

(No Model.)

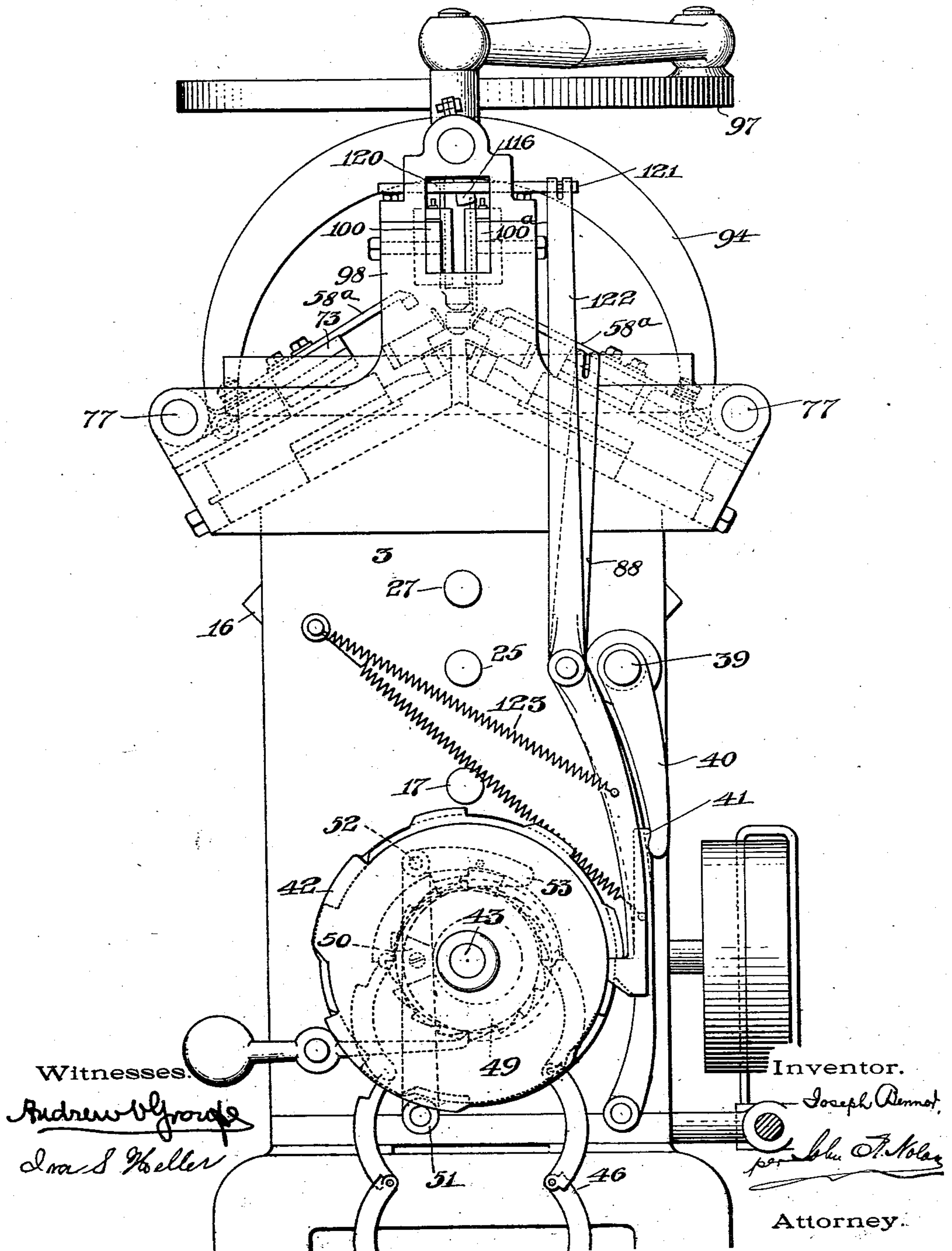
6 Sheets—Sheet 1.

J. BENNOR.
AUTOMATIC STRAIGHT KNITTING MACHINE.

No. 557,641.

Patented Apr. 7, 1896.

Fig. 1.



(No Model.)

6 Sheets—Sheet 2.

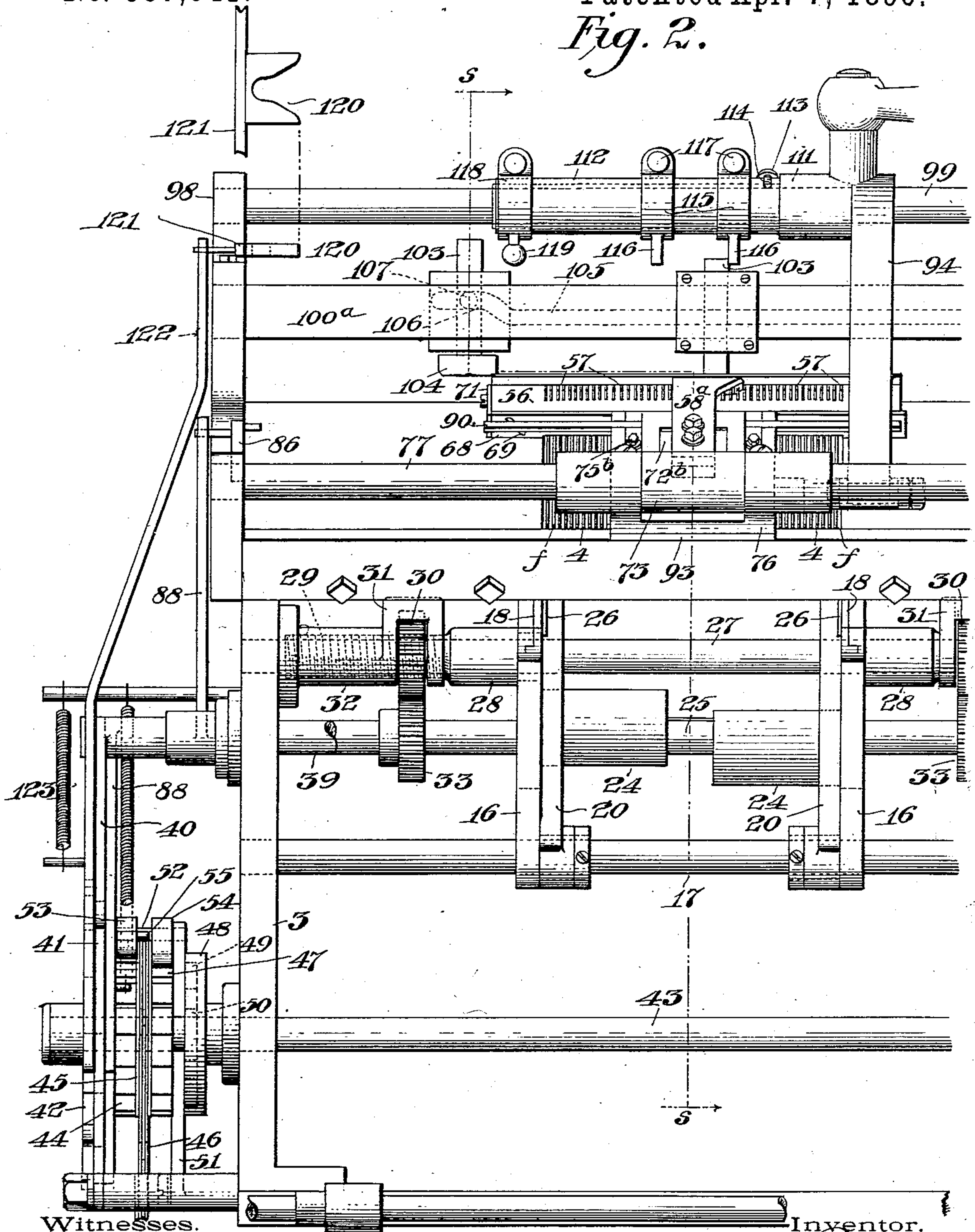
J. BENNOR.

AUTOMATIC STRAIGHT KNITTING MACHINE.

No. 557,641.

Patented Apr. 7, 1896.

Fig. 2.



Witnesses.

Andrew V. Grouse
David S. Keller

Inventor.

Joseph Bennor,
per John F. Nolan

Attorney.

(No Model.)

6 Sheets—Sheet 3.

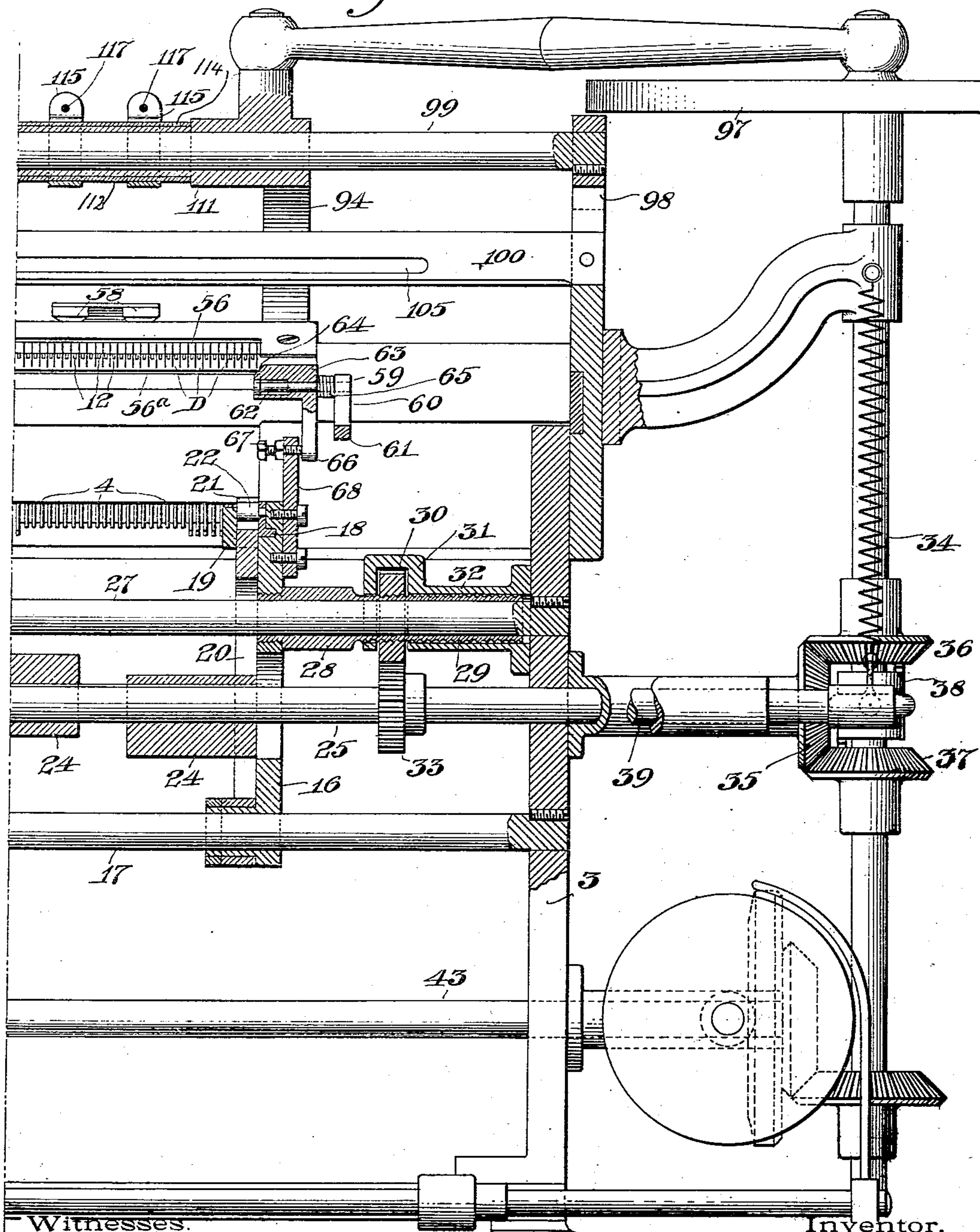
J. BENNOR.

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Fig. 3.



Witnesses.

Andrew Blount

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Inventor.

Joseph Bennor

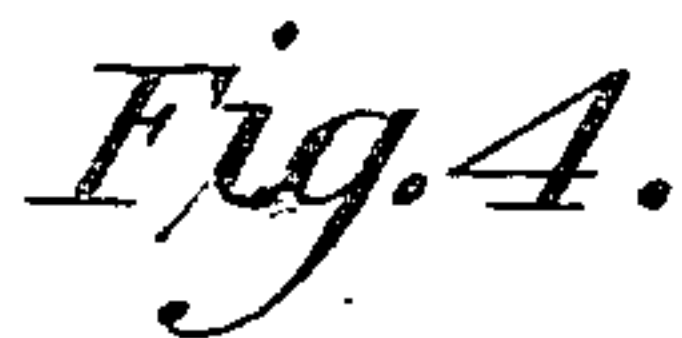
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6 Sheets—Sheet 4.

AUTOMATIC STRAIGHT KNITTING MACHINE.

Patented Apr. 7, 1896.



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(No Model.)

6 Sheets—Sheet 5.

J. BENNOR.
AUTOMATIC STRAIGHT KNITTING MACHINE.
No. 557,641. Patented Apr. 7, 1896.

Fig. 5.

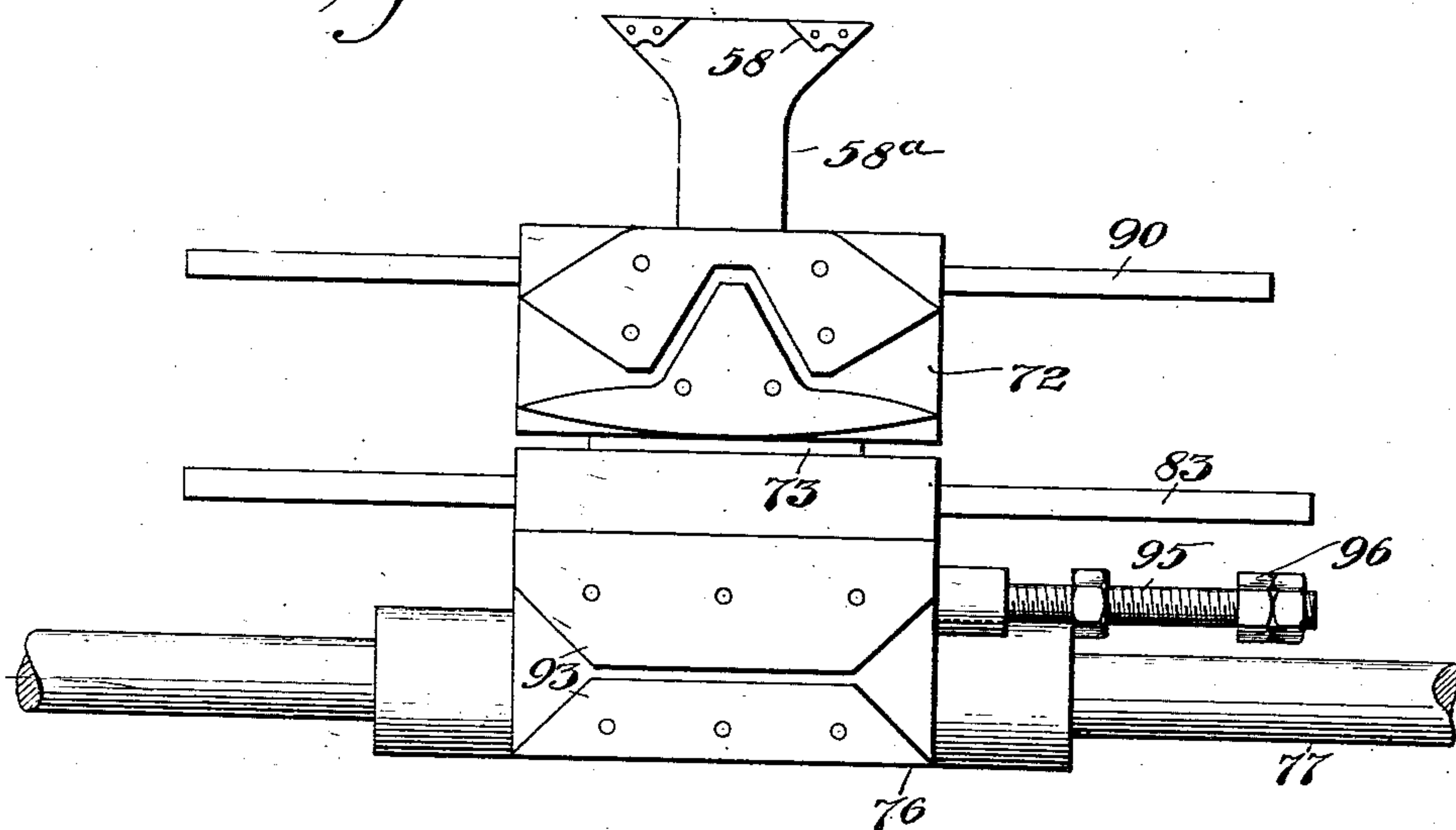


Fig. 7.

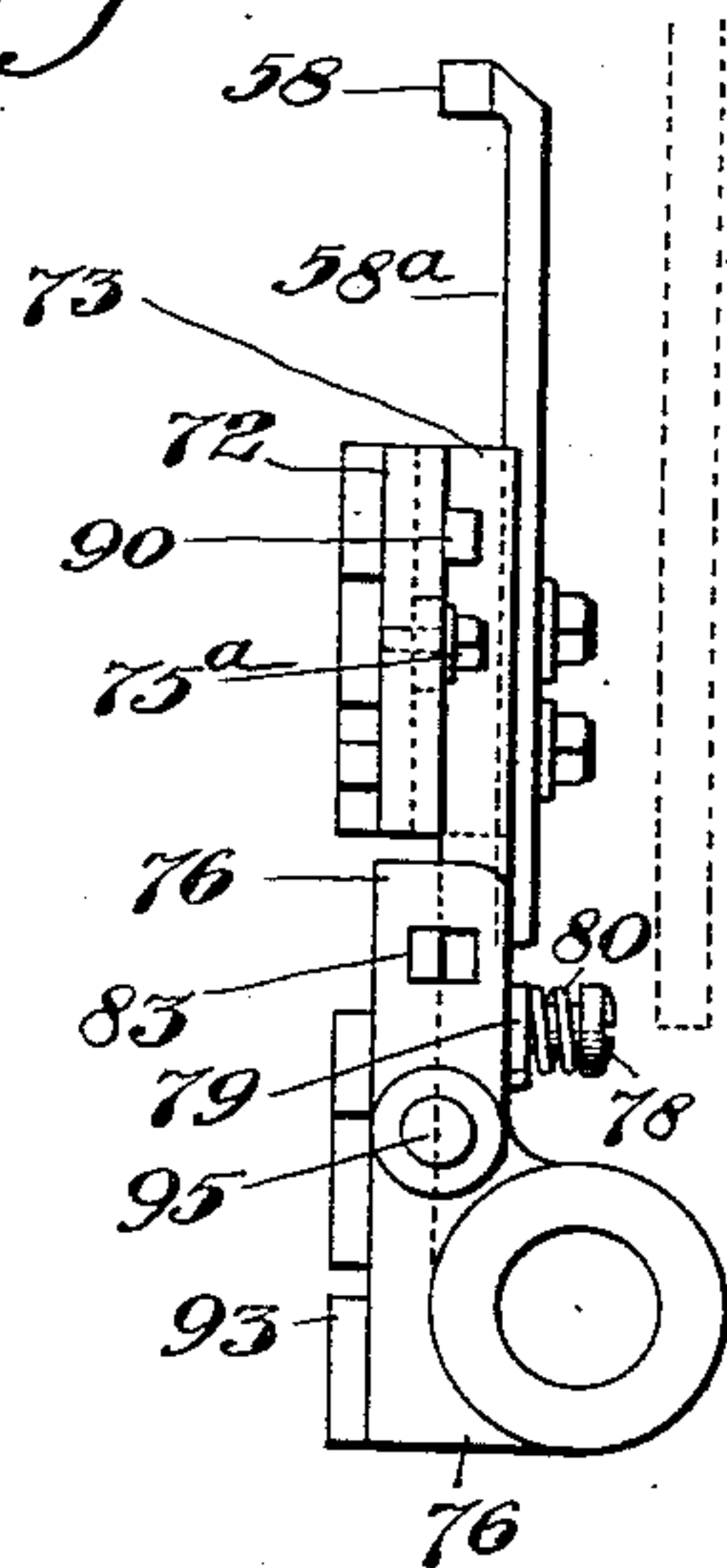


Fig. 6.

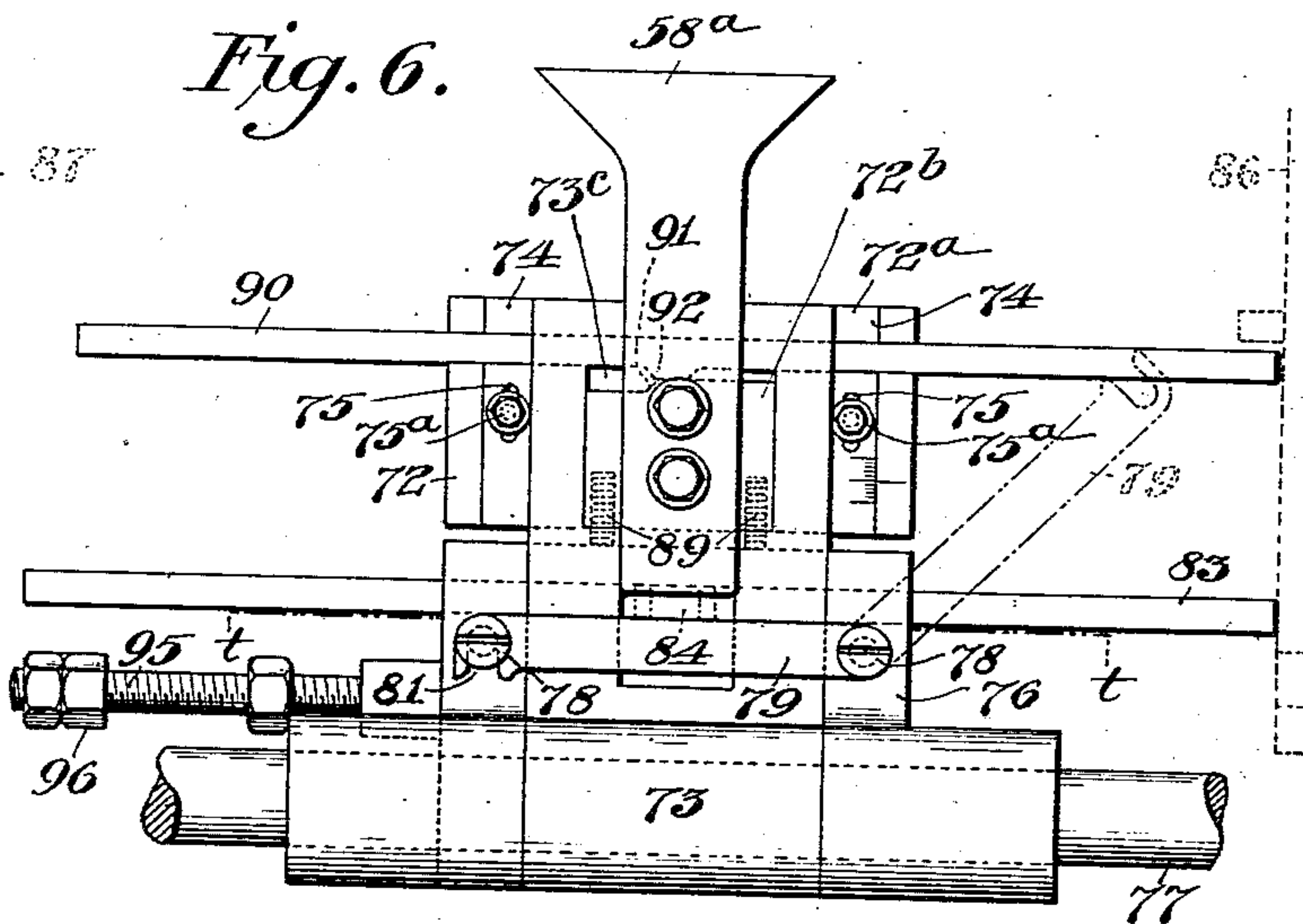
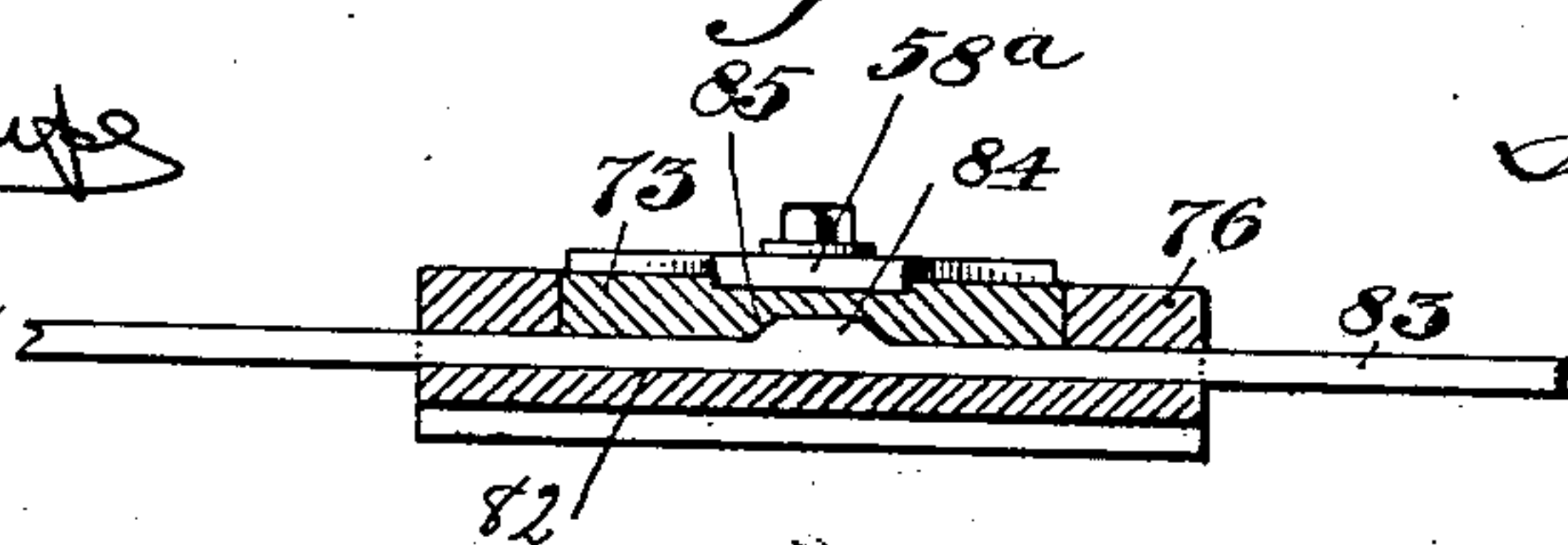


Fig. 8.



Witnesses.

Andrew Blount

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(No Model.)

6 Sheets—Sheet 6.

J. BENNOR.

AUTOMATIC STRAIGHT KNITTING MACHINE.

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Fig. 9.

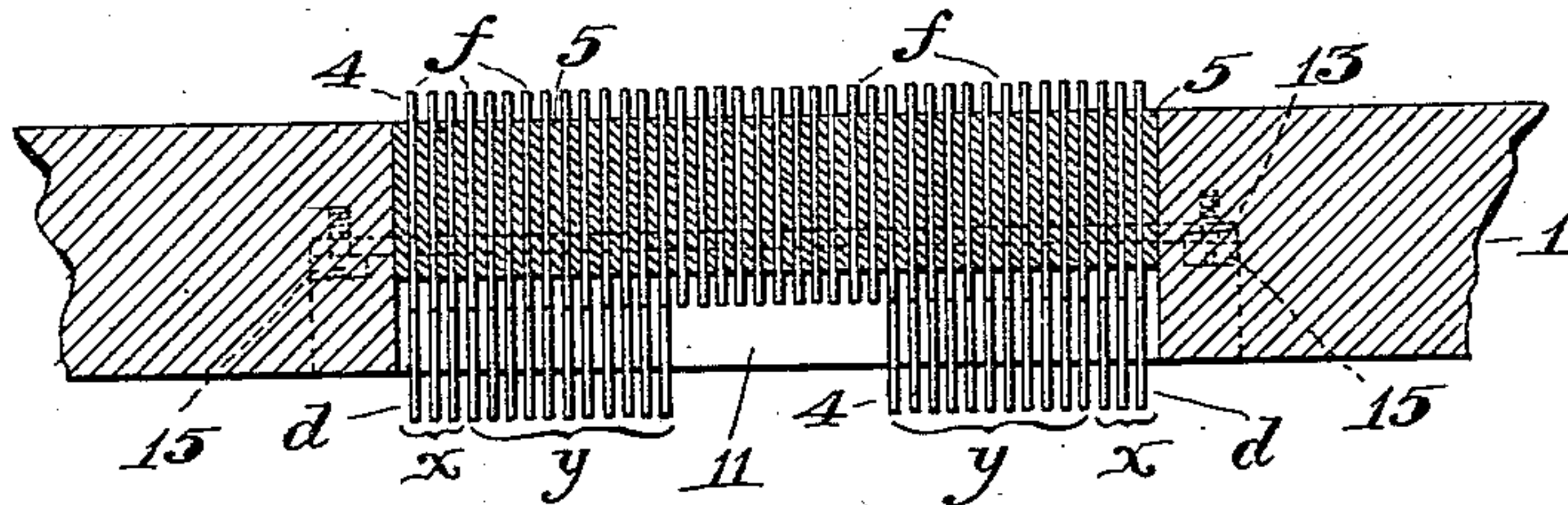


Fig. 10.

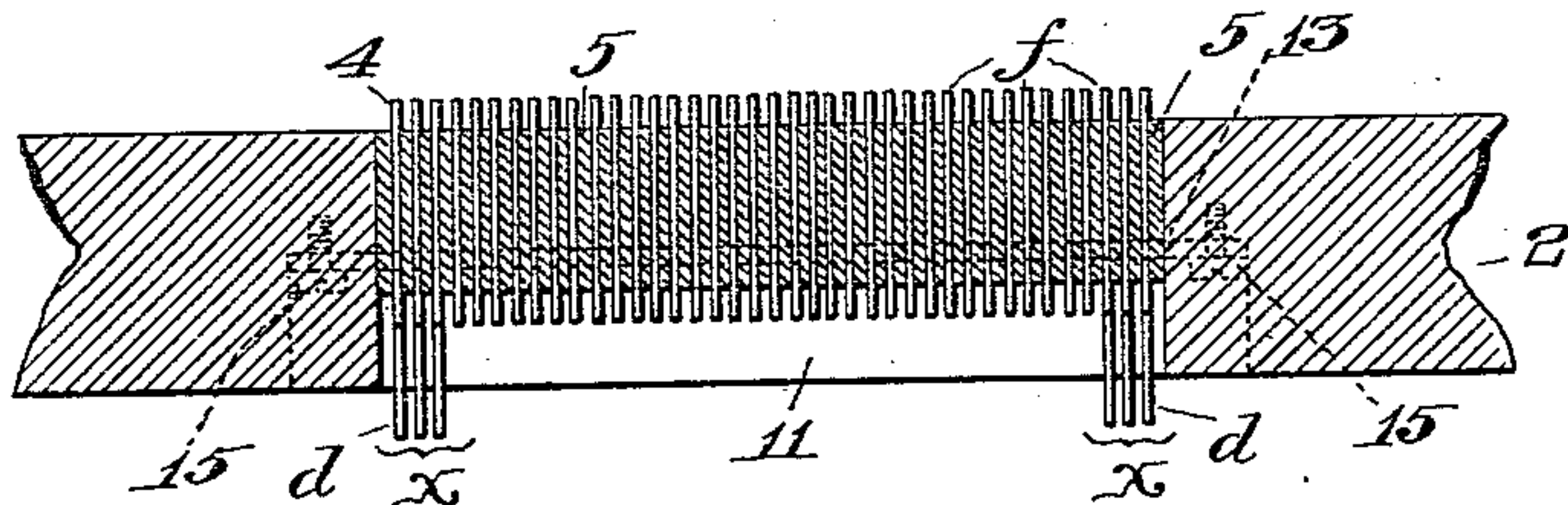


Fig. 15.

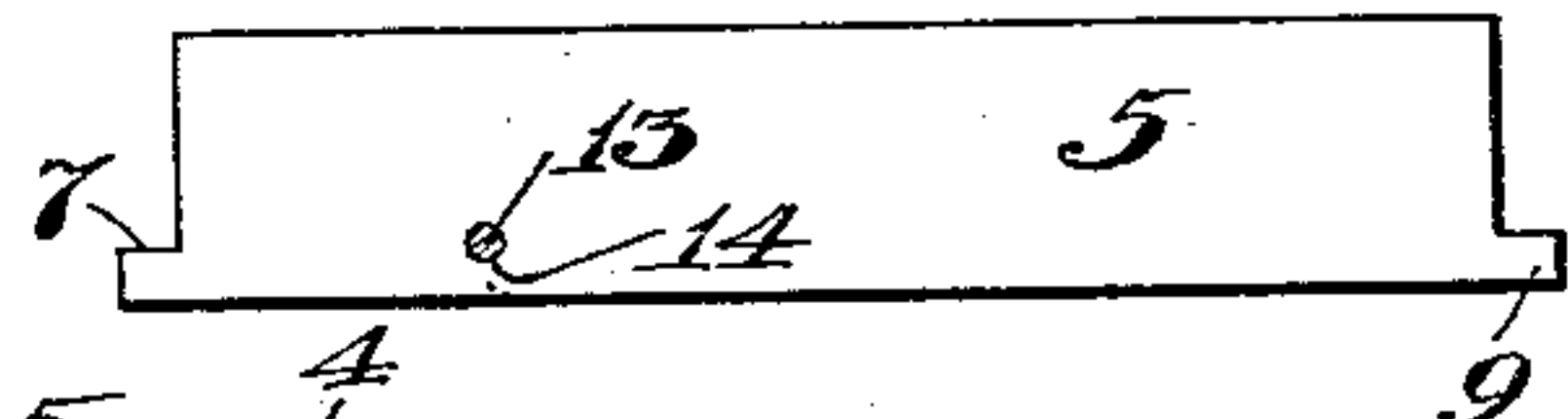


Fig. 11.

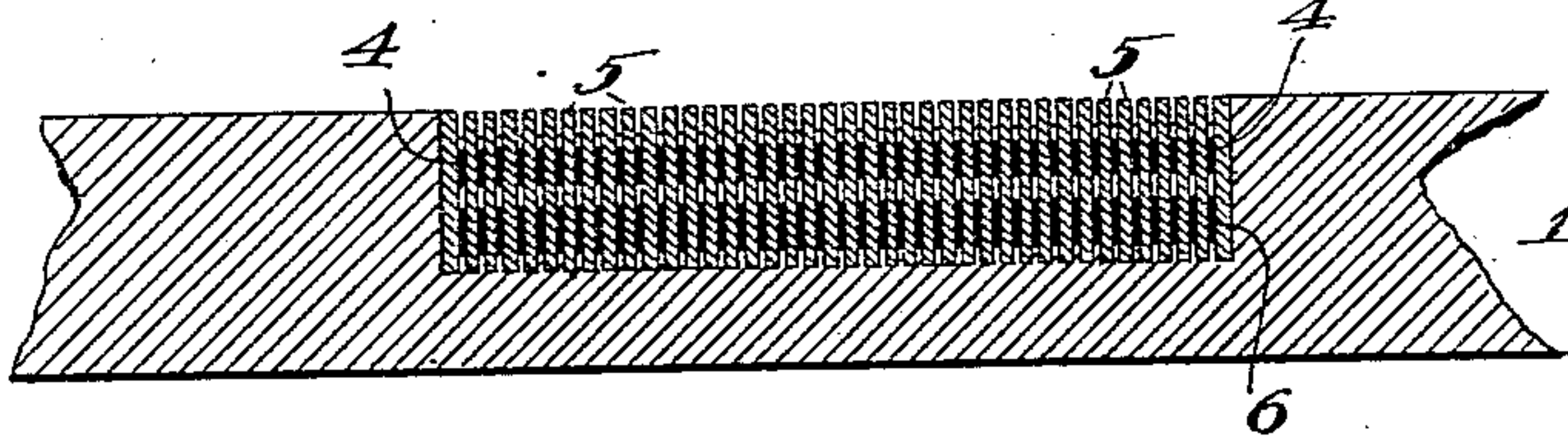


Fig. 12.

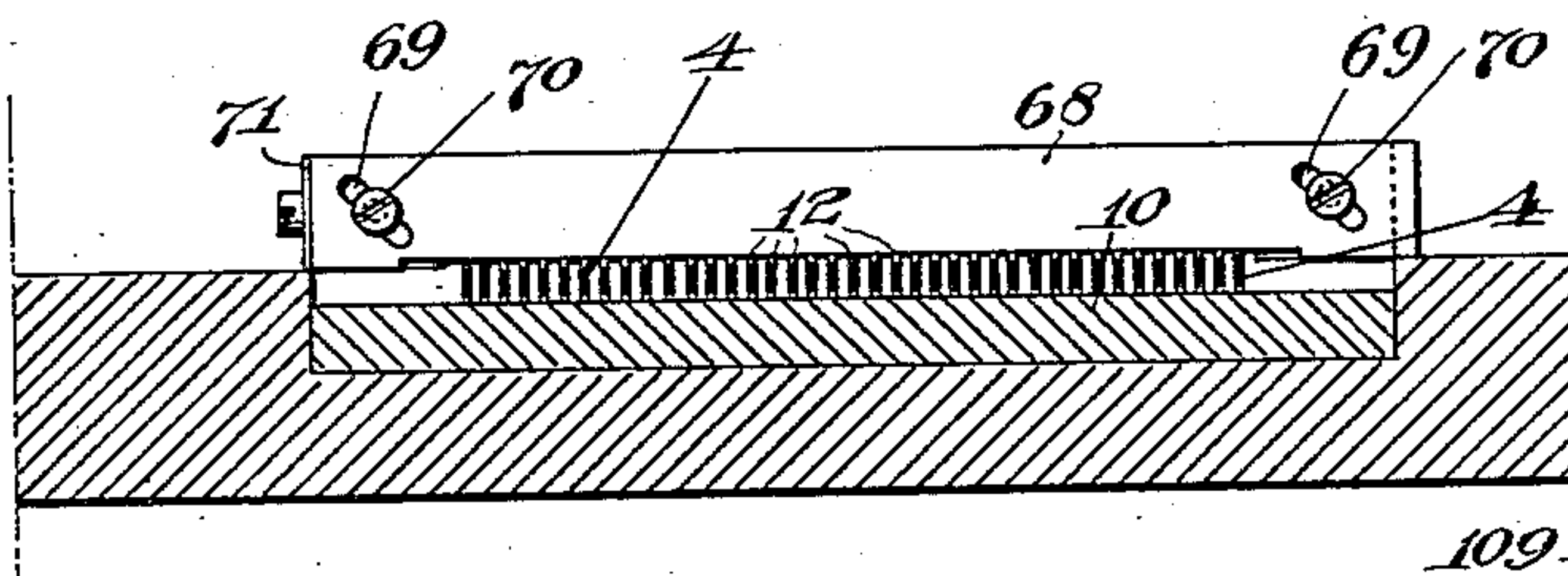


Fig. 13.

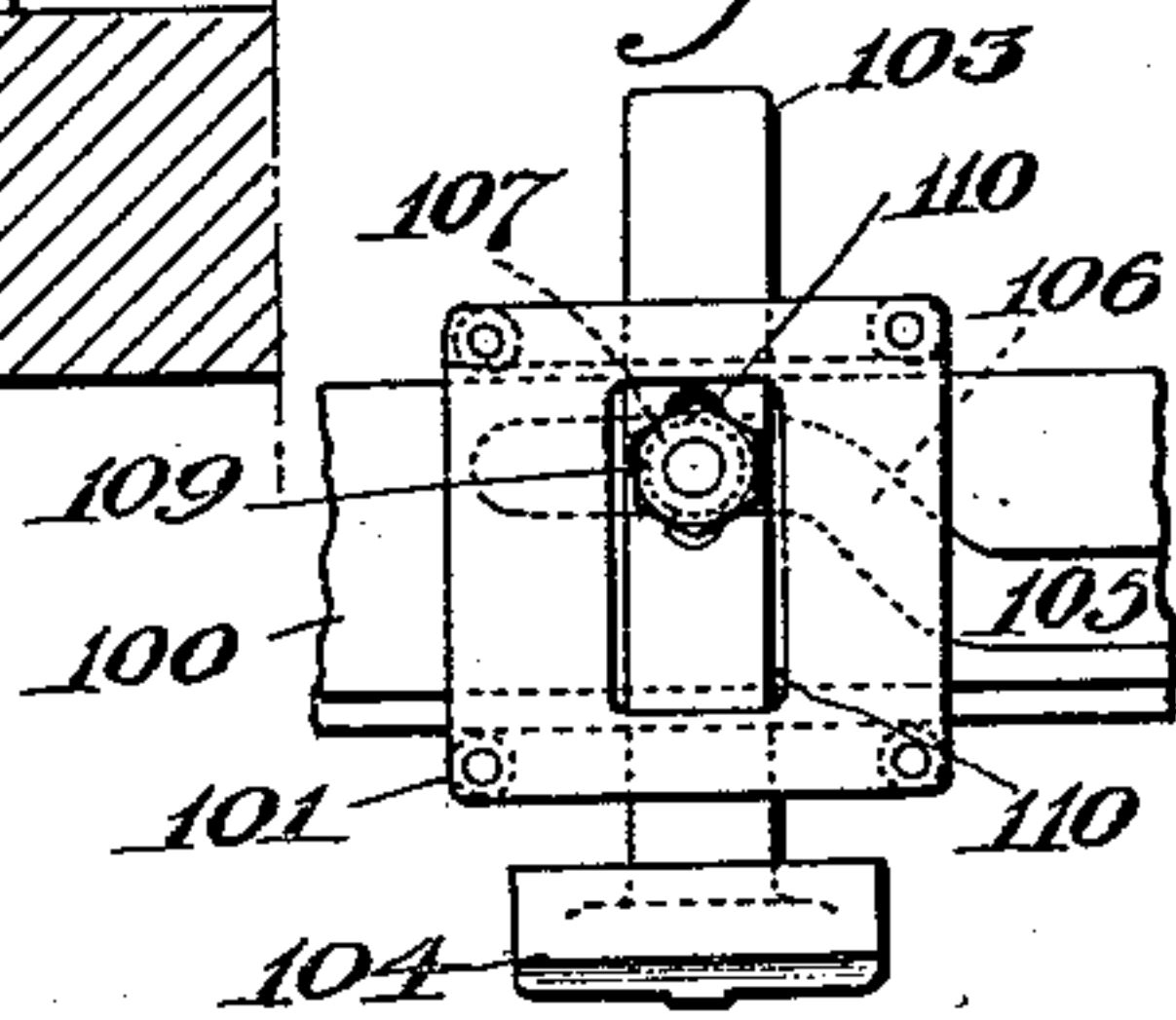
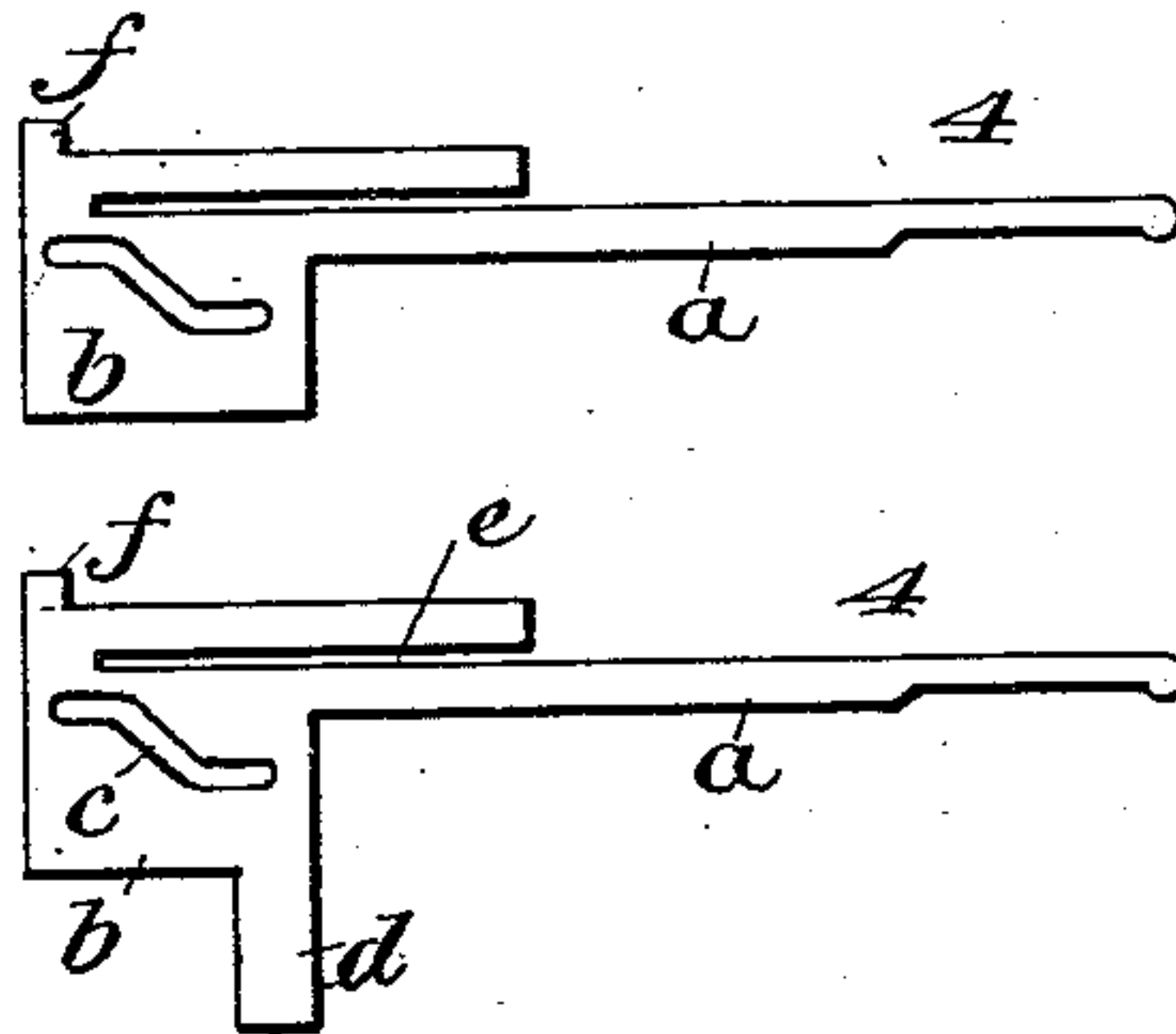


Fig. 14.

Witnesses.

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UNITED STATES PATENT OFFICE.

JOSEPH BENNOR, OF MACON, GEORGIA.

AUTOMATIC STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 557,641, dated April 7, 1896.

Application filed January 18, 1895. Renewed October 21, 1895. Serial No. 566,416. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH BENNOR, a citizen of the United States, residing at Macon, in the county of Bibb and State of Georgia, have invented certain new and useful Improvements in Automatic Straight-Knitting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention is designed to improve the construction of that class of straight-knitting machines wherein the knitting-cams are reciprocated on oppositely-arranged needle-beds in such a manner as to effect the production of stockings in connected series, the knitting of each stocking in such machines being commenced at a point near the extremity of the toe part and continued down and around such part, thereupon completing the toe and proceeding with the knitting, successively, of the foot, the heel, and the leg of the stocking.

The present improvements relate, first, to a construction and organization of mechanism for rendering certain needles idle and active at predetermined intervals to effect the requisite formation of a full-fashioned stocking; secondly, to a novel construction and arrangement of sinker mechanism; thirdly, to a novel and advantageous construction of the cam-carrier and its knitting-cams; fourthly, to a simple and efficient construction of yarn-guide mechanism whereby threads of variable size or color may be periodically thrown into and out of operation, and, finally, to various minor features of construction whereby advantages are gained, all of which will be hereinafter particularly described and claimed.

In the annexed drawings, Figure 1 is an end view of a machine embodying my improvements. Fig. 2 is a side elevation thereof, part of the right-hand end of the machine being omitted. Fig. 3 is a sectional elevation of the machine, part of the left-hand end thereof being omitted. Fig. 4 is a transverse vertical section enlarged, as on the line *s s* of Fig. 2. Fig. 5 is an under side view of one of the cam-carriers. Fig. 6 is a plan thereof. Fig. 7 is an end view of the same. Fig. 8 is a section, as on the line *t t* of Fig. 6. Fig. 9 is a transverse section through a portion of the needle-

bed 1 in which the toe and heel fashioning needles are contained, the plane of the section being indicated by the dotted line *u* in Fig. 4. Fig. 10 is a similar section through the opposite bed 2, as on the line *v* in Fig. 4. Fig. 11 is a similar section, as on the line *w* of Fig. 4. Fig. 12 is a similar section through one of the beds on a plane directly in rear of the sinker-frame. Fig. 13 is an elevation of one of the thread-carriers. Fig. 14 is a view of two of the needle-supporting jacks. Fig. 15 is a view of one of the division-plates as detached from the needle-bed.

The oppositely-inclined needle-beds 1 2 are supported upon the usual framework 3. Each of the beds is provided with a series of parallel transverse ways, in which is supported and guided a corresponding series of peculiarly-constructed needle-controlling jacks 4, such ways being preferably, though not essentially, formed by and between parallel plates 5, which are let into the recessed bed and are separated or spaced by strips or "leads" 6. The lower ends of the plates are provided with studs 7, which are fitted to a longitudinal groove 8 in a bar 8^a bolted to the lower portion of the bed, while the upper ends of the plates are provided with corresponding studs 9, upon which rests a longitudinally-disposed bar 10. By this construction a strong and substantial needle-bed of very fine gage is provided. The lower portion of the bed is cut entirely through, as at 11, to permit the downward passage and longitudinal reciprocation of depending tailpieces on certain of the needle-controlling jacks hereinafter referred to, which latter jacks each comprise a slotted or bifurcated plate, the lower member *a* of which is reduced and elongated forwardly, its basal portion *b* being expanded and being provided with an appropriate cam-slot *c* and with the depending tailpiece *d*. In the remaining jacks the tailpieces are omitted for reasons hereinafter appearing.

Fitted to the longitudinal slot *e* in each of the jacks is the shank of the knitting-needle 12, such slot being of sufficient length to contain the shank during the reciprocation of the needle by the superposed knitting-cams. Extending through the cam-slots *c* of the several jacks in each bed and through opposite perforations 14 in the division-plates is a lon-

gitudinally-arranged rod 13, the extremities of which are affixed to the under side of the bed by means of set-screws 15 or the like. The several cam-slots in the series of jacks 5 are uniform in shape, and they are so formed that if said jacks, or any of them, be moved in one direction longitudinally the rigid rod will act upon the slots to effect the depression of the lower portion of the jacks or jack 10 so moved, and thus drop the corresponding needles or needle below the path of the knitting-cams, and that if said jacks, or any of them, be retracted the parts will be returned to their original condition. The upper ends 15 of the jacks in each bed rest upon the bar 10, such ends being preferably rounded, as seen, so as to facilitate the oscillatory movement of the jacks. The cam-slots of the jacks in one bed are the reverse in form of those of the 20 jacks in the opposite bed, for a purpose hereinafter appearing.

The number of jacks raised and lowered during the knitting operation is determined by the number of stitches required in each 25 course of the wide and narrow portions of the leg of the stocking, the number of jacks being equal to the difference between the stitches required in the courses of the two portions plus the number of courses to be fashioned in 30 the formation of the toe or the heel of the stocking. The leg-fashioning jacks are marked α , and they are arranged in equal numbers at each end of each bed, and the toe and heel fashioning jacks are marked γ , and they are 35 applied to the intermediate needles in the bed 2 only, as seen most clearly in Figs. 9 and 10. The remaining jacks perform no function other than to support the needles in active position. They are constructed with the cam- 40 slots similarly to the other jacks for economy's sake in their manufacture.

At the beginning of the knitting operation all jacks marked α are depressed to throw 45 their needles out of action. The knitting-cams hereinafter described are then thrown into the active position and they are moved one stroke to throw upward simultaneously the remaining needles in both beds. Yarn is then delivered to the needles, to the end that 50 the cams in the reverse stroke shall retract the needles with the yarn. The cams are then moved to the tube-knitting position (one set active and the other set idle) and a round of stitches is formed. One set of cams is then 55 maintained out of action, and the knitting to and fro is carried on by the other or active set on the bed 1, the needles at the respective ends thereof being alternately thrown out of action by the act of depressing their support- 60 ing-jacks, respectively, so as to produce a gradually-narrowed web the desired length of the toe-pouch, whereupon the said needles are returned to action in inverse order by the upward movement of the jacks. There is thus 65 formed a toe-pouch. Both sets of cams are then thrown into the tube-knitting position and the formation of the foot is effected. The

heel-pouch is then formed similarly to the toe, following which the lower portion of the leg is formed similarly to the foot. The jacks 70 marked α are then raised to throw their needles into action, after which the remainder of the leg is formed in the usual manner by means of all the needles in both beds. This being completed, the web is cast off from the 75 needles as usual and the foregoing-described operation is repeated.

In a pending application, Serial No. 517,970, filed by me July 19, 1894, and intended to be 80 issued simultaneously herewith, there is described a construction of needle-jack devices operating during the successive stages, in the identical manner above described. The difference in the two mechanisms is a structural 85 one, with the view, in this instance, of producing a more substantial and efficient machine. As recited in my said pending application, if all the jacks marked α be thrown into action before the actual knitting operation is continued there will be formed in the 90 resultant web in each side of the leg, at the parts where the end needles were thrown into action, an open projecting portion, which portion, when the web is removed from the machine, is cut off diagonally with the lateral 95 edge of the leg portion, and the gap or slit is sewed or otherwise closed. If, however, the jacks α and their needles be thrown into action at predetermined courses of knitting, the web will be gradually widened, thereby ob- 100 viating the necessity of trimming the sides of the web, which would otherwise project. By returning the successive jacks at the end of each second, third, fourth, or other course the lateral lines of widening may be more or 105 less extended, as desired.

Following is a description of the mechanism for controlling the jacks to effect the periodical operations above mentioned.

The numerals 16 16 designate two follow- 110 ers which are arranged beneath the needle-beds and are constructed to be moved toward and away from each other at predetermined intervals. These followers are preferably in the form of sectors, which are centrally 115 mounted on a longitudinally-disposed shaft 17 fixed in and between the end heads of the main supporting-frame. The inner peripheral edge of each of the sectors is offset to receive a corresponding segment 18, which is 120 reciprocative in an arc described from its center. Lateral displacement of the segment is prevented by means of an offset cap-plate 19 secured to the sector. Fulcrumed on a boss on the inner face of the follower is the 125 lower end of a vertical arm 20, the upper or free end of which extends between the cap-plate and the segment. This upper end of the arm is slotted or recessed, as at 21, to receive a projecting pin 22 on the segment, 130 whereby the act of oscillating the arm will effect a corresponding movement of the segment. The body of the arm is provided with an elongated opening 23 therein to receive an

eccentric 24 on a longitudinally - arranged driving-shaft 25, whereby said eccentric during its rotation will impart the requisite oscillations to the arm in the longitudinal traverse of the latter, as hereinafter described. There are two eccentrics on the shaft 25, one for the arm on each of the followers, said eccentrics being oppositely disposed, so as to effect contrary movements of the two arms. At or near the end of each of the segments is affixed a bifurcated plate 26, the up-projecting members of which are arranged to act upon the depending tails of the jacks (x and y) during the oscillation of the segment in such a manner as to impart the requisite movements to said jacks to effect their depression or elevation—that is to say, if each of the segments be moved in the direction indicated by the arrow in Fig. 4 the lower member of the left-hand plate will act upon the opposed tail-piece in its path and advance the connected jack, the cam-slot therein thus riding upon the rod and lowering the jack, and at the same time the upper member of the right-hand plate will take against the opposed tail-piece of the jack on the opposite bed and correspondingly move the said latter jack, the cam-slot thereof riding upon the rod and similarly depressing the jack. In view of the fact that the lengthwise movements imparted to the oppositely-disposed jacks by the plates on the segments are opposite—one upward and the other downward—the form of the cam-slots in such jacks is reversed, as above mentioned.

Supported in the end heads above and parallel with the shaft 25 is a shaft 27, the same extending through the vertical openings in the arms 20 and through the followers in a manner to support and guide the latter in their longitudinal traverse. Fixed to the outer side of each of the followers is a sleeve 28, part of which is externally screw-threaded, as at 29. The threads of the respective sleeves are oppositely pitched, and they are provided with correspondingly-threaded nuts 30, by the act of turning which the sleeves and, perforce, the followers with their appurtenances are advanced toward or retracted from each other, as desired.

The nuts are embraced by jaws 31 on the ends of sleeves 32, which are affixed to the respective end heads, said jaws thus maintaining the nuts rotatably in place. These nuts, as will be observed, comprise gear-wheels which are engaged with corresponding wheels 33 on the shaft 25, respectively, whereby motion will be transmitted from the latter shaft to the gear-nuts to effect the desired operations of the engaged screws. The pitch of the screw-threads and the relative positions and throw of the eccentrics are so timed that during the inward traverse of the followers the segments in their strokes from left to right engage the bifurcated plates with the respective jacks in a manner to occasion the depression of the jacks, and in their re-

turn strokes to move said plates in the spaces between the jacks, and that during the outward traverse of the followers a reverse action of the plates occurs.

Motion is imparted to the shaft 25 at the prescribed stages of the knitting operation by any appropriate mechanism, the same as illustrated herein being in essential parts similar to the corresponding mechanism set out in my other application referred to—that is to say, one end of the shaft 25 is extended outwardly beyond the head and is equipped with a bevel gear-wheel 35. This wheel engages two similar wheels 36 37, loosely mounted on a vertical shaft 34, to which motion is imparted from a suitable source of power, as illustrated and described in my Letters Patent of the United States No. 485,317, dated November 1, 1892, to which reference may be had. Said wheels 36 and 37 are constructed to be alternately fixed to and removed from their shaft by means of an interposed clutch 38, that is connected with one end of a longitudinal shaft 39 under the control of novel pattern mechanism hereinafter described. The shaft has on its opposite end a depending arm 40, that bears upon the upper end of a lever 41, resting upon the periphery of a pattern-wheel 42 and being held thereon by the action of a suitably-disposed spring. Thus when the arm bears upon a low part of the wheel the clutch is engaged with the upper bevel-gear 36, which latter thereupon rotates the shaft in one direction. When the arm bears upon a high part of the wheel, the clutch is disengaged from the upper wheel and engaged with the lower wheel, which latter thereupon rotates the shaft in a reverse direction, and when the arm bears upon a medium part of the wheel the clutch is thrown into its normal or intermediate position, in which case it is disengaged from both wheels and the shaft 25 is at rest.

The pattern-wheel is loosely mounted on the outwardly-extending end of a longitudinal shaft 43, which is supported in the end heads of the main frame. This wheel, in the present instance, comprises three parts or disks fastened together face to face, their respective peripheries being formed with relatively-arranged risers and depressions to control the operation of the several elements engaged thereby, as below explained.

On the inner face of the wheel, concentric therewith, is fixed a ratchet-wheel 44, which is actuated at predetermined intervals to advance the pattern-wheel. Loosely mounted on the shaft 43, adjacent to the ratchet-wheel, is a sprocket-wheel 45, around which passes a chain 46, whose peculiarly-formed links determine the governing positions of the pattern-wheel. This sprocket-wheel has affixed thereto a ratchet-wheel 47, which is similarly mounted on the shaft 43. Adjacent to the last-named ratchet-wheel there is fixed on the shaft a disk 48, with an eccentric groove 49 in the face thereof, to which groove

is fitted a block 50 on a pivoted arm 51, whereby during the rotation of the shaft said arm will be oscillated. On the upper or free end of the arm is fixed a laterally-extending pin 52, upon which are supported two pawls 53 54, which are adapted to engage the teeth of the ratchet-wheels 44 47, respectively. It will be seen that if the pawls be engaged with said wheels the latter will be intermittently rotated during the oscillation of the arm, the chain thus being advanced step by step and the pattern-wheel being correspondingly impelled.

Projecting from the inner side of the pawl 53 is a stud 55, which is acted upon by the successive links of the chain at predetermined intervals to raise said pawl out of action, in which case the pattern-wheel remains idle while the chain is advanced. Certain links 20 of the chain are cut away or reduced, to the end that when such links pass under the stud the pawl 55 will drop into engagement with the ratchet-wheel, and thus effect the advancement of the pattern-wheel to bring the desired peripheral portion or portions of the wheel into action. This being done, the pawl is raised and held out of action, as before, until a change in the work is required, whereupon the pawl 53 is brought into play in the manner above stated. In this way the links of the pattern-chain govern the determinate positions of the pattern-wheel during the successive stages of the knitting operation.

The vibratory sinkers D are supported in 35 kerfs in longitudinally-disposed bars 56, arranged along the opposed edges of the needle-beds, respectively. These bars are preferably superimposed on longitudinally-slotted bars 56^a, affixed to the respective beds, the forward 40 under portions of the former bars being recessed or cut away, as at 56^x, to communicate with the slots 56^y in the bars 56^a. Hence any lint, &c., that may enter the kerfs in the bars 56 will pass through the slotted bars 56^a into 45 and through the throat of the machine instead of lodging within the kerfs and interfering with the free action of the sinkers.

The sinkers alternate with the needles, and they are held normally engaged with the web 50 by means of springs 57, which are interposed between the backs of the sinkers individually and the backs of the kerfs to which the sinkers are fitted. These springs are preferably shaped similarly to a cotter-pin, the bends or 55 loops thereof extending above the tops of the respective bars 56, to the end that the springs or any of them may be readily removed from or applied to the sinkers without disturbing other parts of the machine. That limb of the 60 spring which bears against the sinker is preferably bent slightly to form a teat, which enters a notch in the sinker, as seen.

The sinkers are retracted at the proper times relatively to the knitting-cams by 65 means of cams 58, which are connected with and impelled by the reciprocating cam-carriages (hereinafter described) similarly to the

like parts set out in my pending application aforesaid.

Those sinkers which coact with the end needles under the influence of the jacks marked *x* are moved out of and into action simultaneously with said needles, the means for effecting such operations of the sinkers being practically the same as provisions for a like 75 purpose illustrated and claimed in a pending application, Serial No. 515,911, filed by me June 28, 1894. Said sinkers are rendered inactive in order to prevent their engagement with the yarn when the coacting needles are 80 out of operation.

In the present construction 59 represents one of two brackets, which are fitted to the throat of the machine at the respective ends thereof. Each of the brackets comprises an 85 arm 60 rising between the needle-beds from an inclined lug 61, which is bolted to the under side of one of the beds. Extending inwardly from this arm is a pin 62, upon which is supported and guided a longitudinally-movable 90 head 63, the forward or acting edge of which is beveled, as at 64. Encircling the rod intermediate the outer end of the head and the opposed arm is a spiral spring 65, which acts to force the head normally inward beneath 95 the tails of the two sets of end sinkers for the purpose of raising said sinkers out of action. Depending from the head is an arm 66, the lower end of which is engaged by a set-screw 67 on a vertical arm 68 rising from the adjacent 100 follower.

When the followers are moved inward to effect the dropping of the end needles out of action, the springs 65 force the respective heads inwardly simultaneously in a manner 105 to advance the beveled ends thereof beneath the tails of the sinkers, thereby raising the latter out of action. When the followers are retracted or moved outward to effect the raising of the needles into active position, the 110 arms on the followers correspondingly retract the heads and thereby permit the sinkers to become active. By properly adjusting the set-screws 67 the positions of the heads in relation to the sinkers and to the respective followers may be nicely determined. 115

As a simple and efficient means to hold in position the needles in the respective beds I mount on the outer edge of each of the sinker-supporting bars 56 a longitudinal bar or gib 120 68, which is provided near its ends with inclined slots 69, to which are fitted suitable screw-pins 70 on the bar 56. On one end of the latter is fastened a flat spring 71, which bears against the adjacent end of the gib in 125 a manner to thrust the declining slot-walls against the pins and thus normally depress the gib. When it is desired to remove a needle or needles from the machine, the gib-bar is pressed longitudinally against the force of 130 the spring, the slots thus riding upon the pins.

Concerning the knitting-cams and their supporting parts they are substantially the same, except in matters of detail, as the cor-

responding elements described in my aforementioned application, Serial No. 517,970. These cams are mounted on a plate 72, which is connected with a superposed plate 72^a sustained, as below described, by a hinged section 73 of the cam-carriage. The upper face of the plate 72 is recessed to receive the plate 72^a, the lateral parts 74 of which are provided with elongated holes 75, through which pass the connecting-screws 75^a, such holes permitting to be had the requisite adjustment of the lower or cam-bearing plate to determine the throw of the knitting-cams in respect to the needles, and in consequence the tension or size of the stitches produced. The lower portion of the section 73 is hingedly connected with the sliding recessed section 76 of the carriage by means of a longitudinal guide-rod 77, which extends through suitably disposed bosses on said sections. Secured to the lateral flanges of the section 76 are upwardly-extending screws 78 78, by which are freely held the respective ends of a transverse plate 79, between which and the heads of the screws (or pins) are interposed spiral springs 80. The tendency of these springs is to press the plate upon the hinged section, and thus to maintain said section, with its knitting-cams, normally in the down or active position. One of the orifices in the plate 79, through which the screw extends, is cut through the edge of the plate, as at 81, to the end that the latter may be readily swung on the other screw as a pivot to permit the application of the hinged section to or its removal from the slide-section. (See dotted lines in Fig. 6.)

Extending through the lateral walls of the section 76 and through a recess or channel 82 in the latter is a longitudinal slide-bar 83, on which is a beveled stud 84, that registers, normally, with a socket 85 in the hinged section. When the slide-bar is moved in one direction, the stud bears against the under side of the hinged section in a manner to raise such section and thus throw the cams out of action, and when the bar is returned the stud enters the socket and permits the parts to resume their previous or operative position. The requisite movements of the bar are effected by the usual end stops 86 87, one of which, 86, is movable into and out of the path of the bar at predetermined intervals, the other stop, 87, being a permanent one. The movable stop is connected with one end of a vertical lever 88, which is controlled by the pattern-wheel hereinbefore described.

The plate 72^a, to which the lower or cam-bearing plate is secured, is provided with a projection 72^b, which extends freely through an opening 73^a in the section 73, so as to have some little play therein longitudinally of the needles, to the end that the said cams may be primarily set or adjusted to effect the knitting of a course of comparatively close stitches, such stitches being desirable at the commencement of each stocking. Fitted to sockets in the lower edge of the projection 72^b and

the opposed portion of the hinged section are spiral springs 89, the tendency of which is to advance the former.

Coacting with the upper edge of the projection to depress the plate against or to permit it to be raised by the force of the springs 89 is a longitudinal slide-bar 90, that is fitted to the upper portion of the hinged section. The opposed edges of the projection and the bar are provided with steps 91 92, respectively, that are so arranged in relation to each other that the step on the bar may be slid upon or off the step on the projection by the act of reciprocating the bar, thereby depressing the plate or permitting its elevation, as above stated. The movements of the bar are effected by its impact at certain intervals with the usual end stops before mentioned.

The sinker-cam-supporting arm 58^a is secured to the projection of the plate 72^a, to the end that the sinker-cam 58 shall be rendered active and inactive concertedly with the knitting-cams.

On the under side of the carriage-section 76 are arranged longitudinal cams 93, which are adapted to engage lugs or projections *f* on the jacks during the traverse of the cam-carriage, when the jacks are raised or active, and thus obviate any liability of such jacks accidentally dropping while the knitting-cams are passing over them.

Heretofore the cam-carriages have been fixedly connected by means of a yoke or saddle, no provision being made for their relative adjustment to compensate for wear or for inaccuracy in fitting. To overcome this defect, I adjustably connect the yoke (noted 94) with the sliding sections of the carriages, respectively, as follows: On the sides or flanges of the two sliding sections are screw-threaded studs 95, respectively, to which are fitted the respective perforated ends of the yoke, said studs being equipped with suitable set-nuts 96, whereby the requisite adjustments of the parts may be effected.

The yoke is connected with and impelled by a positively-driven crank-wheel 97 on the vertical shaft 34, as usual. Supported in suitable brackets 98 on the end heads is a longitudinal rod 99, which extends through and affords a guide for the yoke.

The yarn-guide mechanism herein employed differs only in points of detail from the corresponding mechanism set out in my application, Serial No. 517,970, above alluded to, the novel features in this instance residing more especially in the mechanism for reciprocating the carriers.

Referring to Figs. 2, 3, 4, and 13, 100 100^a designate a pair of parallel bars extending lengthwise of and above the throat of the machine, and 101 102 designate the yarn-carriers mounted on the bars, respectively, and adapted to be reciprocated longitudinally thereon. On the inner side of each of the carriers is a vertical rod 103, on the depending end of which is formed the yarn-guide

head 104, the same being disposed directly above the median line of the machine. The rod on the carrier 101 is reciprocative vertically, while that on the other carrier is fixed in place by means of a suitable set-screw. The bar 100 is provided on its inner face with a longitudinal groove 105, which extends parallel with the edge of the bar, excepting at one end, where it is inclined upward, as at 106. Engaged with this groove is a pin or roller 107 on the inner side of the adjacent rod, which pin or roller, following the course of the groove during the traverse of the carrier, is directed upward by the inclined portion of the groove in a manner to elevate the rod and its guide-head. The latter is raised and maintained above the track of the other or fixed guide-head, so that the heads will not interfere with each other, it being understood that one of the carriers is idle at this end of the machine, while the other is active, the carriers being thrown into and out of operation at predetermined intervals.

The arrangement and the operation of parts just described are precisely the same as in my pending application last above referred to. As a means to adjust the roller on the rod so as to regulate the position of the yarn-guide head in respect to the needles I extend the stud of the roller through an elongated slot 108 in the rod, and secure the stud in place by means of a nut 109 thereon, the faceplate of the carrier being cut away, as at 110, to receive the nut and permit the requisite vertical play thereof. (See Figs. 4 and 13.)

The upper ends of the rods extend above the respective carriers in a manner to be engaged by improved devices for reciprocating the carriers, which devices I shall now describe. On the inner side of the yoke-head is an elongated boss 111, through which the guide-rod 99 freely extends. Surrounding this boss is a sleeve 112, which is partially rotatable, its range of movement being determined by means of a set-screw 113 extending from the boss through a peripheral slot 114 in the sleeve. Clamped on this sleeve a suitable distance apart are two split collars 115, which are provided with depending studs 116. These studs are so relatively arranged that they may be disposed to embrace either of the up-projecting ends of the rods on the yarn-carriers in a manner to reciprocate the engaged carrier in concert with the yoke and the cam-carriages; or the studs may be moved in a plane between the two rods, so as to be disengaged entirely therefrom, in which latter instance neither carrier will be impelled. The split collars are clamped on the sleeve by means of set-screws 117 fitted to lugs on the ends of the respective collars, so that said collars, or either of them, may be nicely adjusted on the sleeve. On the outer or free end of the sleeve is a similarly-clamped collar 118, which is provided with a depending ball-shaped lug 119, that is adapted, during the forward strokes of the yoke, to engage a V-shaped cam-head 120 on the opposed end

of the machine and to be moved thereby to determine the position of the sleeve and its depending lugs in respect to the yarn-carriers. This head is mounted upon a horizontally-sliding plate 121, which is connected with the upper arm of a lever 122 pivoted on the adjacent end head of the machine, the lower arm of the lever being provided with a foot that rests upon the periphery of the pattern-wheel. The foot is held yieldingly upon the wheel by means of a spring 123, to the end that the appropriately-formed surfaces on the wheel will control the plate, and thus determine the positions of the cam-head relatively to the path of the lug 119.

Respecting the yarn-guide heads, it will be observed that their lower ends are expanded laterally and oppositely beveled, so as to travel adjacent to the knitting-needles in the respective beds, by which construction the beveled surfaces during the traverse of the heads coact with the latches of the needles to insure the opening of partially-open latches.

I claim—

1. In a knitting-machine, the combination, with the needle-bed, of the oscillatory needle-supporting jack provided with a cam-slot therein, and a support coacting with said slot, substantially as described.

2. In a knitting-machine, the combination, with the needle-bed, of a series of independently-movable needle-supporting jacks provided with cam-slots therein, and a rod extending through said slots, substantially as described.

3. In a knitting-machine, the combination, with the needle-bed, of a series of needle-supporting jacks therein, the same being longitudinally and vertically movable and being provided with camways, and a fixed rod coacting with said camways, substantially as described.

4. In a knitting-machine, the combination, with the needle-bed, of a series of needle-supporting jacks therein, the same being longitudinally and vertically movable and being provided with camways, a fixed rod coacting with said camways, and means for longitudinally reciprocating said jacks, substantially as described.

5. In a knitting-machine, the combination, with a needle-bed provided with a longitudinally-disposed jack-supporting bar therein, of a series of needle-supporting jacks contained in said bed, the upper ends of the jacks resting upon said bar and the lower ends thereof being provided with camways, a rod coacting with said camways, and means for reciprocating the jacks, substantially as described.

6. The combination, with the needle-bed, the jacks therein, the needles, and provisions whereby the jacks are temporarily sustained in the raised or the depressed position, of the follower; the rocking device thereon having provisions to act upon the jacks, means whereby said follower and rocking device are

intermittently impelled, and means whereby the latter is rocked during its traverse, substantially as described.

7. In a knitting-machine, the combination, with the oppositely-arranged needle-beds, of oscillatory needle-supporting jacks therein provided with camways, those of the jacks in one bed being the reverse of those in the other bed, rods coacting with the said camways respectively, and means for longitudinally reciprocating the jacks, substantially as described.

8. The combination of the supporting-frame, a shaft, a follower thereon, a rocking segment having provisions for effecting the action and inaction of the needles and being fitted to a guide in the follower, screw devices to impel said follower and segment, an oscillatory arm provided with an elongated opening therein, provisions whereby it is connected with the segment, an eccentric fitted to said opening, and a shaft for the eccentric, substantially as described.

9. The combination, with the needle-beds, the jacks therein, their supporting parts, and the needles, of the follower, the segment thereon provided with means to act upon the jacks in the respective beds, means for impelling said follower and segment, and means for oscillating said segment during its traverse, substantially as described.

10. The combination, with the needle-beds, the jacks therein, their supporting parts, and the needles, of the follower, the segment thereon provided with means to act upon the jacks in the respective beds, an oscillatory arm on said follower, provisions whereby the arm is connected with the segment, means whereby the follower is impelled, and means whereby the arm thereon is oscillated, substantially as described.

11. In a knitting-machine, the combination, with the follower and its supporting parts, of the screw-threaded sleeve on the follower, the shaft for said sleeve, the gear-nut on the sleeve, means for holding the nut in place, a pinion engaged with said nut, the shaft for the pinion, and means for actuating the shaft, substantially as described.

12. The combination, with the follower, oscillatory needle-controlling mechanism thereon, a shaft upon which said follower is supported and guided, a screw-threaded sleeve on the follower, a shaft for said sleeve, a gear-nut on the sleeve, means for holding the nut in place, a pinion engaged with said nut, the shaft for said pinion, means on the latter shaft to oscillate the said needle-controlling mechanism, and means for actuating the shaft, substantially as described.

13. The combination, with the needle-beds, the jacks therein, their supporting parts and the needles, of the follower, the segment thereon with means to act upon the jacks, an oscillatory arm on said follower, provisions whereby it is connected with the segment, the screw-threaded sleeve on the follower, the

shaft for said sleeve, the gear-nut on the sleeve, means for holding the nut in place, a pinion engaged with said nut, the shaft for said pinion, an eccentric on the shaft to oscillate the said arm, and means for operating the shaft, substantially as described.

14. The combination, with the needle-bed, of the open or slotted bar thereon, the sinker-frame on said bar, and the sinkers in said frame, substantially as described.

15. The combination, with the sinker-frame, the vibratory sinkers therein, the sinker-cam and its supporting and operating parts, of the independent looped springs detachably fitted to kerfs in the frame rearward of the sinkers so as to act upon the sinkers individually, the looped portions of the springs extending above the upper side of the frame in rear of the path traversed by the sinker-cam, substantially as described.

16. The combination, with the needle-beds, their needles, the sinkers, and their supporting parts, of the reciprocating head fitted to the throat of the machine so as to act upon the sinkers in both beds, and means for operating said head, substantially as described.

17. The combination, with the needle-beds, their needles, the sinkers and their supporting parts, of the reciprocative head fitted to the throat of the machine so as to act upon the sinkers in both beds, the bracket-support for said head, the spring tending to force the head inward, and means for forcing the head outward against the action of the spring, substantially as described.

18. The combination, with the needle-beds, their needles, the sinkers and their supporting parts, of the reciprocative head fitted to the throat of the machine so as to act upon the sinkers in both beds, the follower, means for impelling the same, and connections between said follower and the reciprocative head, substantially as described.

19. The combination, with the needle-bed and its needles, of a bar or support on said bed, a gib-bar connected with said bar by means of a pin-and-cam-slot connection, and a spring acting upon said gib-bar to effect its depression, substantially as described.

20. In a knitting-machine, the combination of the needle-bed and its needles, knitting-cams, a sectional carriage therefor, one of the sections being arranged at the lower portion of the needle-bed, and the other section being pivotally connected therewith and supporting the knitting-cams, a rod pivotally connecting said sections and affording a longitudinal guide for the carriage, and provisions whereby the pivoted cam-supporting section is operated to throw the cams into and out of action, substantially as described.

21. In a knitting-machine, the combination of the needle-bed and its needles, knitting-cams, a sectional carriage therefor, one of the sections being a slide-section and the other section supporting the knitting-cams and being pivotally connected with the slide-section,

a latched spring-actuated plate arranged on the slide-section to depress the pivoted section and provisions whereby the latter section is thrown out of action, substantially as described.

22. In a knitting-machine, the combination of the needle-bed and its needles, knitting-cams, a sectional carriage therefor, one of the sections being arranged at the lower portion of the needle-bed and the other section being pivotally connected therewith and supporting the knitting-cams, a rod pivotally connecting said sections and affording a longitudinal guide for the carriage, a sinker-cam, means whereby it is connected with said pivoted section, provisions whereby said pivoted section is operated to throw the cams into and out of action, together with the sinkers and their supporting parts, substantially as described.

23. In a knitting-machine, the combination, with the needle-bed, the longitudinally-reciprocative needle-supporting jacks therein provided with upward projections, and the cam-carriage provided with a cam to coact with said projections, substantially as described.

24. The combination of the reciprocative carrier provided with a vertical opening in the face-plate thereof, the supporting-bar for said carrier provided with a longitudinal guiding and raising groove therein; a vertically-reciprocative rod in said carrier bearing a yarn-guide head, a pin or roller engaging the groove, the stem of which roller extends through a slot in the rod, and a set-nut on said stem, substantially as described.

25. The combination, with the needle-beds, the needles, the cam-carriers and their cams, of the projecting pins on the carriers, the yoke, and means for adjustably securing its ends on the pins, substantially as described.

26. The combination, with the needle-beds, the needles, the cam-carriers and their cams, of the screw-threaded pins on said carriers,

the yoke having its ends fitted to the pins, respectively, and the adjusting-nuts on said pins, substantially as described.

27. The combination, with the needle-beds, the needles, the cam-carriers and their cams, of the yoke connecting said carriers, the partially-rotatable sleeve on said yoke, the collars thereon provided with depending lugs, a reciprocative yarn-carrier, supporting means therefor, and provisions whereby the sleeve is actuated at predetermined intervals to engage the lugs with or disengage them from the carrier, substantially as described.

28. The combination, with the needle-beds, the needles, the cam-carriers and their cams, of the yoke connecting said carriers, the longitudinal guide-rod for the yoke, said yoke being provided with a boss or extension, the sleeve on said boss or extension, the collars on said sleeve provided with depending lugs, the reciprocative yarn-carriers, supporting means therefor, and provisions whereby the sleeve is actuated at predetermined intervals to engage the lugs with or disengage them from the carriers, substantially as described.

29. The combination, with the needle-beds, the needles, the cam-carriers and their cams, of the yoke connecting said carriers, the partially-rotatable sleeve on said yoke, the collars 115 and 188 on the sleeve provided with depending lugs 116 and 119, respectively, the reciprocative yarn-carriers mounted above the respective beds, the reciprocative cam-head at one end of the machine, and means for laterally setting said head at predetermined intervals in respect to the path of the lug 119, substantially as described.

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

JOSEPH BENNOR.

Witnesses:

D. H. HOWES,

H. G. WRIGHT, Jr.