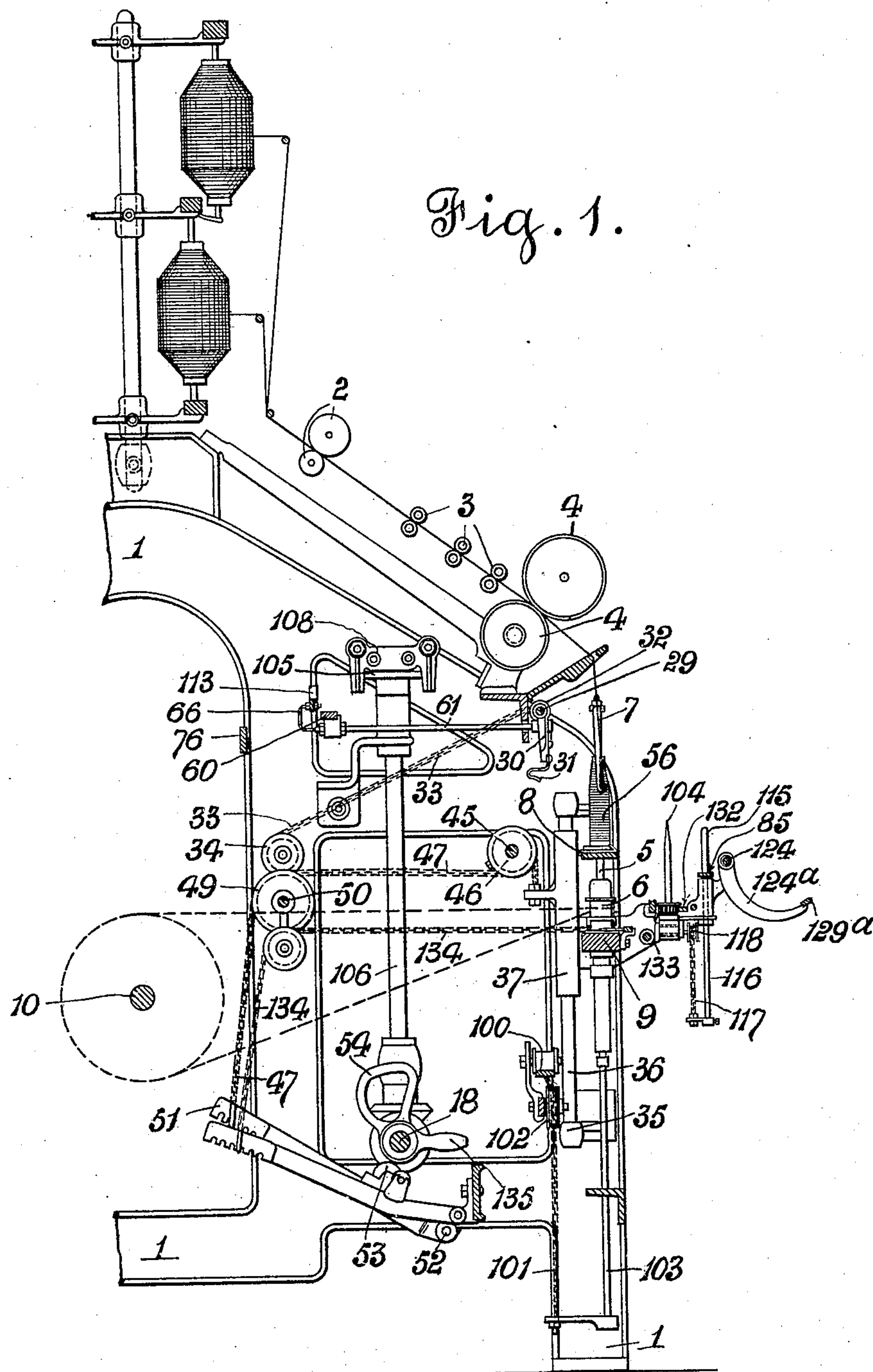


946,144.

F. LISTER.
DOFFING MECHANISM.
APPLICATION FILED FEB. 7, 1908.

Patented Jan. 11, 1910.

5 SHEETS—SHEET 1.



Witnesses.
W. H. Burch
H. C. Barclay

Inventor
Frank Lister
by Hubert W. Jenner
attorney.

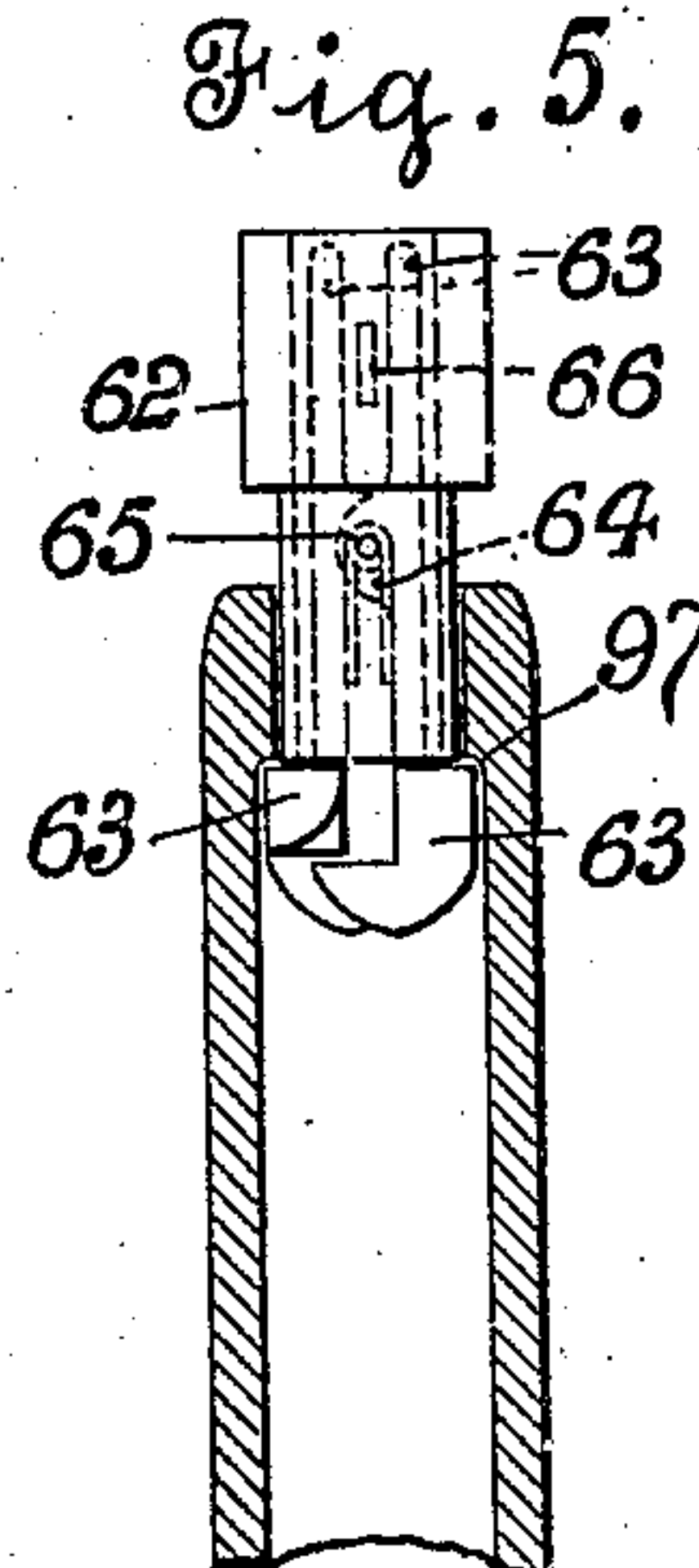
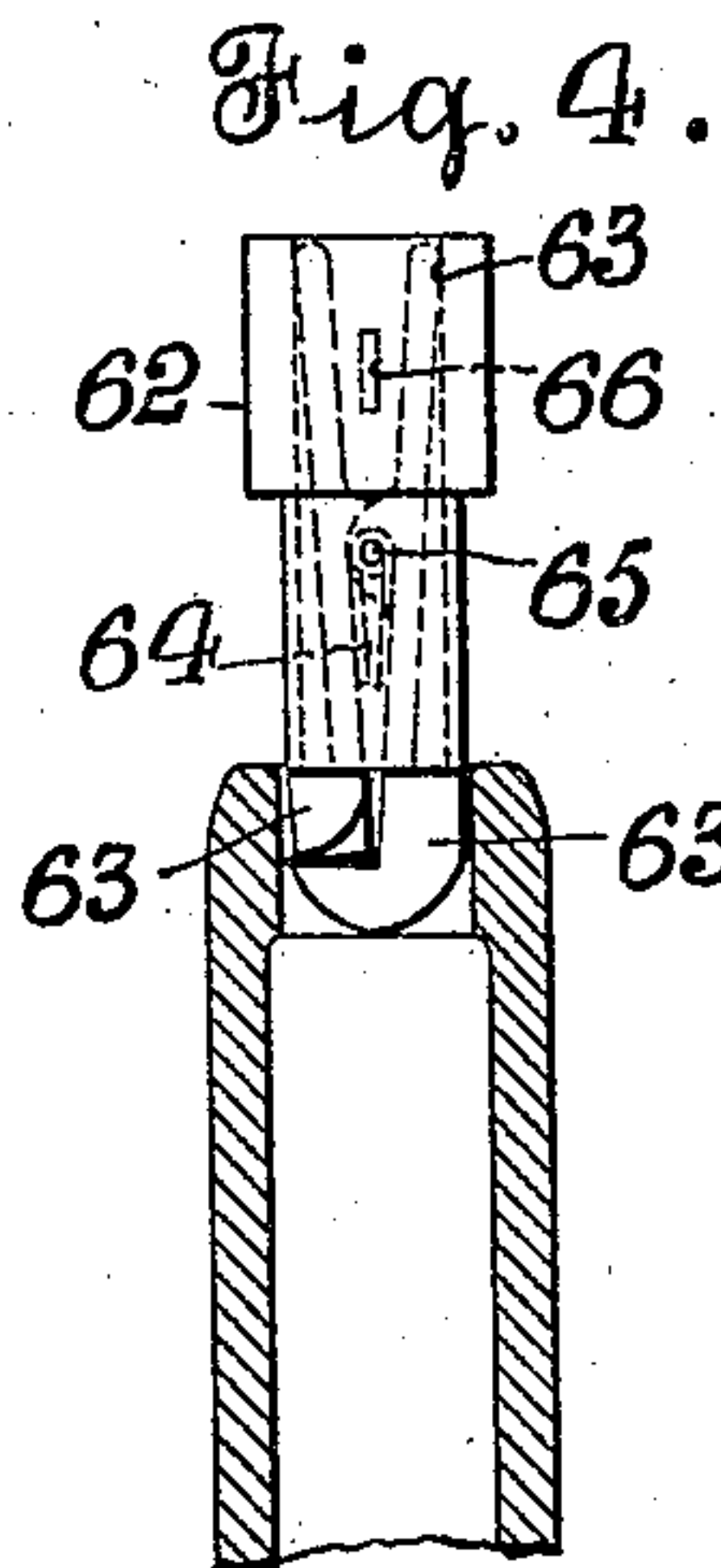
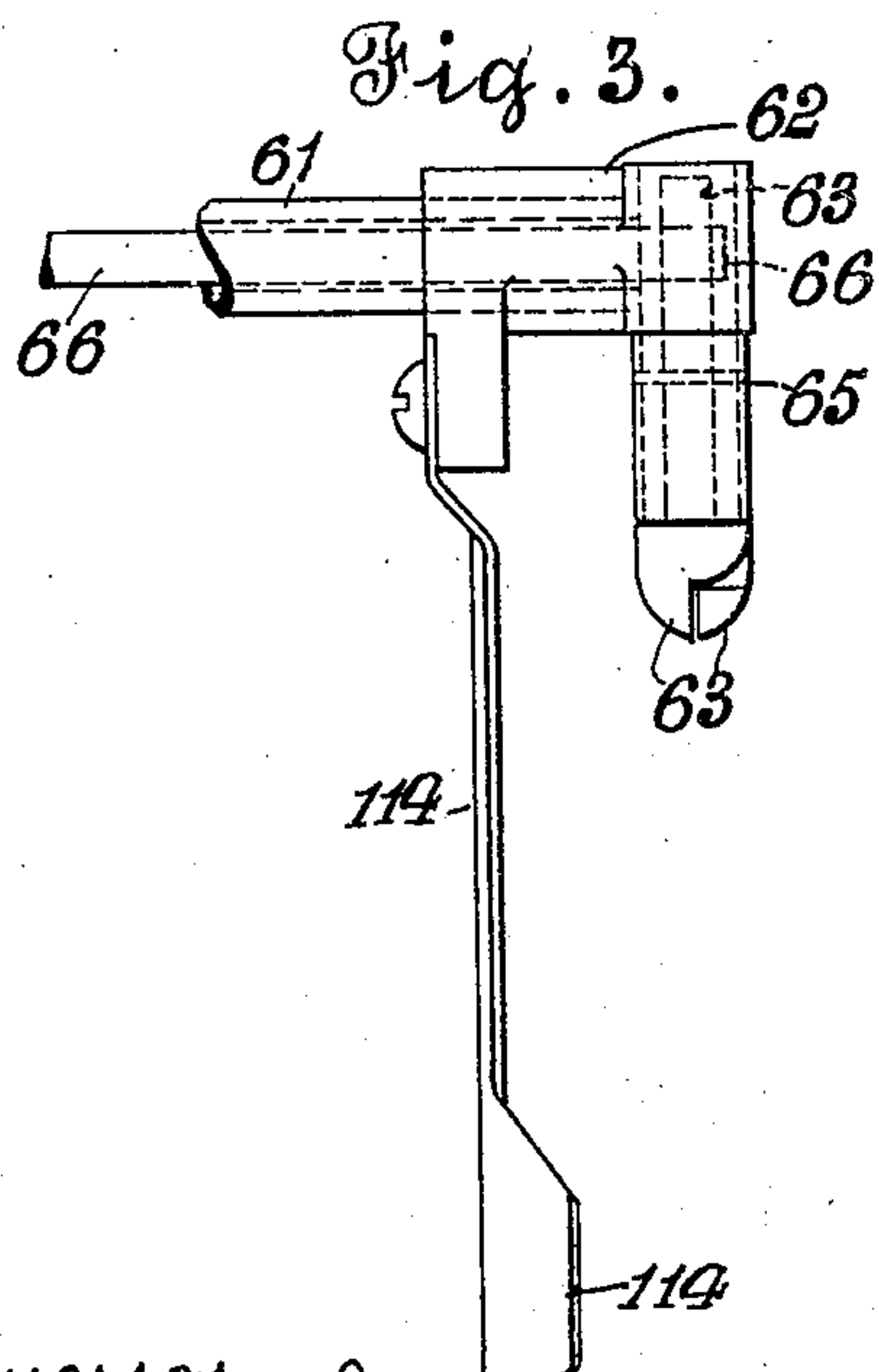
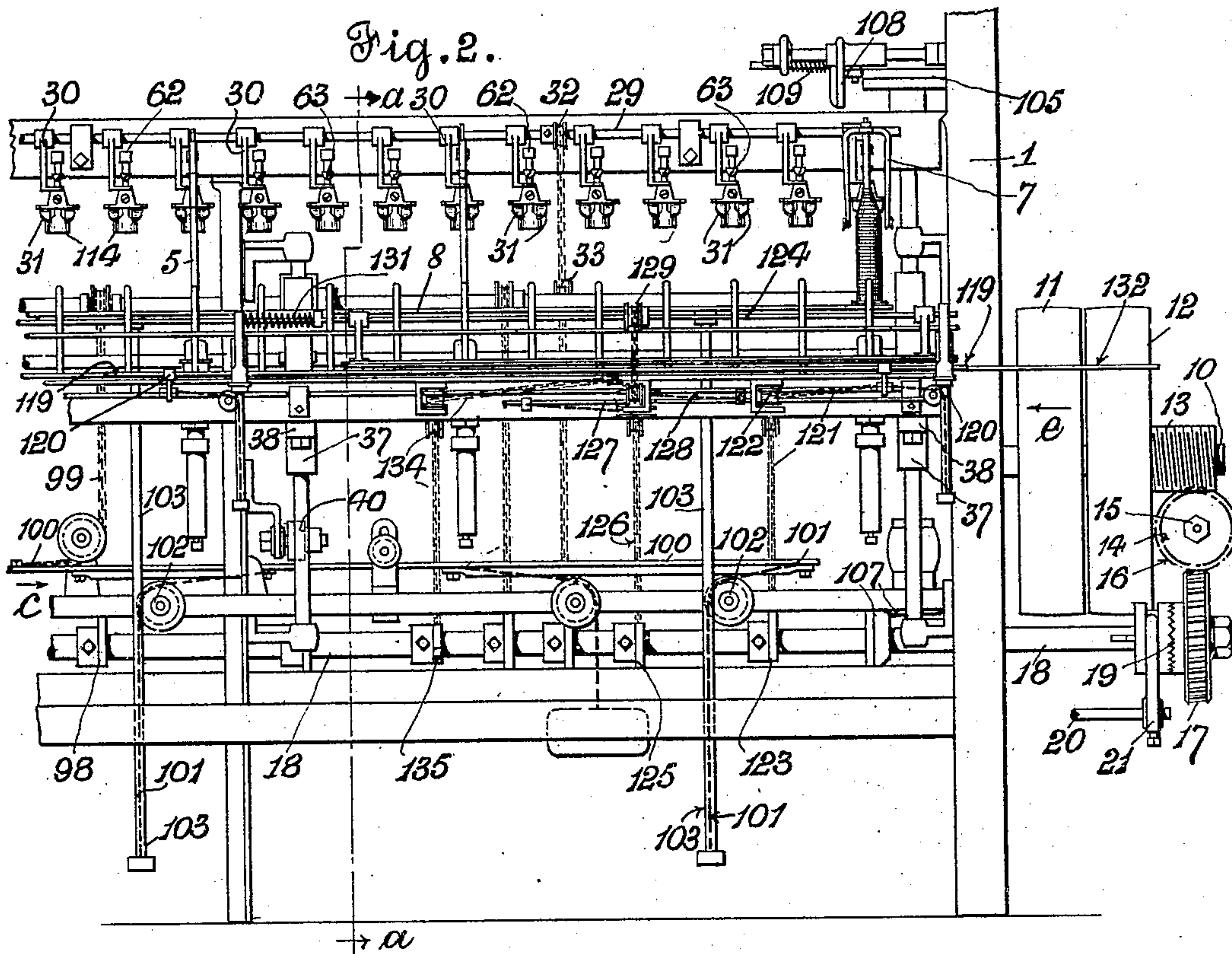
DOFFING MECHANISM.

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Patented Jan. 11, 1910.

5 SHEETS—SHEET 2.

946,144.



Witnesses.

Witnesses.
W. L. Burch
H. Barclay

Inventor.

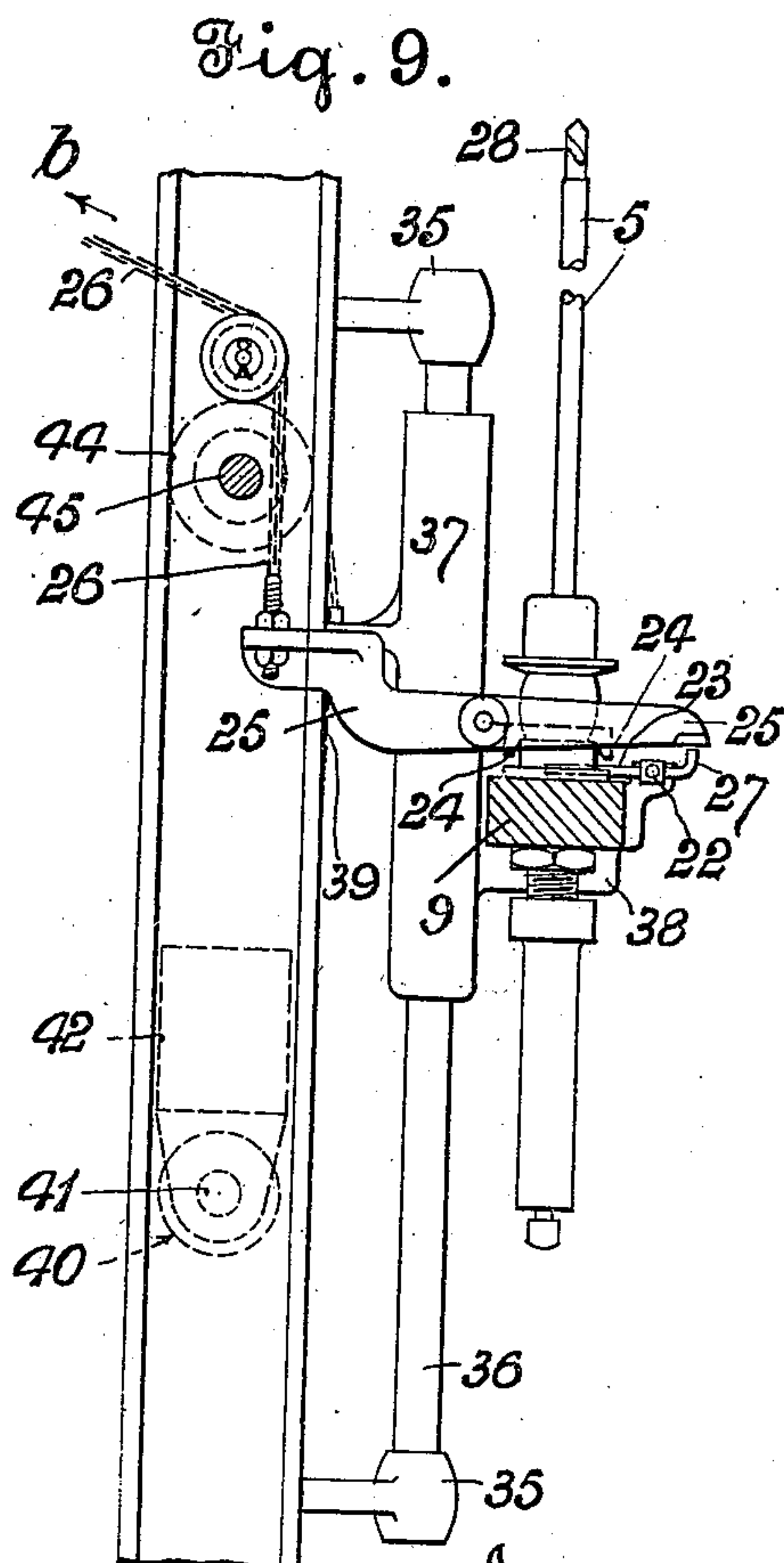
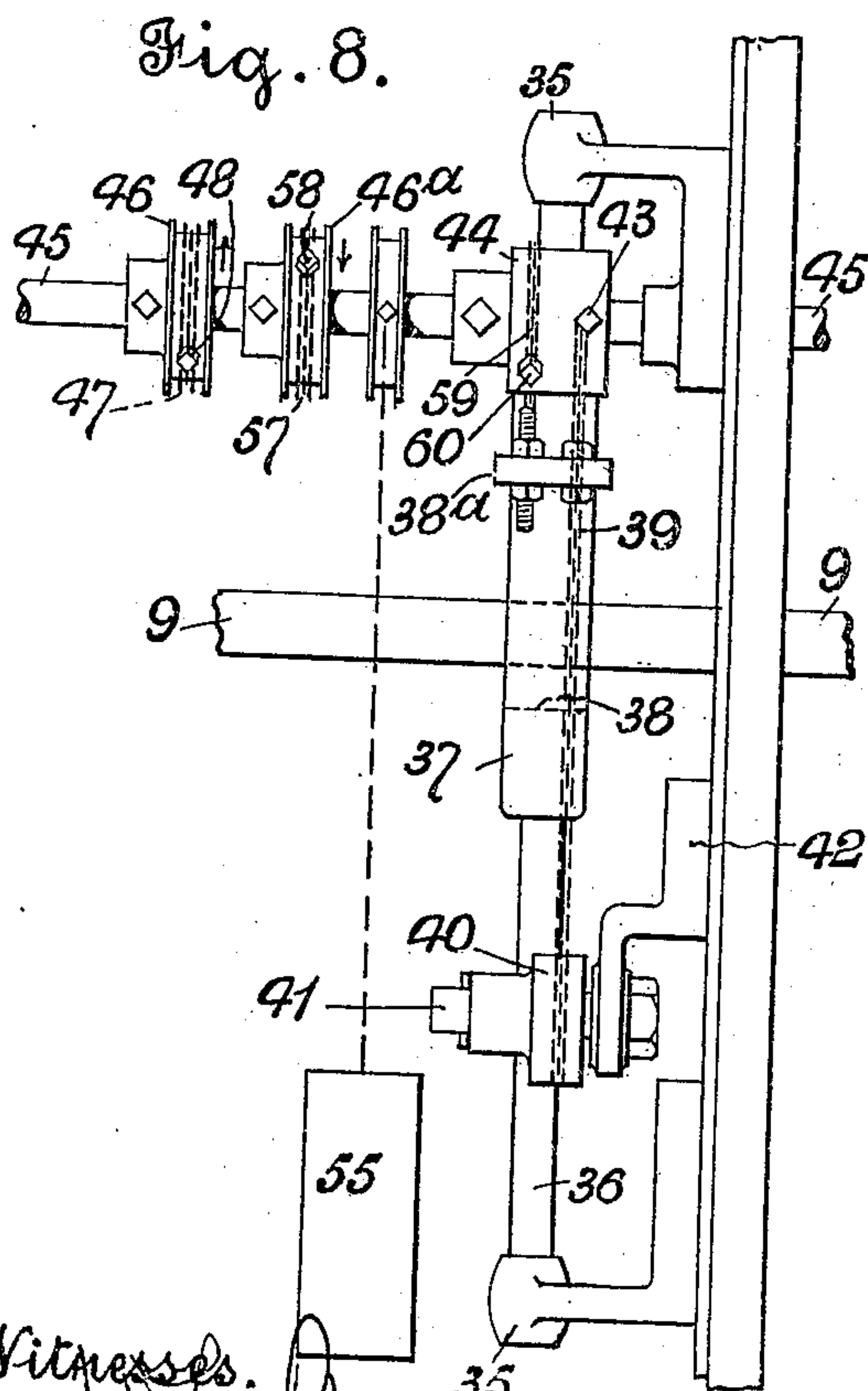
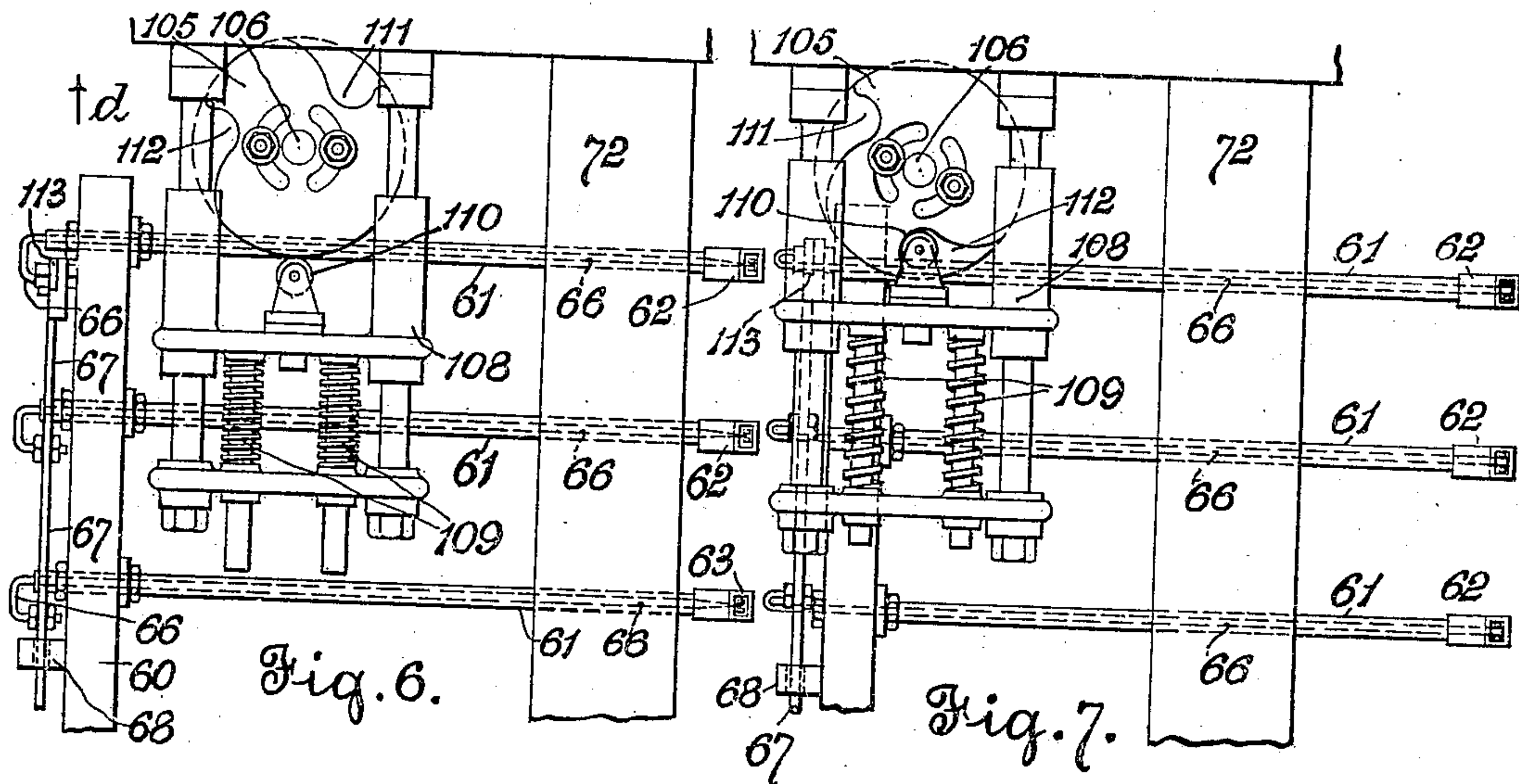
Frank Lister.
by Herbert W. Jenner.
Attorney

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F. LISTER.
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APPLICATION FILED FEB. 7, 1908.

Patented Jan. 11, 1910.

5 SHEETS—SHEET 3.



Witnesses.
W. L. Dura
H. C. Bawley

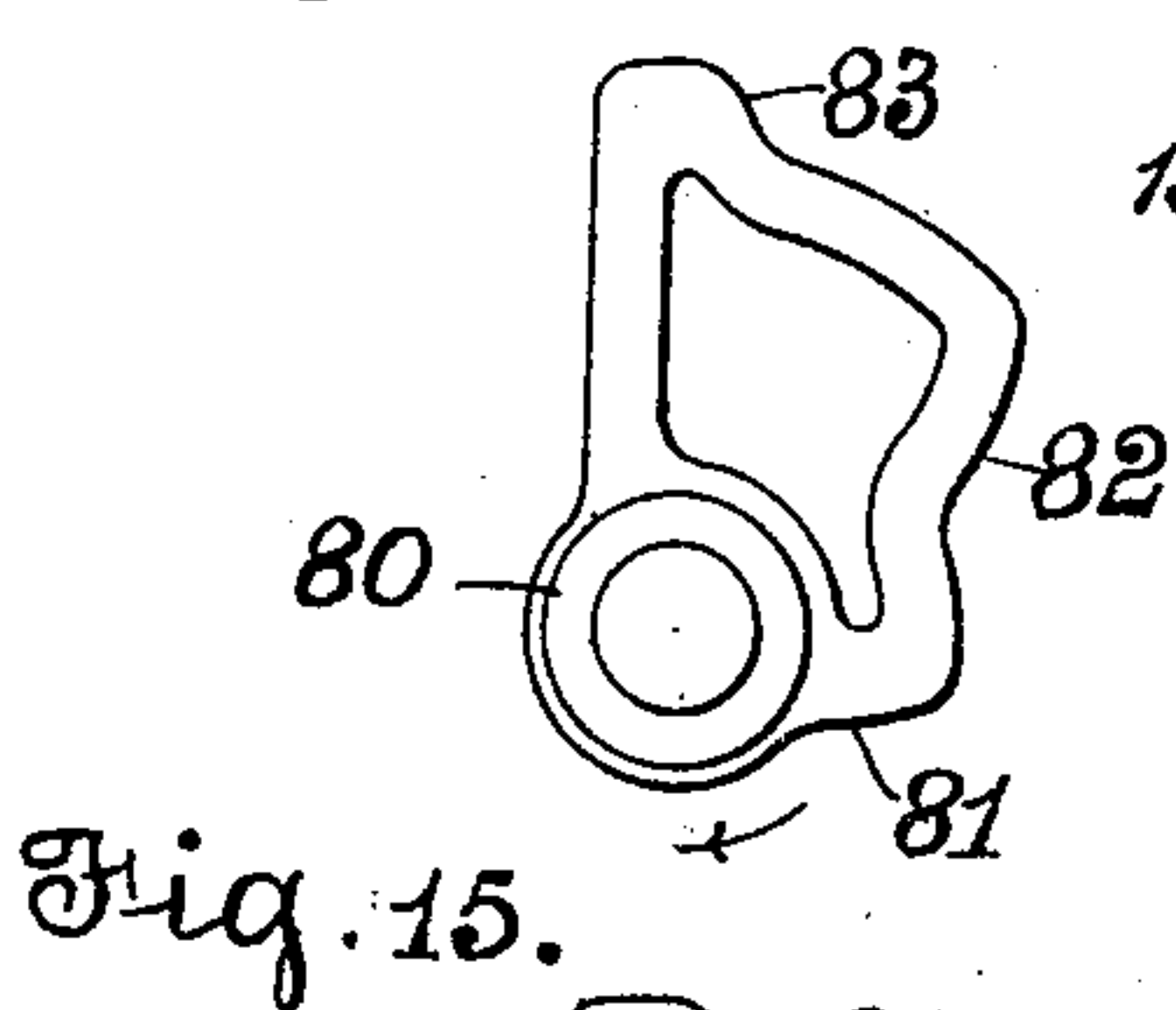
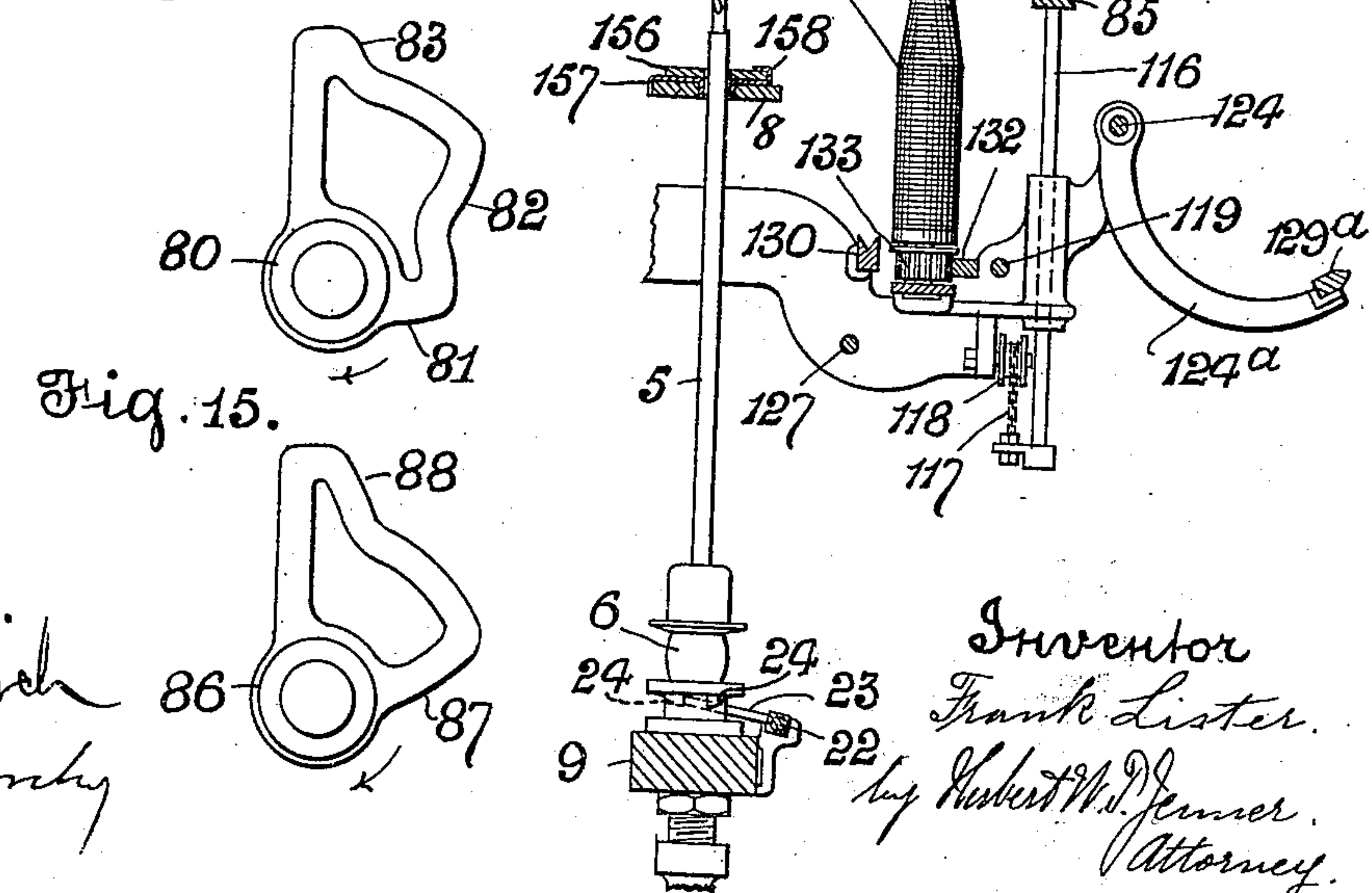
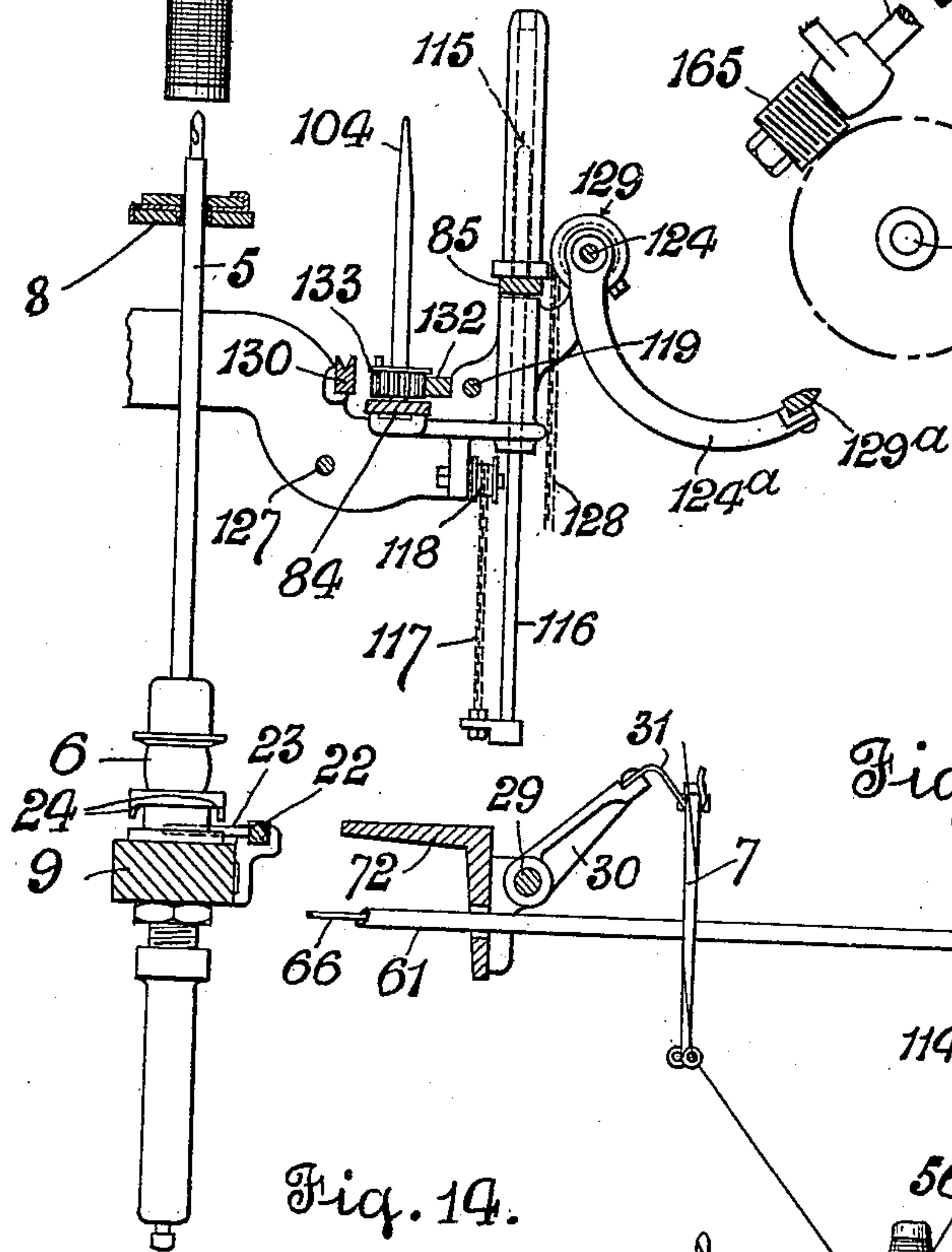
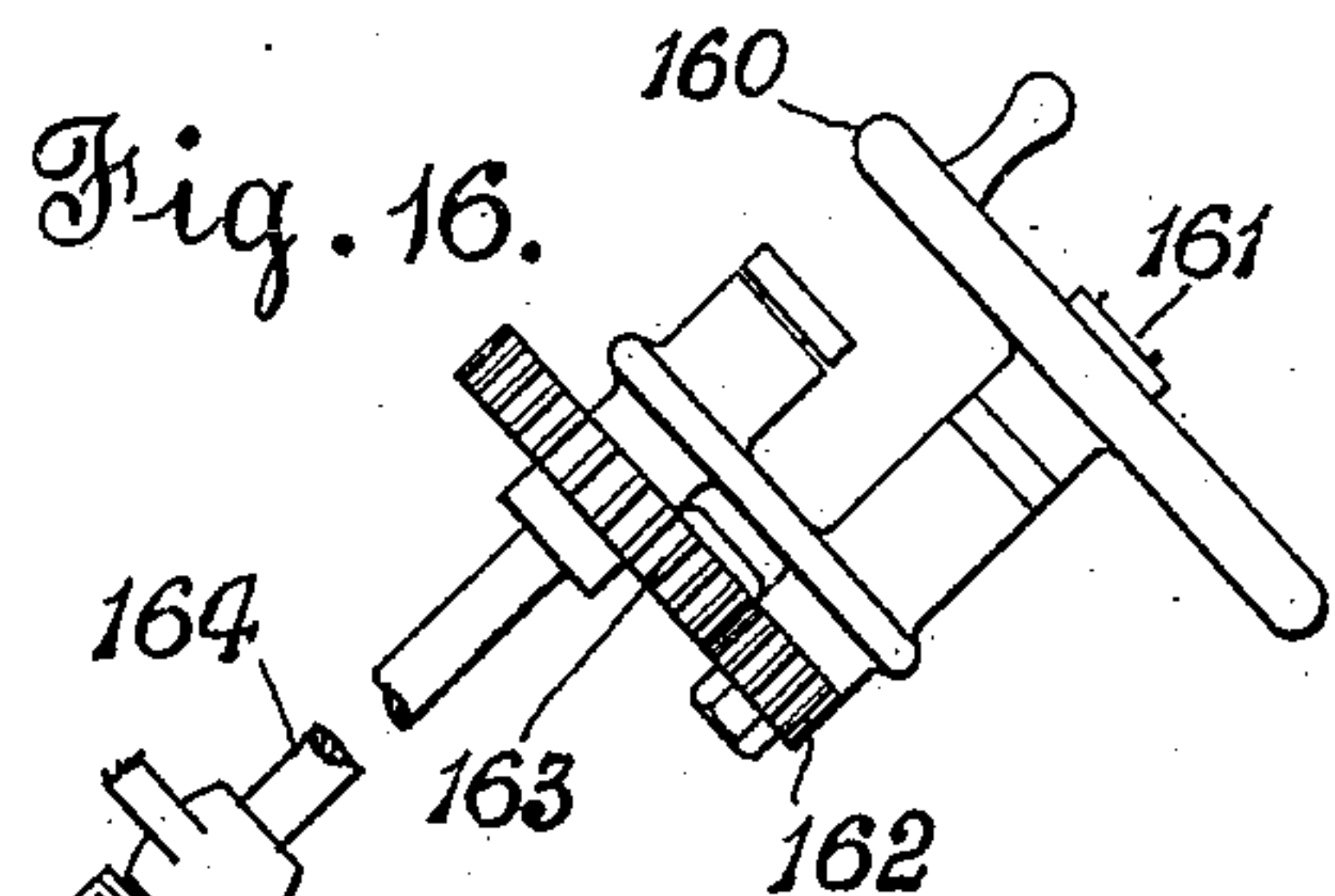
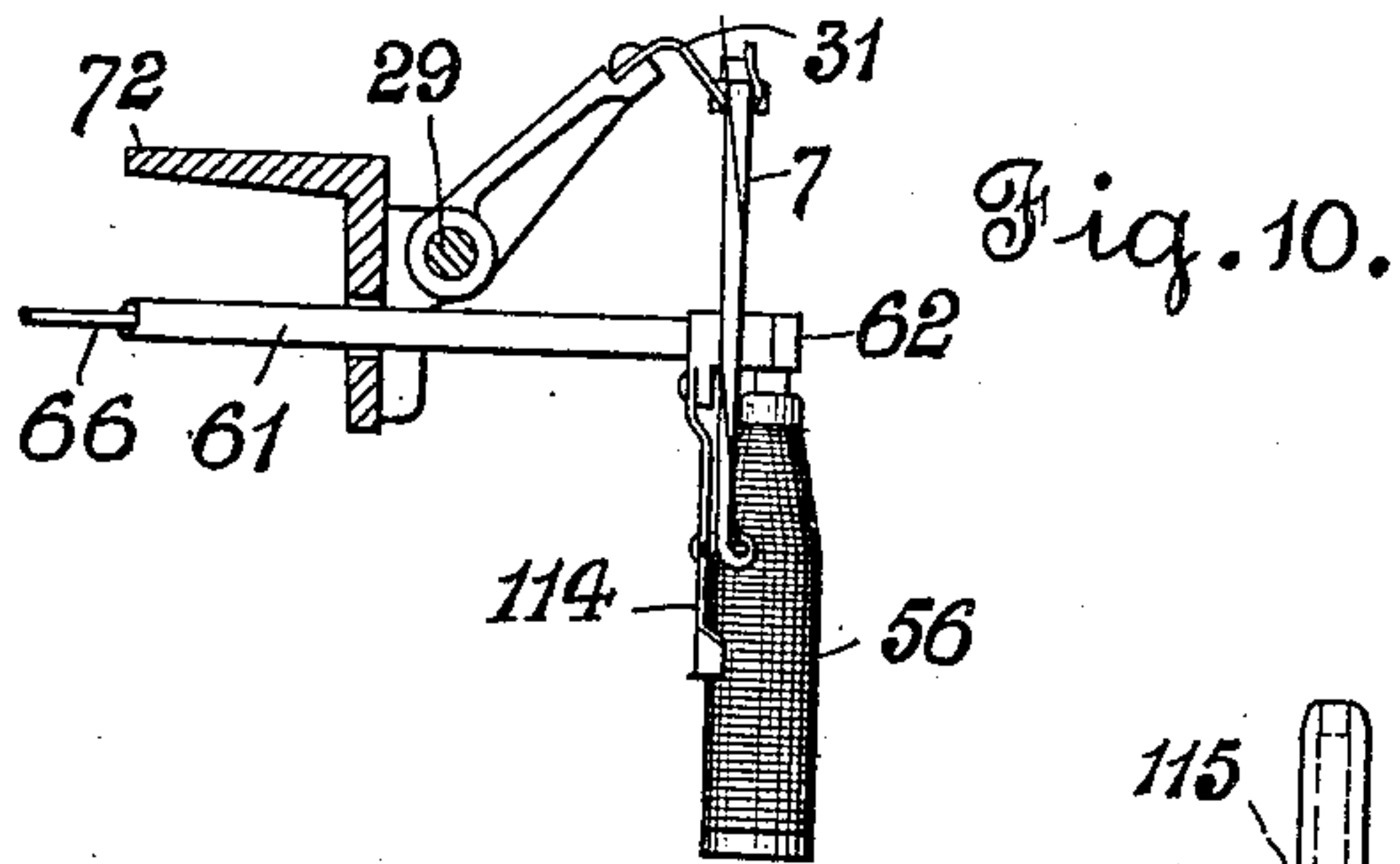
Inventor.
Frank Lister
by *Robert W. Jenner*
Attorney.

946,144.

F. LISTER.
DOFFING MECHANISM.
APPLICATION FILED FEB. 7, 1908.

Patented Jan. 11, 1910.

5 SHEETS—SHEET 4.



Witnesses.
W. H. Burch
H. A. Burch

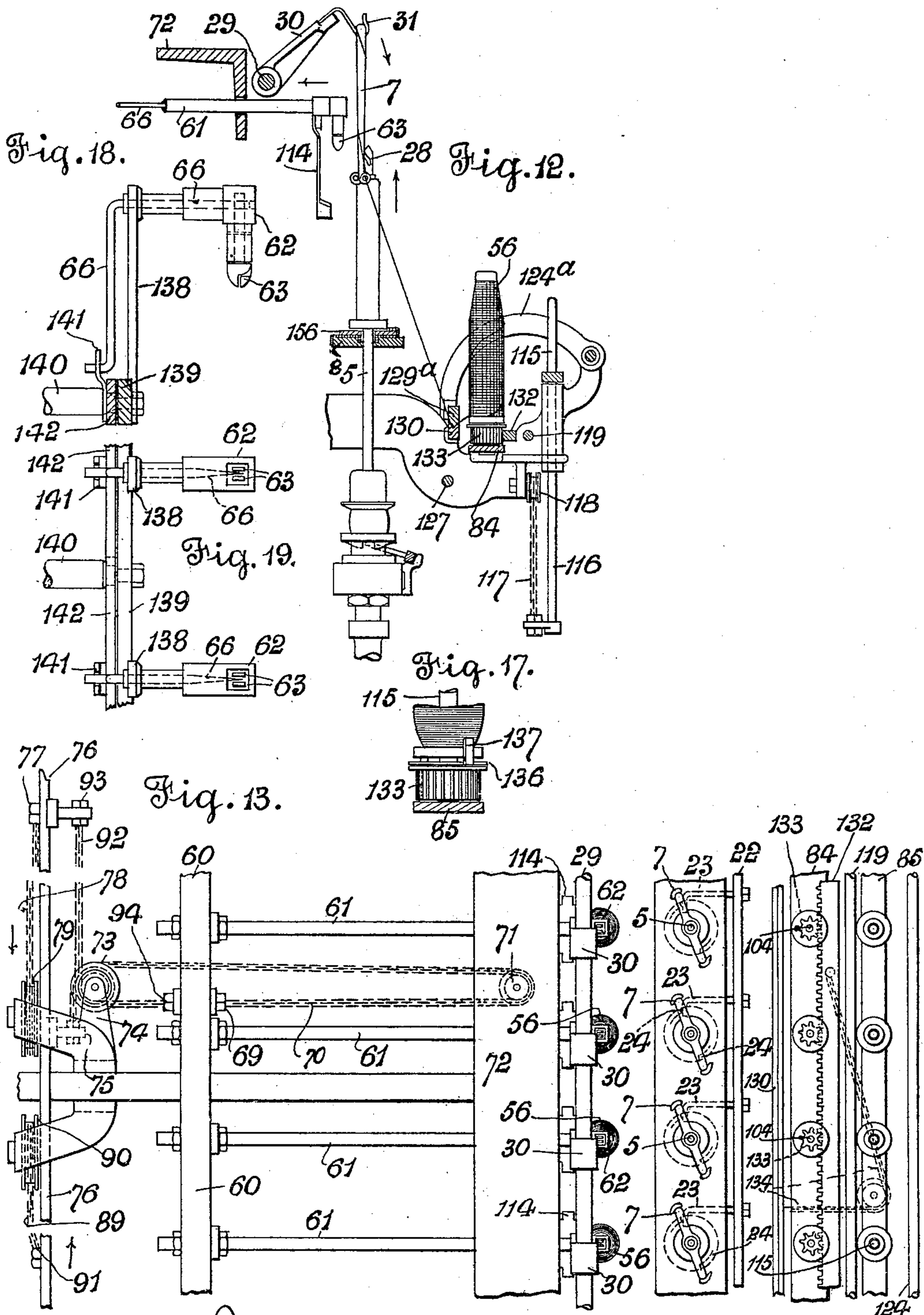
Inventor
Frank Lister.
by Herbert W. Jenner.
Attorney.

F. LISTER.
DOFFING MECHANISM.
APPLICATION FILED FEB. 7, 1908.

946,144.

Patented Jan. 11, 1910.

6 SHEETS—SHEET 5.



Witnesses
Burch
H. C. Burch

Inventor.
Frank Lister.
by Herbert W. Jenner, Attorney

UNITED STATES PATENT OFFICE.

FRANK LISTER, OF CLAYTON, NEAR BRADFORD, ENGLAND.

DOFFING MECHANISM.

946,144.

Specification of Letters Patent.

Patented Jan. 11, 1910.

Application filed February 7, 1908. Serial No. 414,757.

To all whom it may concern:

Be it known that I, FRANK LISTER, a subject of King Edward VII of Great Britain, and resident of Clayton, near Bradford, in the county of York, England, have invented certain new and useful Improvements in Doffing Mechanism, of which the following description, in connection with the accompanying drawings, is a specification.

10 This invention has reference to the doffing of full bobbins in spinning and twisting or like machines and comprises new or improved means for self-actingly doffing the full bobbins from the spindles and placing
15 empty bobbins thereon.

The object of my invention is to provide automatic or self-acting mechanism which can be put into action on the stoppage of the machine for mechanically performing all the
20 operations incidental to the doffing of the full bobbins from, and installing empty bobbins on, the spindles, in readiness for re-starting the machine, the said means avoiding practically all hand labor in the several
25 operations, and performing them efficiently and without loss of time.

My said invention comprises improved mechanism for effecting in their proper sequence the following operations, namely:—

30 (1) in the case of flier frames, stopping the fliers in a predetermined position; (2) removing the fliers or caps from the spindles and subsequently replacing them; (3) removing the full bobbins or tubes from the
35 spindles and depositing them on dummy spindles or pegs on a receiving rail; (4) picking up bobbins or tubes from a supply rail and placing them on the spindles, and
40 (5) severing the yarns or threads between the full bobbins or tubes and the fliers, and twisting in the ends of yarn on the full bobbins to prevent subsequent accidental unwinding of same. The construction of the
45 mechanism by which these various operations are effected, and the sequence in which they are performed, will be fully explained in the subjoined specification, taken in connection with the accompanying drawings, and more particularly pointed out in the following claims.

Figure 1 is a transverse section of so much of a spinning frame as is necessary to show the application thereto of my improvements, the section being taken as on

the line *a—*a**, of Fig. 2; Fig. 2 is a front
view of the right hand end of the frame, the drawing rollers and non-essential parts being omitted; Fig. 3 is an enlarged side
view of one of the bobbin carriers and a bobbin support; Fig. 4 is a front view of a
bobbin carrier showing same just as a bobbin is being push thereonto; Fig. 5 is a
similar view to Fig. 4, but shows the bobbin
fully home on the carrier and engaged by
the jaws thereof; Fig. 6 is a plan view showing
the mechanism for releasing the bobbins
from the carriers prior to operation thereof;
Fig. 7 is a similar view to Fig. 6 but shows
the positions of the parts just after releasing
and dropping the empty bobbins on to
the spindles; Fig. 8 is a rear view of the
means for raising and lowering the spindle
rail; Fig. 9 is a side view of the flier stopper
actuating mechanism; Fig. 10 is a transverse
sectional detail showing the positions of
some of the parts just prior to the bobbin
carriers moving out to position the full bobbins
over the pegs on the receiving rail;
Fig. 11 is a similar view to Fig. 10 showing
the positions of the parts when the full
bobbins have been deposited on the receiving
rail, and the bobbin carriers are just receiving
the empty bobbins from the supply
rail; Fig. 12 is a similar view to Figs. 10
and 11, showing the parts in the positions
they occupy when the empty bobbins have
been placed on the spindles, and just prior
to breakage of the threads between the full
bobbins and the end holder; Fig. 13 is a part
plan view showing the means for traversing
the bobbin carriers; Figs. 14 and 15 show,
respectively, the cams from which the movements
to traverse the bobbin carriers out,
and back again, are obtained; Fig. 16 shows
a side view of an arrangement for operating
the cam shaft by hand, if so desired;
Fig. 17 is a detail showing the means I adopt
for cutting the ends when the yarn is wound
on to tubes instead of on to single or double
ended bobbins; Figs. 18 and 19 are respectively
side and plan views showing a modified
arrangement of mounting and operating
the bobbin carriers.

Referring to the drawings, the framing 1,
back rollers 2, carrier rollers 3, front rollers
4, spindles 5, driving-whirls or whorls 6,
fliers 7, lifter rail 8, spindle rail 9, main
driving shaft 10 and fast and loose pulleys

11 and 12, are or may be all of ordinary construction and form no part of my invention.

For the purpose of my invention, I secure
 5 on the boss of the loose pulley 12 on the main driving or cylinder shaft 10, a worm 13 which meshes with a worm wheel 14 fast on one end of a short transverse shaft 15. The shaft 15 is supported in bearings in a
 10 suitable bracket (not shown) and has fast on its front end a worm 16 which meshes with a worm wheel 17 revoluble loosely on the end of a cam shaft 18. The boss of the worm wheel 17 is formed or provided with
 15 a clutch surface or member with which is adapted to engage a clutch member 19 slidable on but rotatably secured to the shaft 18.

The shifting of the driving strap from the fast pulley 11 to the loose pulley 12,
 20 in stopping the machine, causes the driving-strap to impart rotary motion to the said loose pulley and through worm 13, worm wheel 14, shaft 15, and worm 16 to the worm wheel 17. By operation of the rod 20 carrying a clutch fork 21, the clutch 19 can
 25 be slid into engagement with the clutch surface on the boss of the worm wheel 17, as shown in Fig. 2, to cause the motion of said wheel to be transmitted to the cam
 30 shaft 18 to bring into operation the doffing apparatus either on one or both sides of the machine.

I have only shown in the drawings the application of my invention to one side of
 35 a frame, an exactly similar arrangement being applied to the other side of the frame to automatically doff the bobbins or tubes from the spindles on that side and supply fresh bobbins or tubes thereto. The move-
 40 ment for operating the various motions comprised in the invention is obtained, for one side of the frame, from the cam shaft 18 and for the other side of the frame from a separate cam shaft, or if found conven-
 45 ient, both sides of the frame might be operated from a common shaft.

I will now proceed to describe the mechanism of the various motions my invention embodies, commencing firstly with the means
 50 for stopping the fliers 7 in predetermined position, and removing them from and replacing them on the spindles.

Mounted in suitable bearings in brackets attached to the front of the spindle rail 9
 55 is a longitudinal rod 22 provided with a series of fingers or stop pieces 23 adapted on oscillation of the said rod to be moved into a position to engage projections 24 on the whirls 6. The rod 22 is operated by
 60 a lever 25 (see Fig. 9) pivoted to a bracket (not shown) and having one arm connected by a chain 26 to the stop rod of the machine, the other arm of the said lever being adapted to engage a projection 27 on the front
 65 of the said rod 22. The movement of the

stop rod to stop the machine is caused to pull the chain 26 in the direction of the arrow *b*, thus tilting the lever 25 and depressing the projection 27. The rod 22 is thereby oscillated and the fingers 23 placed
 70 in the path of the projections 24, the engagement of the fingers with the said projections causing the spindles to come to rest with the fliers 7 preferably in the slightly angular position shown in Fig. 13. 75

The upper end of each spindle is provided with an inclined peripheral or circumferential slot or opening 28 in which a pin on the interior of the neck of the flier is adapted to register. The fliers are
 80 thus rotatively secured to the spindles, while they can be easily lifted vertically from and replaced in position thereon, it being essential to my invention, as applied to flier frames, to disconnect and remove the fliers
 85 from the spindles and then replace and connect them thereon by a simple lifting and lowering motion. The upper ends of the spindles are preferably slightly conical or tapered, and the openings through the flier
 90 necks are similarly tapered or made conical to accurately fit thereon.

The means for removing and replacing the fliers comprise a shaft 29 extending longitudinally of the frame and having se-
 95 cured thereon, opposite each spindle, an arm or lever 30 whose extremity or free end is provided or formed with two outwardly extending hooks, forks, or projections 31. Fast on the shaft 29 is a pulley 32 (Figs. 100
 1 and 2) to the periphery of which is attached one end of a chain 33, which passes over a pulley 34 and has its other end fast to the outer end of a cam lever acted upon by
 105 a suitably shaped cam on the shaft 18, the said lever not being shown but being similar to the other cam levers hereafter referred to.

The action of the cam causes the chain 33 to pull on the periphery of the pulley 34
 110 and rock the shaft 29. The rocking or partial rotation of the shaft 29 causes the series of arms 30 fast thereon to move upwardly in the arc of a circle and during such movement, the hooked ends thereof engage with
 115 the upper horizontal ends or necks of the fliers 7 and detach them from the spindles and carry or lift them upwardly and rearwardly clear thereof.

The position in which the spindles and
 120 fliers are stopped, facilitates the removal of the fliers, as the twisting movement given to them by the flier lifters 31 as they are engaged thereby tends to disengage the pins in the necks of the fliers from the slots 28. 125
 The cam by which the flier lifters are operated is so shaped as to keep them in a raised position until the doffing is completed and the empty bobbins placed on the spindles, when the cam will gradually release 130

the shaft 29 and the fliers will fall back by their own weight on to the spindles. A coiled spring may be provided if necessary, on the shaft 29, to assist in returning the fliers. As the flier lifter arms 30 pick up the fliers, the spindle rail 9, which in this instance is made movable vertically, instead of being a fixture, commences to move in a downward direction, the motion being obtained as follows.

Mounted on the frame of the machine are brackets 35, 35, (see Figs. 1 and 8) secured between which are vertical guide rods 36. Slidable on these guide rods 36 are slides 37 to projections or lugs 38 on which the spindle rail 9 is attached. A chain 39, secured at one end to the projection 38^a, passes under a carrier pulley 40 mounted on a stud 41 carried by a bracket 42 attached to the frame, and thence extends upward and is secured at 43 to a pulley 44 fast to a longitudinal shaft 45. Also fast on the shaft 45 is a pulley 46 having one end of a chain 47 secured to it at 48. The chain 47 passes around and under the pulley 46 and is carried over a carrier pulley 49 (Fig. 1) loose on a longitudinal shaft 50 and the end thereof coupled or connected to the end of a lever 51 pivoted at 52 and carrying a bowl 53 adapted to be engaged by the cam 54 fast on the cam shaft.

Depression of the lever 51 by the cam 54, causes the pulley 46 to be partly rotated in the direction of the arrow. This causes the pulley 44 to be rotated in the same direction whereby the chain 39 is wrapped around the pulley 44, and the slide 37 and with it the spindle rail 9 pulled in a downward direction against the action of a balance weight 55. The downward movement of the spindle rail 9 causes the spindles to be gradually withdrawn from the full bobbins 56.

The spindle rail is raised again at the proper time by a cam similar to the cam 54 acting on a chain 57 fast to the pulley 46^a at 58. This causes the pulley 46^a to be partly rotated in the reverse direction and through the chain 59 fast to the pulley 44 at 60 to raise the slide 37 supporting the spindle rail.

Mounted horizontally at the rear of the rock shaft 29 carrying the flier lifter arms 30, is a bar or rod 60 (Fig. 6) adapted to be slid backward and forward on guide rods or bars, or in ways or grooves, not shown. Passing through and secured to the bar 60, opposite each spindle 5, is a hollow tube 61 at the front end of which is a box or chamber 62 wherein are pivoted a pair of jaws or bobbin-carriers 63, 63, the lower ends or active engaging portions of which project below the box or casing 62 and are normally forced apart or maintained in an opened out position by a spring 64 coiled around the pivot 65 and having depending

ends engaging the jaws below the pivot center, as shown at Figs. 4 and 5. Through each tube 61 extends a wire or rod 66 whose front end is flattened and passes between the upper ends of the jaws 63, 63. The rear projecting end of the wire or rod 66 is cranked and secured to the horizontal rail 67 slidable in and carried by guide brackets 68 secured to the bar 60 (see Figs. 6 and 7).

As the spindles 5 are lowered, by the descent of the spindle rail 9, the bar or rod 60 commences to move in a forward direction, the motion being obtained as follows (see Fig. 13). Fastened to the said bar or rod at 69 is one end of a chain 70 which passes around a horizontal pulley 71 mounted on the fixed rail 72, thence around the horizontal pulley 73 carried by the bracket 74, and has its other end secured at 75 to the longitudinally movable rail 76. Fast to this movable rail at 77 is one end of a chain 78 which passes over a carrier pulley 79 to a cam lever operated from the cam shaft by a cam 80, shaped substantially as shown at Fig. 14. This cam is provided with three cam surfaces 81, 82 and 83. The cam surface 81 causes the bobbin carriers to move from their normal position, or that shown in Fig. 1, to a position directly over the spindles 5 as at Fig. 10. The cam surface 82 traverses them from this position to over the bobbin receiving rail 84, and the cam surface 83 traverses the carriers still farther out to a position over the empty bobbin supply rail 85 as shown at Fig. 11. The bobbin carriers are traversed back, at the required time, by a cam 86 (Fig. 15). The cam surface 87 traverses the carriers from their outward limit over the supply rail 85 to the position over the spindles 5, and the cam surface 88 returns the carrier from over the spindles 5 back to normal position. The motion is transmitted from the cam 86 to the rail 76 by chain 89 passing over carrier pulley 90 and fast to the rail at 91, and from the rail 76 to the bar or rod 60 by chain 92 fast to the rail 76 at 93 and to the bar 60 at 94.

As previously stated, the bar or rod 60 commences to move forward as soon as the spindles have been lowered, and this forward movement continues until the jaws or bobbin carriers 63, 63, are centered and accurately positioned over the full bobbins 56 on the spindle 5. The lifter rail 8, on which the full bobbins 56 rest, is now caused to rise and force the upper ends of the bobbins into abutment with the jaws 63, 63, the nose or lower end of each member of which is suitably inclined or shaped so that as the bobbin rises, it presses the jaws together, as shown in Fig. 4. The bobbin continues to rise until the shoulder 97 has passed up clear of the engaging portions of the jaws, when the spring 64 causes the said lower

ends of the jaws to open out, as shown at Fig. 5, and grip the bobbin. The lifter rail 8 then returns to its normal position, the parts now occupying the position shown at Fig. 10. The lifter rail is actuated from the cam shaft by a suitable cam 98 acting on the chain 99 (Fig. 2) attached to the horizontal rail 100. The cam 98 is caused at the required moment to pull on the chain 99 and cause the rail 100 to move in the direction of the arrow *c*. This movement of the rail 100 pulls on the chains 101 fast to the said rail and passing over pulleys 102 and secured at their opposite ends to the lifter rods 103 supporting the lifter rail 8, and raises the said rail. After the cam passes clear, the lifter rail 8, by its own weight, moves in the opposite direction to its normal position. When the lifter rail has returned to its normal position after forcing the full bobbins up on to the bobbin carriers, 63, the cam surface 82 on the cam 80 acts to move the bobbin carriers forward to their second position, that is to say, centered over pegs 104 on the bobbin receiving rail 84. As soon as the bobbin carriers have reached this position, the bobbin releasing mechanism operates.

The bobbin releasing mechanism comprises a horizontal cam 105 (Figs. 6 and 7) mounted on a vertical shaft 106 driven by bevel wheels 107 from the cam shaft. A slide 108 carried on two horizontal rods projecting from the framing, is normally pressed toward the cam by means of springs 109. The slide 108 carries a small bowl 110 which runs against the periphery of the cam, which is provided with two recesses or depressions 111, 112, so disposed and timed that at the moment when the bobbin carriers are centered over the pegs 104 on the receiving rail 84, the recess 111 is presented opposite the bowl 110. This permits the slide 108 to be forced toward the cam by the springs 109 and in its movement it engages a projection 113 from the horizontal rail 67, which by the forward movement of the bobbin carriers has been brought opposite the forward end of the slide, and moves the said rail in the direction of the arrow *d* a distance sufficient to give a quarter turn to each of the wires 66. The quarter turn given to the wires 66 moves the flats or heads thereon from the vertical to the horizontal position, thereby expanding or opening out the upper ends of each pair of jaws 63, 63, and contracting the lower ends thereof, by which means the hold of the jaws upon the full bobbins is released and the bobbins thereupon fall by their own weight on to the pegs 104 placed to receive them.

The bobbin carriers are provided with depending fingers or supports 114 which maintain the bobbins in a vertical position from the time they are engaged by the jaws 63

until released or discharged therefrom, in order to avoid any accidental displacement which would prevent them from dropping truly, when released, on to the receiving pegs or spindles.

Immediately the full bobbins have dropped from the carriers on to the pegs 104 on the receiving rail, the cam surface 83 of the cam 80 causes the carriers to be traversed to their third or foremost position to center the jaws or bobbin-carriers 63, 63, over the pegs 115 of the supply rail 85, containing a series of empty bobbins one for each spindle 5. As the carriers are making this third forward movement, the cam 105 permits the wires 66 to return to normal position with their flattened heads vertical ready for the next releasing operation. A suitable spring may be employed to return or assist in returning the rail 67 and wires 66 to normal position.

When the carrier jaws are centered over the pegs 115 of the supply rail 85, the said rail is lifted up to force the empty bobbins on to the carriers, the parts now occupying the positions shown in Fig. 11. Attached to the lifter rods 116 of the supply rail 85 are chains 117 which pass over pulleys 118 and are secured to a longitudinally slidable rod 119 at 120. Also secured to the rod 119 is a chain 121 which passes around a pulley 122 and then to a cam lever operated upon by cam 123. When the rail 85 is to be raised, the cam 123 acts to pull on the chain 121 and slides the rod 119 endwise in the direction of the arrow *e*, Fig. 2. The supply-rail 85 descends by its own weight when permitted by the cam, or a separate cam and connections or a spring or springs may be employed to pull the said rail down positively if found necessary.

After placing the empty bobbins on to the carriers, the rail 85 lowers out of the way clear of the bobbins suspended from the carriers, which latter now commence their return or inward movement, through the operation of the cam surface 87 of the cam 86. When the carriers have traveled far enough inward to center the empty bobbins over the spindles, the projection 113 on the horizontal rail 67 is, by the presentation of the recess 112 opposite the bowl 110 (see Fig. 7), again engaged by the slide 108 to give a quarter turn to the wires 66, which release the empty bobbins and allow them to drop on to the spindles 5, which are now commencing to rise.

Simultaneously with the first part of the return movement of the bobbin carriers with the empty bobbins to deposit them on the spindles, a rock shaft 124 is actuated from cam 125 by chain 126, longitudinally movable rod 127, chain 128, and a pulley 129 on the shaft 124, to the periphery of which said pulley the chain 128 is attached. The actuation of the shaft 124, by means of arms 124^a

fast thereon (Fig. 10), carries or moves over a longitudinal bar 129^a which engages the ends or threads extending from the full bobbins and the fliers and nips them between itself and a fixed bifurcated or grooved rail 130. A coiled spring 131 secured on the shaft 124 (Fig. 2) takes up the weight as the bar 129^a is dropping down on to the bifurcated rail, or this may be effected by a brake or friction surface.

As the bar 129^a engages the ends or threads, a longitudinal rack 132, meshing with pinions 133 on the pegs 104, is moved endwise to cause the said bobbins (by means of pins on the upper surfaces of the pinions which enter recesses in the lower ends of the bobbins) to be rotated to unwind a portion of yarn therefrom. When the bar 129^a has nipped the ends between itself and the bifurcated rail 130, the rack is moved endwise in the opposite direction to tighten the ends around the full bobbins and then draw or twist the ends in between the bottom of the yarn mass and the top of the flange on the bobbin, as shown in Fig. 12. This twisting in of the ends of the full bobbins prevents liability of the said loose ends projecting and unwinding when the full bobbins are removed and during transit from the spinning machine to their destination. During the backward movement of the rack, the ends or threads are also broken where they are nipped between the bar 129^a and the bifurcated rail 130. The rack 132 is operated in one direction by chain 134 from cam 135 and in the other direction by a similar cam and chain at the opposite end of the machine. By the time the ends of yarn are tightened, twisted in, and broken, the spindle rail 9 has reached its normal or raised position again, causing the spindles to project through the empty bobbins dropped over them by the bobbin carriers, which have been moved back by the cam surface 88 of the cam 80 to their normal or rearward positions shown at Fig. 1.

The cam controlling the operation of the flier lifter arms now operates to permit the flier lifters to replace the fliers on to the spindles and then, continuing their semicircular downward movement, fall clear of the spindles and fliers into their normal positions, as at Fig. 1. On the conclusion of these movements, the parts are all in readiness for the re-starting of the machine, the clutch 19 being operated through rod 20 and clutch fork 21 to disconnect the cam shaft from its rotary connection with the worm wheel 17, and thus throw the doffing mechanism out of action. The movement of the stop rod to re-start the machine, slackens the chain 26 and allows the lever 25 to tilt and permit the fingers 23 to move clear of the projections 24 on the whirls. If necessary, I may employ stop pieces movable synchro-

nously with the bobbin carriers to engage the bar 60 or the bobbin carriers to accurately position the said carriers at the end of each movement thereof.

In the event of paper tubes being employed to receive the yarn instead of single or double ended bobbins, the means described for breaking the ends would not serve as the tubes which are placed on wooden spools, could not be engaged by the pegs on the pinions 133 and therefore the backward rotation of the said pinions would not put any strain on to the ends to break them. I provide, therefore, on the pinions 133, loose or detachable disks 136 (Fig. 17) adapted to be engaged with the pins or studs on the pinions 133, and provided with upturned projections or knives 137 which engage the ends or threads as the end holder bars 129^a and 130 grip them and, as the rack rotates the pinions, sever the said ends.

Figs. 18 and 19 show a modification in which the tubes 61 are dispensed with, and the bobbin carriers are mounted on vertical brackets 138 attached to a horizontal bar 139, capable of being moved backward and forward in suitable ways by rods 140 actuated from the cams 80 and 86 to traverse the bobbin carriers in the same manner as the bar 60. In this instance, the wires 66 are made much shorter and are cranked downwardly and engaged by forks or projections 141 from a horizontal bar 142 slidable longitudinally by the same means and in the same manner as the bar 67. By this arrangement the construction of the bobbin carrier mechanism is simplified and friction is reduced.

In order to prevent the felt or like washers 156 (see Figs. 10, 11 and 12) on which the bobbins rest on the lifter rail 8, from adhering to and being carried away by the said bobbins on their removal, I provide metal rings 157 which are suitably clamped on or secured to the rail 96 and have upturned projections 158 to engage the washers 156 and secure them thereon. The projections 158 also serve to prevent the yarn from passing under the bobbin and being wound around the spindle. Should it be desired to actuate the cam shaft by hand instead of by power, I provide the drive shown at Fig. 16, this comprising a hand wheel 160 on a short shaft 161 carrying a pinion 162 which meshes with and drives a spur gear 163 on a shaft 164 having a worm 165 thereon, the worm 165 meshing with and driving a worm wheel 166 on the cam shaft. In the event of the spindle driving bands not being slackened on the stoppage of the machine by means of tension pulleys or the like, I provide the driving drum or cylinder with two diameters for each band in the known way, the bands, on the machine being stopped, being moved from the larger to the smaller

diameters of the drum by means of forks or guides on a longitudinal rail actuated by lever from the starting or stopping rod of the machine, the slackening of the bands being essential to admit of the vertical movement of the spindle in doffing as before set forth. Projections on the enlarged diameters of the driving cylinder lead the band on to same on the re-starting of the machine.

10 It will be manifest that the connections intermediate the levers or parts actuated by the cams or tappets on the cam shaft and the parts they operate may vary considerably according to the make of machine and to the

15 space allowed for the introduction and working of same, any suitable transmission means adapted for the purpose being employed and the necessary connections made as found to answer best. In most of the

20 motions, the operation of the parts is positive, but, where required, I provide springs or the like for insuring re-instatement or return movement of said parts. Each side of the frame is provided with its own respective self-acting doffing mechanism both of

25 which, however, may be actuated from one transverse worm shaft.

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

30 1. The combination, with a spindle-rail, and a series of revoluble spindles supported by the said rail and provided with fliers and driving-whirls having projections; of a rod

35 pivoted adjacent to the said rail and provided with a series of stop-fingers, and means for tilting the said rod to place the said fingers in the paths of the said projections, whereby the said fliers are stopped

40 simultaneously in a prearranged position preparatory to doffing.

2. The combination, with a spindle-rail, and a series of revoluble spindles supported by the said rail and provided with spiral

45 slots at their upper parts, and having a series of fliers provided with pins for engaging with the said slots and having also driving-whirls provided with projections; of a rod pivoted adjacent to the said rail and provided with a series of stop-fingers, and

50 means for tilting the said rod to place the said fingers in the paths of the said projections to stop the said fliers in a prearranged position preparatory to doffing.

55 3. The combination, with a series of revoluble spindles, a series of removable fliers splined to the said spindles, and stop mechanism for arresting the motion of the said spindles when the said fliers are in a prearranged position preparatory to doffing; of

60 a rock-shaft provided with a series of lifting-arms having hooks at their free ends for engaging with the said fliers, and means for oscillating the said rock-shaft, whereby the

said fliers are removed from and replaced 65 on the said spindles.

4. The combination, with a row of vertical spindles, and bobbins carried by said spindles; of a supporting-bar arranged parallel with the said row of spindles, horizontal 70 tubes secured at one end to the said bar opposite the said spindles, bobbin-carriers supported by the free end portions of the said tubes above the said bobbins, disengaging devices provided with rods inclosed in 75 the said tubes and adapted to operate the said bobbin-carriers simultaneously, and means for sliding the said supporting-bar toward and away from the said row of spindles. 80

5. The combination, with a horizontally slidable support, and a series of bobbin-carriers connected with the said support and provided with coupling-devices for engaging with the openings in the upper ends 85 of bobbins; of a vertically movable lifter-rail, a series of bobbin-spindles arranged crosswise of the said lifter-rail, a series of bobbins normally engaging with the end portions of the said spindles above the lifter-rail, means for sliding the lifter-rail vertically to place the openings of the bobbins in engagement with the said coupling-devices, means for sliding the lifter-rail and spindles downwardly to clear the bobbins, 95 and means for sliding the said support horizontally to place the bobbins out of line with the spindles.

6. The combination, with a horizontally slidable support, horizontal tubes carried by the said support, and bobbin-carriers carried by the said tubes; of rods inclosed in the said tubes and provided with means for operating the said bobbin-carriers so that they release the bobbins, a rail provided with a 105 projection and operatively connected with all the said rods, a stationary guide, a spring-pressed slide working in the said guide crosswise of the path of the said support, and a revoluble cam which permits the said slide 110 to operate the said projection at a prearranged point in the travel of the said support.

7. The combination, with a horizontal supporting-tube, and means for sliding the said tube longitudinally; of a pair of spring-pressed jaws for engaging automatically with the opening in the upper end of a bobbin and depending vertically from the said tube, and a releasing-rod inclosed in the said 120 tube and provided with an end portion for contracting the said jaws so that they release the said bobbin.

8. The combination, with a horizontal supporting-tube having a chamber at one 125 end, a depending finger for temporarily holding a bobbin in a vertical position, and means for sliding the said tube longitudi-

nally; of a pair of spring-pressed jaws for carrying a bobbin pivoted together and arranged in the said chamber, and a releasing-rod inclosed in the said tube and provided
5 with an end portion for operating the said jaws so that they release the said bobbin.

9. The combination, with a support provided with bobbin-carriers having automatic jaws for engaging with the openings in the
10 upper ends of bobbins, and means for sliding the said support horizontally to place the said bobbin-carriers in alinement with bobbins; of a lifter-rail, bobbins arranged above the lifter-rail, and means for sliding the said
15 lifter-rail vertically to press the said bobbins into engagement with the jaws of the said bobbin-carriers after the bobbin-carriers have been placed in alinement with the bobbins.

10. The combination, with a row of revoluble spindles, and a row of pegs for receiving the wound bobbins; of doffing-mechanism for removing the wound bobbins from the said spindles and placing them on
20 the said pegs, a rail arranged between the said rows, an operating-shaft mounted parallel with the said rail on the opposite side of the said pegs from the said spindles, arms secured to the said shaft, a rail secured to
25 the said arms and arranged to nip the end

portions of the threads which project from the said bobbins against the aforesaid rail, and means for oscillating the said shaft to retract the movable rail crosswise of the said
35 pegs clear of the threads.

11. The combination, with a row of revoluble spindles, and a row of pegs for receiving the wound bobbins; of nipping-devices for the threads arranged between the
40 said rows, and means for revolving the wound bobbins after being placed on the said pegs whereby the end portions of the threads are twisted-in and secured.

12. The combination, with a row of revoluble spindles, and a row of revoluble pegs
45 for receiving the wound bobbins provided with toothed driving-pinions; of nipping-devices for the threads arranged between the said rows, a toothed rack gearing into the said pinions, and means for moving the
50 said rack longitudinally to revolve the said pegs and wound bobbins, thereby twisting-in and securing the end portions of the said threads.

In testimony whereof I affix my signature
55 in the presence of two witnesses.

FRANK LISTER.

Witnesses:

THOMAS H. BARRON,
ELSIE GLEDHILL.