

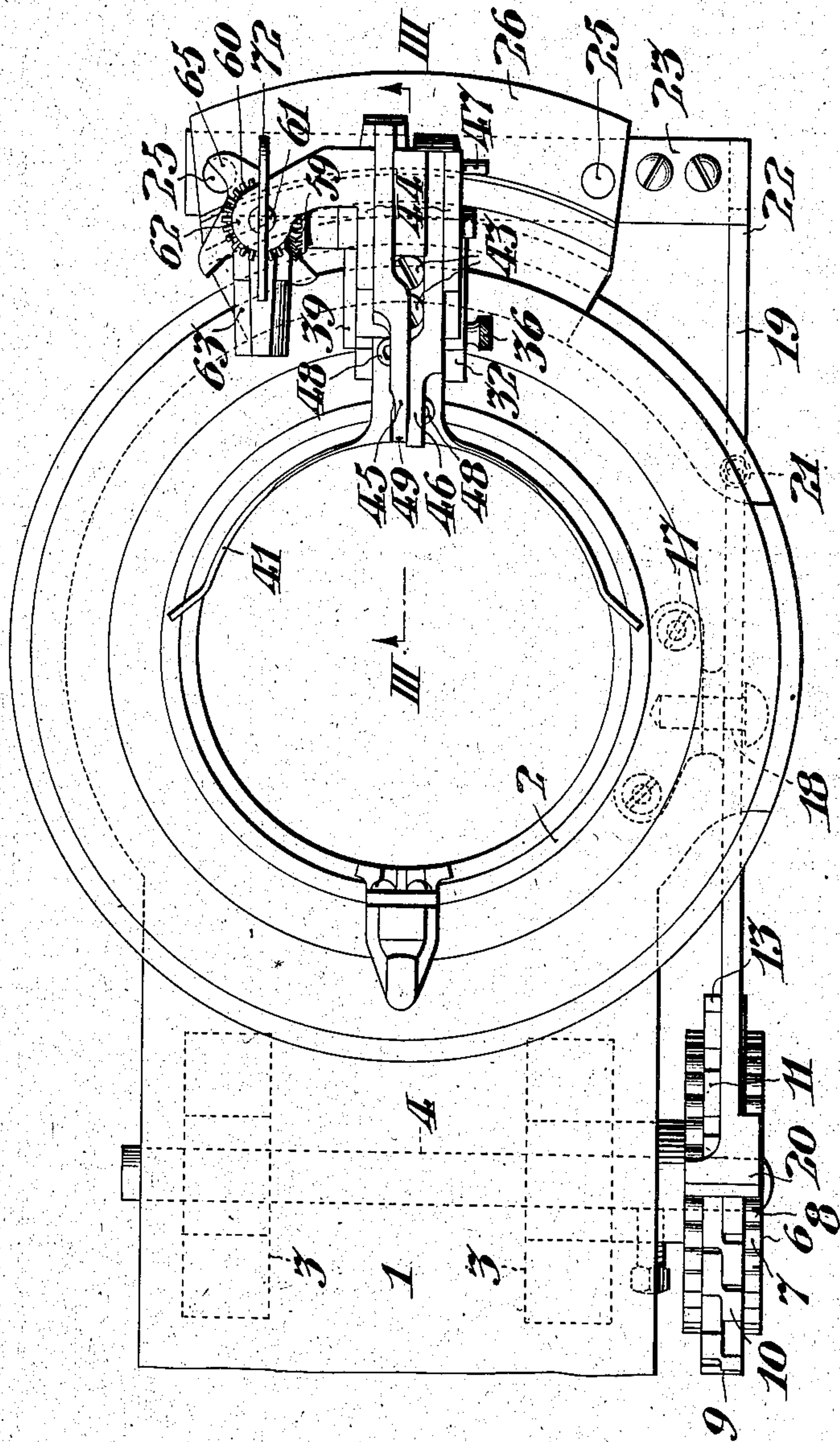
No. 815,167.

PATENTED MAR. 13, 1906.

J. B. HIPWELL.  
KNITTING MACHINE.  
APPLICATION FILED JUNE 28, 1904.

5 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:

Clifton C. Hallowell  
John C. Bergner

INVENTOR:

JOHN B. HIPWELL,  
By Paige, Paul & Friley,  
Attys.

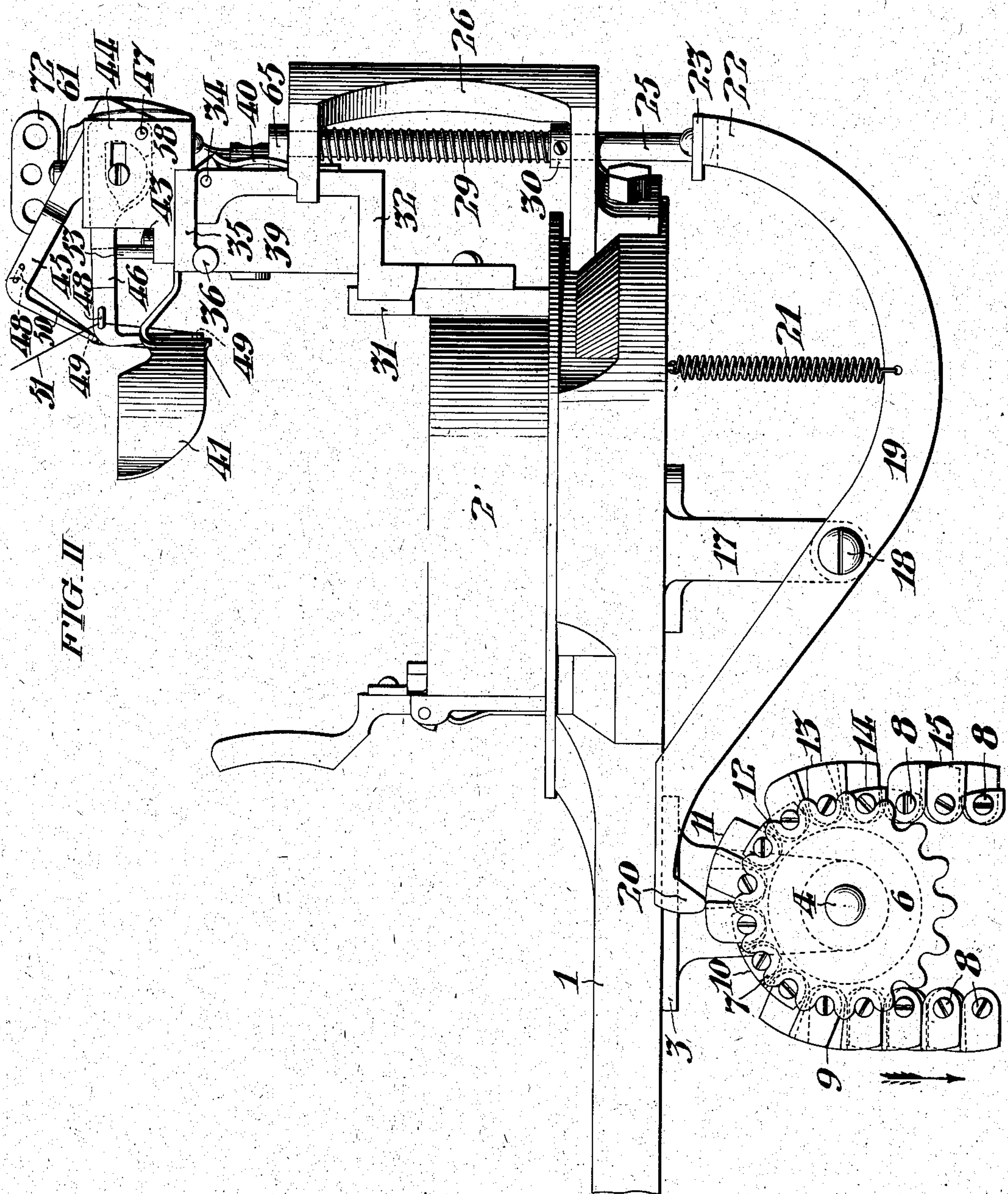


No. 815,167.

PATENTED MAR. 13, 1906.

J. B. HIPWELL.  
KNITTING MACHINE.  
APPLICATION FILED JUNE 28, 1904.

5 SHEETS—SHEET 2.



WITNESSES:

*Clifton C. Hallowell*  
*John C. Berghner*

INVENTOR:

*JOHN B. HIPWELL,*  
*by Paige, Paul & Haley,*  
*Attys.*

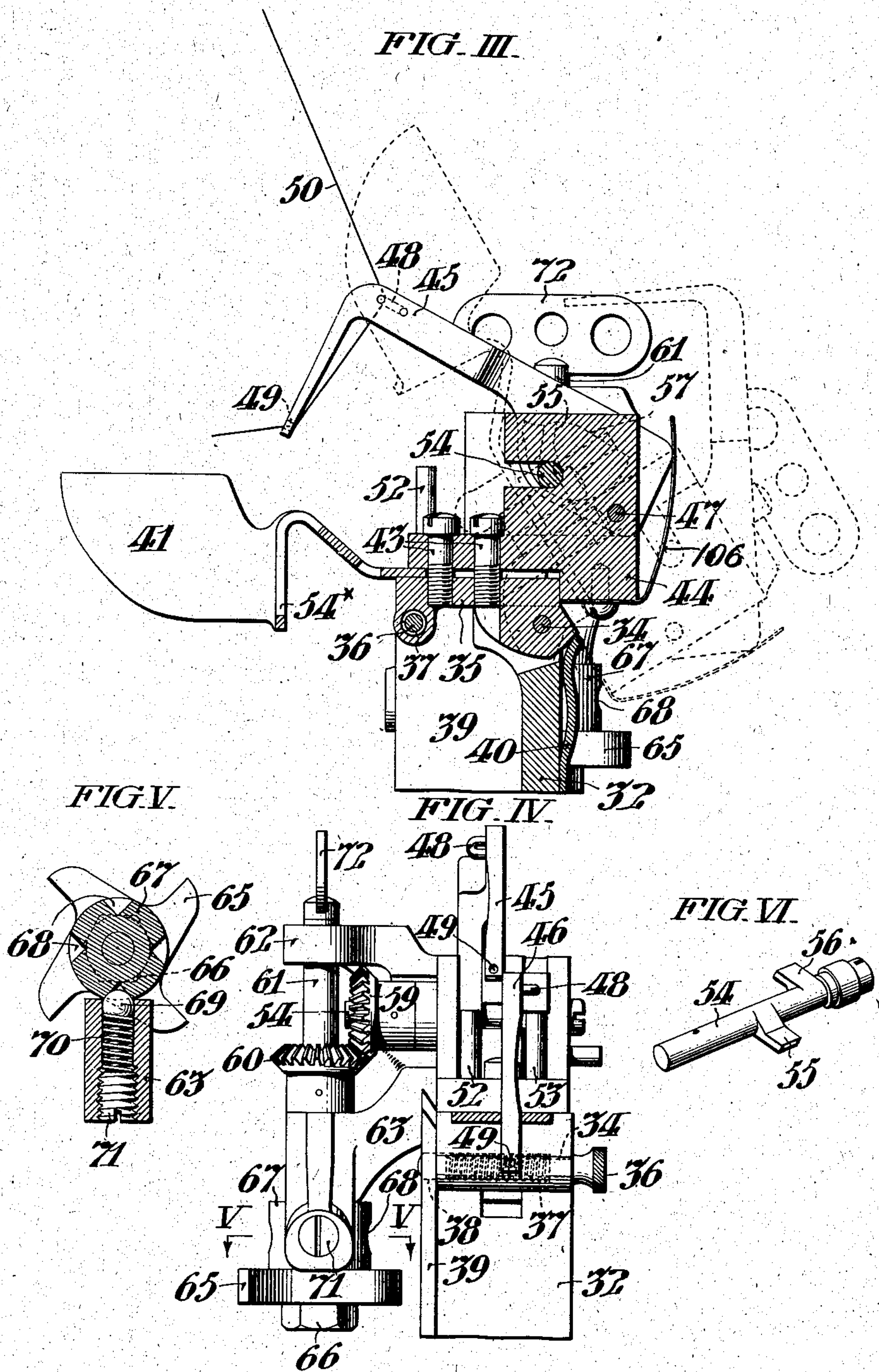


No. 815,167.

PATENTED MAR. 13, 1906.

J. B. HIPWELL.  
KNITTING MACHINE.  
APPLICATION FILED JUNE 28, 1904.

5 SHEETS—SHEET 3.



WITNESSES:  
*Clifton C. Halliwell*  
*John C. Reigner*

INVENTOR:  
JOHN B. HIPWELL,  
*By Craig, Paul & Haley*  
*Atty.*



No. 815,167.

PATENTED MAR. 13, 1906.

J. B. HIPWELL.  
KNITTING MACHINE.  
APPLICATION FILED JUNE 28, 1904.

5 SHEETS—SHEET 4.

FIG. VII.

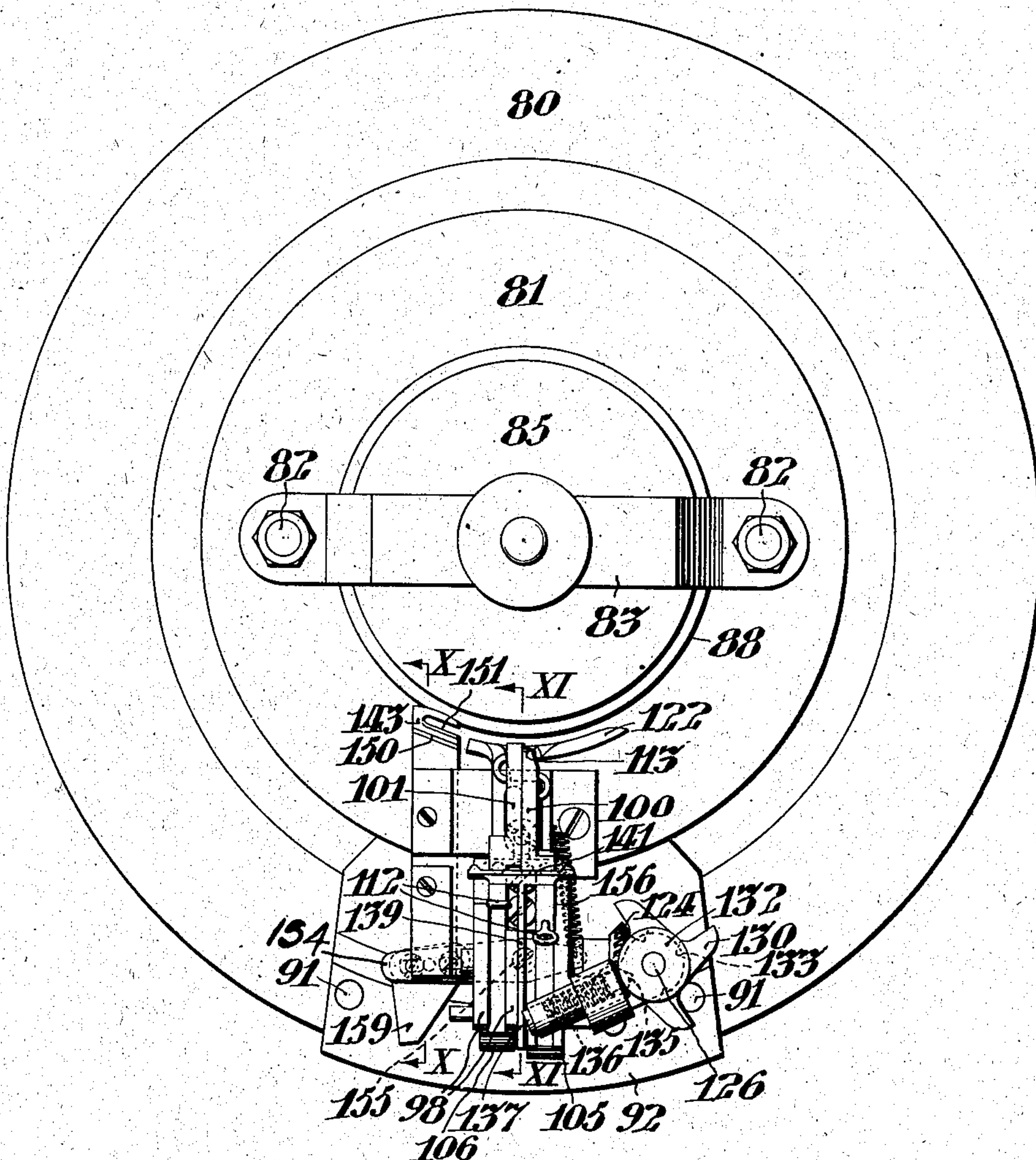
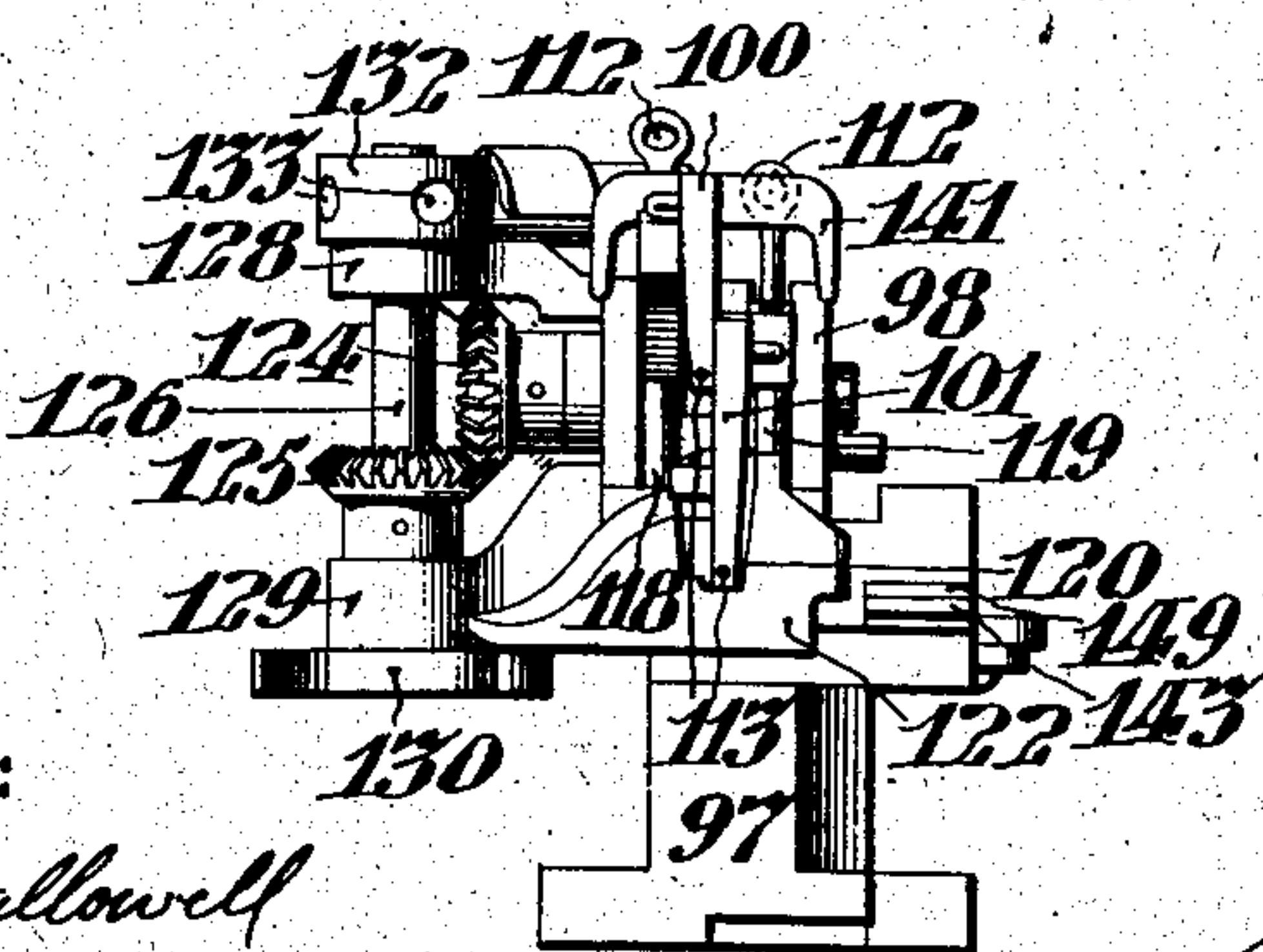


FIG. IX.



WITNESSES:

Clifton C. Hallowell  
John C. Bergner.

INVENTOR:

JOHN B. HIPWELL,

By Paige, Paul & Hally  
Atty's.



No. 815,167.

PATENTED MAR. 13, 1906.

J. B. HIPWELL.  
KNITTING MACHINE.  
APPLICATION FILED JUNE 28, 1904.

5 SHEETS—SHEET 5.

FIG. VIII.

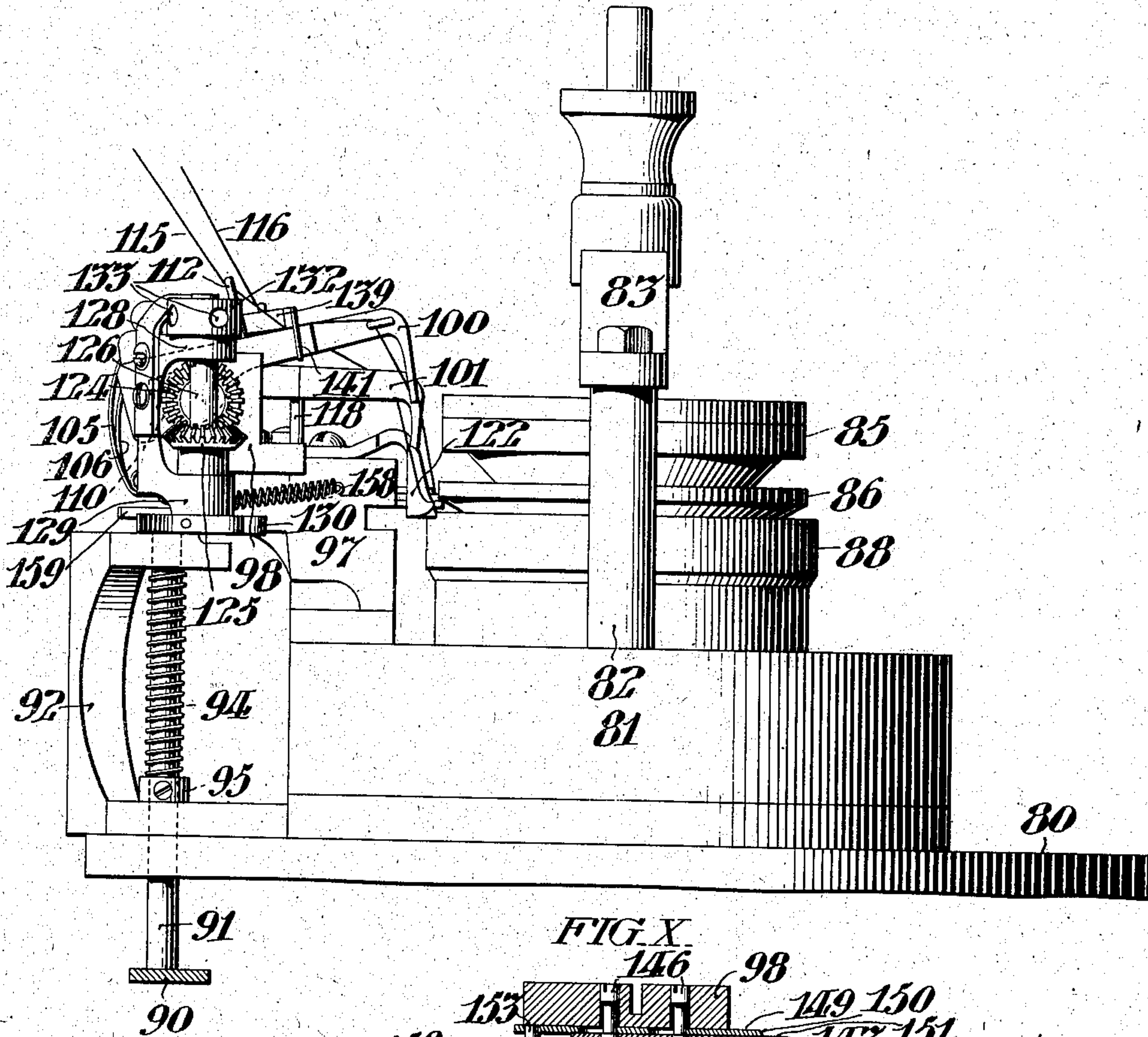


FIG. X.

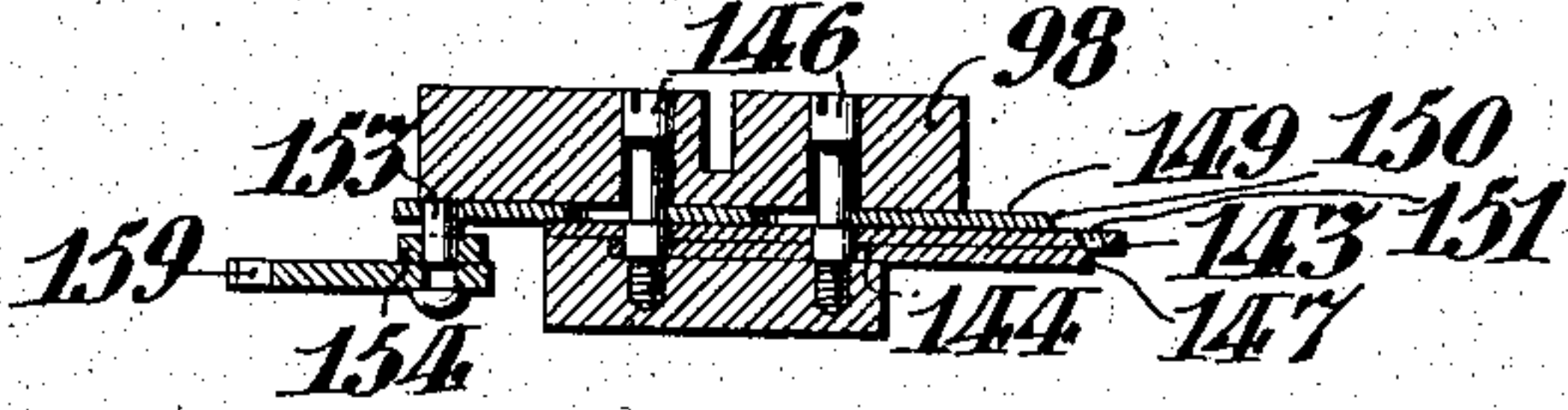
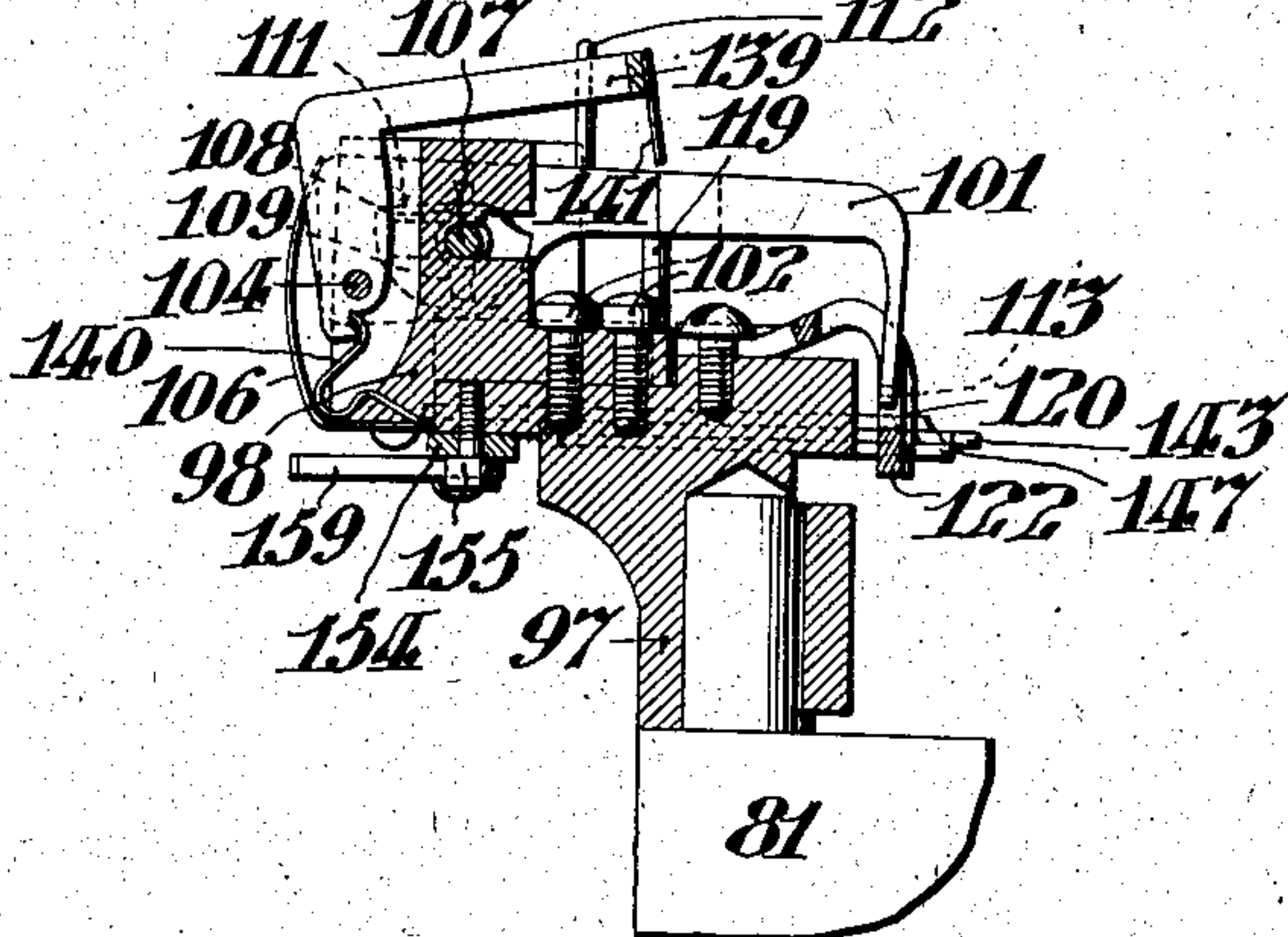


FIG. XI.



WITNESSES:

Clifton C. Halliwell  
John C. Berquier

INVENTOR:

JOHN B. HIPWELL,  
By Paige, Paul & Friley  
Attys.



# UNITED STATES PATENT OFFICE.

JOHN B. HIPWELL, OF READING, PENNSYLVANIA, ASSIGNOR TO WINDSOR MACHINE COMPANY, OF READING, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## KNITTING-MACHINE.

No. 815,167.

Specification of Letters Patent.

Patented March 13, 1906.

Application filed June 28, 1904. Serial No. 214,459.

*To all whom it may concern:*

Be it known that I, JOHN B. HIPWELL, of Reading, in the State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, whereof the following is a specification, reference being had to the accompanying drawings.

My improvements relate particularly to means for changing the threads supplied to a circular series of knitting-needles during their operation, so as to produce transverse stripes in a tube knit by said needles.

I have chosen two embodiments of my invention for illustration, respectively, in connection with an ordinary circular-knitting machine of the rotary-cam-cylinder type and a circular-rib-knitting machine of the rotary-cam-cylinder type. In both of said forms of my invention the thread-changing operations are effected under control of a pattern-chain and may be varied in accordance therewith. The form of my invention applied to said rib-knitting machine includes means arranged to sever the idle thread from the fabric and clamp said thread until required for the knitting, the thread shearing and clamping operations being also under the control of said pattern-chain. It is obvious that this thread-severing mechanism may also be applied, if desired, to the first-illustrated embodiment of my invention.

My invention comprehends the various novel features of construction and arrangement hereinafter more definitely specified.

In the accompanying drawings, Figure I is a plan view of an ordinary circular-knitting machine comprising a rotary cam-cylinder and embodying my invention. Fig. II is a side elevation of the machine shown in Fig. I. Fig. III is a sectional view taken on the line III III in Fig. I, but on a larger scale. Fig. IV is an elevation of the left-hand side of the mechanism shown in Fig. III. Fig. V is a horizontal sectional view taken on the line V V in Fig. IV. Fig. VI is a perspective view of the crank-shaft for lifting the thread-changing levers shown in Fig. III. Fig. VII is a plan view of an ordinary circular-rib-knitting machine comprising a rotary cam-cylinder and embodying a modified form of my invention. Fig. VIII is an elevation of the right-hand side of the machine shown in Fig. VII. Fig. IX is an elevation of the in-

ner side of the thread-changing mechanism shown in Fig. VII. Fig. X is a vertical sectional view of the thread-shearing device, taken on the line X X in Fig. VII. Fig. XI is a vertical sectional view of the thread-changing mechanism, taken on the line XI XI in Fig. VII.

Referring to the form of my invention shown in Figs. I to IV, inclusive, 1 is the bed-plate of the machine, in which is suitably mounted the rotary cam-cylinder 2, which may be provided with actuating means of ordinary construction. (Omitted from the drawings.) Said bed-plate 1 has two pendent bearing-brackets 3 for the shaft 4, which latter is provided with the sprocket-wheel 6, having teeth 7 arranged to engage the pins 8 on the pattern-chain comprising the links 9, 10, 11, 12, 13, 14, and 15. Said shaft 4 may be rotated by the mechanism which rotates said cam-cylinder 2 and in definite relation with the movement of the latter. Said plate 1 is also provided with the depending bracket 17, having the fulcrum 18 for the lever 19, which is adapted to be raised by its end 20, riding on the high links 9, 11, 13, and 15 of the pattern-chain, which latter is shifted in the direction of the arrow shown in Fig. II. Such movement of the lever 19 is effected against the stress of the spring 21, which depresses said lever end 20 when the low links 10, 12, and 14 of the pattern-chain are presented beneath said lever end. The opposite end 22 of said lever 19 carries the plate 23 in operative relation with the plungers 25. Said plungers 25 are mounted for vertical reciprocation in the stationary bracket 26, supported by the bed-plate 1, and each plunger is provided with a spring 29, (effectively weaker than the spring 21,) tending to maintain it in the lower position shown by pressure against its collar 30. Said cam-cylinder 2 is provided with the standard 31, upon which the bracket 32 is adjustably secured. Said bracket 32 is provided with the shaft 34, upon which the frame 35 may be tilted from its operative position shown. Said frame 35 is normally retained in its operative position by means of the locking-bolt 36, which is pressed by the spring 37 into engagement with the recess 38 in the side wall 39 of the bracket 32. The spring 40, secured on said bracket 32, bears against the end of said



frame 35 and tends to return it to its lower operative position when upraised. Said frame 35 carries the latch-guard 41 in proper relation to a circular series of needles carried by a needle-cylinder within said cam-ring 2. Said series of needles and their cylinder may be of ordinary construction and are omitted from the drawings. Said latch-guard 41 is conveniently secured in adjustable relation on said frame 35 by the screws 43, which also serve to secure the housing 44 of the thread-changing levers 45 and 46, which are mounted to oscillate upon the horizontal pivot 47 in said housing. Each of said levers comprises a main horizontal arm and a vertically-depending extremity, and each carries an eye 48 in proximity to the right-angled bend between these parts and a terminal aperture 49, the said eyes and apertures being the guiding elements for the respective threads 50 and 51. The pivoted end of the main horizontal arm of each lever is expanded to present extensive flattened surfaces on each side in contact with the housing, and the housing is made of considerable size and has separate slots cut in it, as shown, for the reception of the pivoted ends of the levers. Thus the sides of these slots bearing upon the flattened sides of the levers insure the greatest accuracy in the motion of the levers on their pivot. Said housing 44 is provided with abutment-pins 52 and 53, which respectively limit the downward movement of the thread-changing levers 45 and 46, and it is to be understood that when either of said levers is in its lower operative position (occupied by the lever 46 in Figs. II and IV) the inner end of the lever presents the thread within the recess 64 of the latch-guard 41 in proper relation to engage the needles. This recess consists of a vertical slot reaching almost but not quite to the bottom of the latch-guard and is of sufficient width to allow the thread-changing levers to enter it, in which position the face of the depending extremity of the lever is substantially flush with the surface of the latch-guard, rendering it substantially continuous, and the terminal aperture 49 occupies in relation to the latch-guard the position of the usual thread-guide. Said levers 45 and 46 are raised and lowered in alternation by means of the crank-shaft 54, (shown in section in Fig. III and in perspective in Fig. VI,) said shaft being provided with cranks 55 and 56, situated on opposite sides of the shaft. The expanded pivoted ends of the levers 45 and 46 have cam-holes 57 and 58 cut through them, and the shaft 54 passes through these cam-holes, one of its cranks being in operative relation to each one of the levers. Each of the cam-holes is provided with cam-surfaces above and below in such relation to the crank which rotates within it that the turning of the crank to its uppermost position raises the thread-changing lever against the

opposition of the spring 160, while the turning of it to its lowermost position locks the lever in its lower position. When the shaft 54 is in its ordinary position, one of its cranks is up and the other down, and therefore one of the levers is held up and the other locked down. If now the crank is given a quarter-rotation, the curvature of the cam-surfaces of the cam-holes is such that the lever previously raised is lowered by its spring, while the one previously locked down is not raised, but remains down under the tension of its spring until the succeeding quarter-rotation of the shaft raises it and locks the other down. Said crank-shaft 54 is arranged to be intermittently rotated by the bevel-gear 59 (shown in Fig. IV) in operative relation with the bevel-gear 60 on the vertical shaft 61, which latter is mounted for rotation in the brackets 62 and 63, projecting from said housing 44, and is provided at its lower end with the star-wheel 65, secured thereon by the nut 66 and arranged to be partially rotated a quarter-rotation at a time whenever its teeth encounter the ends of one of the plungers 25, projecting above the bracket 26. The hub 67 of said star-wheel 65 is provided with four sockets 68 (best shown in Fig. V) to receive the detent comprising the ball 69, which is pressed therein by the spring 70, mounted in the bracket 63 and retained by the screw-plug 71. Said shaft 61 is conveniently provided with the handle 72 at its upper end, whereby it may be manually set in any desired position, although it is to be understood that during the normal operation of the machine the movement of said shaft 61 is controlled by the pattern-chain above described, which effects the vertical projection and retraction of said plungers 25 in a sequence predetermined by the arrangement of its links, said plungers when raised being in the path of the star-wheel and when lowered, as shown in Fig. II, being flush with the top of the bracket 26 and clear of said star-wheel—that is to say, referring to Fig. II, it is to be understood that when the high links 9, 11, and 15 uphold the lever 19 by contact with its end 20 said plungers 25 are in inoperative position and the star-wheel 65, shaft 61, and mechanism connected therewith, including the thread-changing levers 45 and 46, remain stationary, whereas when the low links 10, 12, and 14 register with the end 20 of said lever 19 the spring 21 shifts the latter so as to uplift the plungers 25 into the path of said star-wheel to rotate the latter and effect a corresponding change in the relative position of the thread-changing levers 45 and 46, said wheel 65 being required to successively encounter both of said plungers 25 to effect the complete transposition of said levers 45 and 46. Owing to the opposed position of the cranks 55 and 56 on the crank-shaft 54, the quarter-rotation of the star-wheel 65, which



results from its contact with the first of the two plungers, is effective to lower whichever one of the levers 45 and 46 has been previously raised, while the succeeding quarter-rotation, which results from the contact of the star-wheel 65 with the other plunger, effects the raising of the other thread-changing lever. Accordingly it results that the throwing into action of a new thread is always effected somewhat before the old thread is withdrawn from action, the circumferential interval between these two successive motions being measured by the interval between the plungers. In other words, the length of the overlap of the old and the new thread is dependent upon the distance between the two plungers 25.

In the form of my invention shown in Figs. VII to XI, inclusive, 80 is the bed-plate, in which is mounted the rotary cam-cylinder 81, provided with the standards 82 and cross-head 83, supporting the dial-cam plate 85 and needle-dial 86 in concentric relation with the stationary needle-cylinder 88. It is to be understood that said bed-plate 80 supports any suitable pattern device—for instance, a wheel or a pattern-chain similar to that shown in Fig. II—in operative relation with a lever, having the end plate 90, (shown in Fig. VIII,) similar to the plate 23, above described, adapted to cooperate with the plungers 91, mounted for reciprocation in the bracket 92. Each of said plungers 91 is provided with a spring 94, which normally retracts it to the lower position (shown in Fig. VIII) by pressure against its collar 95. The thread-changing mechanism (shown in Figs. VIII to XI, inclusive) is conveniently mounted in the stationary bracket 97, which is secured upon the rotary cam-cylinder 81. The housing 98 for the thread-changing levers 100 and 101 is conveniently secured to said bracket 97 by the screws 102. (Shown in Fig. XI.) Said levers are mounted to oscillate on the pivot 104 in said housing 98 and are respectively provided with springs 105 and 106, which tend to thrust them into their lower operative position, occupied by the lever 101 in Figs. VIII and XI. Said levers 100 and 101 are arranged to be raised and lowered in alternation by means of the crank-shaft 107, (shown in section in Fig. XI,) which is similar to the shaft 54 and is provided with cranks 108 and 109, (indicated in dotted lines in Fig. XI,) which turn in cam-holes 110 and 111 in the respective levers 100 and 101. Each of said levers 100 and 101 is provided with an eye 112 intermediate of its length and an aperture 113 in its depending extremity for the respective threads 115 and 116. Said housing 98 is provided with abutment-pins 118 and 119, which respectively limit the downward movement of the thread-changing levers 100 and 101, and it is to be understood that when said levers are in their lower position their de-

pending extremities are presented in the recess 120 of the thread-guide 122, which is disposed in proper relation with the needle-dial 86 and cylinder 88. Said crank-shaft 107 is arranged to be intermittently rotated by the bevel-gear 124 (shown in Figs. VIII and IX) in operative relation with the bevel-gear 125 on the vertical counter-shaft 126, which latter is mounted for rotation in the brackets 128 and 129, extending from the housing 98. Said shaft 126 is provided at its lower end with the star-wheel 130, which is arranged to be actuated by said plungers 91 in the manner described with reference to the other form of my invention, said shaft 126 being provided at its upper end with the collar 132, having recesses 133 adapted to engage the detent comprising the ball 135, which is pressed by the spring 136, retained by the screw-plug 137 in the bracket 128. The thread-clamping lever 139 is mounted to oscillate upon the pivot 104 in the housing 98 and is provided with the spring 140, which tends to retain it in the position shown in Fig. XI. Said lever 139 is provided at its inner end with the yoke 141, which, as shown in Fig. IX, overhangs the two thread-changing levers 100 and 101. It is to be understood that the threads 115 and 116, respectively, controlled by the levers 100 and 101, extend from the thread-eyes 112 to the thread-apertures 113 along the upper surface of the respective levers, so that when either of the levers is uplifted the thread carried thereby is clamped between its lever and the clamping-lever 139, which is slightly uplifted by the thread-changing lever under tension of its spring 140. In the embodiment of my invention which I have described first in this specification I omitted to show any thread-severing mechanism in order to simplify the drawings and description, for in the ordinary circular-knitting machine idle threads may be floated within the tube which is being knit, and thus thread-severing mechanism may be dispensed with; but in a ribber such as I am now describing it is desirable to provide such thread-severing mechanism because of the difficulty of floating the threads, and I have therefore shown this embodiment of my invention as provided with means for effecting such severance. It will of course be understood that the same or similar means may be applied, if desired, to the first form of knitting-machine described by me. As shown in the drawings, Figs. VII to XI, inclusive, means are provided to sever the threads 115 and 116 from the fabric when they are uplifted to idle position by their respective levers 100 and 101, and for this purpose I provide the mechanism comprising the hook-shaped ledger-blade 143, (shown in Fig. VII,) which is retained in the recess 144 of the frame 98 by the screws 146, (shown in Fig. X.) This ledger-blade 143 is provided with a deep notch 151, inclined so as to occupy



a position substantially parallel to the line of the needles and in close proximity to the latches when in operation. The spring-plate 147, which extends beneath said blade 143, has an upward set at its inner end, so as to press said blade against the reciprocatory blade 149, whose cutting edge 150 is adapted to cooperate with the inner edge of the outer portion of the notch 151 in said blade 143 to shear the thread, which when uplifted to idle position by the thread-changing lever 100 or 101 is drawn therein. The outer end of said shear-blade 149 is provided with the stud 153, which engages the lever 154, by which said blade is reciprocated at predetermined times. Said lever 154 being mounted to oscillate on the screw-stud 155 (shown in dotted lines in Fig. VII and in full lines in Fig. XI) and having its opposite end provided with the spring 156, which extends to the pin 158 on the housing 98, as shown in Fig. VIII, said spring tends to normally retract said blade 149 into its idle position. (Shown in Figs. VII and X.) However, said lever 154 is provided with the cam 159, which encounters the plunger 91, (shown at the right-hand side of Fig. VII,) and is operated by the same when the plunger is uplifted by the pattern-chain. It may be noted that if said cam 159 encounters the plunger 91 (shown at the left-hand side of Fig. VII) its resulting operation is merely idle, as the thread to be sheared is not presented within the blade-recess 151 until its lever 100 or 101 is uplifted to idle position by the encounter of the star-wheel 130 with both of said plungers 91 in succession.

It is to be understood that I do not desire to limit myself to the particular details of construction and arrangement herein set forth, as various modifications may be made therein without departing from the essential features of my invention.

I claim—

1. In a knitting-machine, the combination with thread-changing levers, each provided with means to guide a thread to the needles; of means arranged to transpose said levers, comprising a crank-shaft provided with cranks operatively related to the respective levers; means arranged to rotate said crank-shaft, comprising a counter-shaft connected therewith; a star-wheel on said counter-shaft; a plunger; means arranged to present said plunger in operative relation with said star-wheel, comprising a lever and a pattern-chain arranged to actuate it; a shearing device arranged to sever the idle thread from the fabric, comprising a reciprocatory blade; a lever arranged to reciprocate said blade; and, a cam on said lever, in operative relation with said plunger, substantially as set forth.

2. In a knitting-machine, the combination with thread-changing levers each provided with means to guide a thread to the needles; of means arranged to shift said levers, com-

prising a crank-shaft provided with cranks operatively related to the respective levers; means arranged to rotate said crank-shaft, comprising a counter-shaft connected therewith; a star-wheel on said counter-shaft; a plunger; and, means arranged to present said plunger in operative relation with said star-wheel, comprising a lever and a pattern-chain arranged to actuate said lever, substantially as set forth.

3. In a circular-knitting machine, vertically-swinging thread-changing levers pivoted in parallel relation to each other; each of said levers comprising a main horizontal arm and a vertical depending extremity; and each being provided with a thread-guiding aperture piercing the vertical portion near its lower end; and a thread-eye mounted on the lever near its right-angled bend, substantially as set forth.

4. In a circular-knitting machine, the combination of thread-changing levers pivoted horizontally so that their extremities swing vertically toward or away from the needles; a cam-surface upon each of said levers; and a horizontal shaft mounted beneath the levers, carrying cranks corresponding to each of the levers, which cranks by the rotation of the shaft are brought into contact with the cam-surfaces of the levers to effect the raising thereof, substantially as set forth.

5. In a circular-knitting machine, the combination with thread-changing levers pivoted horizontally so that their extremities swing vertically toward or away from the needles; a cam-surface upon each of said levers; and a horizontal shaft mounted beneath the levers, carrying cranks corresponding to each of the levers, which cranks by the rotation of the shaft are brought into contact with the cam-surfaces of the levers to effect the raising thereof, said cam-surfaces having a contour such that, after the lever has been raised by the contact of the crank beneath it, a quarter-rotation of said crank permits the lowering of the lever, substantially as set forth.

6. In a circular-knitting machine, the combination with thread-changing levers pivoted horizontally so that their extremities swing vertically toward or away from the needles; a cam-hole in each of said levers; and a horizontal shaft passing through the cam-holes carrying cranks corresponding to each of the levers, which cranks by the rotation of the shaft are brought into contact with the lower surface of the cam-holes to effect the locking of the levers in their lower position, said lower surface having a contour such that after each lever has been locked by the crank a quarter-rotation of said crank may occur without alteration of the position of the lever, substantially as set forth.

7. In a circular-knitting machine, the combination of a pair of vertically-swinging pivoted thread-changing levers; a horizontal



shaft beneath said levers; two cranks on opposite sides of said shaft in positions corresponding to the thread-changing levers; cam-surfaces on each thread-changing lever of such extent and contour that if the cranks are horizontal, a quarter-rotation raises one lever and a succeeding quarter-rotation lowers it; a star-wheel having four arms in operative connection with said shaft; and a plunger by the raising or lowering of which the star-wheel is progressed by quarter-rotations, substantially as set forth.

8. In a circular-knitting machine, the combination of a rotating cam-cylinder carrying two pivoted thread-changing levers the free arms of which swing vertically; a horizontal shaft with opposing cranks under the thread-changing levers by the rotation of which said levers are successively raised; cam-surfaces on said levers where they come in contact with the cranks of such contour that if the cranks are vertical a quarter-rotation of the shaft lowers the raised lever, while the succeeding quarter-rotation raises the other lever; a four-armed star-wheel in operative connection to said shaft; and two vertical plungers in fixed relation to each other mounted on the non-rotary parts of the machine, whereby the contact of one of these plungers with the star-wheel effects the lowering of the raised thread-changer, while its contact with the other plunger effects the raising of the other thread-changer, substantially as set forth.

9. In a circular-knitting machine, the combination of pivoted thread-changing levers, the free ends of which swing vertically into and away from proximity with the needles; a crank-shaft parallel to the pivot of said levers provided with cranks operatively related to the respective levers; and means for effecting successive partial rotation of said crank-shaft to raise and lower the levers, substantially as set forth.

10. In a circular-knitting machine, the combination of pivoted thread-changing levers, the free ends of which swing vertically into and away from proximity with the needles; a crank-shaft parallel to the pivot of said levers provided with cranks operatively related to the respective levers; and means for effecting successive partial rotation of said crank-shaft, to raise and lower the levers comprising a variable-pattern mechanism, substantially as set forth.

11. In a circular-knitting machine, the combination of a housing mounted upon the cam-cylinder; a horizontal pivot fixed therein; thread-changing levers carried thereby, the free ends of which swing vertically over the needles; springs whereby said thread-changing levers are normally pressed down into position to feed their thread to the needles; and a horizontal shaft with cranks rotating beneath said thread-changing levers

by the contact of the cranks of which with the levers they are successively raised against the opposition of the springs, substantially as set forth.

12. In a circular-knitting machine, a thread-changing lever pivoted in fixed relation to the cam-cylinder and having its free end swinging vertically in relation to the needles; a cam-hole in said lever; a shaft passing through said cam-hole with a crank upon it; by the contact of which with the edges of the cam-hole the lever is operated, substantially as set forth.

13. In a circular-knitting machine, a thread-changing lever pivoted in fixed relation to the cam-cylinder and having its free end swinging vertically in relation to the needles; a cam-hole in said lever with cam-surfaces on its upper and lower edges; a shaft passing through said cam-hole with a crank which when it is turned up contacts with the upper cam-surface to raise the lever, and when it is turned down contacts with the lower cam-surface to lock the lever in its lower position, substantially as set forth.

14. In a circular-knitting machine, the combination of a pivoted thread-changing lever, having its free end swinging vertically over the needles; thread-guiding eyes whereby the thread which is controlled by the lever is caused to travel along its upper surface; and a spring-pressed thread-clamp pivotally mounted above the thread-changing lever with which the upper surface of said lever comes in contact whenever it is raised to withdraw thread from the needles, whereby the raising of the lever clamps the thread which it controls, substantially as set forth.

15. In a circular-knitting machine, the combination of a pivoted thread-changing lever, having its free end swinging vertically over the needles; thread-guiding eyes whereby the thread which is controlled by the lever is caused to travel along its upper surface; a spring-pressed thread-clamp, pivotally mounted above the thread-changing lever with which the upper surface of said lever comes in contact whenever it is raised to withdraw thread from the needles, whereby the raising of the lever clamps the thread which it controls; and a shearing device whereby upon the raising of the thread-changing lever the thread which is withdrawn from the needles and clamped is severed between the end of the lever and the knitting, substantially as set forth.

16. In a circular-knitting machine, the combination of a plurality of pivoted thread-changing levers having their free ends swinging vertically over the needles; thread-guiding eyes whereby the thread which is controlled by each lever is caused to travel along its upper surface; a single spring-pressed thread-clamp pivotally mounted above said thread-changing levers, and extending trans-



versely to contact with the upper surface of any one when it is raised, whereby the raising of any lever clamps the thread which it controls, substantially as set forth.

5 17. In a circular-knitting machine, a shearing device arranged to sever an idle thread from the fabric comprising a pair of blades one of which is arranged to reciprocate with reference to the other; thread-changing  
10 mechanism; a plunger by contact with which the thread-changing mechanism is operated and by contact with which the reciprocatory shearing-blade is also operated; the thread-changing mechanism and the thread-shear-  
15 ing mechanism being so mounted in relation to each other that the latter comes into contact with said plunger immediately after the former comes in contact with it, substantially as set forth.

20 18. In a circular-knitting machine, the combination of thread-changing mechanism comprising a plurality of thread-changing levers; two vertical plungers; means where-  
25 by contact of the thread-changing mechanism with the first plunger introduces a new thread to the knitting while contact with the second plunger withdraws the old thread from the knitting; and thread-shearing mechanism which is operated by contact with the  
30 first plunger, substantially as set forth.

19. In a circular-knitting machine, the combination of thread-changing mechanism comprising a plurality of thread-changing levers; two vertical plungers; means whereby  
35 the contact of the thread-changing mechanism with the first plunger introduces a new thread to the knitting, while contact with the second plunger withdraws the old thread from the knitting; thread-shearing mechanism which is operated by contact with the  
40

first plunger; and a pattern mechanism whereby the elevation or depression of said plungers to contact with the thread-changing and thread-shearing mechanism is controlled, substantially as set forth.

45 20. In a knitting-machine, the combination with thread-changing levers, each provided with means to guide a thread to the needles; of means arranged to transpose said levers, comprising a crank-shaft provided  
50 with cranks operatively related to the respective levers; means arranged to rotate said crank-shaft, comprising a counter-shaft connected therewith; a star-wheel on said counter-shaft; plungers; means arranged to pre-  
55 sent said plungers in operative relation with said star-wheel, comprising a lever and a pattern mechanism arranged to actuate it, substantially as set forth.

21. In a knitting-machine, the combina- 60  
tion of thread-changing levers and means to operate them; a shearing device arranged to automatically sever the idle thread from the fabric; a thread-clamping device comprising  
65 a lever, arranged to automatically clamp the idle thread when severed from the fabric and to hold it in position; a spring operatively engaged with said clamping-lever; and, means arranged to shift the thread-changing levers  
70 into operative relation with said clamping-lever, comprising a variable pattern mechanism, substantially as set forth.

In testimony whereof I have hereunto signed my name, at Reading, in the State of Pennsylvania, this 25th day of June, 1904. 75

JOHN B. HIPWELL.

Witnesses:

GEORGE D. HORST,  
CARL OLDOERP.