-carrier slide *e* is furnished with shoulders 57 on its inner side, one at each end, which are adapted to be engaged by a stop 58, Figs. 1, 4, 14, and 15, carried by the cam-plate *f*, this stop being pivoted in the usual manner to the cam-plate and being adapted to engage one of the shoulders 57 upon one stroke of the cam-plate and the other shoulder upon the other stroke. 56 are cams secured upon the inside of the rails *d* in such a manner that the thread-carriers can pass without engaging them, but which as the cam-plates *f* pass them engage and lift the stop 58 clear of the shoulders 57, permitting the thread-carrier which it has been driving to come to rest. The driven thread-carrier (represented by dotted lines in Fig. 15) engages or almost engages the one next to it, and the cam 56 is so arranged that the stop 58 is carried onto this next thread-carrier, which it engages and moves along as it did the first. Upon the reverse motion of the cam-plate the action of these several parts is repeated.

The cam-plates *f* are removably carried by the frames *f'*. This construction is particularly valuable in the form of machine shown in Fig. 1, for should any accident happen which would cause the cam-plate or its carrying-frame to stick or jam at any point of its travel the cause of the trouble may be found by simply removing the cam-plate *f* from the frame *f'*, which gives free access to the needles and jacks beneath the cam-plate without the necessity of further dismantling the machine.

Having thus described our invention, we

claim as new and desire to secure by Letters Patent—

1. In a knitting-machine, in combination, a needle-bed, a movable jack-bed, needles carried by said needle-bed, jacks carried by said jack-bed, a cam-carrying plate adapted to be reciprocated across said needle and jack beds, and two sets of cams carried by said cam-plate one set adapted to operate said needles and the other said jacks.

2. In a knitting-machine, in combination, a needle-bed, a movable jack-bed, needles carried by said needle-bed, jacks carried by said jack-bed, a cam-carrying plate adapted to be reciprocated across said needle-bed, two sets of cams carried by said cam-carrying plate, one set adapted to operate the needles directly, the other to operate the needles through the jacks, and means whereby either or both sets of cams may be thrown into or out of operative action.

3. In a knitting-machine, in combination, a bed one portion of which is stationary and the other movable, needles carried by one portion of said bed, jacks carried by the other portion of said bed, means for actuating said needles directly and means for actuating said needles through said jacks.

4. The combination in a knitting-machine of a horizontal rising cam formed in two pieces, the upper part, or apex, of which is vertically movable in relation to the lower part or base, means for automatically lifting and for automatically lowering the movable part of said cam at predetermined intervals, needles, jacks operated by said raising-cam, adapted to engage and lift said needles, cams for returning said jacks to their lowered positions and stitch-cams adapted to return said needles to their lowered positions.

5. In a knitting-machine, in combination, a horizontal rising cam formed in two pieces, the upper part, or apex, of which is vertically movable in relation to the lower part or base, a stem upon which the movable part of said cam is carried, a ratchet-wheel surrounding said stem, a collar upon said stem, said wheel and collar carrying one a notch and the other a tooth, a pawl adapted to engage and rotate said ratchet-wheel, a stop carried by the stationary frame of the machine for actuating said pawl, jacks with heels of unequal lengths adapted to be raised by said cam, needles adapted to be engaged and raised by said jacks, cams for returning said jacks to their lowered positions, and stitch-cams for returning said needles to their lowered positions.

6. In a knitting-machine, in combination, a needle-bed and a jack-bed, the latter of which is lengthwise movable in relation to the former, needles and jacks carried by said beds, cams for operating said needles and jacks, a pivoted lever the free end of which is



connected to the movable bed, a cam adapted to rock said lever, and means for rotating said cam.

7. In a knitting-machine in combination, 5 a needle-bed and a jack-bed the latter of which is movable lengthwise in relation to the former, needles and jacks carried by said beds, a set of cams for operating said needles, a set of cams for operating said jacks, 10 means for carrying and means for reciprocating said cams, means whereby either set of said cams may be thrown into or out of operative action, a pivoted lever the free end of which is connected to the movable bed, a 15 cam adapted to engage and rock said lever, a shaft upon which said cam is carried, a ratchet-wheel upon said shaft, a pawl engaging said ratchet-wheel, an arm connected with said pawl, a cam upon the driving-shaft 20 of the machine for operating said arm, and said driving-shaft.

8. In a double plate, or pyramid, knitting-machine, in combination, oppositely-inclined 25 plates each of which comprises a stationary needle-bed and a jack-bed beneath said needle-bed, which is lengthwise movable in relation to said needle-bed, needles carried by said needle-bed, jacks carried by said jack-

bed, cams for operating said needles and jacks, a pivoted lever the free ends of which 30 are adapted to be attached one to one jack-bed, the other to the other jack-bed, and means for rocking said lever a predetermined distance.

9. The combination with the needle-bed 35 of a knitting-machine, of a bifurcated slide adapted to hold certain, or all, of the needles out of operative contact with the needle-actuating mechanism.

10. In a knitting-machine, in combination, 40 a needle-bed, a jack-bed movable lengthwise of said needle-bed, needles carried by said needle-bed, jacks having heels of unequal lengths carried by said jack-bed, means substantially as set forth for elevating said jacks 45 to cause said needles to make a full or a tuck stitch, cams for returning said needles and jacks to their first position, and means for moving said jack-bed so that a particular jack may engage and operate different needles 50 as may be desired.

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