

No. 876,815.

PATENTED JAN. 14, 1908.

E. LIPPITT.

KNITTING MACHINE.

APPLICATION FILED OCT. 19, 1905.

8 SHEETS—SHEET 1.

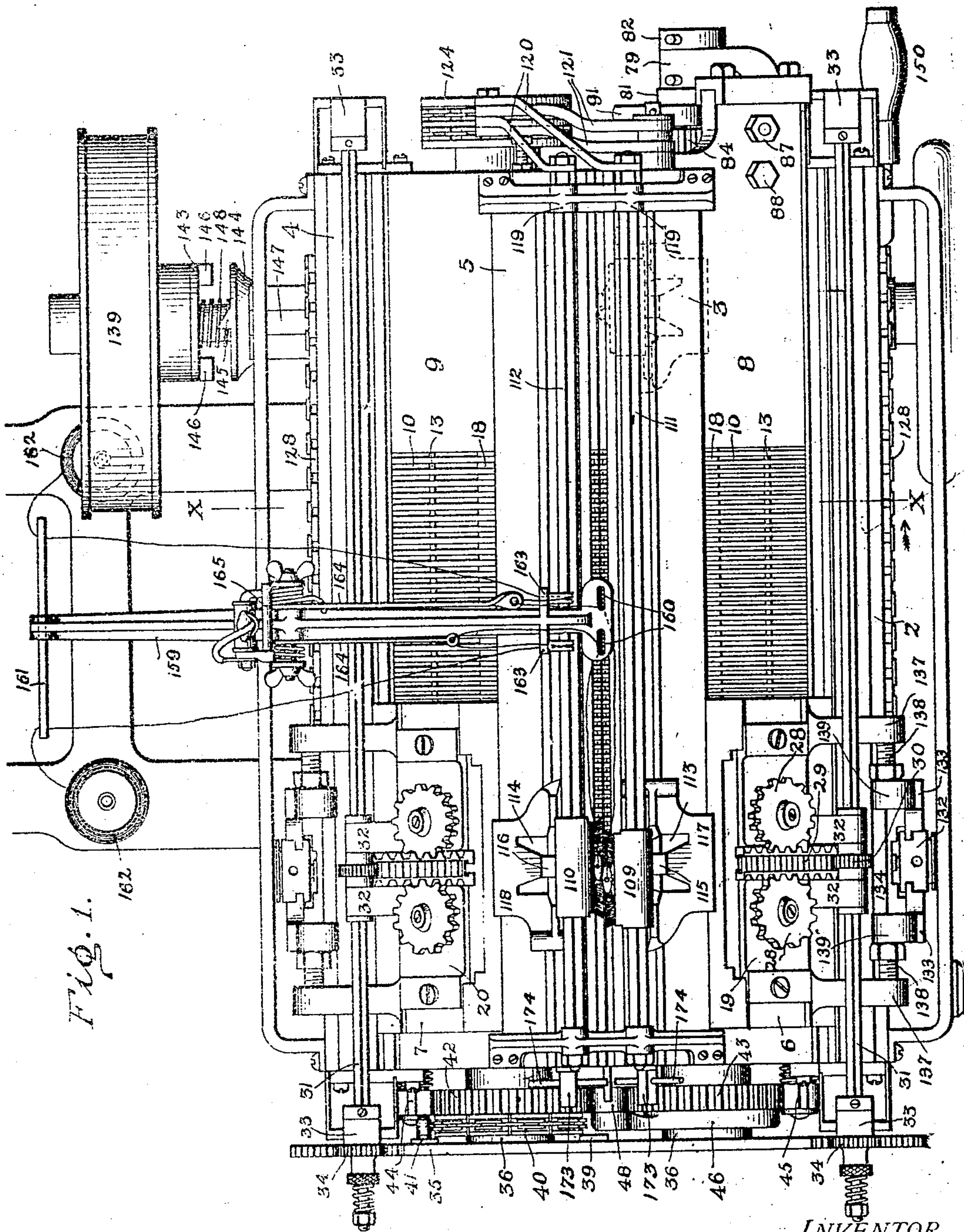


Fig. 1.

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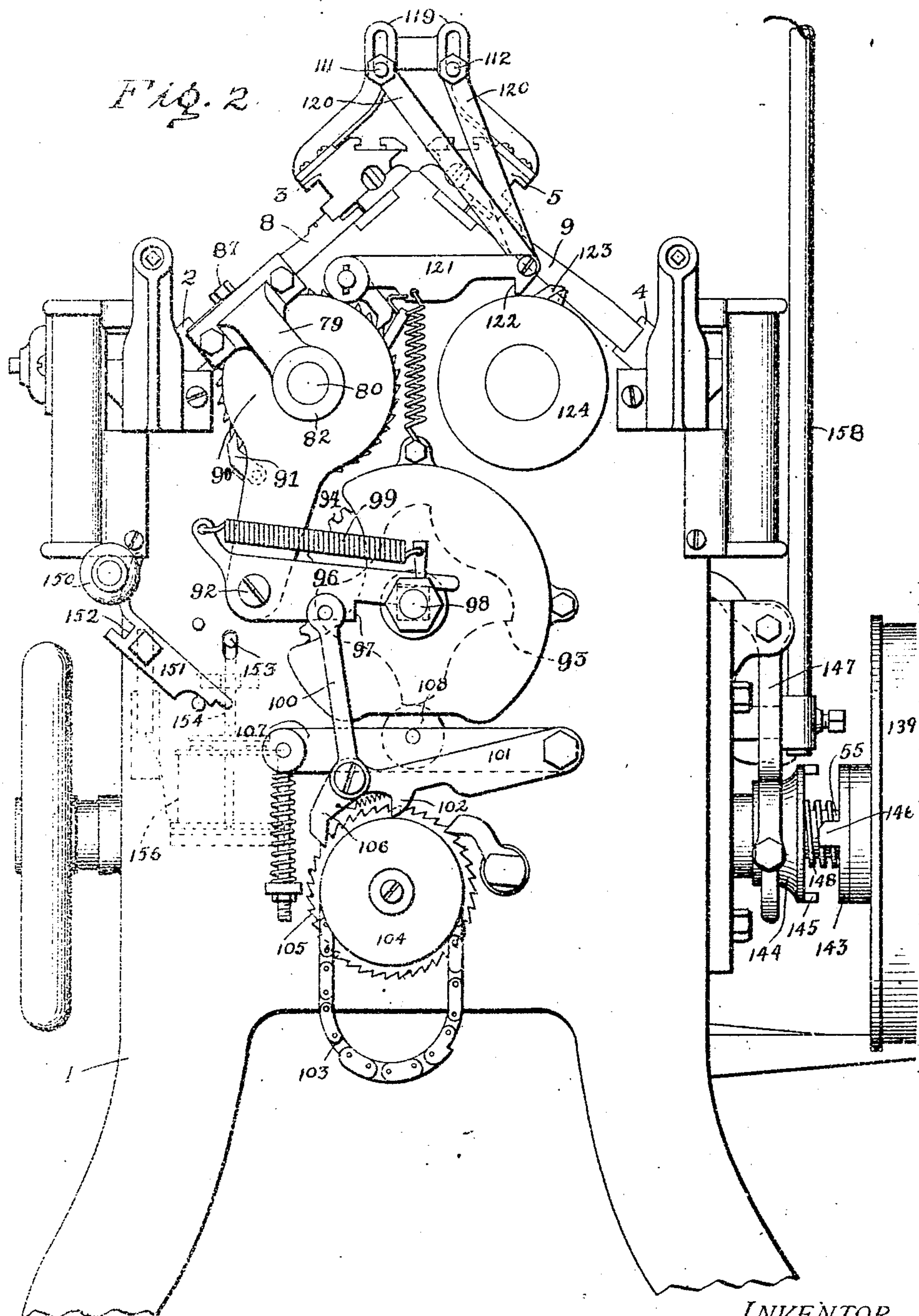
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8 SHEETS—SHEET 2.



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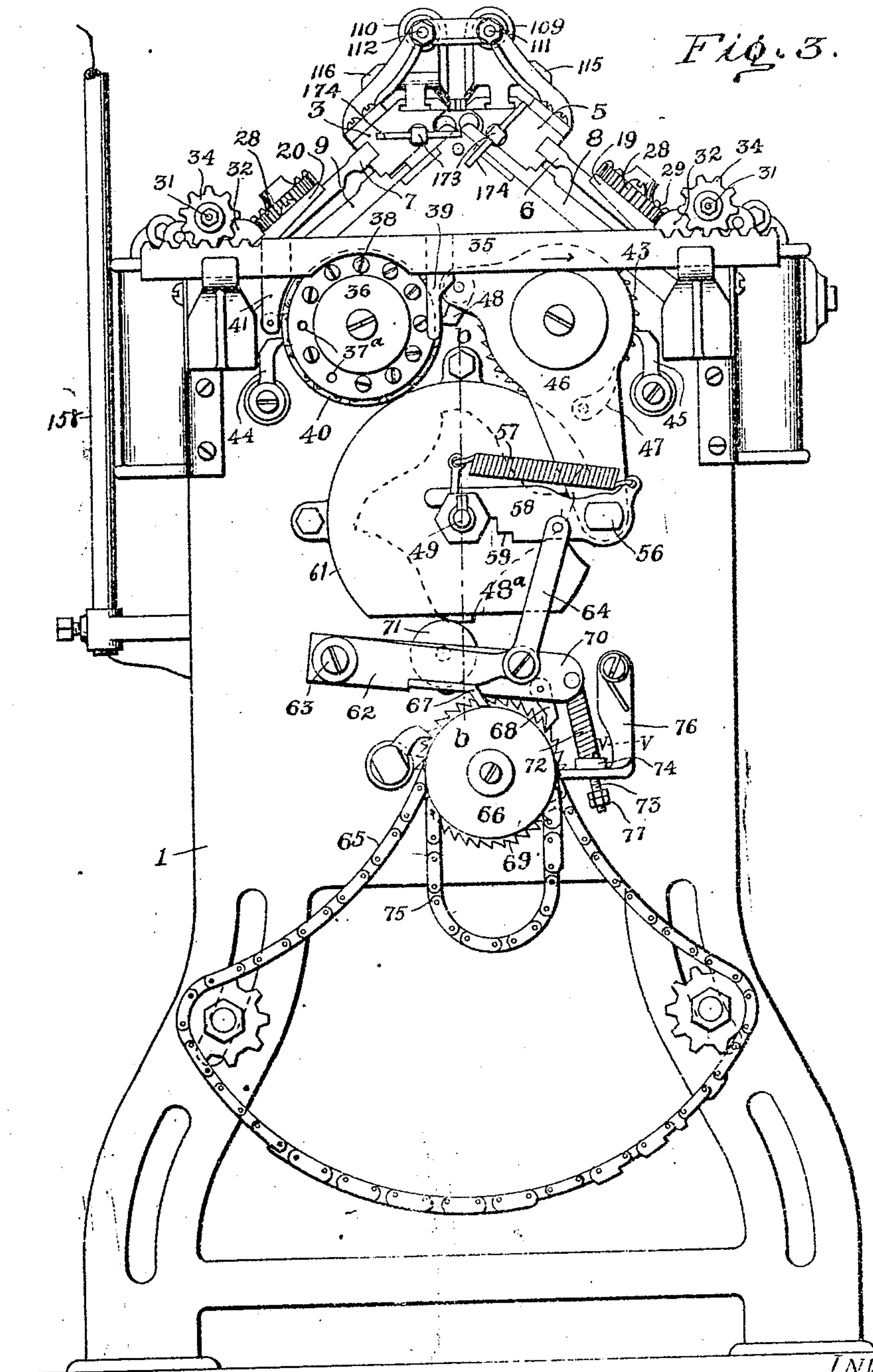
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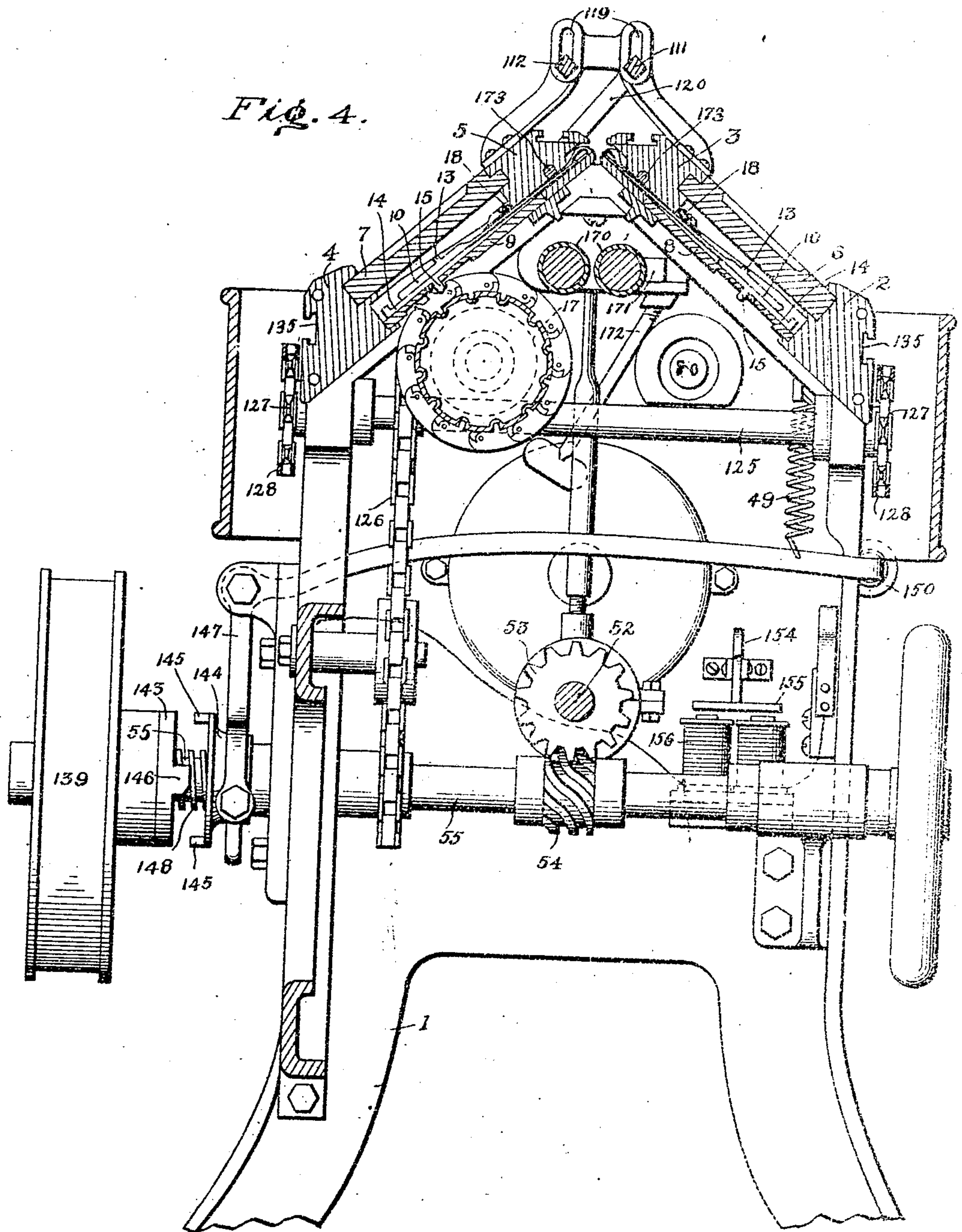
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Fig. 4.



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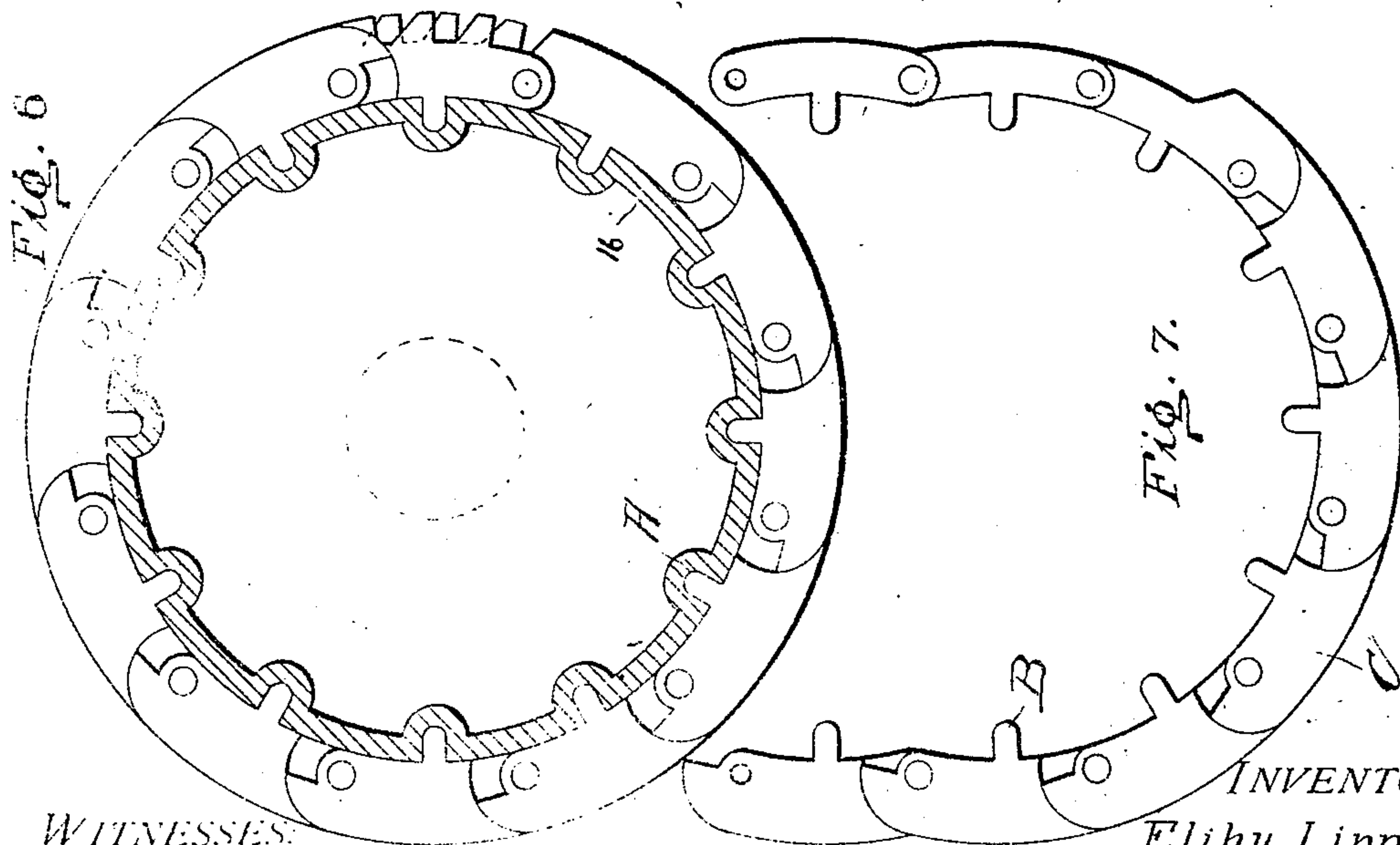
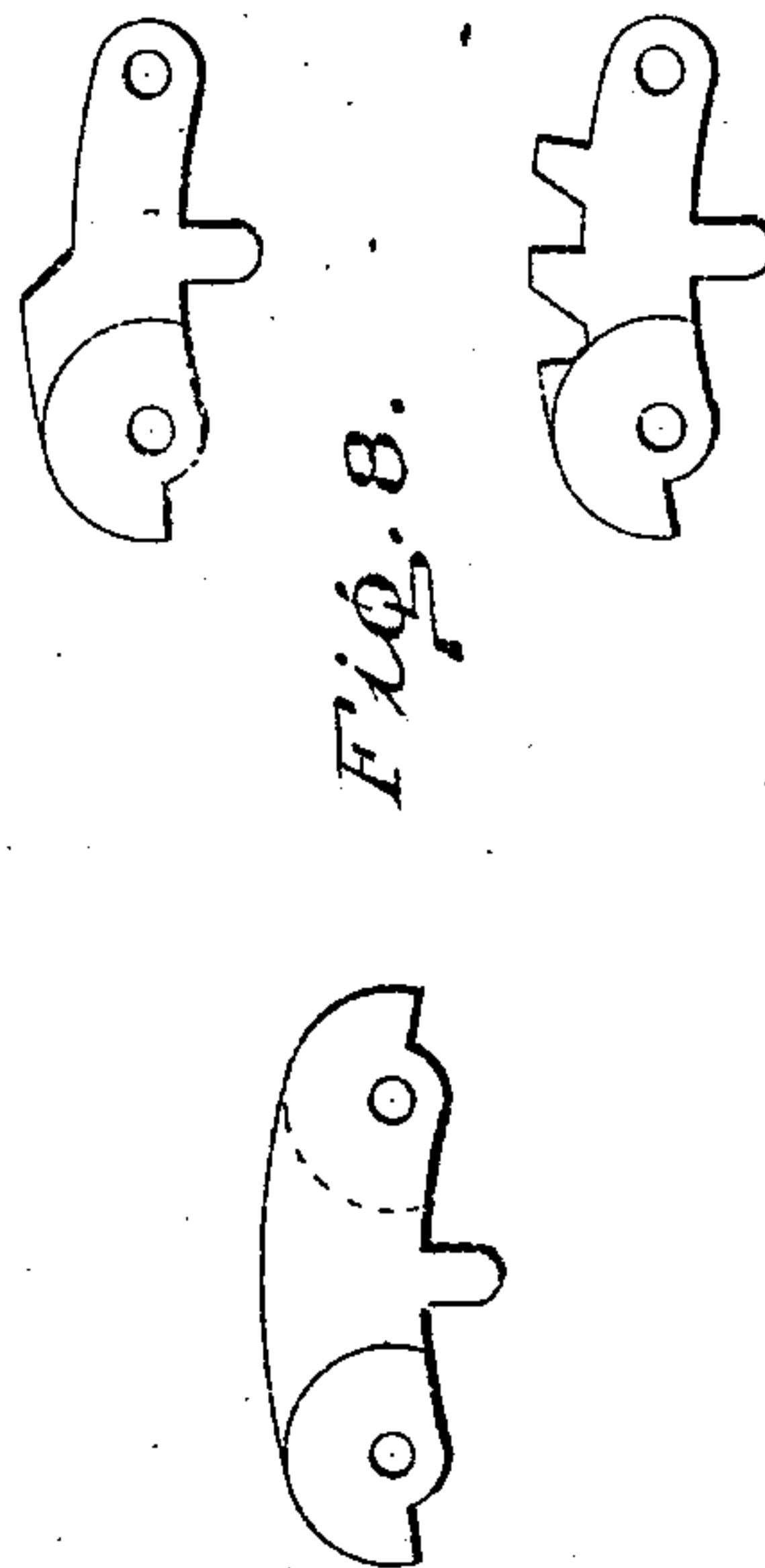
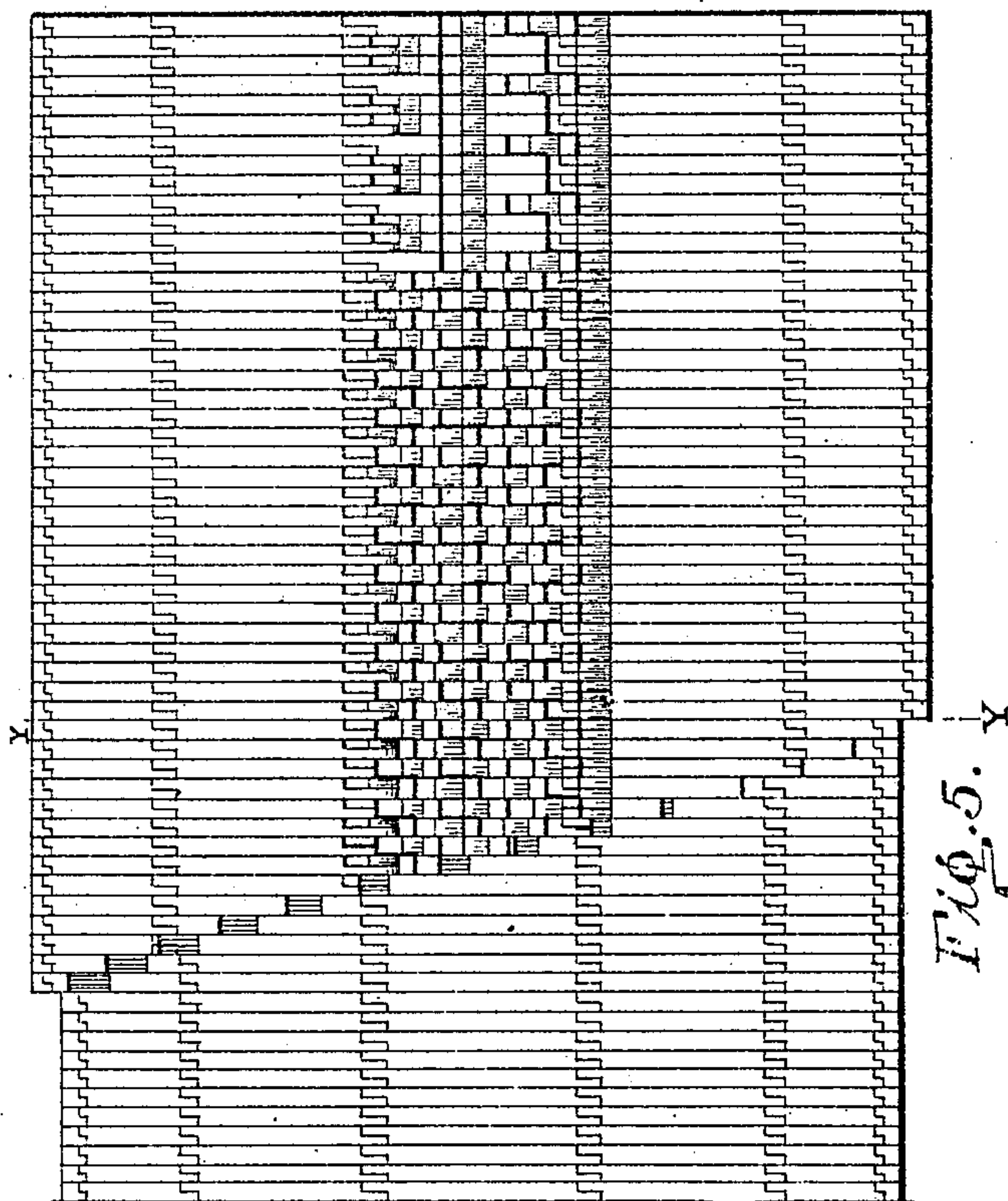
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8 SHEETS—SHEET 5.



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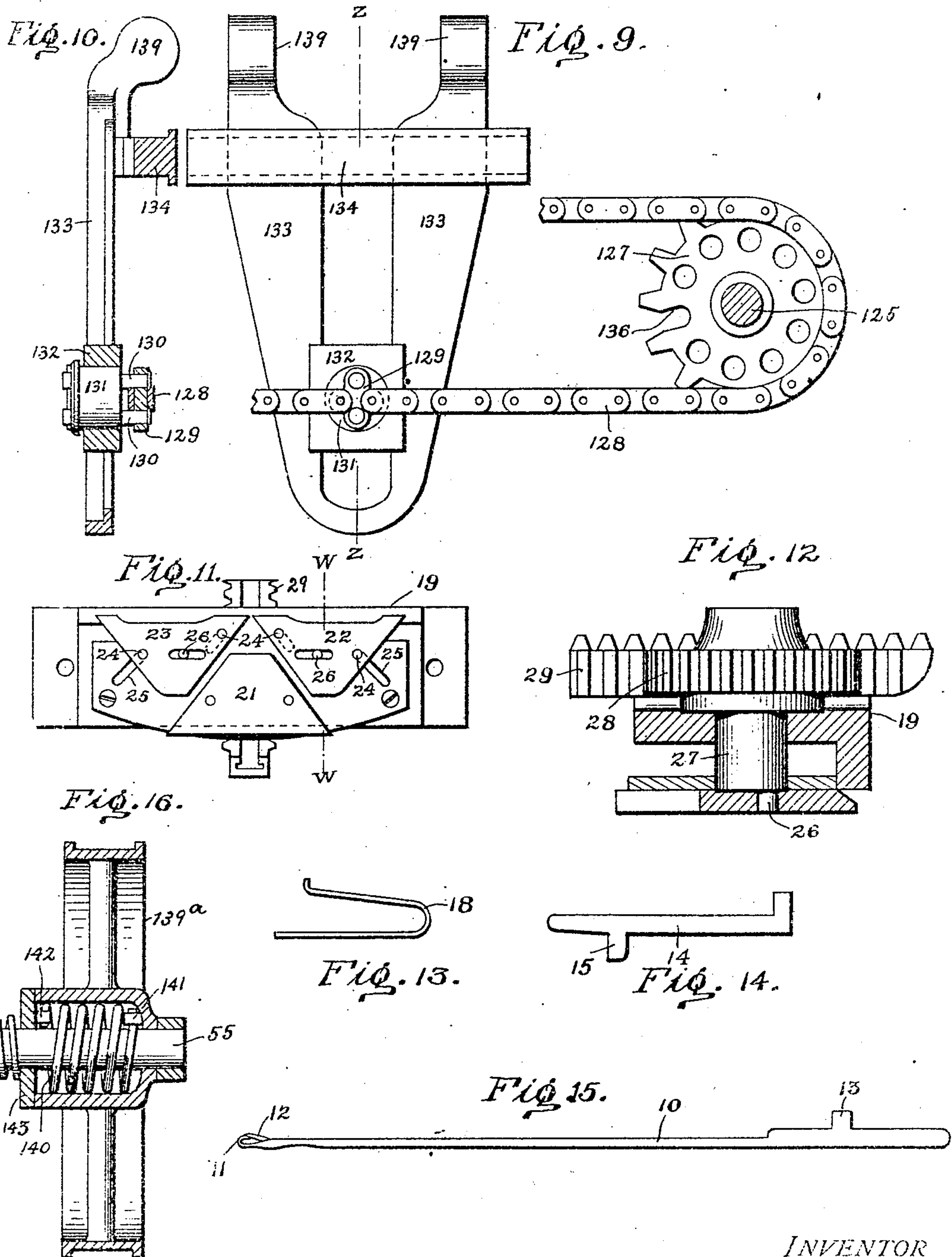
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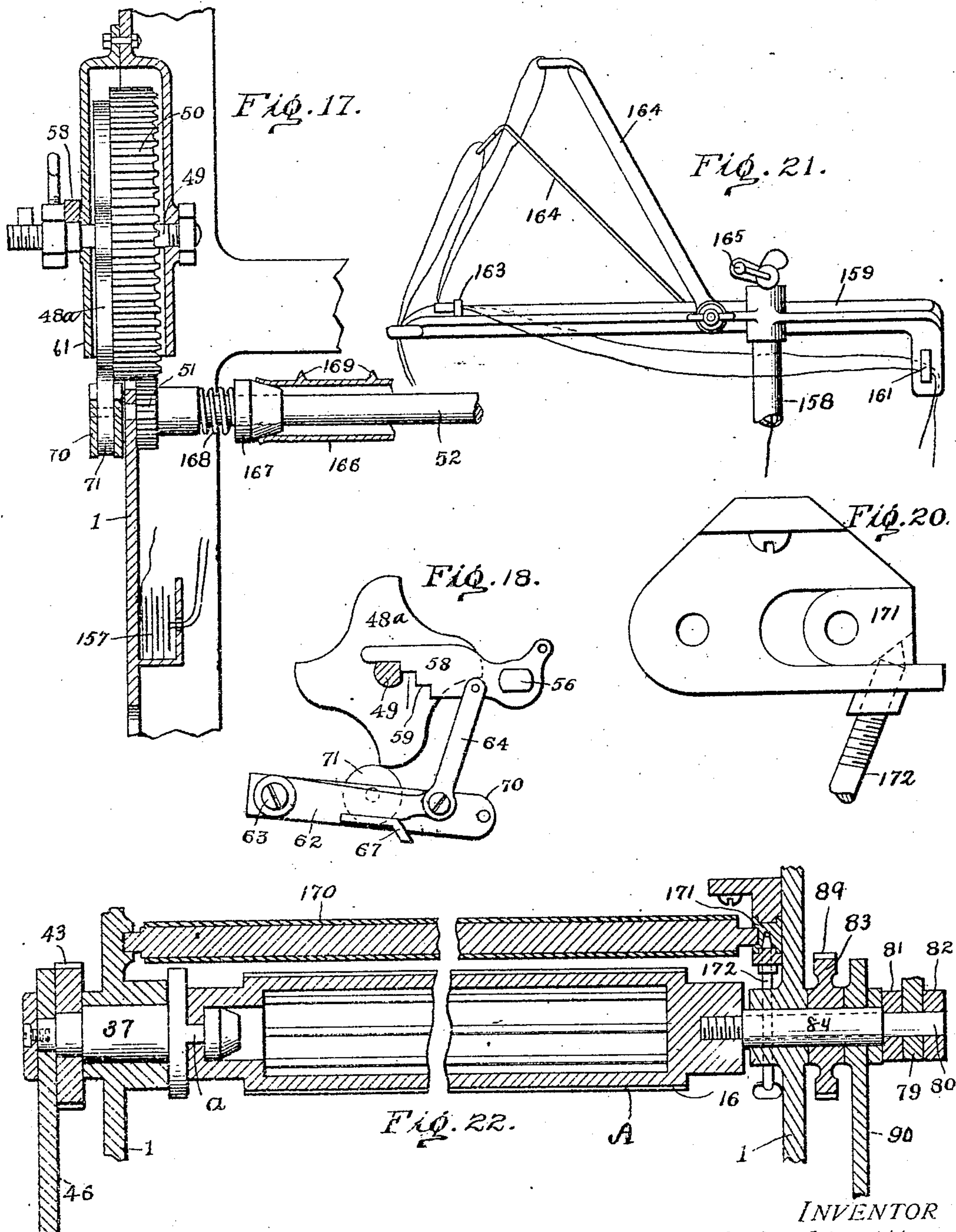
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Fig. 19.

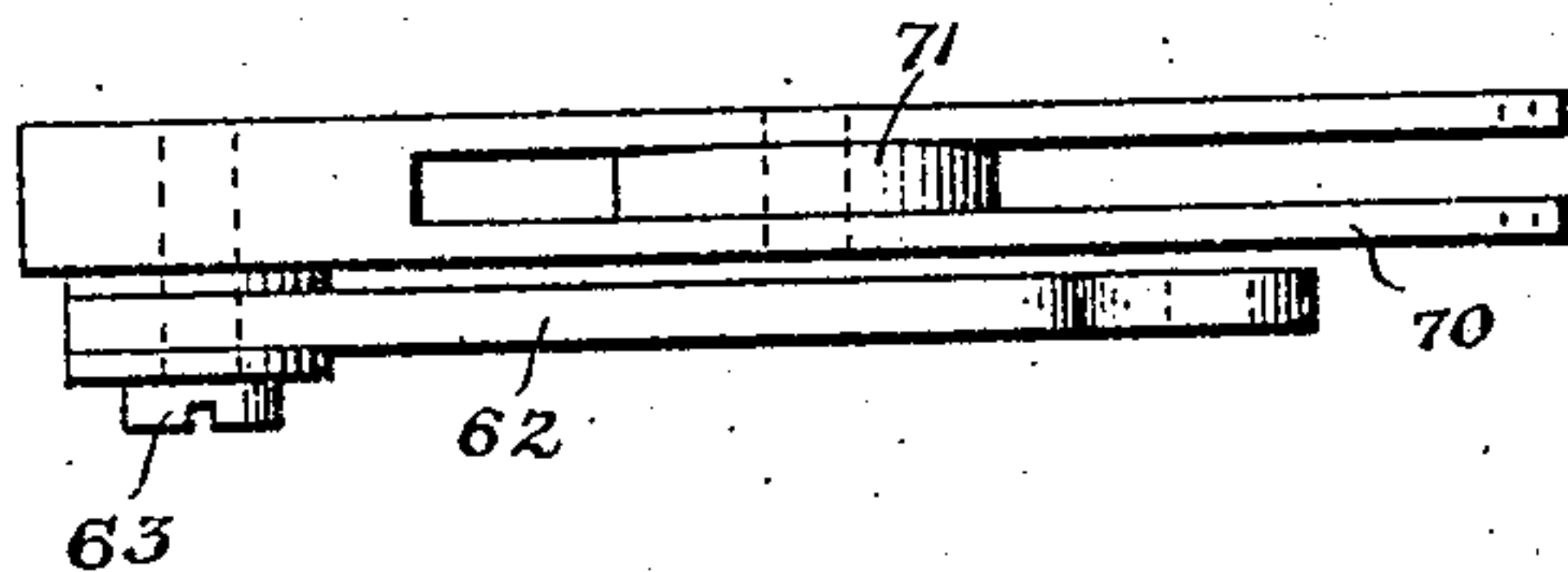


Fig. 24.

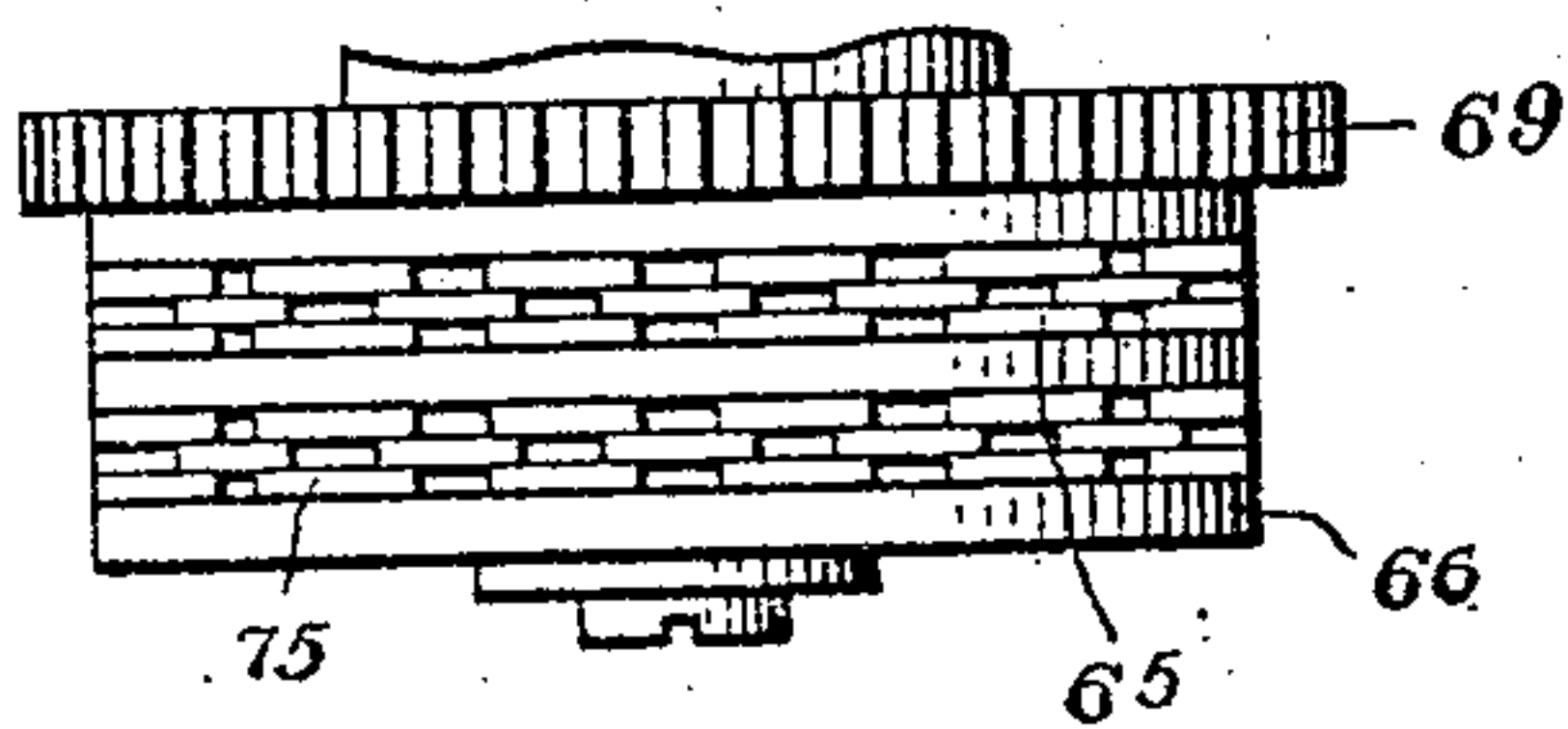


Fig. 23.



Fig. 26.

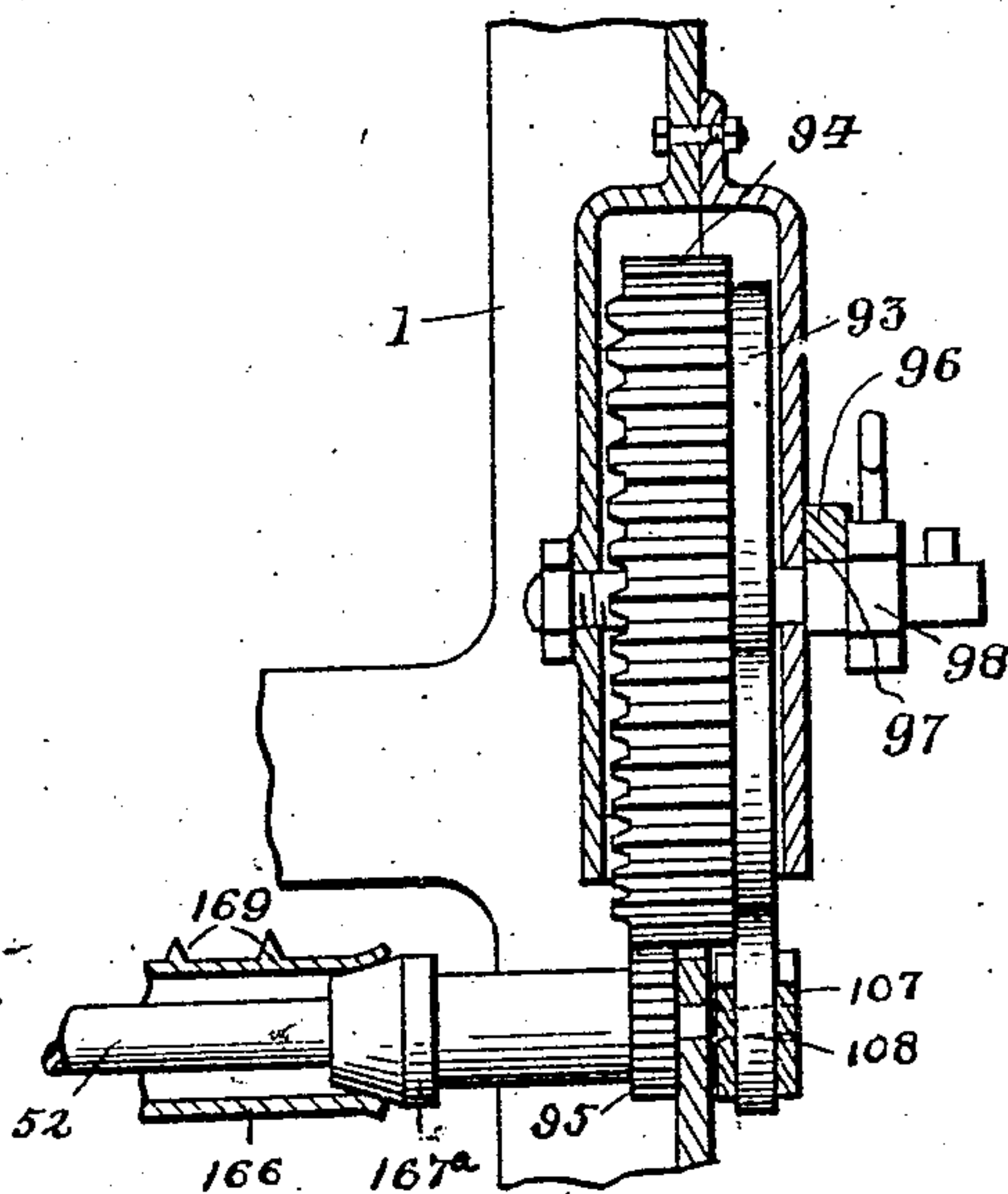
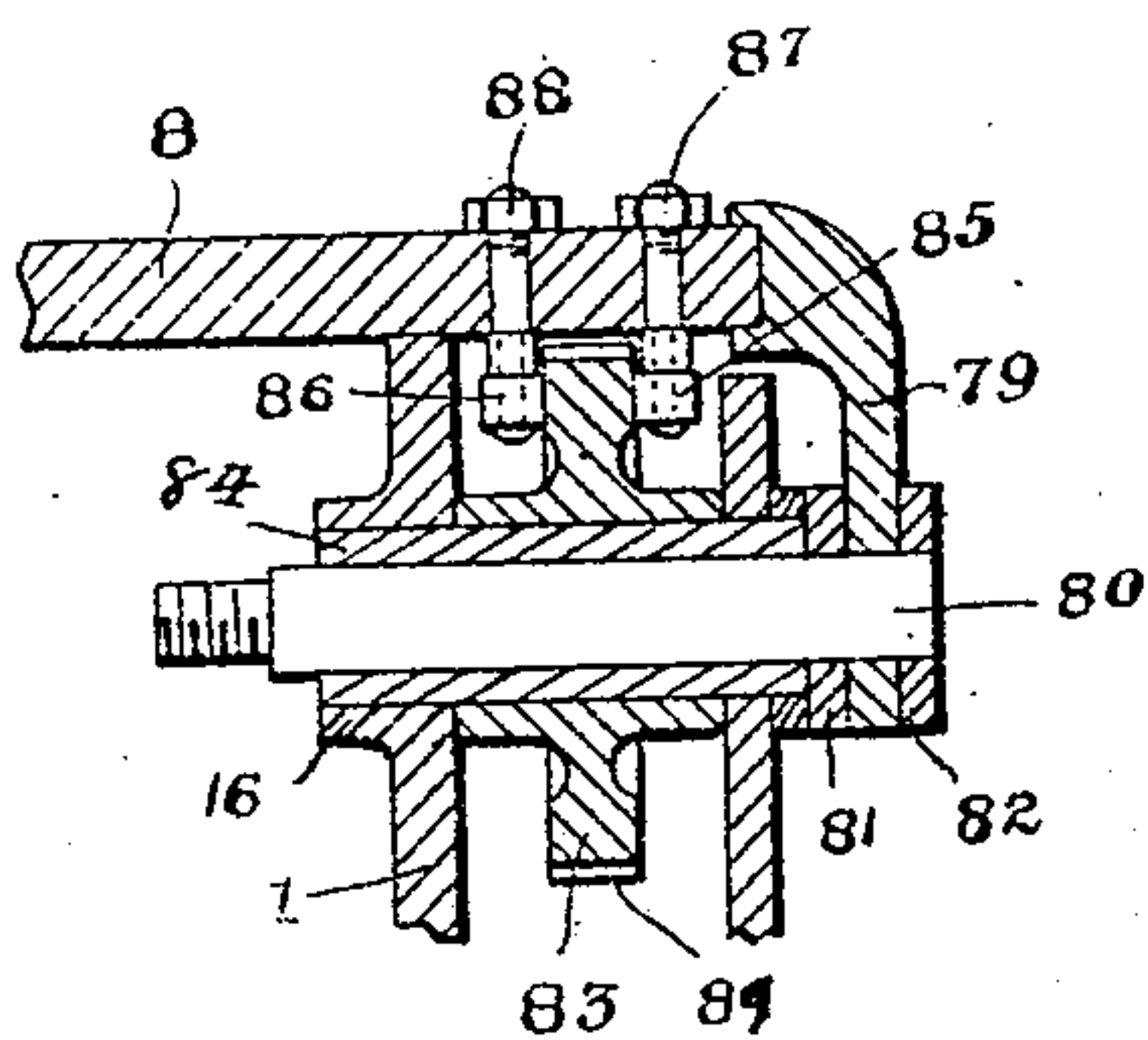


Fig. 25.



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UNITED STATES PATENT OFFICE.

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KNITTING-MACHINE.

No. 876,815.

Specification of Letters Patent.

Patented Jan. 14, 1908.

Application filed October 19, 1905. Serial No. 283,374.

To all whom it may concern:

Be it known that I, ELIHU LIPPITT, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a certain new and useful Improvement in Knitting-Machines, of which the following is a specification.

My invention relates to certain new and useful improvements in knitting machines of the class known as Lamb knitting machines, and has for its object to so construct a machine of the description as to provide for the manufacture of articles of every description now capable of being knitted by machine or hand, but more especially the manufacture of garments known as union underwear; to produce such garments entirely automatically, widening and narrowing the fabric according to predetermined pattern, ribbing and selvaging, tightening and loosening the stitches, crossing and recrossing the stitches, dropping and picking up the threads, and changing from one thread to another.

Another object of my improvements is to provide a continuous drive mechanism for actuating the cam carriages to and fro at a uniform speed, thereby overcoming the variations of the stitches now occasioned by the uneven throw of the needles.

With these and other ends in view, my invention consists in the details of construction and combination of elements hereinafter set forth and then specifically designated by the claims.

In order that those skilled in the art to which this invention appertains may understand how to make and use the same, I will describe its construction in detail referring by numbers to the accompanying drawing forming a part of this specification, in which—

Figure 1, is a plan view of my improved knitting machine; Fig. 2, a side elevation taken from the right of the machine; Fig. 3, a similar view taken from the left; Fig. 4, a vertical section taken at the line X—X of Fig. 1 looking in the direction of the arrow; Fig. 5, an enlarged detail view of the pattern chain drum showing the pattern chains for putting the needles into the field of the actuating cam; Fig. 6, a section at the line Y—Y of Fig. 5 showing one of the pattern chains in elevation; Fig. 7, a detail of one of the needle pattern chains before being adjusted around the drum; Fig. 8, a detail of three forms of links which go to make up the needle pattern

chain; Fig. 9, an enlarged detail of the mechanism for driving the cam carriage; Fig. 10, a section at the line Z—Z of Fig. 9; Fig. 11, an inner face view of the variable cam for actuating the needles; Fig. 12, an enlarged section at the line W—W of Fig. 11, looking in the direction of the arrow adjacent thereto; Fig. 13, a detail of one of the springs for forcing the needles downward out of the field of the actuating cam; Fig. 14, a detail view of one of the jacks by which the needles are raised into operative position; Fig. 15, a detail of one of the needles; Fig. 16, a section of the driving pulley showing the compensating spring for taking up the shock incident to starting the machine; Fig. 17, a detail view showing the driving mechanism for the take-off reel which is intended to receive the fabric as it is knitted. Fig. 18, a detail of the cam mechanism for revolving the pattern chain drums intermittently and also for revolving the chain wheel for controlling the mechanism by which the intermittent revolving of the pattern chain drums is determined; Fig. 19, a plan view of the lower levers shown in Fig. 18; Fig. 20, a detail view of the adjusting device for varying the pressure on the fabric while passing through the spreader rolls; Fig. 21, an enlarged view of the take-up and stop mechanism; Fig. 22, is a longitudinal section of pattern chain drum, showing the arrangement by which it is adapted to be shifted to and fro; Fig. 23, a section at the line V—V of Fig. 3; Fig. 24, a plan view of the lower chain wheels of Fig. 3. Fig. 25, a detail section of cam and connections at right hand of Fig. 22, taken at right angles thereto; Fig. 26, a view similar to Fig. 17 taken from the opposite end of the machine.

Referring by number to these drawings 1 represents the frame of the machine which is of a general rectangular form and adapted to support the various operating parts as hereinafter set forth.

Secured to the top of the frame on one side are the guide-ways 2 and 3 and to the opposite side similar guide-ways 4 and 5, and these sets of guide-ways are set at approximately right angles to each other as clearly shown more particularly in Fig. 4, each set serving to guide one of the needle actuating cam carriers 6 and 7.

Beneath the plane of travel of each of the cam carriers is arranged one of the needle beds 8 and 9, said beds being slotted to receive and guide the needles 10, which latter

are of ordinary construction having the hooks 11 and latches 12 and also the lugs 13 by which they are actuated by the cam, as hereafter explained.

5 A jack 14 is placed beneath each needle in the same groove therewith and has a downwardly projecting lug 15 passing through an opening in the needle bed and within the field of the pattern chains carried by the drums 16 and 17.

10 A spring 18 is provided for each needle and so placed as to bear down upon the same, thus tending to force the shank of the needle and the jack beneath it downward and carry the lug 13 out of the field of the cams 19 or 20.

15 These cams 19 and 20 are secured to their respective carriages 6 and 7, and as they are both alike in construction and operation a description of the one designated 19 and shown in detail in Figs. 11 and 12 will serve as a description of both. Each of these cams consists of stationary angle blocks 22 and 23, and these last named blocks are secured to the cam frame by pins 24 which pass through inclined slots 25, so that when they are moved up or down their inner edges will always remain in parallel with the outer edges of the stationary block 21, and at the same distance therefrom. As the cam is reciprocated to and fro over the needles those whose shanks are elevated to bring the lugs 13 within the plane of travel of the cam will first be moved up and then down making one loop or stitch and casting the preceding one as is well understood in the art of knitting, and the looseness of the stitch will be determined by the extent to which the blocks 22 and 23 are lowered.

20 The movement of the blocks 22 and 23 is controlled by the pins 26 which are set eccentrically in the ends of the short shafts 27 journaled in the cam frame 19 and each of these shafts carries a pinion 28. These pinions mesh with the teeth formed upon the opposite sides of the rack bar 29, so that when said bar is moved up or down the pinions will be revolved and consequently the blocks 22 and 23 will be raised or lowered as the case may be. This rack bar is also provided with teeth upon its upper surface with which the pinion 30 meshes, the latter being fitted upon the square rod 31 so as to revolve therewith while sliding thereon, and this pinion is set between the lugs 32 projecting from the cam carriage whereby it is caused to slide in unison with said carriage; thus when the rod 31 is revolved the pinion 30 by moving the rack bar will raise or lower as before described.

25 30 The rod 31 is journaled in the brackets 33, and carries upon one end the gear 34, it being understood that there are two of these rods and gears, one on each side of the machine, and these gears mesh with the rack bar 35 fitted in suitable bearing to move back and

forth crosswise of the machine, from which it will be seen that when this rack bar 35 is thus moved back or forth the gears 34 will be revolved in one or the other direction bringing about the adjustment of the cam as just described. 70

A jacquard wheel 36 is secured upon the outer end of one of the shafts which drive the pattern chain drums and has a series of holes 37^a in the face thereof in which are set screw pins 38 at predetermined points so that as this wheel is revolved the pins set therein will come in contact with the lug 39, depending from the rack bar 35, moving said bar in the direction of the arrow marked thereon, and this will effect the rotation of the gear wheels 34 in one direction, and in order that the rack bar may be moved in the opposite direction to effect an opposite rotation of these gear wheels, a jacquard chain 40 is carried by the wheel 36, predetermined links of said chain having suitable projections thereon for striking the small roll journaled in the lower end of the lug 41, which also projects downward from the rack bar 35, thus moving this rack bar in the opposite direction from the arrow marked thereon. Thus it will be seen that the arrangement of the screw pins and jacquard chain will determine the adjustment of the needle cams to tighten or loosen the stitches taken by the needles. 80 85 90 95

There are two short shafts 37 journaled in the left hand side of the frame, and upon the rear one on which the jacquard wheel 36 is secured is also secured a ratchet wheel 42, and upon the forward short shaft 37 is secured a corresponding ratchet wheel 43 and the pawls 44 and 45 serve to lock these ratchet wheels respectively against reverse movement, and in order that these ratchet wheels may be revolved step by step in the proper direction to revolve the needle pattern chain drums, a lever 46 is pivoted concentric with the ratchet wheel 43, and carries a spring actuated pawl 47 shown in dotted lines in Fig. 3, engaging with the teeth of said ratchet wheel, and this lever also carries a pawl 48 which engages with the teeth of the ratchet wheel 42, so that when this lever is oscillated these two pawls will simultaneously revolve the ratchet wheels 42 and 43 step by step. 100 105 110 115

A four pointed cam 48^a is journaled upon the stud 49, and the gear wheel 50 is secured to the cam so as to revolve the latter, said gear wheel meshing with the pinion 51 carried by the shaft 52, the latter running lengthwise of the machine and having secured thereon the worm gear 53 which meshes with the worm 54, said worm being secured upon the power shaft 55. 120 125

The lower end of the lever 46 has set therein a stud 56 which may carry a small roll against which the points of the cam 48 will act when said stud is swung within the field of said points, the spring 57 drawing the 130

lever inward when said lever is not locked out of the field of action of the cam by the lock-lever 58, the function of which will be next described.

5 The lock lever 58 is pivoted to the lever 46 by the stud 56, and has a series of notches 59 formed thereon adapted to engage with the stud 49 which projects beyond the housing 61 in which the cam and gear are inclosed, and the spring 57 is attached to the heel of the lock lever 58 in such manner as to cause the notched end thereof to be normally held down in engagement with the stud 49. When the lever 58 is locked in the position shown 15 in Figs. 3 and 18, the points of the cam 48 will not act upon the stud 56, or roll carried thereby and therefore the lever 56 will remain at rest, but when this lever 58 is unlocked the spring 57 will draw the lever 46 inward bringing the stud 56 within the field of action of the cam 48, and as this cam is constantly revolving during the operation of the machine the lever 46 will be moved back and forth by said cam in conjunction with 20 the spring 57 as long as the lock lever 58 is held in an elevated position, thus actuating the ratchet wheels 42 and 43.

The lock lever 58 is controlled by the lever 62, the latter being pivoted upon the stud 63 and connected with the lock lever 58 by the link 64 so that when the lever 62 is raised the lock lever 58 will be raised, and the times at which the lever 62 is raised and the heights to which it is raised is determined by the pattern chain 65 carried in one of the grooves of the wheel 66, said chain being provided with links of varying thicknesses, some of said links having only a portion thereof thickened, and when these thickened links or portions of links pass 40 under the toe 67 projecting from the lever 62, the latter will be raised to the predetermined height and held up during a predetermined time; effecting a similar movement of the lock lever 58, and should this movement be such as to elevate the lock lever to its highest point, then the lever 46 will be thrown inward by the spring 57 to the limit of its inward movement, being 50 stopped by the lowest notch therein, which will cause the pawls 47 and 48 to slide over two teeth of their ratchet wheels, so that when the cam 48 throws the lever 46 outward, these ratchet wheels will be turned two teeth, and this turning of the ratchet wheels two teeth will continue as long as the lock lever 58 is held in its highest position. When a link of the chain 65 having a less thickness passes under the toe 67, the lock lever will be raised only sufficiently to clear the first notch thereon when it will be stopped in its inward movement by the second notch, thus permitting the lever 46 to impart but a one tooth movement of the 65 ratchet wheels 42 and 43. The wheel 66 is

constantly revolved step by step as long as the machine is in operation by the pawl 68, engaging with the ratchet wheel 69 secured to the wheel 66, said pawl being carried by the lever 70 which is pivoted concentric with 70 the lever 62 upon the stud 63, and has journaled therein the roll 71 located in the line of action of the four pointed cam 48. A spring 72 coiled around the rod 73 is interposed between the stationary lug 74, and 75 the end of the lever 70, and is intended to force said lever upward causing the rolls 71 to always follow upon its cam.

In the operation of the machine it becomes necessary at times to increase the 80 stroke of the lever 70 in order that the ratchet wheel 69 may be turned two teeth at each stroke of this lever, thereby accelerating the rotation of the ratchet wheel 69 and the pattern chain carried thereby, and 85 to accomplish this a jacquard chain 75 is set in one of the grooves of the wheel 66, certain links of which are thickened or carry projecting lugs, and when these lugs come into contact with the toe of the spacing 90 lever 76 the latter will be forced backward against the action of its spring, thus permitting the stop nuts 77 to pass through the cut away portion 78 of said spacing lever and abut against the stationary lug 74, 95 which will permit the lever 70 to move upward to a greater distance than when the nuts are stopped by the spacing lever. This carries the pawl 68 over two teeth of the ratchet wheel 69, and when said pawl is 100 moved downward by the action of the cam 48 the ratchet wheel will consequently be moved two teeth instead of one, thereby accelerating the movement of the pattern chain 65 which as above described controls 105 the lock lever 58, and through it the movements of the needle pattern chain drums and the needle cam, the latter tightening or loosening the stitch, and the former putting in or dropping out of action any number of needles, thereby narrowing or widening 110 the fabric being knitted.

In order to form a cross stitch during the process of knitting it is necessary to rack or move one set of the needles to one side and 115 then backward, and this I accomplish by racking the front needle bed 8 which is fitted in suitable guideways so as to have this limited longitudinal movement, and has secured to one end thereof the bracket 79 120 which overhangs the frame and surrounds the outer end of the short shaft 80, being held against longitudinal movement on said shaft by the collars 81 and 82, the latter being secured upon the shaft by suitable set 125 screws, thus any longitudinal movement of the bracket will impart a corresponding movement to the short shaft.

A cam 83 is secured upon the sleeve 84 fitted to revolve upon the short shaft 80 so as 130

to permit the latter to slide longitudinally therethrough, and the rolls 85 and 86 journaled upon the studs 87 and 88 depending from the bracket 79 embrace this cam, and the faces of the latter are of such contour as to act upon these rolls when said cam is revolved, forcing them first in one direction and then the other and consequently giving a corresponding motion to the bracket which will also be imparted to the needle bed to which said bracket is secured. This to and fro racking movement will also be imparted to the needle pattern chain drum 16, as it is obvious that when the needles are shogged the pattern chain drum which put said needles in or out of operative position must also have a corresponding movement in order that the chains thereon may remain in alignment with the needles they are intended to control. To permit this longitudinal movement of the pattern chain drum the latter is coupled to the short shaft 37 so as to be revolved by said shaft and yet permit a limited longitudinal sliding movement relative thereto, this coupling consists of the T-shaped shank *a* which fits in the corresponding slot in the end of the chain pattern drum.

To effect the rotation of the cam 83 and to time its movements to produce a predetermined pattern I provided the mechanism next to be described:—

The cam 83 has formed upon its periphery the ratchet teeth 89, and a lever 90 see Fig. 2 is pivoted concentric with this cam and carries a pawl 91 which engages with the ratchet teeth, and the lower end of this lever is provided with a stud 92 having a suitable roll thereon adapted to be operated by the four pointed cam 93; this cam is carried by the gear wheel 94 which is constantly revolved while the machine is in operation by the pinion 95 secured upon the shaft 52.

A lock lever 96 is pivoted to the lower end of the lever 90, and has a series of notches 97 in its outer end adapted to engage the stud 98 in the same manner as that described in connection with the lock lever 58, so that when the outer notch in this lock lever is in engagement with this stud the roll carried by the stud 92 will be without the field of action of the cam, and the lever 90 will remain at rest.

In order to unlock the lever 96 and permit the spring 99 to bring the lever 90 into action, a link 100 connects the lock lever with the lever 101, the latter having a toe 102 projecting within the field of travel of the pattern chain 103 carried by the wheel 104, and as this chain is made up of links certain of which have projections thereon, when these projections pass under the toe 102 the lever 101 will be forced upward and consequently the lock lever 96 will also be moved upward, carrying its notches out of engage-

ment with the stud 98, and permitting the lever 90 to be drawn within the field of operation of the cam 93, thereby revolving the cam 83 through its ratchet teeth 89, as will be readily understood.

The wheel 104 carries a ratchet wheel 105 with which the pawl 106 engages, said pawl being pivoted to the lever 107 carrying the roll 108 which is also actuated by the four pointed cam 93, thereby constantly revolving the ratchet wheel 105 step by step.

From this it will be seen that the racking of the needle bed is controlled and can be varied to any predetermined pattern by the pattern chain 103.

In knitting with different weight threads or with threads of different colors it becomes necessary at various times during the knitting to drop one thread and pick up another, and this is accomplished in the following manner:—The thread carriers 109 and 110 are mounted upon the square rods 111 and 112 respectively, so as to be free to slide back and forth thereon, the threads passing through eyes secured on these carriers, the latter having forks 113 and 114 projecting therefrom for engagement with the lugs 115 and 116 respectively, said lugs being secured to the plates 117 and 118 which connect with one of the cam carriages so that when these forks are engaged with the lugs the thread carriers will be slid back and forth upon their respective rods in unison with the cam carriages, and when so slid back and forth the threads carried thereby will be engaged by the needles and knitted into the fabric. In order that either of these carriers may be dropped or thrown out of action, one end of each of the rods 111 and 112 is fitted in one of the slots 119 formed in a suitable bracket, so that either of these rods may be raised or lowered at this end, and to effect this raising and lowering of these rods the links 120 connect them with the levers 121, each of which having a nose 122 within the line of travel of projections formed upon the jacquard chain 123 carried by the wheel 124, which wheel is secured upon the end of the shaft of the needle pattern chain drum 17 so as to revolve therewith. By this arrangement it will be seen that the threads can be thrown into or out of action at predetermined times by the arrangement of the lug upon the jacquard chains 123, and when the nose of one of the levers 121 rides upward upon one of these lugs, the corresponding rod 111 or 112 will be raised thereby raising the corresponding fork 113 or 114 out of engagement with its lug 115 or 116, thus leaving that particular thread carrier stationary, which will again be put into action when the lever 121 is dropped.

The reciprocating movements of the two cam carriages are each effected in the same

manner, and therefore a description of one of the mechanisms for actuating one of these carriages will serve as a description of both.

A shaft 125 is journaled crosswise of the machine, and is revolved from the power shaft by a sprocket chain 126 run over suitable wheels on each of the shafts, and upon the outer ends of the shaft 125 is secured the sprocket wheels 127; a sprocket chain 128 runs over each of the sprocket wheels 127 and over corresponding sprocket wheels at the opposite end of the machine, and each of these sprocket chains 128 is attached to the fourway link 129 which is secured by the pins 130 to the swiveled block 131, the latter being set in the sliding block 132. This block 132 is fitted to slide vertically in the guide ways formed in the hanger 133 which latter is secured to the T-shape bar 134 fitted in the groove 135 so as to slide longitudinally of the machine. Now as the chain 128 is constantly revolved from the power shaft 55 as long as the machine is in operation, the block 132 being carried by said chain will move the hanger in one direction, when the block is upon the lower side of the chain until the latter reaches one of the sprocket wheels and passes around the same, after which the block will, of course, travel in an opposite direction, thereby reversing the movement of the hanger, and in order that the four-way link 129 may pass around the sprocket wheel, the space between two of the teeth of said wheel is elongated as indicated at 136, and as this four-way link passes into this elongated space the block 131 will take up a rotary motion while passing around the sprocket wheel making a one-half turn by the time it reaches the upper side of said wheel. By this arrangement the hanger will be moved back and forth at a fixed rate of speed until reaching the vertical center line of the sprocket wheel where its movement will slow down until it ceases and then gradually be taken up on its reverse movement until again reaching the vertical center line of the sprocket wheel, after which it will move at the same rate of speed in the opposite direction until reaching the sprocket wheel at the opposite end of the machine. This is a very important feature of my present improvements as it entirely overcomes the uneven throw of the needles, for as the cam by which the needles are actuated is reciprocated by this movement said cam will also be moved at the same rate of speed in both directions, thus imparting a like throw to all of the needles.

To transmit the movement of the hanger 133 to the cam carriage said carriage has projecting therefrom the lugs 137, in which are threaded the bolts 138 so set as to abut against the ears 139 formed upon the upper ends of the hanger. Therefore as the hanger

moves in one direction or the other its movement will be transmitted through the bolts 138 to the cam carriage and these bolts may be adjusted so as to allow the proper loss of motion between the hanger and the cam carriage for compensating for the blank space between the cam blocks 22 and 23 as will be readily understood by those skilled in the art of knitting.

Power applied to the shaft 55 through the belt wheel 139^a which is journaled on the outer end of said shaft so as to run independent thereof and within the hub of this wheel is located a coil spring 140, one end of which is attached to the pin 141 carried by the hub and the other end to the pin 142 carried by the clutch disk 143 which is also free to revolve upon the shaft 55 and likewise independent of the hub except for its connection therewith through the spring 140.

A clutch 144 is splined upon the shaft 55 and the teeth 145 of this clutch are adapted to engage with the corresponding teeth 146 projecting from the clutch disk 143 so that when the clutch is moved toward the disk sufficiently for these teeth to engage the rotation of the belt wheel 139 will be transmitted to the clutch and through it to the shaft 55; the first effect of the engagement of the clutch being to tighten the spring 140 until its tension is capable of carrying the load at full speed. Thus no undue shock will be transmitted to the working parts of the machine when the clutch is thrown into engagement, such shock being absorbed by the spring and the power shaft permitted to pick up the load gradually.

Forked ends of the lever 147 engage the clutch so as to throw it into operation and the spring 148 is interposed between the clutch and clutch disk, and is of sufficient tension to throw the clutch out of engagement when the clutch lever is released and this spring may be assisted in its operation by a spring 149 attached to the horizontal end of the lever 147, the latter terminating in the handle 150 in easy reach of the operator by which the clutch may be thrown into engagement to start the machine.

In order that the clutch lever may be locked when the clutch is thrown into engagement a keeper 151 is pivoted to one end of the machine having a notch 152 therein for the reception of the bent end of the clutch lever 147 and when this lever is depressed to put the clutch into engagement this bent end passes into said notch, at the same time swinging the keeper 151 so that its heel end passes above the latch pin 153, the latter springing outward and holding the keeper in its position thereby holding the clutch lever and consequently the clutch in engagement by which means the machine will continue to operate.

The latch pin projects from the lever 154 the inner end of which carries the armature 155 arranged in proper relation to the electromagnet 156, from which it will be seen that should the magnet be energized the armature will be attracted thereby, thus withdrawing the latch pin and releasing the keeper 151 which in turn will release the clutch lever, thus permitting the clutch to be thrown out of engagement by springs 148 and 149 stopping the machine.

The fabric as it is being knitted is drawn downward by a take-off roll 166 which consists of a tube surrounding the shaft 52 and held between the spring actuated head 167 fitted upon this shaft and a corresponding head 167^a secured to the opposite end of the shaft. The head 167 is forced tightly within the tube by the spring 168 so that as the shaft revolves the take-off roll will also be revolved but should the shaft be running faster than the fabric is being knitted the take-off roll may drag on account of its loose connection with the heads.

Suitable pins 169 may project from the take-off roll to engage the fabric and prevent it from slipping around said roll.

As the fabric travels from the needles to the take-off roll it passes between the spreader rolls 170 which I prefer to cover with sponge rubber or similar material so as to avoid unduly compressing the fabric, and the tension of these rolls may be varied by means of the sliding block 171 in which one of the rolls is set and which may be adjusted by the threaded rod 172, the nose of which bears against the inclined surface formed upon the block as clearly shown in dotted lines in Fig. 22.

The play which the needles have in their guide ways or slots may be adjusted by means of the flattened rods 173 which run just above the needles and are provided with the wrench handles 174.

Each of the needle pattern chain drums 16 and 17 are provided with longitudinal grooves A providing a form of sprocket wheel in which the lugs B projecting from each of the links of the needle pattern chains C are adapted to fit, and these chains are made up of links of different thicknesses, as clearly shown in Fig. 7, or each link may have projections thereon as clearly shown in Fig. 8.

In making up a drum for producing a predetermined pattern the chains C are placed thereon so as to bring the thickened links or links having projections in proper relation to each other to throw the needles in operative position for widening or narrowing the fabric to be knitted, it being understood that the thickened links or projections upon certain of the links will act upon the lugs 15 of the jacks 14 to force said jacks upward thereby carrying the lugs 13 down the needle shank

within the plane of action of the needle cams. By this form of drum and pattern chain therefor any shape of garment may be produced, and as the movements of this drum are under control, mechanism in turn controlled by a pattern chain it is obvious that the widening or narrowing of the fabric will take place at predetermined times, the drum and its pattern chains being intended to produce one cycle in the knitting of the fabric, which will be repeated at every revolution of the drums as long as the machine continues to operate.

Having thus fully described my invention, what I claim as new and useful, is:—

1. In a machine of the character described, needle beds, pattern chain drums adapted to carry a series of pattern chains, said chains being made up of links of varying thicknesses by which the needles are put into or out of operative position, means for revolving said drums intermittently to produce a predetermined pattern or shape of garment, means for reciprocating one of said drums longitudinally, means for simultaneously moving the needle bed acting in conjunction therewith, and means for controlling this reciprocatory movement.

2. In a knitting machine of the character described, two needle beds each carrying a series of needles, said beds being set at an angle to each other, one of said beds being fitted in guides to have a to and fro longitudinal movement, a pattern chain drum arranged beneath each of the beds, said drums adapted to carry pattern chains for putting the needles into or out of operative position, means for connecting one of said drums with the longitudinally moving needle bed whereby said bed and drum will reciprocate in unison, means for intermittently reciprocating said bed and drum, a pattern wheel, means for revolving said wheel, and a pattern chain carried by said pattern wheel for controlling the intermittent reciprocations of the bed and drum, as specified.

3. In a knitting machine of the character described, two needle beds in which the needles are set, one of said beds adapted to slide to and fro longitudinally to form cross stitches, a cam adapted to impart this to and fro movement to said bed, mechanism for intermittently actuating said cam, and a pattern chain carried by a suitable wheel for controlling the intermittent movements of said cam, whereby they are made at a predetermined time, as specified.

4. In a knitting machine, a stationary needle bed, a reciprocating needle bed, a bracket secured to the last named bed and overhanging the frame of the machine, a pattern chain drum located beneath the reciprocating needle bed, said drum being coupled to a shaft at one end so as to have a im-

ited reciprocating movement and be driven by said shaft, a shaft to which the opposite end of said drum is secured, the last named shaft being connected to the bracket from which it receives a corresponding reciprocating movement with the needle bed, a cam for imparting these reciprocating movements to the bracket, mechanism for intermittently actuating said cam, a pattern chain for controlling the intermittent movements of said cam, and mechanism for operating said pattern chain.

5. In a knitting machine as herein described, mechanism for reciprocating one of the needle beds and the needle pattern chain drum connected therewith and controlling the times of said reciprocations for producing cross stitches in a predetermined pattern, consisting of the cam 83 for reciprocating said needle bed and drum, a lever 90 carrying a pawl adapted to engage ratchet teeth upon said cam to revolve the latter step by step, a cam 93 adapted to actuate the lever 90, a lock bar 96 adapted to hold the lever 90 out of the field of operation of the cam 93 during predetermined periods, a lever 101 connected to said lock bar, a chain wheel, a pattern chain running thereon, said chain being composed of links of varying thicknesses whereby the lever 101 is raised at predetermined times and to predetermined heights for imparting a corresponding movement to the lock bar, a ratchet 105 carried by the chain wheel and a lever 107 carrying a pawl engaging the last named ratchet wheel, said last named lever being constantly operated by the cam 93 to give an intermittent movement to the pattern chain wheel, as and for the purpose set forth.

6. In a machine of the character described, needle beds, pattern chain drums adapted to carry a series of pattern chains, said chains being made up of links of various thicknesses by which the needles are put into or out of operative position, means for revolving said drums intermittently to produce a predetermined pattern or shape of garment, means to reciprocate one of the drums longitudinally and means for simultaneously moving the needle bed acting in conjunction therewith.

7. In a knitting machine of the character described, two needle beds, a series of needles set in each bed, a series of jacks arranged beneath the needles, said jacks having downwardly projecting lugs, two pattern chain drums journaled beneath the needle beds, a series of pattern chains arranged upon each drum, said chains being composed of links of varying thicknesses adapted to act upon the lugs of the jacks for putting the needles into and out of operative position, traveling cams for actuating the needles

when in operative position, a ratchet wheel connected with each of the drums for revolving the same, a lever 46 carrying pawls engaging with the ratchet wheels so that each of said ratchet wheels will be revolved step by step at each reciprocation of the lever 46, a cam 48 adapted to constantly revolve while the machine is in operation, and also adapted to actuate the lever 46 when the latter is in operative position, a lock lever 58 adapted to lock and unlock the lever 46 so that said lever may be brought into operative position or held out of such position, a lever 62 connected with the lock lever, a pattern chain wheel 66 carrying two chains, a ratchet wheel 69 secured to the pattern chain wheel, a lever 70 carrying a pawl adapted to actuate the ratchet wheel 69 whereby the pattern chain wheel will be revolved step by step, a roll 71 carried by the lever 70 adapted to bear upon the cam 48 whereby the lever 70 will be actuated, a chain carried by the wheel 66 having different thicknesses of links adapted to raise or lower the lever 62, the latter being connected with the locking mechanism and adapted to control said mechanism whereby the rotation of the needle pattern chain drums will be controlled as and for the purpose set forth.

8. In combination, a pattern chain wheel, a ratchet wheel carried by said chain wheel, a lever carrying a pawl for operating said ratchet wheel, a cam for actuating said lever in one direction, a spring for actuating said lever in the opposite direction, a chain consisting of links of predetermined thicknesses carried by the chain wheel, a spacing lever adapted to be controlled by said chain, and to determine the throw of the pawl lever so as to increase or decrease the rotation of the ratchet wheel, a second pattern chain carried by said wheel, the last named chain being composed of links of predetermined thicknesses, said last named chain being adapted to control the mechanism for actuating the needle pattern chain drums whereby a predetermined number of needles may be put into or out of operation for knitting a predetermined pattern or shape of fabric, as specified.

9. In a knitting machine of the character described, two needle beds each containing a series of needles, one of said beds being adapted to reciprocate longitudinally, mechanism for reciprocating said bed, and mechanism under the control of a jacquard chain for determining the times of said reciprocations, two pattern chain drums journaled beneath the needles, a series of pattern chains composed of links of varying thicknesses, mechanism under the control of a pattern chain for determining the rotation

of said drums, cams adapted to travel cross-wise of the needles and actuate those that are in operative position, mechanism for feeding the threads to the needles and mechanism for dropping or picking up the threads, as specified.

In testimony whereof, I hereunto affixed

my signature in the presence of two subscribing witnesses.

ELIHU LIPPITT.

Witnesses:

MARY E. HAMER,
S. S. WILLIAMSON.