

(No Model.)

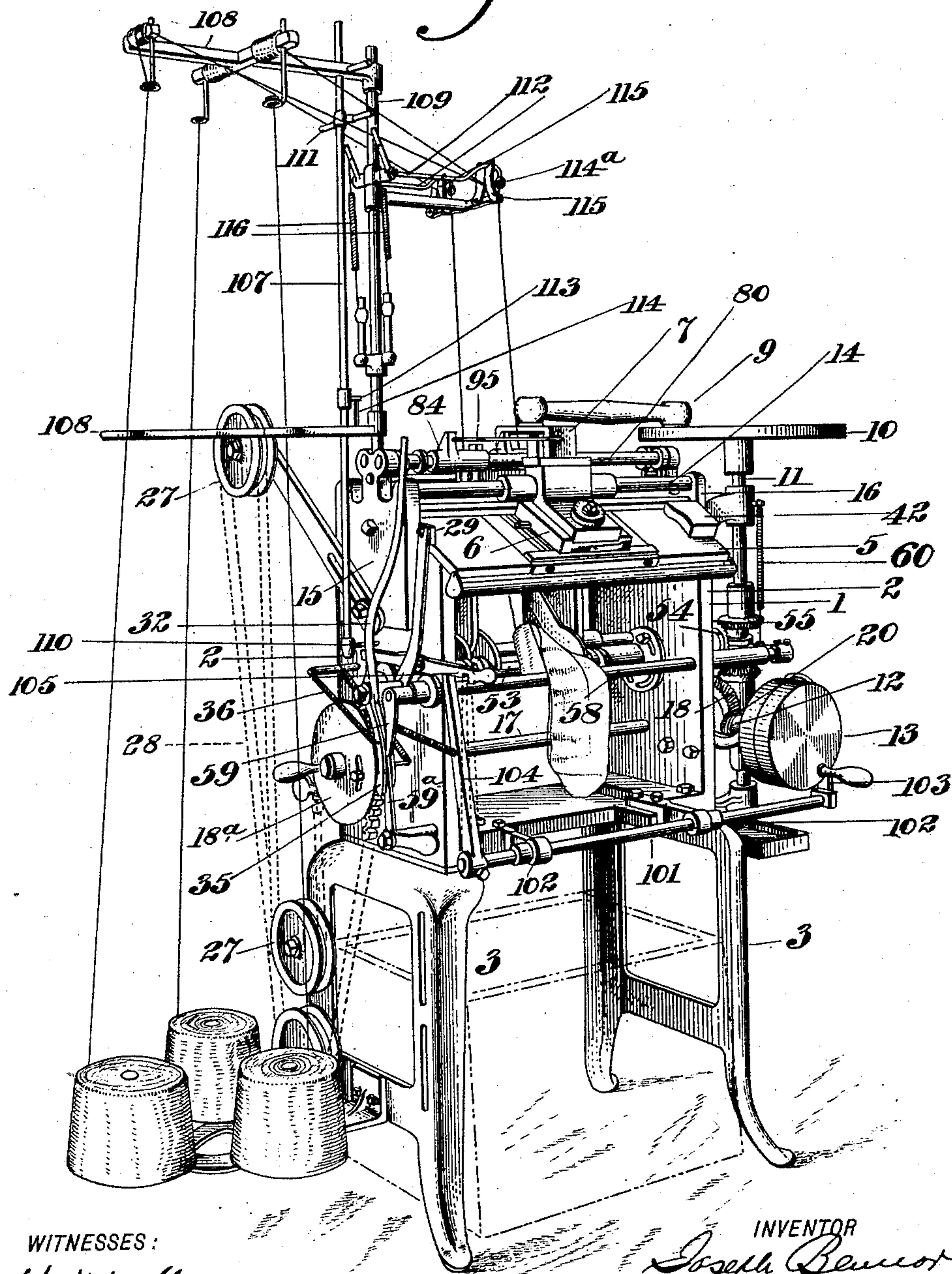
6 Sheets—Sheet 1.

J. BENNOR.
KNITTING MACHINE.

No. 485,317.

Patented Nov. 1, 1892.

Fig. 1.



WITNESSES:

John H. L. L. L.
Est. V. Beck

INVENTOR

Joseph Bennor,

BY

John P. Nolan

ATTORNEY.

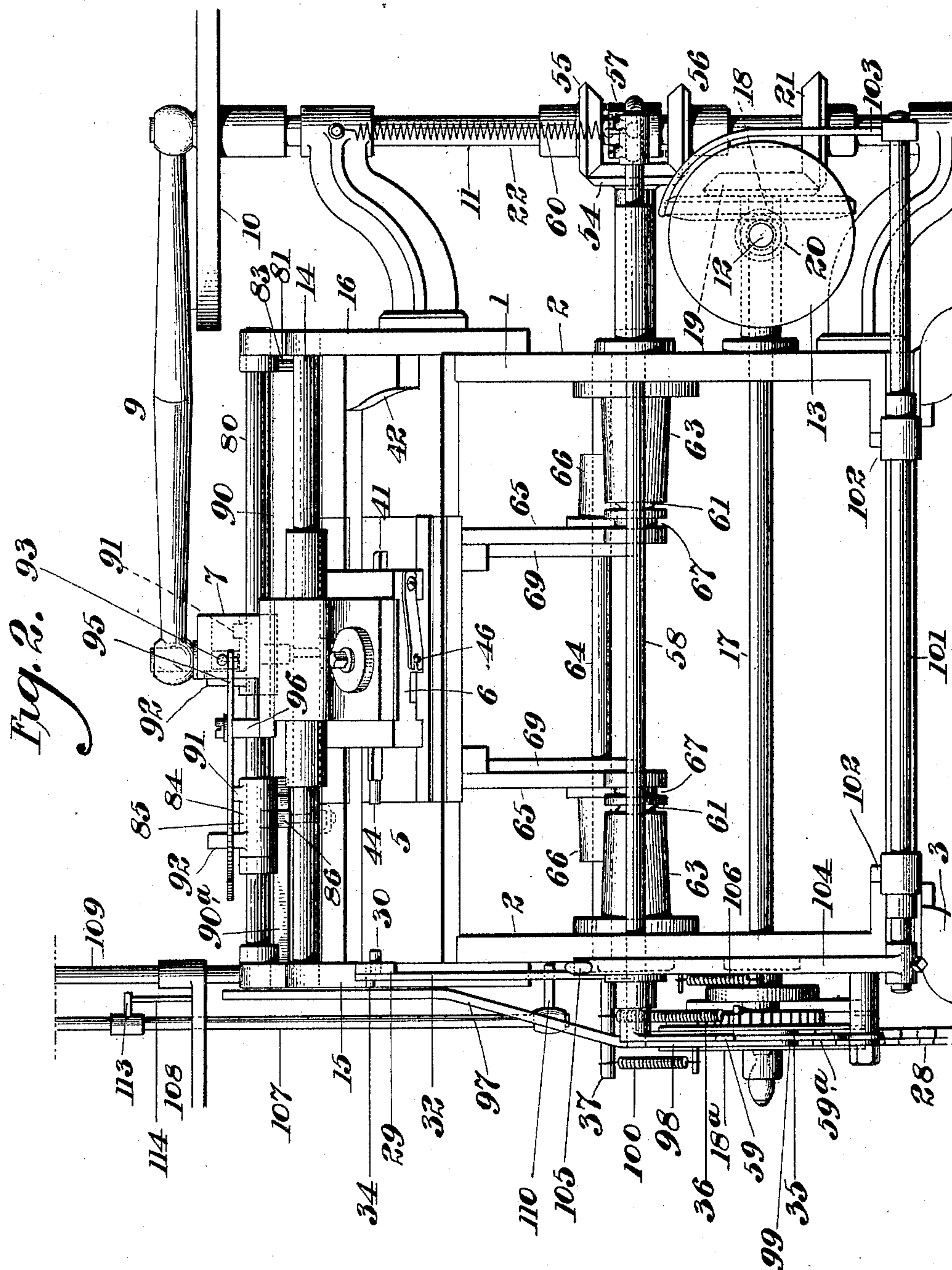
(No Model.)

6 Sheets—Sheet 2.

J. BENNOR.
KNITTING MACHINE.

No. 485,317.

Patented Nov. 1, 1892.



WITNESSES :

John L. Hootch
C. S. Beck

INVENTOR.

INVENTOR
Joseph Benmor
BY
John B. Kolay
ATTORNEY.

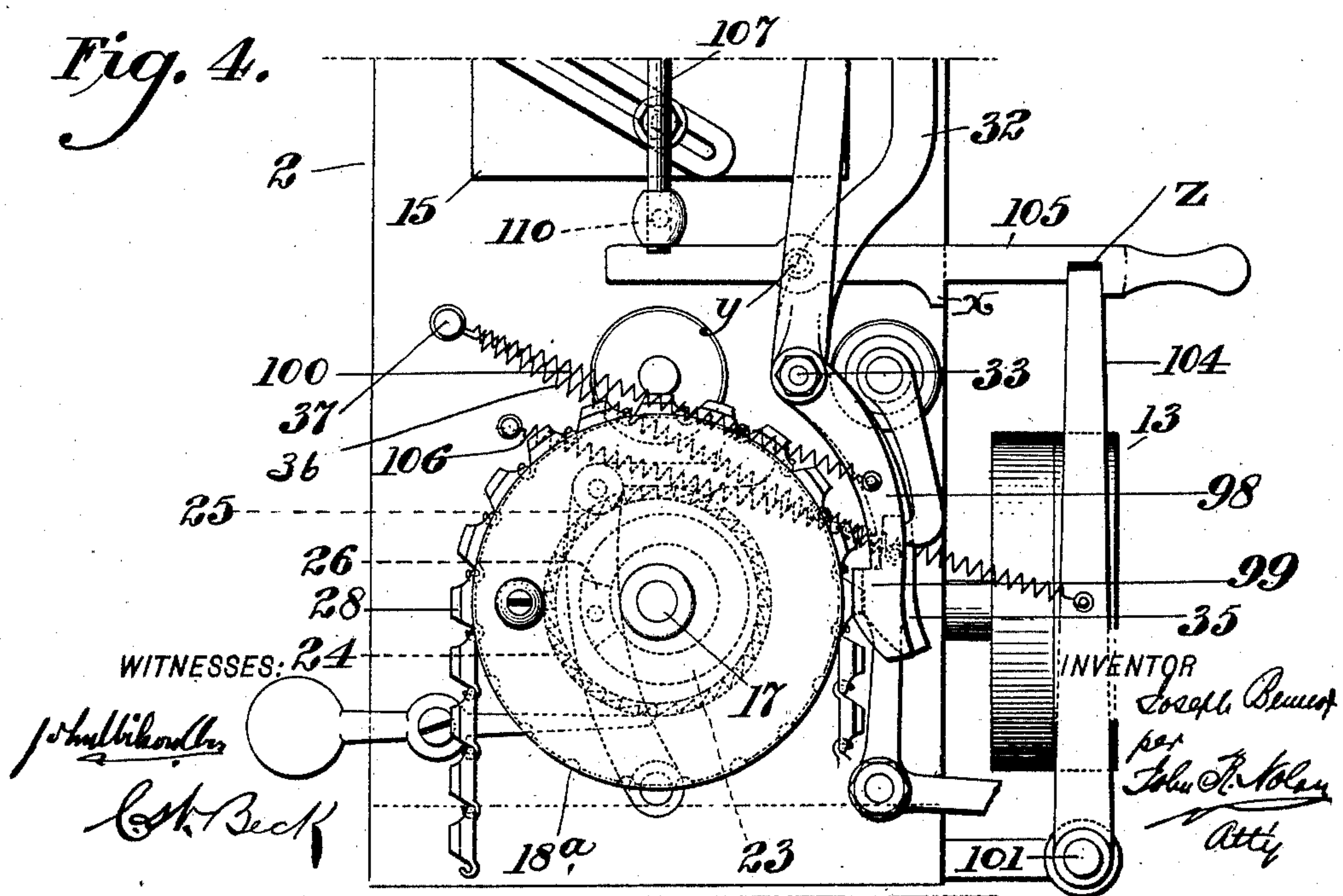
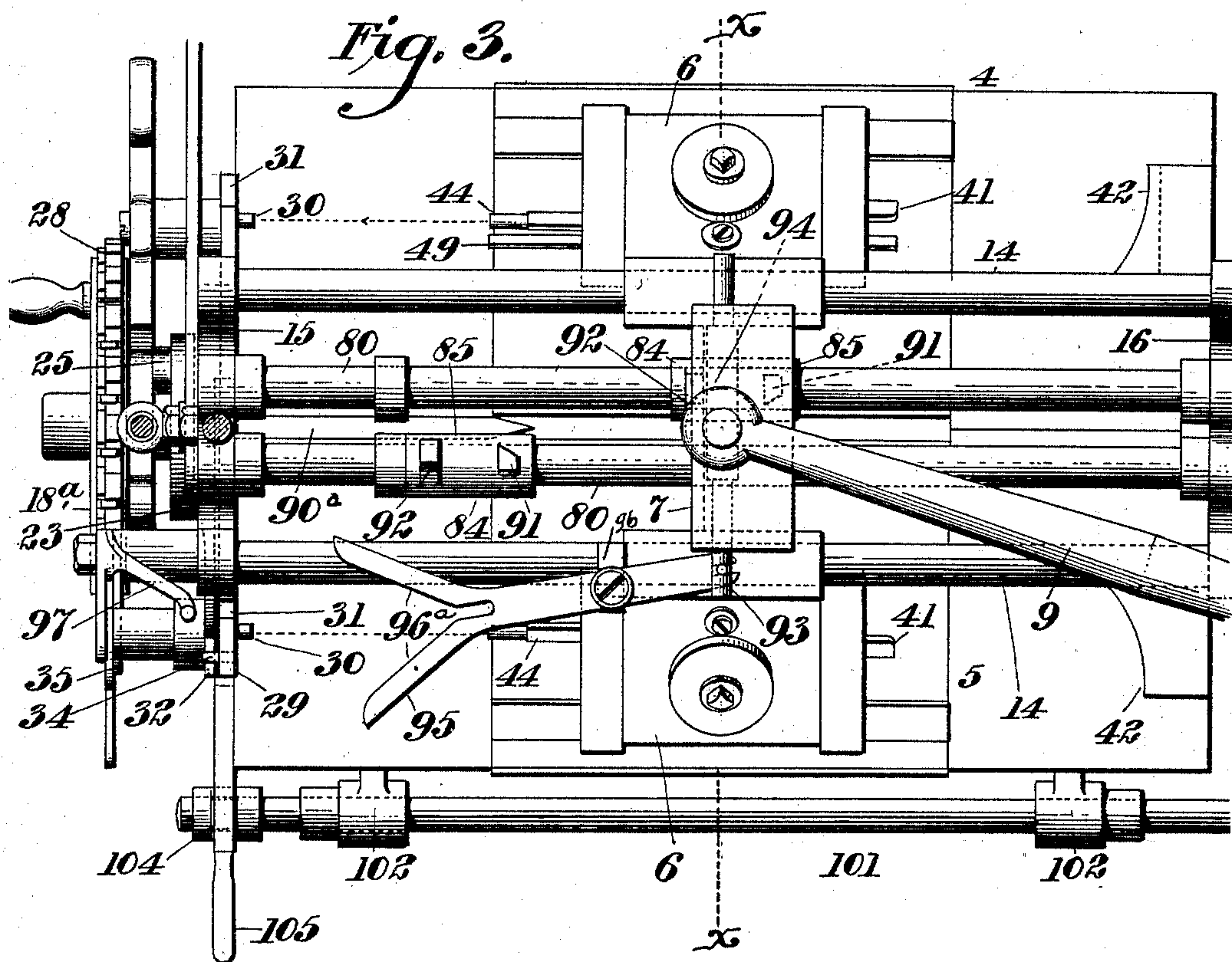
(No Model.)

6 Sheets—Sheet 3.

J. BENNOR.
KNITTING MACHINE.

No. 485,317.

Patented Nov. 1, 1892.



(No Model.)

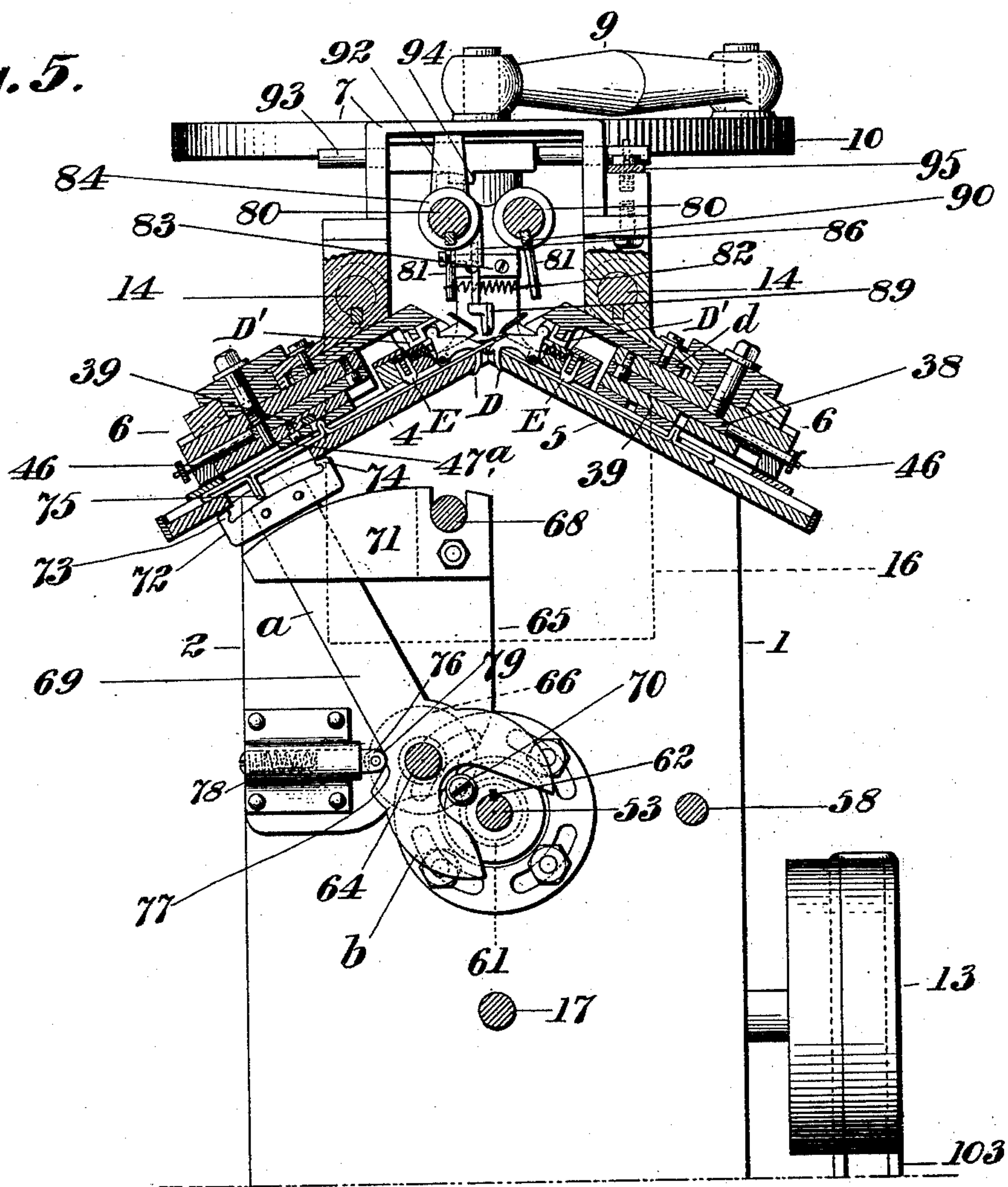
6 Sheets—Sheet 4.

J. BENNOR.
KNITTING MACHINE.

No. 485,317.

Patented Nov. 1, 1892.

Fig. 5.



WITNESSES:

John H. ...
Chas. Beck

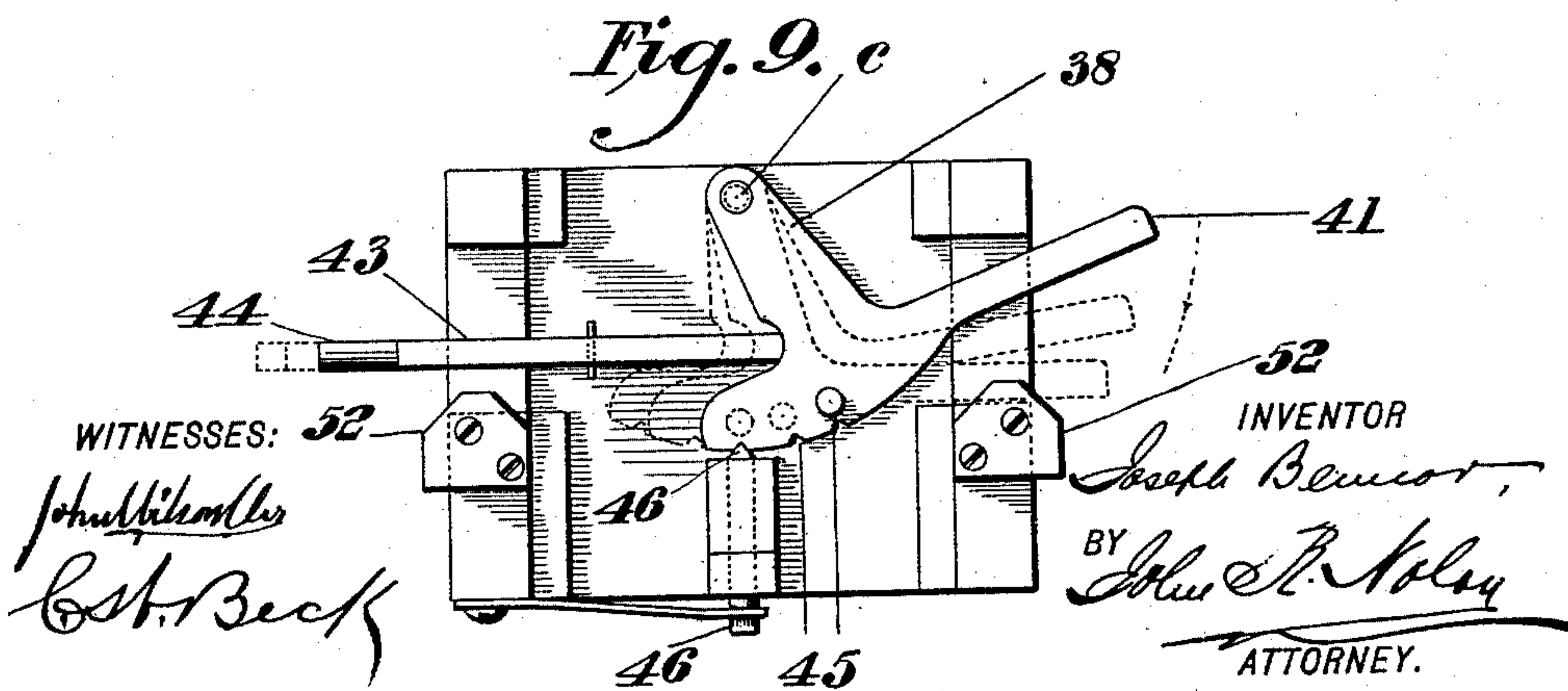
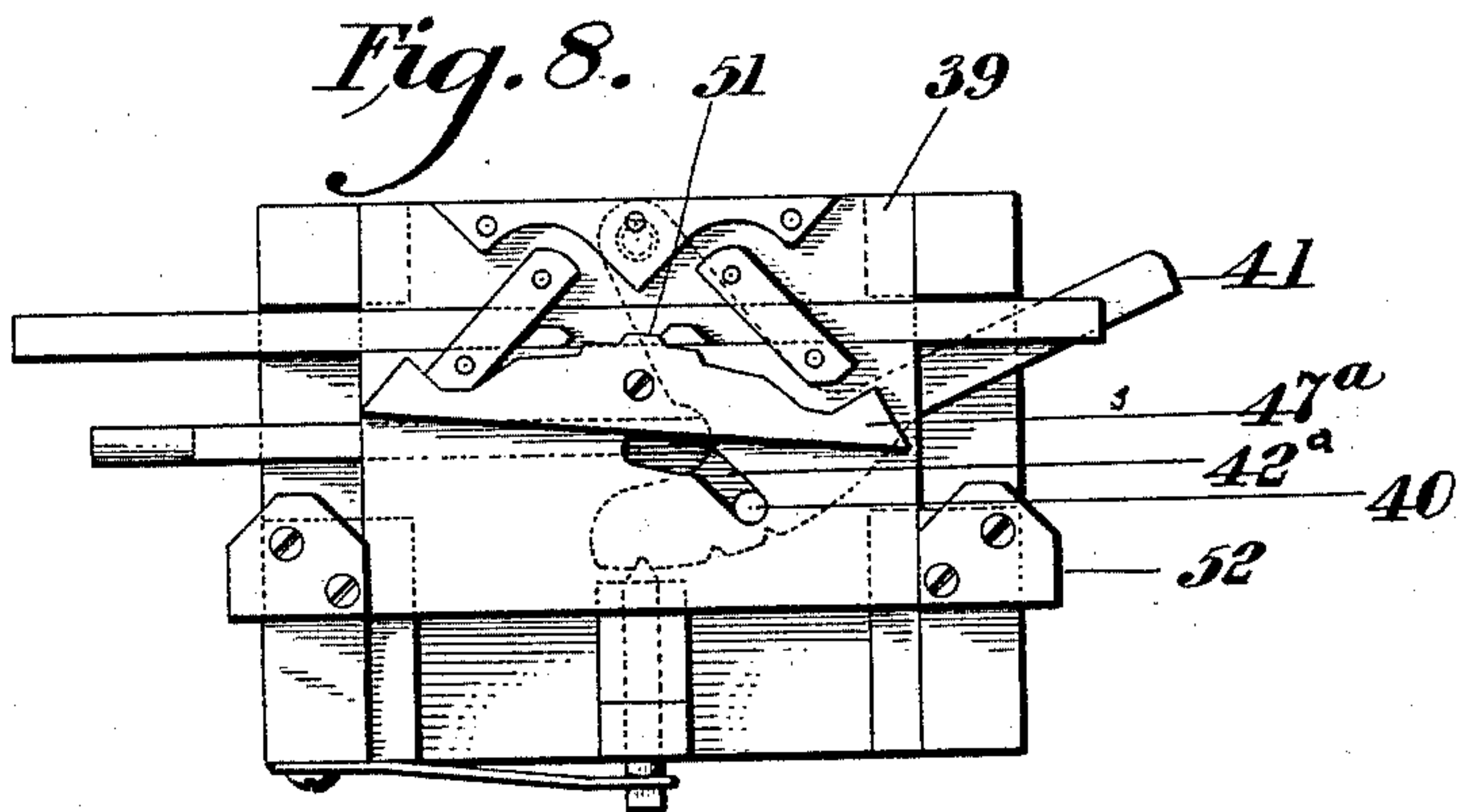
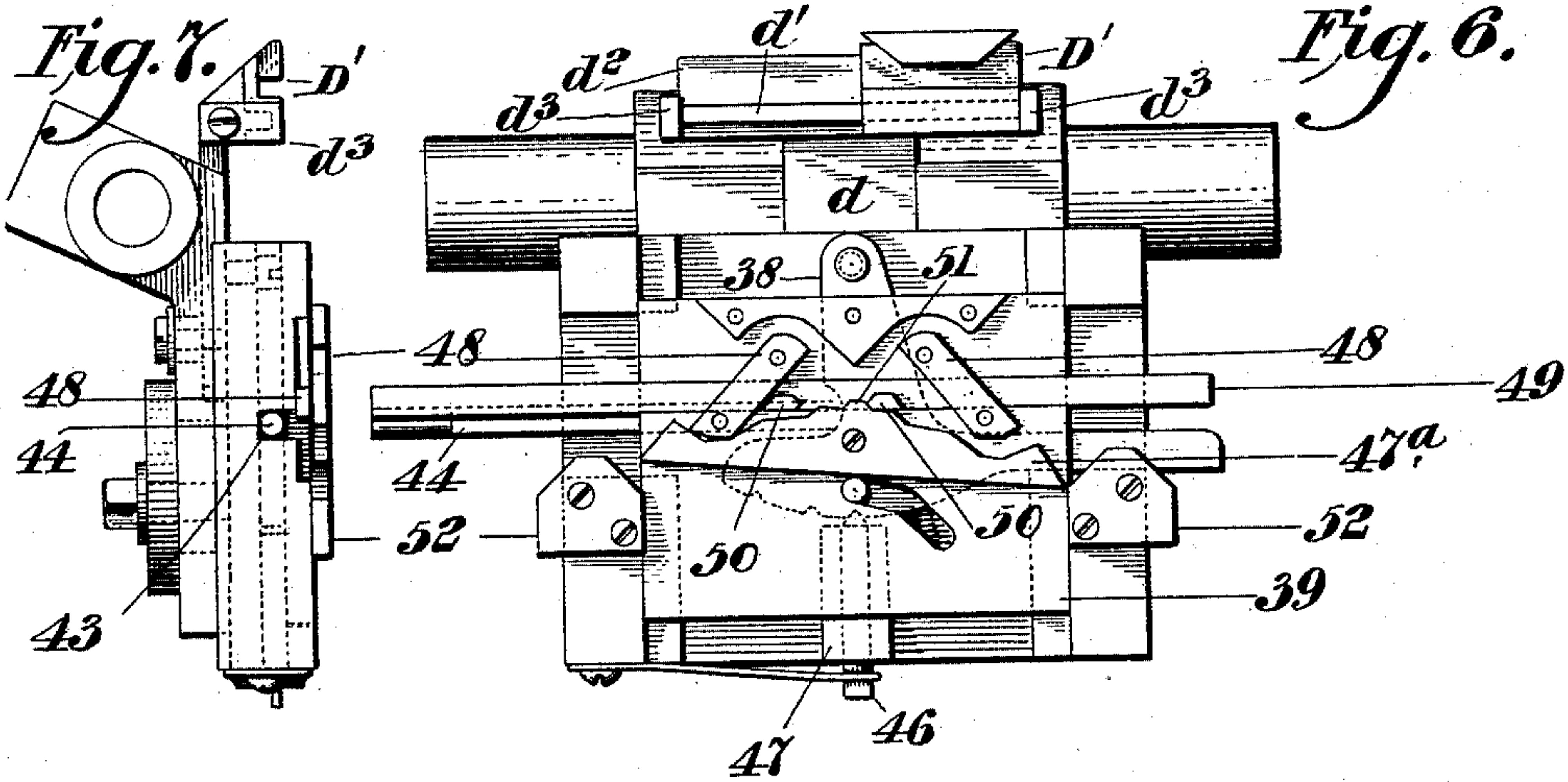
INVENTOR

Joseph Bennor
BY *John P. Tolay*
ATTORNEY.

J. BENNOR.
KNITTING MACHINE.

No. 485,317.

Patented Nov. 1, 1892.



(No Model.)

6-Sheets—Sheet 6.

J. BENNOR.
KNITTING MACHINE.

No. 485,317.

Patented Nov. 1, 1892.

Fig. 10.

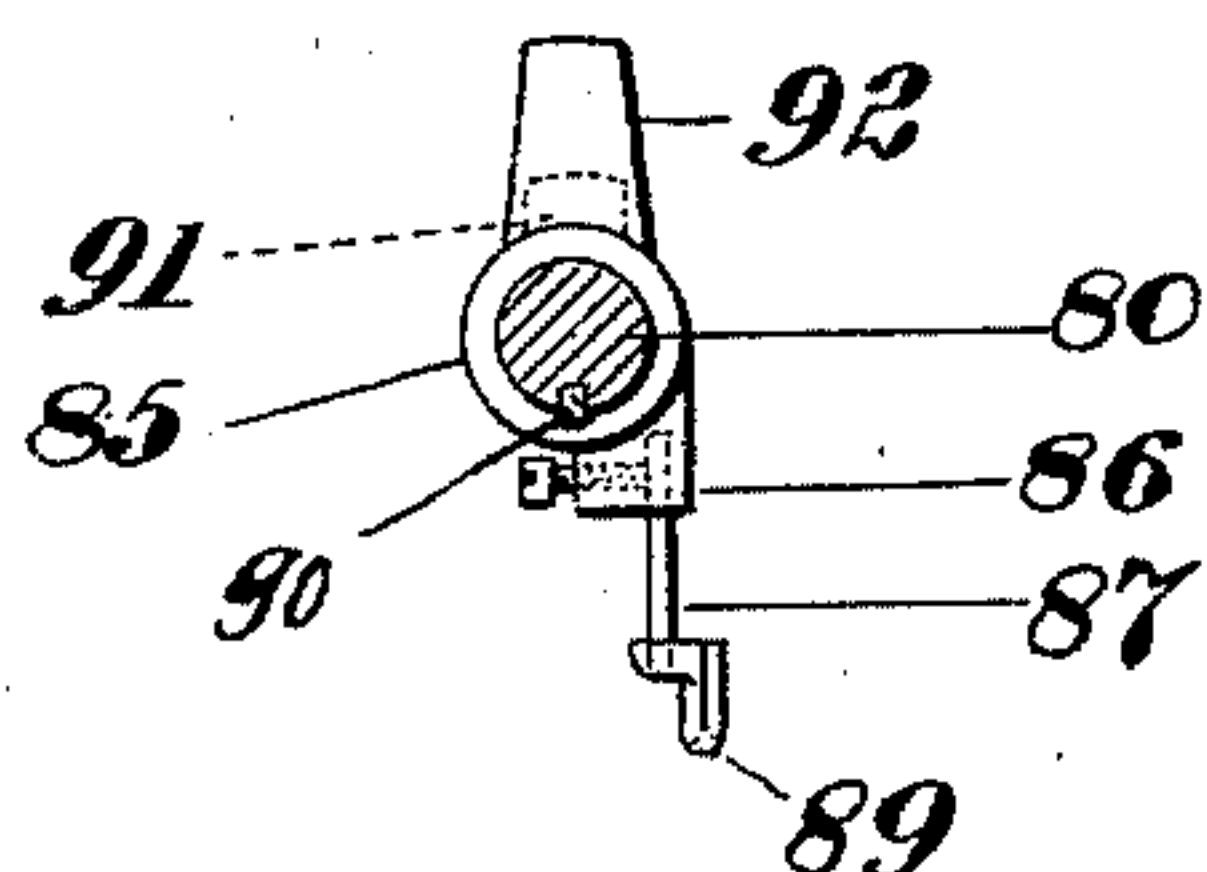


Fig. 11.

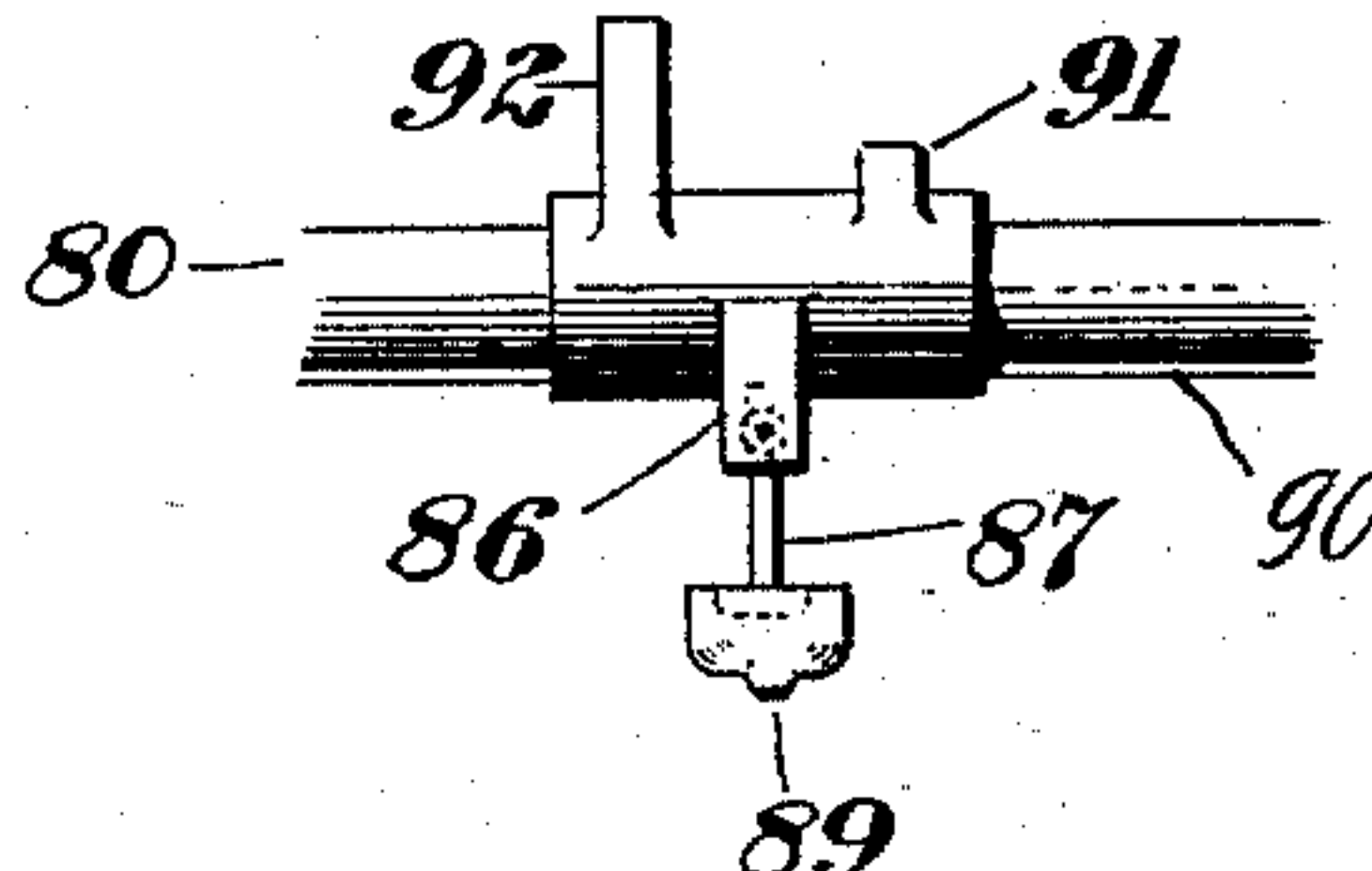


Fig. 12.

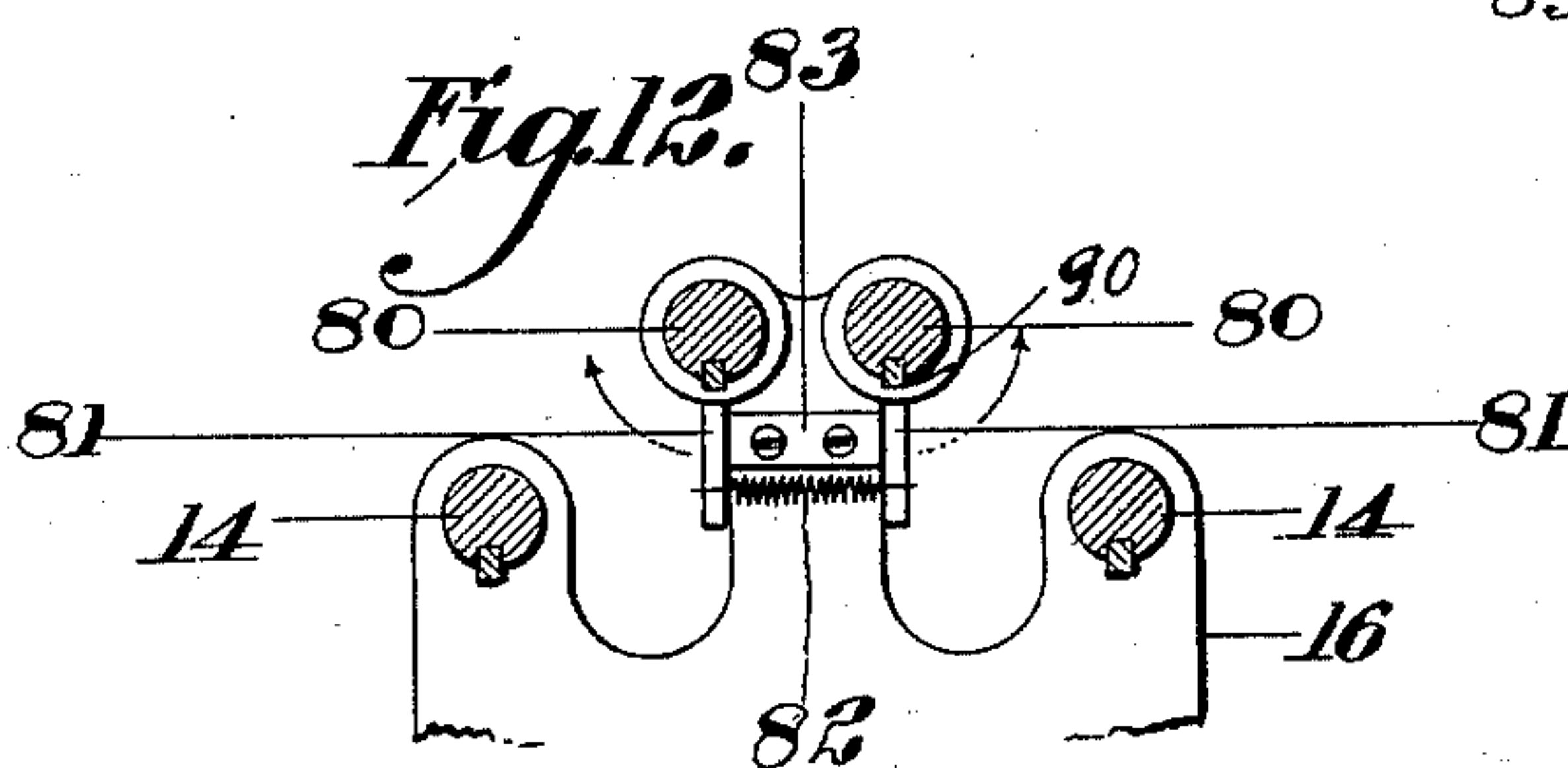


Fig. 13.

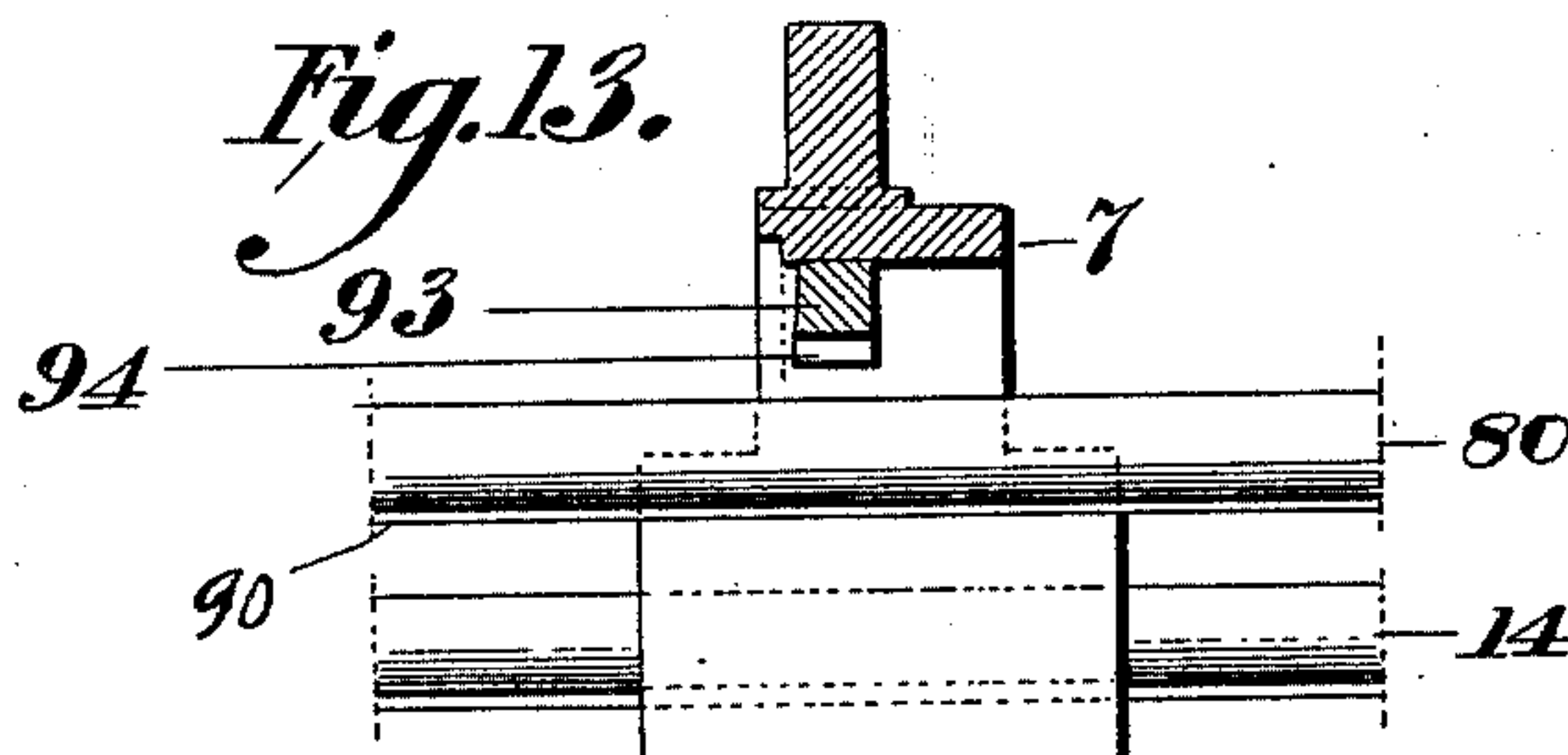
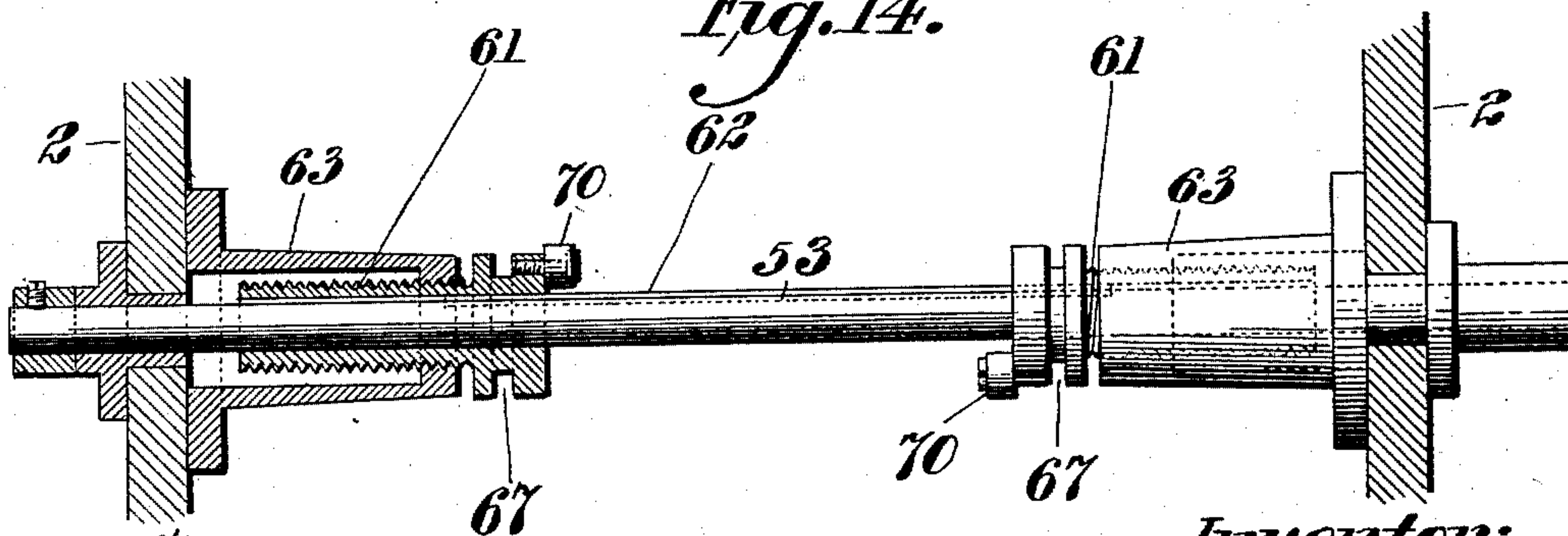


Fig. 14.



Witnesses:

John H. Brouncker
Est. Beck

Inventor:

Joseph Bennor
per John H. Brouncker
Att'y

UNITED STATES PATENT OFFICE.

JOSEPH BENNOR, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 485,317, dated November 1, 1892.

Application filed May 25, 1892. Serial No. 434,241. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH BENNOR, a citizen of the United States, residing at the city and county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in 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.

Figure 1 is a perspective view of a knitting-machine embodying my invention. Fig. 2 is a side elevation thereof, the yarn-take-up mechanism not being shown. Fig. 3 is a partial plan of the machine. Fig. 4 is a partial end view. Fig. 5 is a transverse vertical section as on the line *xx* of Fig. 3. Fig. 6 is an under side view of one of the cam-carriages detached, the knitting-cams being represented in the down or active position. Fig. 7 is an end view of Fig. 6. Fig. 8 is an elevation of the lower or cam-supporting section of the carriage, the cams being represented in the up or active position. Fig. 9 is a like view of said section, the cam-supporting plate being removed therefrom to expose the oscillatory arm or sector and its adjuncts. Fig. 10 is an end view of one of the yarn-carriers as mounted on its rock-shaft. Fig. 11 is a side elevation thereof. Fig. 12 is a detail of one of the end bracket-plates and adjuncts. Fig. 13 is a transverse section through the yoke which connects the cam-carriages. Fig. 14 is a sectional elevation of the duplex-screw mechanism for operating the needle-actuating levers.

This invention relates generally to straight-knitting machines of the kind in which latch-needles are employed, and more particularly to that class of machines designated "automatic," in which are provisions for relatively operating certain end needles during the fashioning process—as, for example, while knitting the heel and toe parts of a sock or stocking. In some of these machines the knitting is commenced at the toe of the sock or stocking and continued therefrom through the foot, heel, and leg portions thereof, whereas in others the order of operation is reversed, the knitting in the latter being commenced at the top of the leg and concluded at the toe portion.

The present invention comprises various

improvements in the general construction and organization of such machines, the precise nature of which improvements will be more clearly understood from the following description and claims, reference being had to the annexed drawings, in which—

The numeral 1 represents the framework of the machine, comprising the end heads 2, the supporting-legs 3, and the oppositely-inclined needle-beds 4 5.

6 represents the cam-carriages that traverse the needle-beds, these carriages being coupled by means of a reciprocating yoke 7. The yoke is connected by means of a pitman 9 with a crank-wheel 10, which is fast on a suitably-disposed vertical shaft 11, geared up with an adjacent shaft or stud 12, upon which the pulleys 13 are mounted.

The cam-carriages are supported and guided in their longitudinal traverse by means of a pair of parallel rods 14, which are supported in bracket-plates 15 16, fixed to the respective end heads 2. Borne in the latter is a longitudinal shaft 17, which is provided on one end with two bevel-wheels 18 19, one of which 18 engages with a bevel-pinion 20 on the stud 12 and the other of which engages a similar pinion 21 on the vertical shaft 11, whereby the latter and the shaft 17 are operated in concert. The shaft 17 is provided on its opposite end with a sprocket-wheel 18^a, to which a step-by-step movement is imparted by any suitable mechanism—such, for example, as that shown in the drawings—that is to say, a grooved-face cam 23 is secured fast to the shaft 17, a ratchet-wheel 24 is affixed concentrically to one side of the sprocket-wheel, and the pivoted pawl-supporting arm 25 is engaged with the cam-groove by means of a stud or block 26. Passing around the wheel 18^a and also around suitably-disposed pulleys 27 is the endless pattern-chain 28, the links of which are properly formed to control the operation of the knitting and yarn-guide mechanisms, as hereinafter described.

The bracket-plate 15 is grooved or channeled transversely for the reception of a horizontal slide-bar 29, the ends of which project beyond the edges of the plate in the path of the tappet or shifter devices for controlling the positions of the knitting-cams, these ends thus constituting stops or abutments for

such devices. The bar is provided on its inner or acting face, near its ends, with studs 30 and openings or offsets 31, which are each adapted to be brought into the paths of the
 5 said shifter devices at certain stages of the knitting operation, as hereinafter explained. The bar is operated through the action of a vertical lever 32, fulcrumed on a stud 33 on the end head, the upper arm of the lever be-
 10 ing slotted and connected by a pin 34 with the slide-bar and the lower arm being provided with a foot 35, that rests upon the links of the pattern-chain. This foot is main-
 15 tained in operation with the links by means of a strong retracting-spring 36, which is connected with the arm and with a stud 37, projecting from the end head. By this con-
 20 struction it will be seen that when the sprocket-wheel is intermittently rotated the links of the pattern-chain will be brought successively into engagement with the foot 35, which latter will thereupon rise or fall in accordance with the height of the faces of the links, and thus impart the predeter-
 25 mined movements to the abutment-bar 29. When the reciprocating knitting-cams are to be alternately thrown into and out of action, the position of this bar is such that the studs 30 lie in the paths of the cam-
 30 shifting devices. When the cams are to be thrown into an intermediate position, the bar is shifted longitudinally, so as to move the studs out of said paths, in which case the shifter devices abut against the face of the
 35 bar, and when one set of cams is to be permitted to remain in action and the other set to remain out of action the position of the bar is such that the openings or offsets 31 are in line with the shifter devices, all as herein-
 40 after more fully set forth.

At the beginning of the knitting operation the cams are thrown into the intermediate position above mentioned, in which case both sets are active. The cams then make one
 45 stroke, thus throwing upward simultaneously the needles in both beds at the same time the yarn is delivered to the needles, whereupon the cams in the reverse stroke retract the needles with the yarn engaged therewith.
 50 At the end of this second stroke the cams are moved into their tube-knitting position—that is, one set is in the extreme down or operative position, while the other set is in the extreme up or inoperative position. The cams
 55 then make a complete reciprocation—i. e., two strokes—thereby forming a round of stitches. The positions of the cams are reversed at the end of the first stroke of this movement, and then at the end of the second stroke returned to
 60 their previous positions. In the succeeding strokes of the cams they are maintained in these relative positions—that is, one set active and the other set inactive. Hence the knitting is carried on by one set of needles
 65 only. During the operation the end needles of this set are alternately thrown out of action with the cams, so as to produce a gradually-

narrowed web the desired length of the toe-pouch, whereupon the outthrown needles are alternately moved back into action with the
 70 cams. There is thus formed the fashioned toe-pouch of the stocking. This done, both sets of cams are thrown into the tube-knitting positions and the formation of the foot effected. Reaching the heel, the pouch there-
 75 for is formed, similarly to that of the toe, following which the leg is formed, similarly to the tubular portion of the foot. When the article is completed, others may be likewise started and formed successively. 80

Examples of machines for producing socks according to the above-described process are illustrated in Letters Patent of the United States to John Nelson, No. 214,308, dated April 15, 1879, and in my assigned Letters Patent, No. 85 440,839, dated November 11, 1890, to which reference may be had. Reference may also be made in this connection to an application for Letters Patent filed by me March 17, 1892, Serial No. 425,286. In the present case the cam-carriages 90 are each made in two sections, similarly to those described in my said pending application, the upper sections being attached to the yoke and the lower sections, which carry the knitting cams, being transversely adjustable 95 in respect to the upper sections, suitable eccentric and screw connections for this purpose being provided. It is unnecessary to describe herein this particular construction, as it is set out very fully in the pending case 100 just mentioned. Instead of employing a transverse slide-bar, as formerly, to control the positions of the knitting-cams I use an oscillating arm or sector 38. This sector is pivoted at c on the under side of the lower section, 105 just back of the transverse slide-plate 39, on which the knitting-cams are mounted. It is connected by means of a pin 40 with an appropriate cam-slot 42^a in the said plate, whereby when the sector is oscillated the plate will 110 be reciprocated transversely. The sector is superior to the slide-bar in that less force is required to operate the former than the latter, and hence the wearing action upon the cam-slots in the slide-plate and upon the other 115 elements which coact with the sector is reduced to a minimum. The sector is provided with a projecting arm 41, which extends outwardly beyond that edge of the cam-carriage which approaches the fixed end stop 42, this 120 edge being suitably cut away to permit of the oscillatory movement of the arm. When the arm abuts against this stop and the sector occupies the position indicated in Fig. 9, the sector is moved forward. The arms of the 125 sectors in the two carriages as they approach the end stops in the position thus indicated are inclined upwardly; but when they abut against the latter the arms are moved downward to a horizontal plane, or nearly so. The 130 stops 42 comprise blocks affixed to the faces of the beds, respectively, the acting edges of which blocks are curved coincidently with the arcs described by the ends of the arms 41.

Inasmuch as these arms project from the adjacent ends of the two carriages, the positions of which upon the needle-beds are reversed, it follows that when one set of cams is moved upward out of action by the operation of the arm just described the other set is moved downward into action. Fitted to offsets 43 in the opposite edges of the cam-carriages are tappet-pins 44, which lie in line with the edge of the sector, whereby when the outer ends of said rods impinge the abutment-bar their inner ends forcibly strike the opposed edges of the sectors, thus returning the latter to their former positions and reversing the positions of the knitting-cams. Of course when the openings or offsets in the abutment-bar are brought into the path of the tappet-pins and held therein the positions of the sectors are unchanged during the succeeding strokes of the cam-carriages.

During the knitting operation, hereinbefore described, the sector is caused to assume three positions—viz., the extreme right and left positions to throw the cams entirely up and down and an intermediate position to throw the cams only partially up. To lock the sector in these positions, its under or convex edge is provided with three suitably-disposed notches 45, with each of which is successively engaged a spring-controlled pin 46, fitted to a perforated lug 47 on the under section. The cams which are borne by that carriage which traverses the bed 4 are caused to actuate the needles upon each stroke of the carriage during the formation of the heel and toe parts of the sock. I have mounted upon the slide-plate of this carriage a rocking guard-cam 47^a, the function of which is to insure the engagement of the reciprocating knitting-cams with the needles. This guard-cam comprises a piece pivoted to the slide-plate 39 at a point midway between the wing-cams 48, the ends of the piece being oppositely beveled or inclined, similarly to the outer edges of said wing-cams, and being extended below and slightly beyond the lower ends of the latter. The disposition of the pivot is such that when the piece is rocked its extremities will be alternately brought into and out of contact with the lower ends of the wing-cams, respectively—that is to say, when the piece is tilted, as represented in Fig. 6, its advancing end will abut against the adjacent wing-cam—the needles in the path of said end thus being directed thereby onto the leading wing-cam, while the opposite end of the piece will be below the end of the other or following wing-cam, so as to leave a gate or way by which the needles may escape. When the knitting-cams are moving in the reverse direction, the inclined position of the piece is reversed, its action thereupon corresponding with that just described. A means whereby I oscillate this guard-cam at the end of each stroke of the knitting-cams in order to throw it into the requisite positions is clearly represented in Figs. 6 and 7. It comprises a

longitudinal slide-bar 49, let into the plate just in rear of the knitting-cams, the ends of the bar being extended beyond the outer edges of the carriage. This bar is provided at points between the wing-cams with two studs 50, and the piece is provided on its upper edge in line with the pivot with a stud 51, which extends between the studs 50. The upper edge of the piece is inclined slightly downward on each edge of the stud, whereby when the bar is reciprocated the studs 50 thereon will ride upon the inclined edges alternately, and thus oscillate the guard-cam. The central stud 51 limits the movement of the bar, while the frictional action of its studs upon the inclined edges maintains the parts positively in position. The bar is actuated at the end of each stroke of the knitting-cams by its striking the abutment-stops.

52 52 are beveled blocks fixed to the lower section of the carriage in near relation to the ends of the guard-cam, which blocks are designed during the active traverse of the carriage to direct the needles up above the plane of the lower edge of said cam.

The mechanism which I employ for throwing the end needles in the bed 4 out of and into action during the formation of the heel and toe parts of the sock is illustrated in Figs. 2, 5, and 14 of the drawings. Its construction is as follows: Mounted in and between the end heads of the supporting-frame is a shaft 53, one end of which is extended outwardly beyond the adjacent head and is equipped with a bevel gear-wheel 54. This wheel engages two similar wheels 55 56, loosely mounted on the vertical shaft, which wheels may be alternately fixed to and released from the shaft by means of an interposed clutch 57, that is connected with one end of a longitudinal shaft 58, under the control of the pattern-chain. The shaft 58 has on its opposite end a depending arm 59, that bears upon the upper end of a lever 59^a, that rests upon the links of the pattern-chain, being held thereon by the action of a suitably-disposed spring 60. Thus when the arm rides upon a low-faced link of the chain the clutch is engaged with the upper bevel-wheel 55, which latter thereupon rotates the shaft in one direction. When the arm rides upon a high-faced link, the clutch is disengaged from the upper wheel 55 and engaged with the lower wheel 56, which latter thereupon rotates the shaft in a reverse direction, and when the arm rides upon a medium-faced link the clutch is thrown into its original or intermediate position, in which case it is out of engagement with both wheels and the shaft is at rest. As the construction and operation of the devices last described are known, minute description thereof is unnecessary. On the shaft 53 are two oppositely-pitched screws 61, which are movable longitudinally, the shaft being provided with a spline 62 to prevent their rotating independently of the shaft. These screws work in internally-threaded nuts or bosses

63, fixed to the inner faces of the end heads, the construction being such that when the shaft is properly rotated the nuts or bosses will effect the movement of the screws toward
5 or away from each other.

Fixed in and between the end heads, in proximity to and parallel with the shaft 53, is a shaft 64, on which are mounted a couple of vertical plates 65, that are provided on their
10 outer faces with flanged bosses 66. The flanges of these bosses extend into circumferential grooves 67 on the headed ends of the screws, whereby when said screws are moved longitudinally the plates will be correspondingly
15 impelled. The upper portions of the plates are supported and guided in their traverse by means of a longitudinal shaft or rod 68, suitably disposed between the end heads of the frame. Fulcrumed on the shaft 64, contiguous to the inner faces of the plates, are two levers 69 69, respectively, the longer arms *a* of which extend diagonally to or near to the under
20 side of the needle-bed 4, and the shorter arms *b* of which levers extend to and against the end heads of the screws, respectively. These shorter arms are bifurcated, so as to straddle the shaft 53, and receive small rollers or wrist-pins 70 on the ends of the adjacent screw-heads, respectively, whereby when the said shaft and
25 screws are rotated the rollers or pins, acting against the members of the shorter arms *b*, will oscillate the levers. The longer arms *a* of these levers are held against the faces of the plates 65, so as to be moved therewith. For this purpose I employ bracket-pieces 71, secured to the plates and extended in front of said arms
30 *b*. Secured to or formed on the upper end of each of these arms is a plate 72, the upper edge of which is recessed to form end teats or shoulders 73 74, that lie in close relation to the under side of the bed 4. The needle-grooves in this bed are open, as formerly, and the needles therein are provided with depending tails 75, which project into the planes of
35 the recesses in the plates 72, respectively. The thickness of each of these plates is about equal to the width of a needle-groove, so that the plates may be moved below and caused to act upon the needles individually—that is
40 to say, as the arms are moved inward and upthrown by the action of the screw devices the teats will impinge against the opposed tails of the end needles in the bed 4 successively and throw them up out of action, while,
45 on the other hand, when the arms are retracted or drawn away from each other after the requisite number of needles have been upthrown the opposite teats of the plate will impinge against the tails of the needles and return them successively into action.

The back or return strokes of the oscillating arms *b* during the inward traverse of the levers and the forward or return strokes of said arms during the outward traverse of the
50 levers take place in each instance in the spaces between the needle-grooves, the pitch of the screw-threads and the general organiza-

tion of the parts being designed to this end. The levers 69 are each maintained normally in the intermediate position (represented in
Fig. 5) by means of a spring-actuated plunger 76, which bears against a suitably-shaped cam-surface 77 on the outer edge of the lever. This plunger is disposed in line horizontally
70 with the center of the shaft 64. It is fitted to a bracket 78 on the inner side of the adjacent plate 65 and is preferably equipped on its inner end with a small antifriction-roller 79, that acts upon the cam-surface.

The spring-actuated sinkers *D*, which alternate with the needles and serve to hold the upper rounds of stitches as they are successively formed, together with the spring-actuated bits *E*, which bear upon the needles individually to prevent the jumping of the latter upon their being freed from the knitting-cams, are identical in construction and operation with the like parts set out in an application for Letters Patent of the United States,
80 Serial No. 417,909, filed by me January 13, 1892. The cam device for retracting said sinkers immediately before the back stroke of the needles while the stitch is being formed differs slightly in construction from that disclosed in the application just referred to—that is to say, in lieu of the long cam-bar provided with blocks or studs, between and against
85 which acts the inwardly-projecting arm *d* on the cam-carriage, I use in this instance a grooved end-beveled head *D'*, fitted to a rib *d'* on the under side of a transverse bar *d*² on the arm *d*. The ends of the bar are provided with lips *d*³, that limit the endwise movement of the head *D'*, the space between these lips being equal to the length of the head plus the
90 distance of lost motion thereof requisite at the initial movement of the carriage in each stroke in order to throw the head into proper time with the knitting-cams.

The construction and organization of the yarn-guide devices and of the mechanism for controlling and operating the same are clearly shown in Figs. 1, 2, 3, 10, 11, and 12 of the annexed drawings, as follows: 80 80 represent a pair of parallel rock-shafts disposed longitudinally above the throat of the machine and supported at their extremities by the end brackets 15 16. These shafts are provided at suitable points near to one (16) of the end brackets with depending pins 81, that are connected
95 by a spiral spring 82, the tendency of which is to draw the pins toward each other. Fixed to the bracket 16 is a block 83, the ends of which act as positive stops to limit the inward movement of the pins. On each of the shafts 80 there is mounted a yarn-carrier 84, which is adapted to travel to and fro thereon. The carrier comprises a sleeve-like device 85, provided on its under side with a projection 86, to which is secured a short depending rod 87,
100 that supports the yarn-guide head 89 normally above the throat or median line of the machine. The carrier is guided in its longitudinal traverse by means of a spline 90 on

the rock-shaft. Projecting inwardly from the opposite end head 15 is a pin 90^a, the forward beveled end of which extends slightly beyond the limit of the advancing stroke of the yarn-carrier devices and lies in such respect to the paths of the latter that the projections thereon as the carriers advance will bear forcibly against the sides of the beveled end and be pressed outward laterally thereby. When one of the carriers is drawn back or outward sufficiently far to escape the beveled point of the pin, the shaft of this carrier assumes its original position, and thus returns the guide-head to the median line of the machine for a succeeding operation.

The yarn-carriers are laterally deflected, as above described, so that the inactive one will not obstruct the path of the active one, it being understood that only one of the carriers is in service at a time. Said carriers are each provided on their upper side with two projecting studs 91 92, the function of which will hereinafter appear. The mechanism for reciprocating these carriers comprises a slide rod or bar 93, fitted in the side walls of the yoke and provided about midway of its length with a depending lug 94, which when the rod or bar is properly operated may be disposed directly above either of the shafts 80 or between the same, as desired. Thus when the two carriers are engaged with the pin 90, as above stated, and the yoke properly moved over and above the same the said lug 94 may be slid between the studs 91 92 on either of the carriers, whereupon in the outward stroke of the yoke this stud will abut against the opposed stud 91 on the carrier and perforce impel the latter in concert with the knitting-cams. Obviously when the lug 94 is in the intermediate position the yoke may be reciprocated independently of the yarn-carriers. I prefer to make the stud 92 of each of the yarn-carriers somewhat longer or higher than the other stud 91, so that the edge of the yoke will abut against the former stud in the reverse stroke. This edge of the yoke is offset to the slide-bar, or nearly so, the adjacent face of the former being slightly beveled or inset, as seen in Figs. 11 and 13, so that it will not come in contact with the studs 92 during the advancing strokes. Hence the yoke itself and not the slide-bar will impel the carriers forcibly against the deflecting-pin. The slide-bar, thus being free at this end of its traverse, may be readily slid to and fro to engage or disengage its lug 94 with or from the carriers, as above described. The means which I employ for shifting this bar at the predetermined intervals comprises a horizontal lever 95, pivoted on a block or post 96 on one side of the yoke, one arm of the lever being connected with the projecting end of the bar 93 and the other arm of said lever being provided with a V-shaped opening or recess 96^a. There is fulcrumed on the stud 33 on the end head 2 of the frame a vertical lever 97, the lower

arm 98 of which is provided with a foot 99, that rests upon a link of the pattern-chain, while its upper arm is extended above the plane of the needle-bed in a manner to intersect the path of said horizontal lever during the reciprocation of the cam-carriages. The foot is held in contact with the pattern-chain by means of a strong spring 100, the ends of which are fastened to the arm 98 and the stud 37, respectively, whereby the position of the lever will be directly under the control of the links of the pattern-chain—that is to say, when the foot rides upon a medium-face link the upper arm of the lever will be in a central position, and when it rides upon a high or low face link it will be moved either to a right or left inclined position, as the case may be. Hence when the V-shaped end of the horizontal lever 95 approaches this arm the inclined or flaring sides of the end will embrace the said arm, which latter, according to its position, will thereupon act upon and move the horizontal lever to the central position or deflect it to the right or left. When the horizontal lever is in the central position, the lug 94 is central or inactive, and when said lever is in the right or left inclined position the lug is engaged with one or the other of the yarn-carriers, as above explained.

I shall proceed to describe the novel features of the stop-motion devices which I prefer to employ in conjunction with the foregoing-described mechanisms. Such devices appear very clearly in Fig. 1 of the drawings, to which reference will now be had. 101 represents a longitudinal rocker-shaft mounted in suitable brackets 102 on the front of the machine. One end of this shaft extends beneath the pulleys and bears a suitably-disposed belt-shifting frame 103, through which the driving-belt passes, whereby when the shaft is properly rocked the belt may be transferred from one to the other pulley. Fixed on the opposite end of this shaft is a vertical arm 104, the free end of which extends up to a double notched or shouldered lever 105, fulcrumed at *y* on the end head 2^a. The arm is kept in a normal or retracted position by means of a strong spring 106, secured thereto and to a pin on the head 2. The position of the shifter-frame relative to this arm is such that when the latter is in the position just mentioned the belt is upon the loose pulley and the machine is at rest. In that case the end of the arm bears against the shoulder *x* on the lever 105. When the arm 104 is thrown forward against the action of the spring to transfer the belt from the loose to the fast pulley, the end of the arm engages the forward notch or shoulder *z* in the lever 105 and is locked therein. This being done, the machine is in operation. It will be obvious that if the inner arm of the lever 105 be depressed the outer arm thereof will be raised, so as to free the end of the arm 104 from the notch *z*, whereupon said latter arm will be retracted to its first position to stop the machine. This

lever is operated by means of a vertical drop-rod 107, supported at the end of the machine by the outwardly-extending bracket-arms 108, the latter being sustained by the fixed end rod 109. The lower end of the drop-rod is equipped with a stud 110, that projects directly above the inner arm of the lever 105, while its upper end is provided with a cross-bar 111, that extends into the paths traversed by the spring-actuated take-up levers 112 when they are thrown upward. The drop-rod is also provided at a point above the lower bracket-arm 108 with a stud 113, that rests normally upon a post 114, rising from said arm. When the stud is supported upon this post, the stud 110 lies above the arm of the lever 105; but when the stud 113 is tripped or moved off the post the rod drops by gravity, the stud 110 thereupon striking and depressing said arm, with the effect above described. Normally the inner arms of the spring-controlled take-up levers are held down by the yarn on its way to the yarn-carriers, the yarn passing through eyes 114^a on the ends of the levers and through suitably-disposed check-fingers 115, which are similar in construction and operation to those described and claimed in my aforementioned pending application. By this construction it will be seen that if one of the yarns should break or terminate during the actual operation of the machine the inner arm of the take-up lever will be released, whereupon the other or outer arm thereof will be drawn back by the spring 116. The inner arm, thus being thrown upward, will strike against the arm of the cross-bar in its path, thereby partially turning the drop-rod and releasing or tripping the same.

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

1. In a knitting-machine, the combination, with the needle-beds, the needles, the knitting-cams, and shifting devices therefor, of the sliding abutment-bar so disposed that its ends normally project into the paths of said shifting devices, respectively, and provided with the openings or offsets, the pattern mechanism, and provisions intermediate the same and the abutment-bar whereby the latter may be moved endwise at predetermined intervals, substantially as described.

2. In a knitting-machine, the combination, with the needle-beds, the needles, the knitting-cams, and shifting devices therefor, of the sliding abutment-bar provided with the openings or offsets, the pivoted lever connected with said bar, and the pattern mechanism for operating said lever, substantially as described.

3. In a knitting-machine, the combination, with the needle-beds, the needles, the cam-carriage, and the knitting-cams, of the oscillatory arm or sector mounted in the cam-carriage and provisions whereby said arm or sector is operatively connected with the knit-

ting-cams, together with means for operating said arm or sector, whereby the knitting-cams may be thrown into and out of action, substantially as described.

4. In a knitting-machine, the combination, with the cam-carriage and the knitting-cams therein, of the oscillatory sector provided with the operating-arm, provisions whereby the sector is operatively connected with said cams, and the tappet-pin adapted to act upon said sector, substantially as described.

5. In a knitting-machine, the combination, with the cam-carriage and the knitting-cams therein, of the oscillatory arm or sector, means whereby it is operatively connected with said cams, means whereby it is oscillated, and means whereby it is locked in positions of adjustment, substantially as described.

6. In a knitting-machine, the combination, with the cam-carriage and the knitting-cams therein, of the oscillatory arm or sector provided on one edge thereof with notches or recesses, means whereby this arm or sector is operatively connected with the cams, and means whereby it is oscillated, together with the spring-controlled locking-pin adapted to engage the said notches or recesses, substantially as described.

7. In a knitting-machine, the combination, with the cam-carriage and the knitting-cams therein, of the vibratory guard-cam mounted below the knitting-cams and means for operating said guard-cam during the traverse of the carriage, substantially as described.

8. In a knitting-machine, the combination, with the cam-carriage and the knitting-cams therein, of the guard-cam pivotally mounted below the knitting-cams and the studded slide-bar adapted to operate said guard-cam, substantially as described.

9. The combination, with the supporting-frame, the needle-beds, the needles, and the knitting-cams, of the fixed nut or boss secured to the frame, the shaft, the traveling screw thereon engaged with said nut or boss, the vibratory needle-actuating lever fulcrumed in proximity to the screw, provisions whereby this lever is impelled by and with the screw, and provisions whereby it is vibrated in its traverse, substantially as described.

10. The combination, with the supporting-frame, the needle-bed, the needles, and the knitting-cams, of the fixed nuts or bosses, the shaft, the traveling oppositely-pitched screws thereon, the vibratory needle-actuating levers fulcrumed in proximity to the screws, respectively, provisions whereby the levers are impelled by and with said screws, and provisions whereby they are vibrated in their traverse, substantially as described.

11. The combination, with the supporting-frame, the needle-bed, the needles, and the knitting-cams, of the fixed nuts or bosses, the parallel shafts, the traveling screws on one of said shafts, the vibratory needle-actuating levers fulcrumed on the other shaft, the plates mounted on said latter shaft, provisions

whereby these plates and the levers are impelled by and with the screws, and provisions whereby the levers are vibrated in their traverse, substantially as described.

5 12. The combination of the supporting-frame, the fixed nut or boss, the shaft, the screw provided with the grooved head and the end pin or roller, the plate engaging said groove, a supporting device for said plate, 10 and the needle-actuating lever fulcrumed in respect to said plate and pin or roller, substantially as described.

13. The combination of the supporting-frame, a shaft, a lever supported thereon and 15 provided with a pair of needle-operating teats or projections, means for reciprocating said lever lengthwise of the shaft, and means for oscillating said lever, substantially as described.

20 14. The combination of the supporting-frame, a shaft, a lever thereon, one of the arms of said lever being provided with needle-operating teats or projections and the other arm being bifurcated, means for acting 25 upon the said latter arm in a manner to oscillate the lever, and means for maintaining said lever in a normal position, substantially as described.

15. In a knitting-machine, the combination, 30 with the supporting-frame, a shaft, a needle-actuating lever thereon, and means for operating said lever, of the spring-pressed plunger supported in proximity to said lever and adapted to act upon a V-shaped cam-surface 35 on the edge thereof, together with means for supporting said plunger, substantially as described.

16. The combination of the rock-shaft, the yarn-carrier thereon, means for reciprocating 40 said carrier, and means for rocking or oscillating said shaft at predetermined intervals, substantially as described.

17. The combination of the shaft, the sleeve or block thereon, the yarn-guide head depending 45 from said sleeve or block, and means for oscillating the said sleeve or block at predetermined intervals, substantially as described.

18. The combination, with the rock-shaft, 50 the yarn-carrier thereon, and means for reciprocating said carrier, of the spring operating to maintain said rock-shaft in a normal position and the end device adapted to act upon said carrier to deflect it laterally, substantially 55 as described.

19. The combination, with the needle-beds, the needles, and the knitting-cams, of the rock-shafts mounted above the respective 60 beds, the yarn-carriers on said shafts, the depending pins, the stop therefor, the spring, and the end deflecting device, substantially as described.

20. The combination, with the needle-beds, the needles, and the knitting-cams, of the 65 rock-shafts mounted above the respective beds, the sleeves or blocks on said shafts, the depending projections on said sleeves or

blocks, the yarn-guide heads connected with said projections, the spring adapted to maintain said shafts in a normal position, and the 70 end pin adapted to act upon the said projections to deflect the guide-heads and their connections laterally against the action of the said spring, substantially as described.

21. The combination, with the needle-beds, 75 the needles, the knitting-cams, the yoke connecting the same, the yarn-carrier, and its supporting parts, of the transverse slide rod or bar mounted in respect to the path of said carrier and means for operating the said rod or 80 bar to engage it with or disengage it from said carrier, substantially as described.

22. The combination, with the needle-beds, the needles, the knitting-cams, the yoke connecting the same, the yarn-carrier, and its sup- 85 porting parts, of the transverse slide rod or bar mounted in the said yoke and adapted to be engaged with and disengaged from said carrier, the horizontal lever mounted in proximity to said rod or bar and connected there- 90 with, and means for operating said lever, substantially as described.

23. The combination, with the needle-beds, the needles, the knitting-cams, the yoke connecting the same, the yarn-carrier, and its sup- 95 porting parts, of the transverse slide rod or bar mounted in the said yoke and adapted to be engaged with and disengaged from said carrier, the horizontal lever mounted in proximity to said rod or bar, connected therewith, 100 and provided with the bifurcated end, the vertical lever extending into the path of said bifurcated end, and the pattern mechanism adapted to operate said vertical lever, substantially 105 as described.

24. The combination of the needle-beds, the needles, the knitting-cams, the yoke connecting the same, the yarn-carrier provided with the up-projecting studs, the transverse 110 slide-bar provided with the depending lug, and means for operating said bar to move its lug between and away from said studs, substantially as described.

25. The combination, with the needle-beds, the needles, the knitting-cams, and their sup- 115 porting parts, of the reciprocative yarn-carriers mounted above the respective beds, a transverse rod or bar, a support therefor, and means for operating said rod or bar at predetermined intervals to engage it with and dis- 120 engage it from said carriers, respectively, substantially as described.

26. The combination of the needle-beds, the needles, the knitting-cams and the yoke connecting the same, the reciprocative yarn-car- 125 riers, their supporting parts, and means for laterally deflecting said carriers at one end of the machine, said carriers having each provisions whereby they are impelled toward this end of the machine by the action of the yoke- 130 frame and having provisions whereby they are impelled in the opposite direction by the action of a movable member supported on the yoke, together with said member and means

for operating the same, substantially as described.

27. In a knitting-machine, the combination of the driving mechanism, a rock-shaft 5 mounted in proximity thereto and equipped with means whereby said mechanism may be thrown into or out of action, a locking-lever, an arm upon the rock-shaft adapted to be engaged by said lever, a drop-rod adapted to 10 operate said lever to release the rock-shaft, means for conditionally supporting said rod, together with the take-up lever through which the yarn passes, and means, such as a spring, for maintaining said rock-shaft in a normal 15 position, substantially as described.

28. In a knitting-machine, the combination of the fast and loose pulleys, the rock-shaft, the belt-shipping frame thereon, the vertical arm on said shaft, the notched lever adjacent 20 to said arm, the drop-rod, means for conditionally supporting the same, the take-up lever adapted to operate said drop-rod, and

means, such as a spring, for maintaining the rock-shaft in a normal position, substantially as described. 25

29. In a knitting-machine, the combination, with the needle-beds, the needles, the knitting cams, the sinkers, and their supporting parts, of a grooved end-beveled sinker-actuating head and means for supporting and operating the same in respect to the knitting-cams, substantially as described. 30

30. The combination, with the cam-carriage and the arm extending therefrom, of the sinker-actuating head having a sliding connection 35 with said arm, substantially as described.

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

JOSEPH BENNOR.

Witnesses:

JOHN R. NOLAN,

JOHN WILSON ORR.