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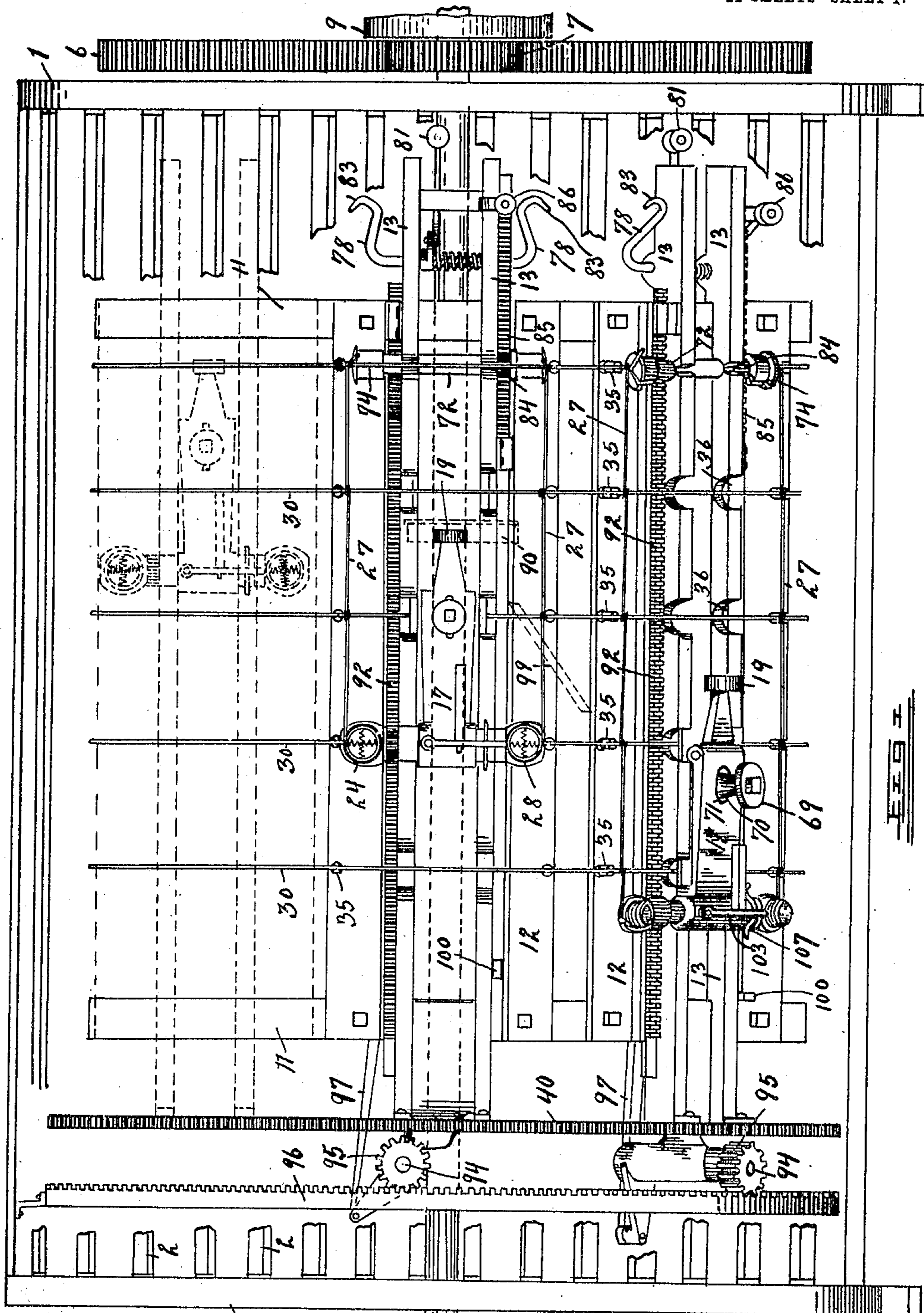
PATENTED FEB. 5, 1907.

G. A. RAYMOND.

WIRE FABRIC WEAVING MACHINE.


APPLICATION FILED JUNE 11, 1904. RENEWED JUNE 4, 1906.

11 SHEETS—SHEET 1.



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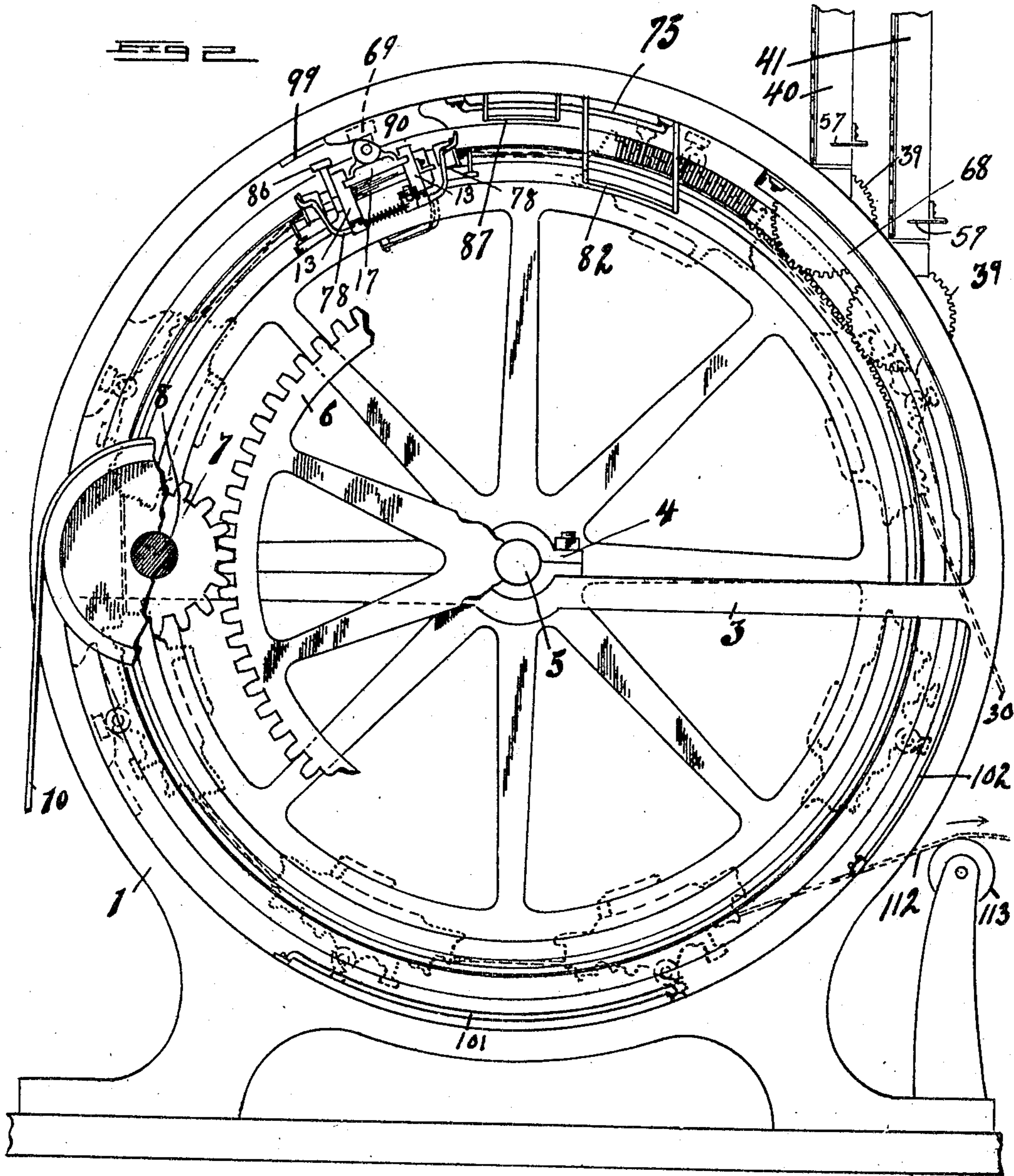
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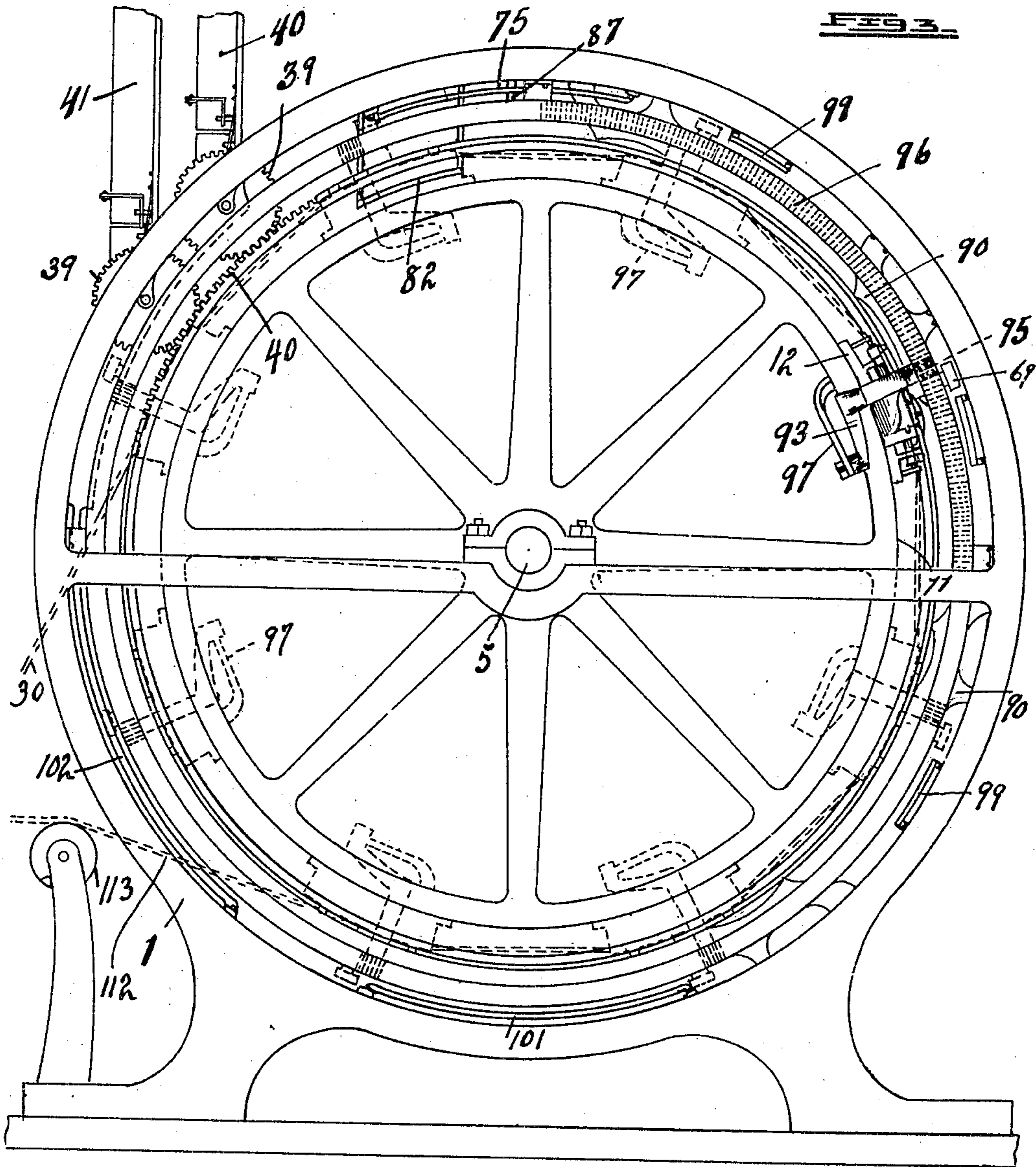
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11 SHEETS—SHEET 3.



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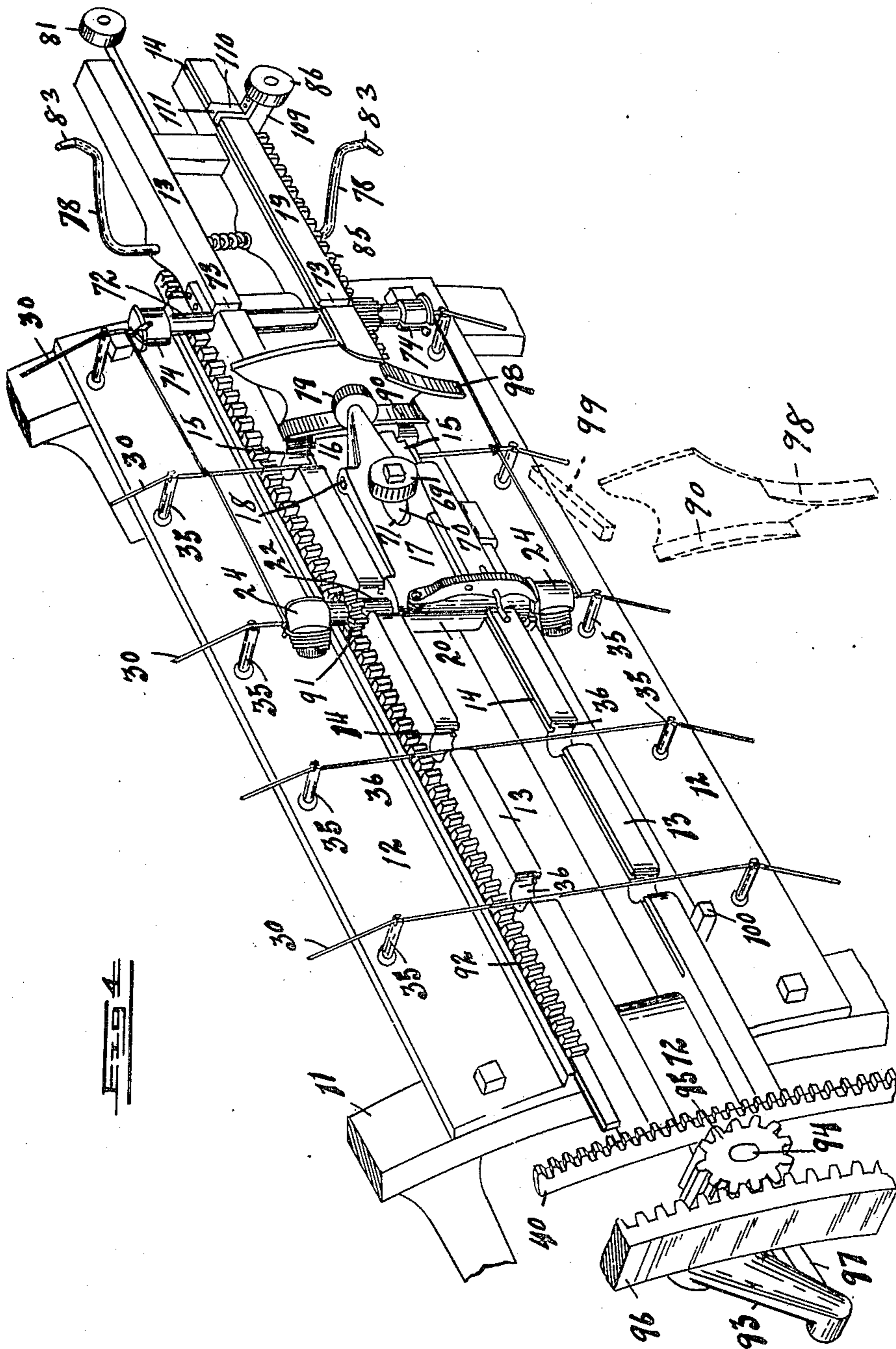
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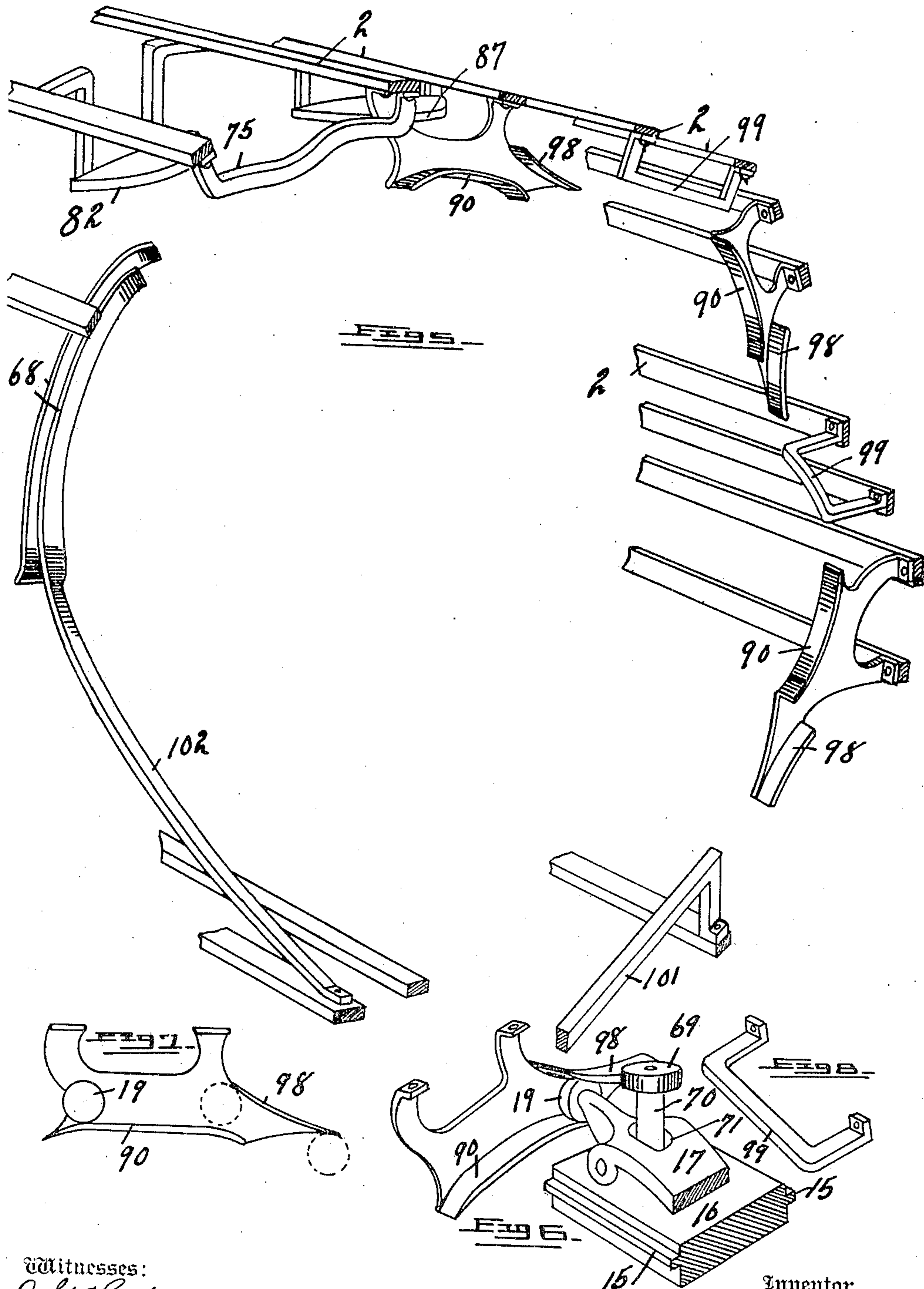
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11 SHEETS—SHEET 5.



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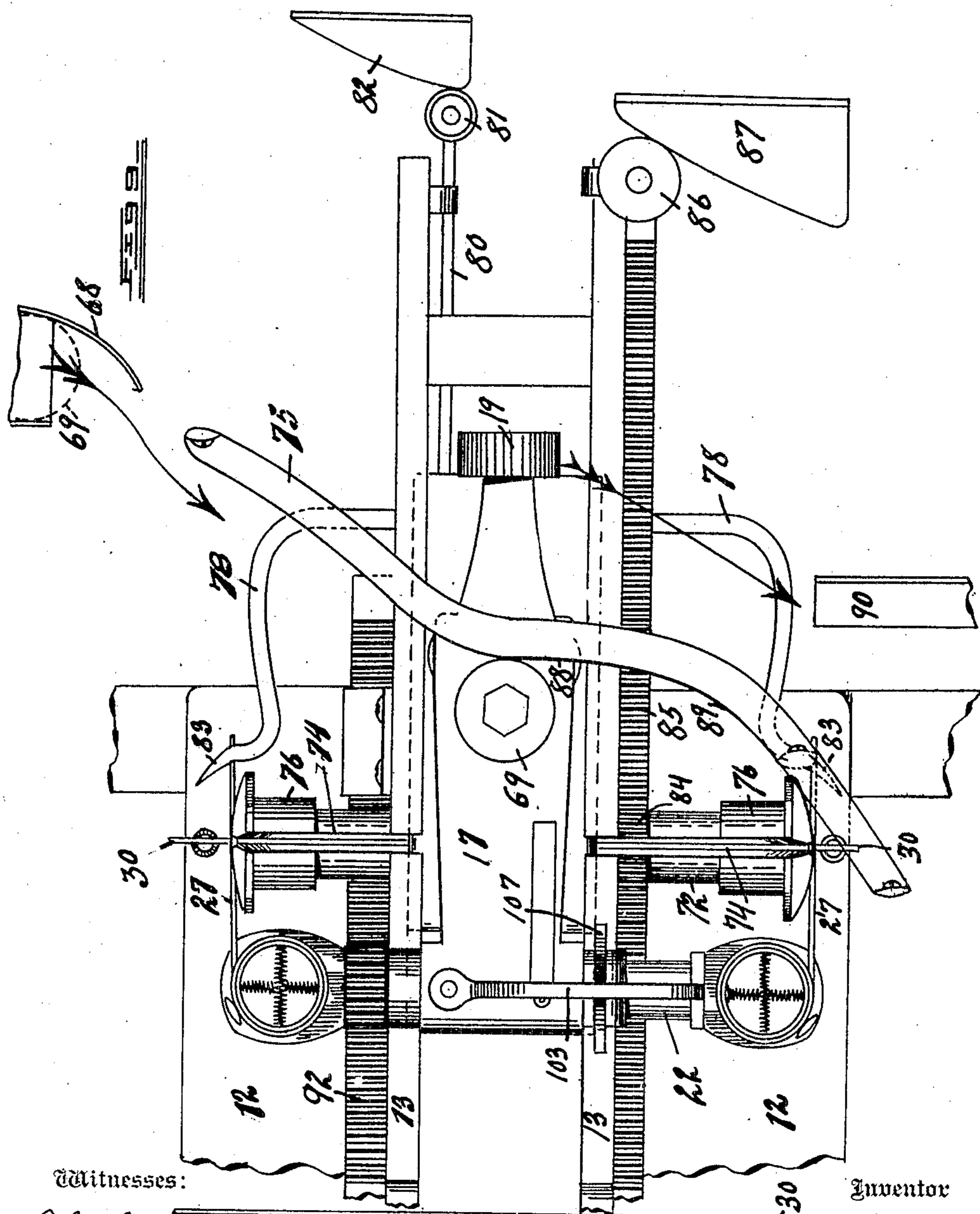
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11 SHEETS—SHEET 6.



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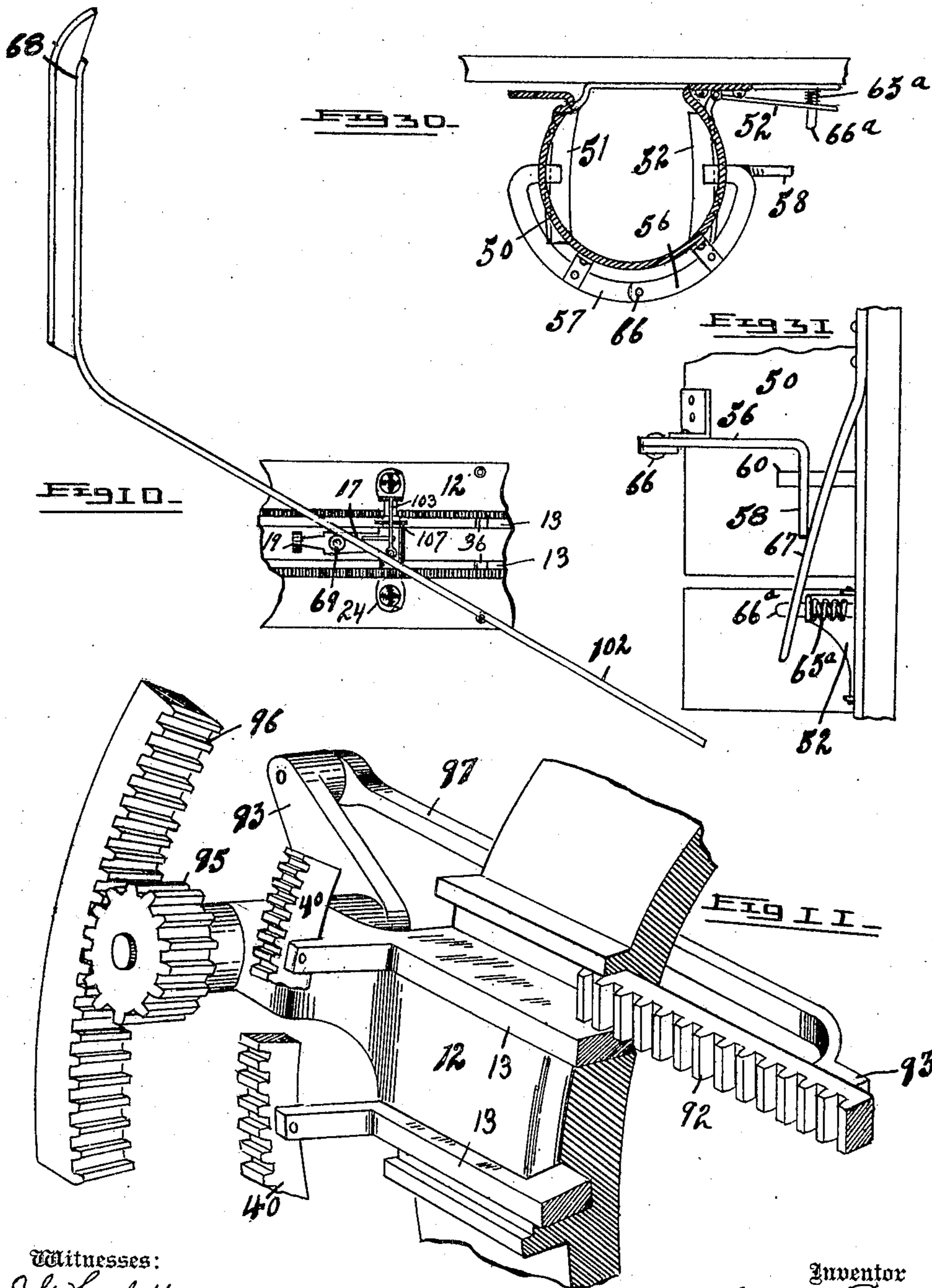
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11 SHEETS—SHEET 7.



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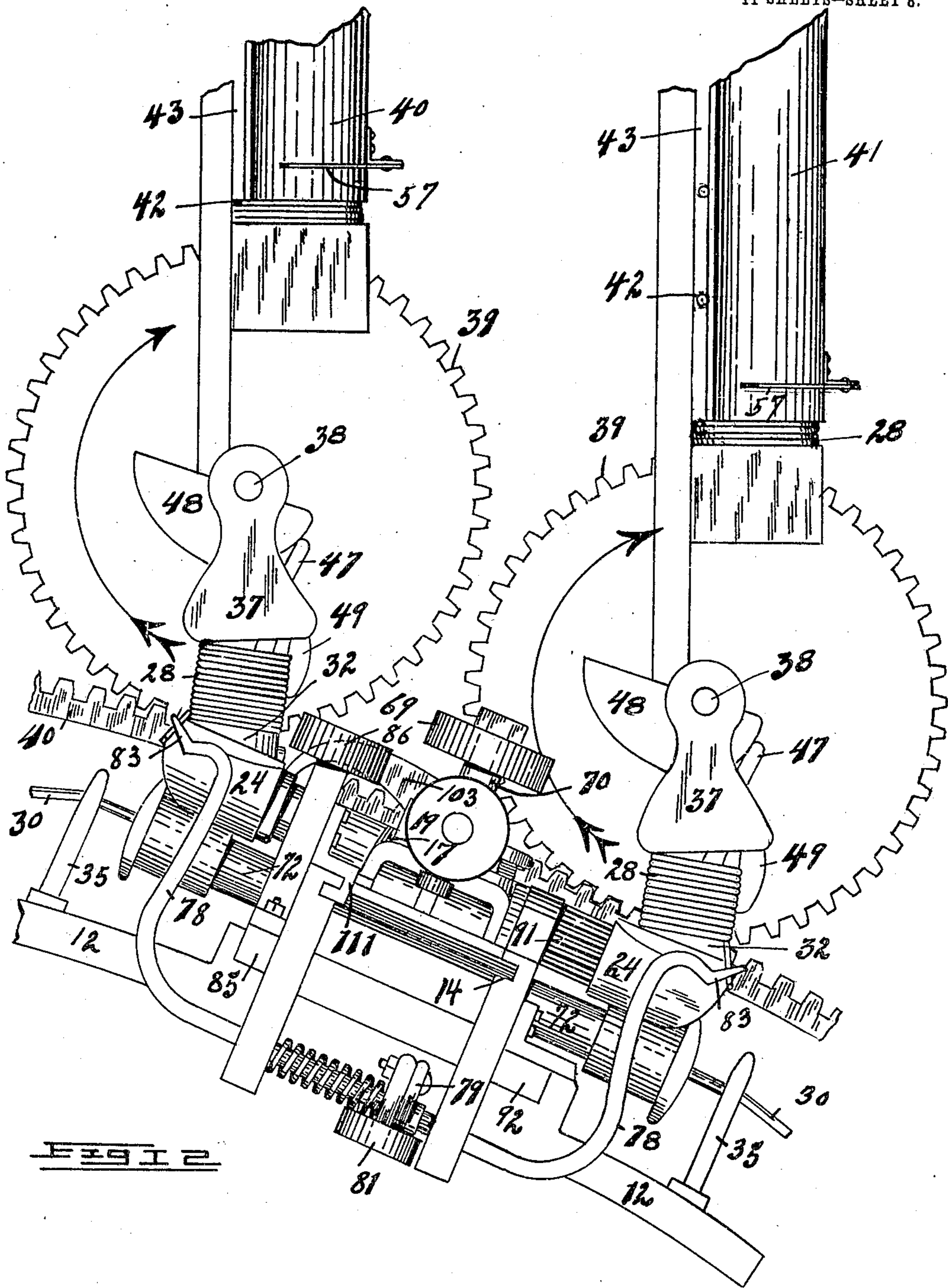
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11 SHEETS—SHEET 8.



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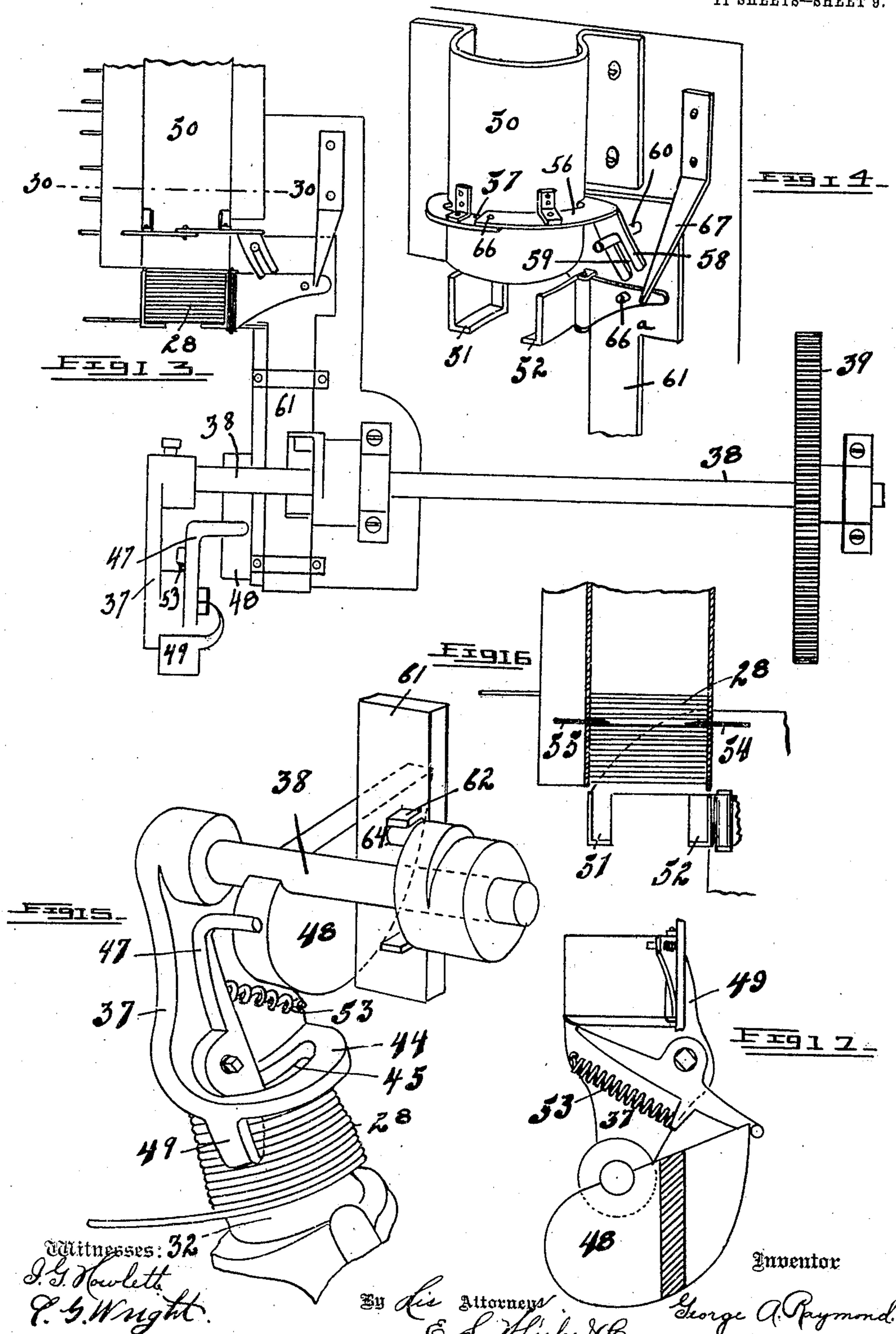
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11 SHEETS—SHEET 9.



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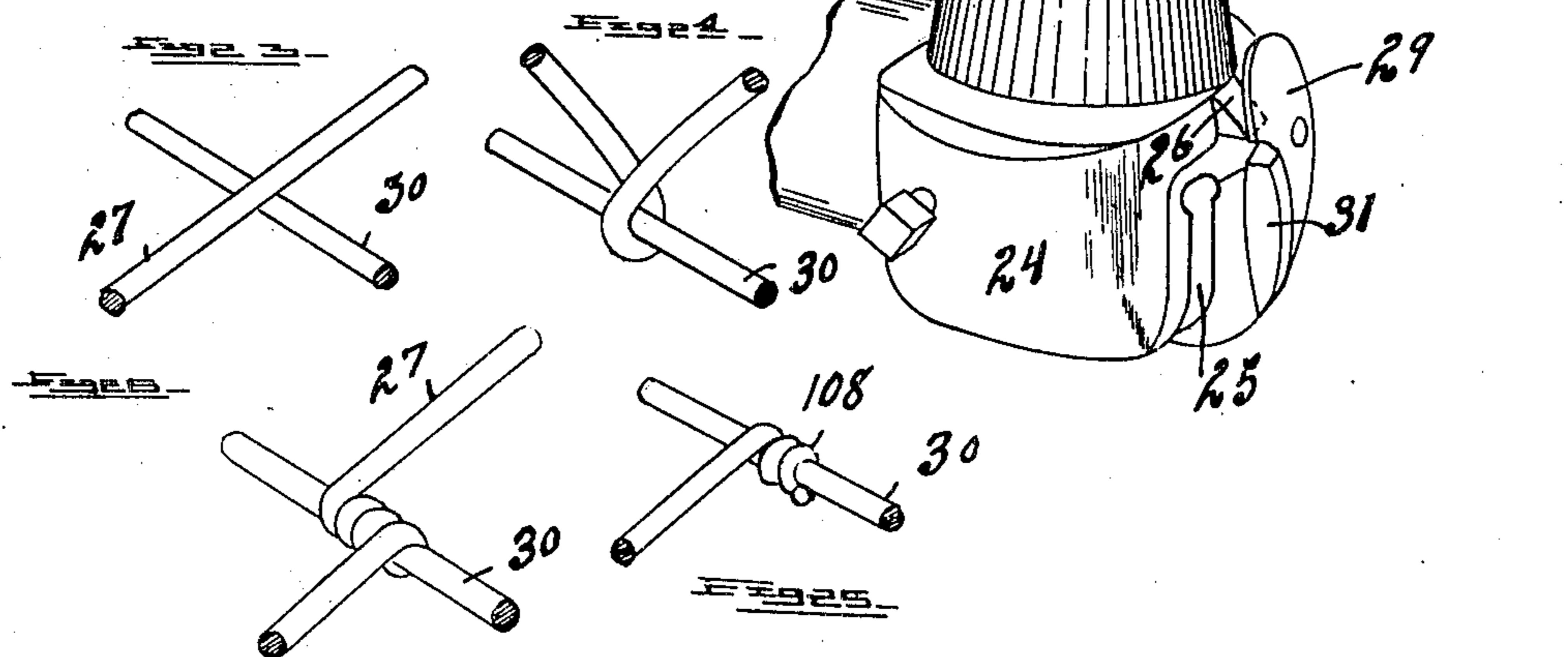
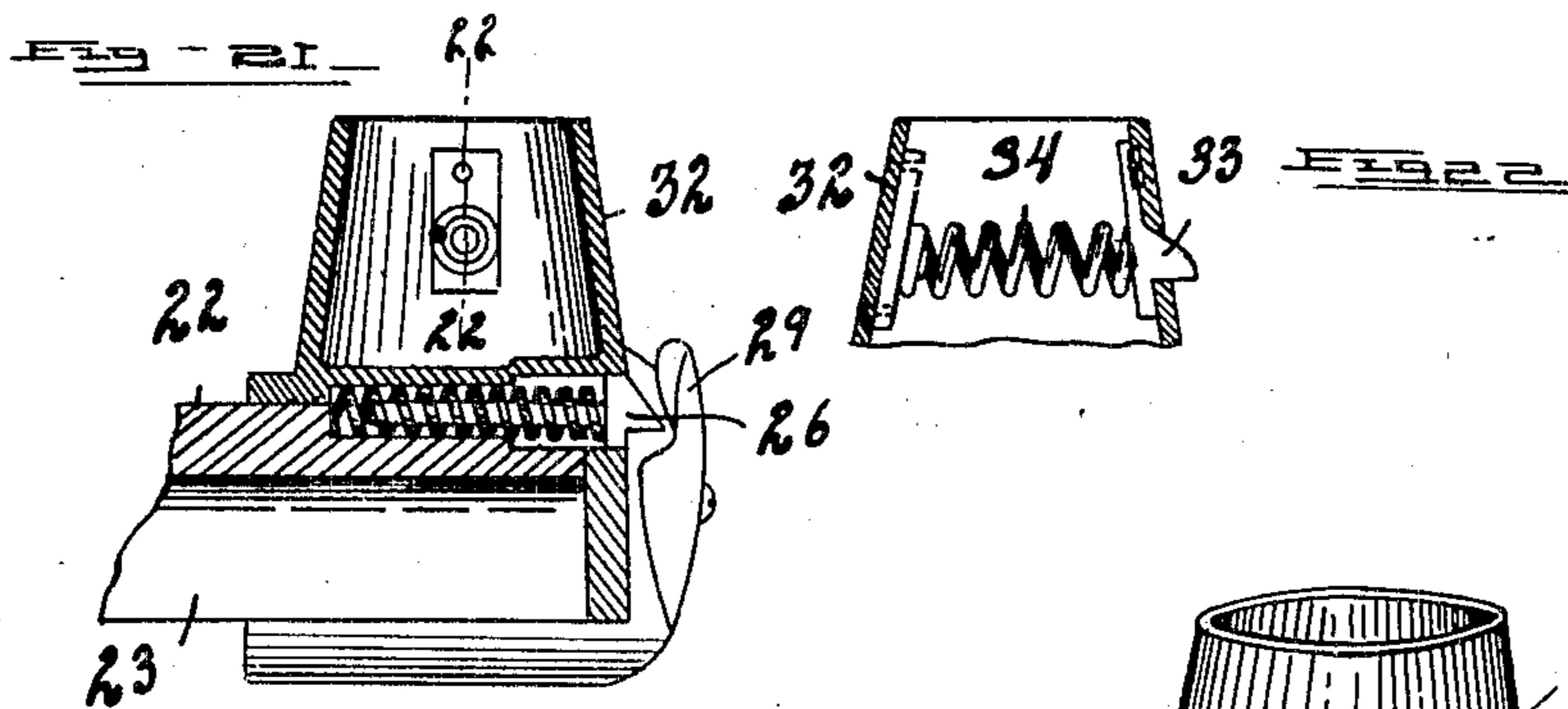
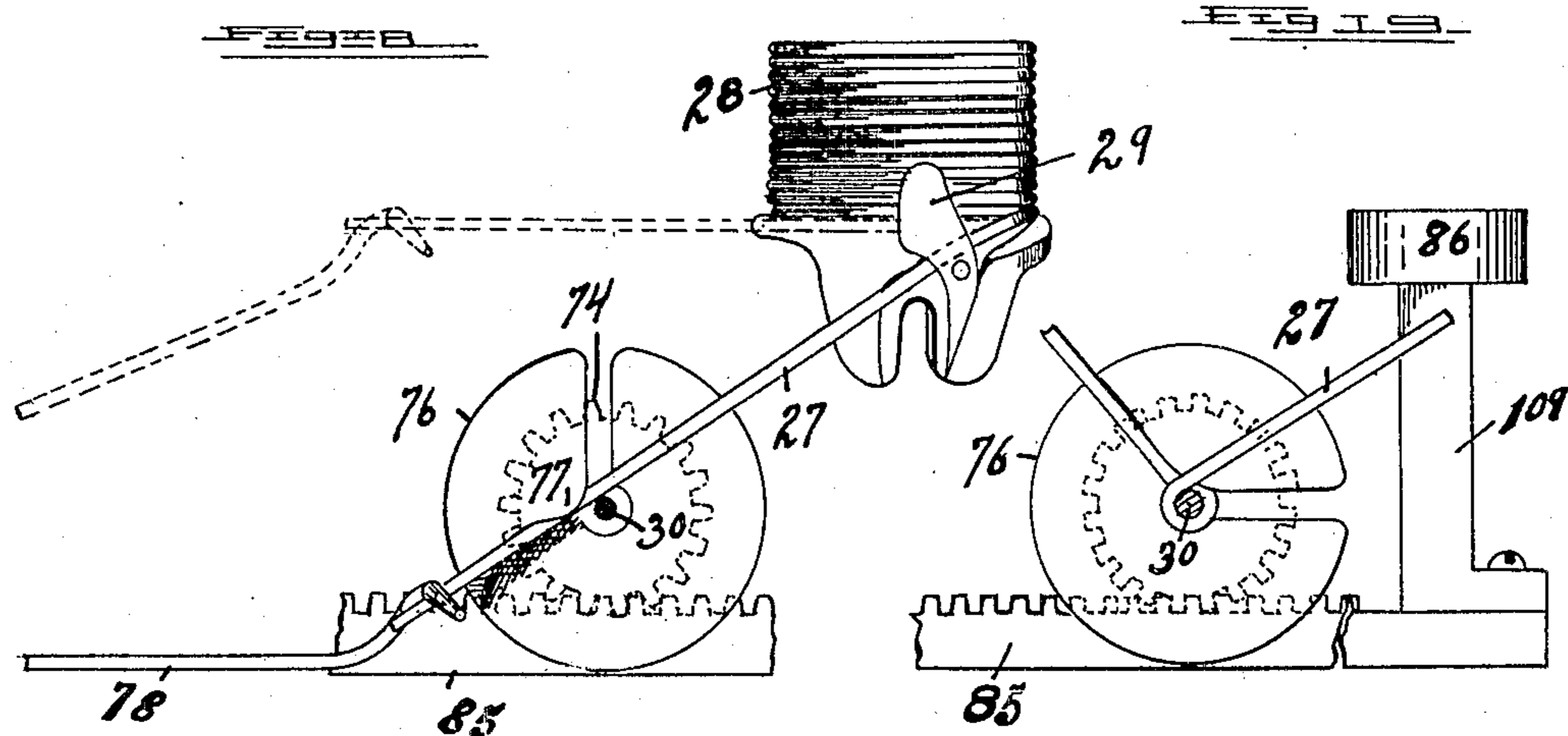
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11 SHEETS—SHEET 10.



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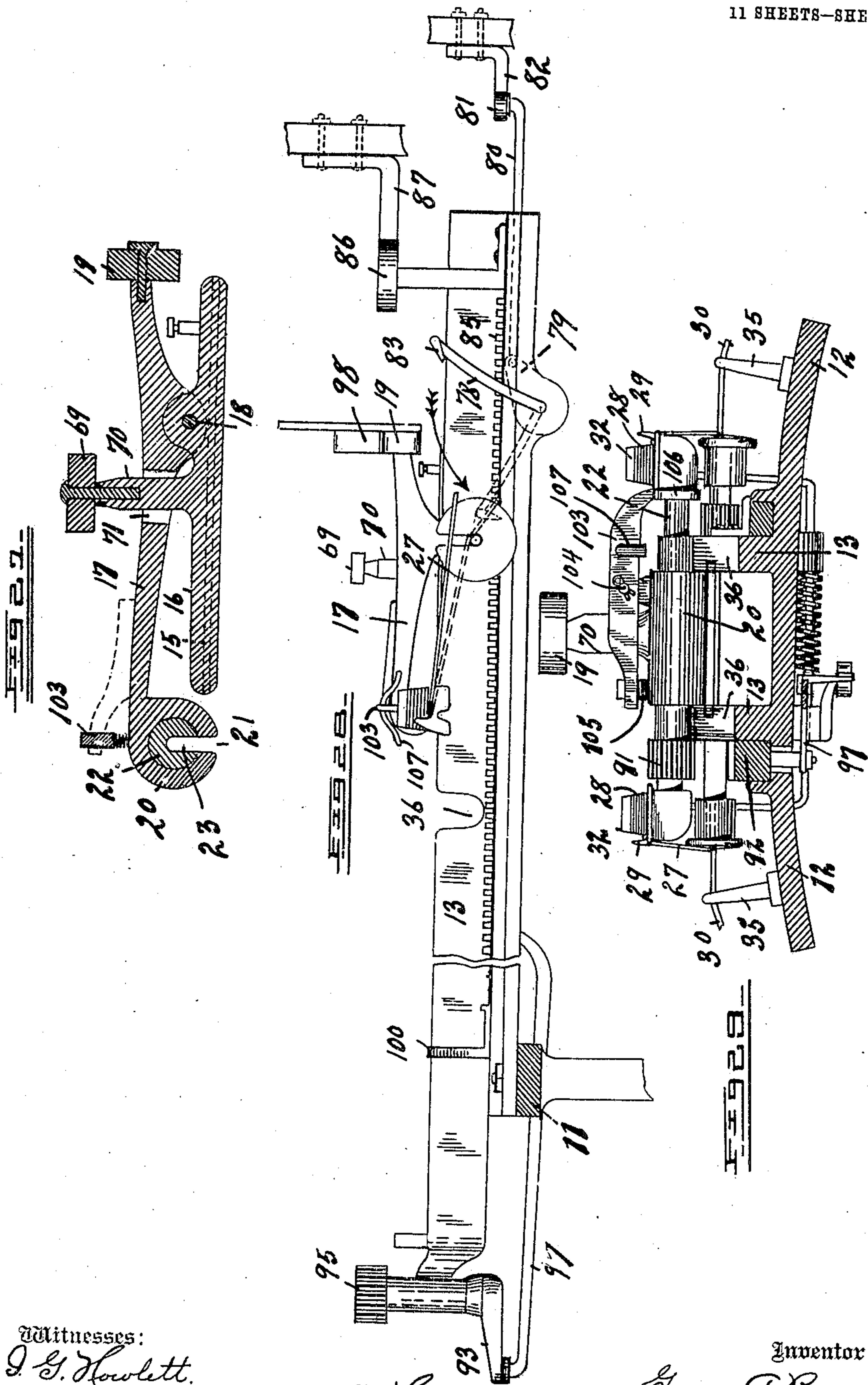
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11 SHEETS—SHEET 11.



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UNITED STATES PATENT OFFICE.

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WIRE-FABRIC-WEAVING MACHINE.

No. 843,299.

Specification of Letters Patent.

Patented Feb. 5, 1907.

Application filed June 11, 1904. Renewed June 4, 1906. Serial No. 320,161.

To all whom it may concern:

Be it known that I, GEORGE A. RAYMOND, a citizen of the United States, residing at Adrian, in the county of Lenawee, State of Michigan, have invented certain new and useful Improvements in Machines for Weaving Wire Fabric; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to a machine for weaving wire fabric, and consists in the construction, combination, and operation of parts hereinafter fully set forth, and pointed out particularly in the claims.

The objects of the invention are to provide simple and efficient means for manufacturing the woven type of wire fencing in a rapid and economical manner, for providing for weaving two transverse or woof strands upon the longitudinal or warp strands simultaneously from a single shuttle, to provide for holding the bobbins which form the woof-strands in a suitable feeding-receptacle and automatically supplying said bobbins to the needles upon the shuttle preparatory to the travel of the shuttle through the loom in the operation of weaving, to provide for supplying said bobbins to a plurality of shuttles in succession and carrying the shuttles across the loom by an intermittent movement as the bobbins are being woven into the fabric to form the woof-strands thereof, to form the loom in the shape of a rotary drum or cylinder upon which the shuttles are carried as they travel transversely of the longitudinal wires which wind upon said drum, and to provide for restoring the shuttles to the point of starting while the drum is rotating after they have completed their passage across the warp-strands in the operation of weaving the woof-strands thereon.

The above objects are attained by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the machine embodying my invention. Fig. 2 is an end elevation thereof. Fig. 3 is an end

elevation opposite to Fig. 2. Fig. 4 is a fragmentary view in perspective of one of the cross-bars connecting the spiders of the machine and forming a track for the shuttle, the shuttle with its opposed needles showing thereon in the operation of attaching the transverse or woof wires to the longitudinal or warp wires of the fabric. Fig. 5 is a fragmentary view in perspective, showing the outer circular frame of the machine and the guides and tracks attached thereto, which serve to throw the shuttles from wire to wire of the warp-wires of the fabric and direct the needles in their work. Fig. 6 is a fragmentary view in perspective, showing the roller on the end of the shuttle engaging one of the tracks on the frame, as when raising the needle-arm of the shuttle after applying the woof. Fig. 7 is a side elevation of the tracks shown in Fig. 6. Fig. 8 is a perspective view of one of the deflected tracks, which shift the shuttles successively from one longitudinal wire to another. Fig. 9 is a fragmentary plan view showing the operation of winding the initial end of the bobbin-wires around the marginal wire of the fabric preparatory to the travel of the shuttle across the machine. Fig. 10 is a fragmentary view, in rear elevation, showing the inclined plane, which restores the shuttles to their initial position to receive the bobbins preparatory to entering upon their travel through the machine in the operation of weaving the cross-wires into the fabric. Fig. 11 is a fragmentary view in perspective, showing the mechanism at one end of the machine for reciprocating the racks that drive the shuttles. Fig. 12 is a fragmentary view in elevation, showing the operation of picking up the bobbins and placing them upon the spools carried by the needles. Fig. 13 is a fragmentary view in elevation of the bobbin-feeding mechanism. Fig. 14 is a perspective view of the bobbin-holder and of the jaws which separate and feed the bobbins consecutively to the needles. Fig. 15 is a fragmentary view in perspective of a portion of the bobbin-feeding mechanism, showing the bobbin in the jaws of the feeding device in the act of being placed upon the spool of the needle. Fig. 16 is a fragmentary view, in vertical section, through the bobbin holder or recepta-

cle. Fig. 17 is a detail in elevation, showing the feeding-arm in the act of extracting a bobbin from the holder. Fig. 18 is a detail showing the manner of fastening the end of the bobbin which forms the transverse wire preparatory to weaving the remaining portion of the wire of the bobbin into the fabric. Fig. 19 is a view showing the completion of the initial wrap of which the inception is shown in Fig. 18. Fig. 20 is a fragmentary view in perspective of the end of the needle and the bobbin-spool thereon. Fig. 21 is a longitudinal sectional view through Fig. 20. Fig. 22 is a vertical section through the spool as on line 22 22 of Fig. 21. Figs. 23, 24, 25, and 26 show the inception and completion of the wraps or ties which unite the wires of the fabric. Fig. 27 is a detail, partly in section, through the needle and a portion of the pivot-arm which carries it. Fig. 28 is an elevation showing the position of the operative parts preparatory to tying the end of the bobbin-wire to the marginal wire of the fabric. Fig. 29 is a sectional view through the bar upon which the shuttle is mounted, showing the shuttle and other parts in elevation. Fig. 30, Sheet 7, is a horizontal section as on line 30 30 of Fig. 13. Fig. 31 is a fragmentary view, in side elevation, showing the spring for actuating the movable jaw of the hopper.

Referring to the characters of reference, 1 designates the frame, which consists of a ring-like member at each end, said members being connected by suitable cross-bars 2, forming, in effect, a stationary open cylinder within which the mechanism is mounted. Crossing diametrically the circular ends of the frame are the bars 3, which carry the boxes 4, in which the ends of the main shaft 5 are journaled, as shown in Fig. 2. Fixed to one end of said shaft is a large gear-wheel 6, which meshes with a pinion 7 on the counter-shaft 8, carrying the band-pulley 9, which is driven from any suitable source of power through the medium of the belt 10.

Fixed to the main shaft 5 within the cylindrical frame and rotatable therewith are the opposed spider-wheels 11, which are positioned upon said shaft such distance apart as to correspond with the width of the fencing or fabric to be woven and are connected by the transverse bars 12, which are bolted at their opposite ends to the peripheries of said spider-wheels and of which there are as many as there are shuttles in the loom. Formed upon and extending from the face of said bars are the longitudinal parallel track members 13, each of which is provided in its inner face with a channel 14, into which extend the laterally-projecting flanges 15 on the sides of the body 16 of the shuttle which lies between the track members and is adapted to slide longitudinally thereon. Mounted upon the body 16 of each shuttle is an oscillatory arm

17, which is pivoted to the body at 18 and carries at one end an antifriction-roller 19. At the opposite end of said oscillatory arm is a head 20, having a longitudinal slot 21 in the under side thereof. (See Fig. 27.) Journaled in said head is the needle-shaft 22, having the longitudinal slot 23, which is adapted at one point in the rotation of said shaft to register with the slot 21. The shaft 22 projects beyond the ends of the head 20, and upon each end thereof is secured a needle 24, having a slot 25 therein, (see Fig. 20,) which registers with the slot in the shaft and having in the upper side thereof a spring-actuated dog 26, as shown in Fig. 21, under which the bobbin-wire 27 is adapted to pass when winding from the coil 28 in the operation of weaving. Also mounted upon the needle, at the end thereof, is a guard 29, which stands in front of the dog 26 and confines the bobbin-wire properly in place as it passes from the coil retaining the final end of the wire, so that it may be properly wound around the last of the longitudinal or warp wires 30 of the fabric before escaping from the needle. Upon the end of the needle is the rounded projecting portion 31, which crowds the wrapped portion of the bobbin-wire along upon the longitudinal wire as the bobbin-wire is wound thereon.

Mounted upon the upper face of each of the needles is a conical spool 32, upon which the coils 28 of the bobbin-wires are placed, as hereinafter explained, there being within said spool a dog 33, which projects through an opening in the wall of the spool and is maintained in place by the coiled spring 34. (See Fig. 22.) This dog recedes as the bobbin is crowded downwardly upon the spool and after the bobbin is in place springs outwardly, so that the point of the dog engages between the coil of the bobbin and retains the bobbin in place, so as to prevent it from flirting when the needle is rotated.

The shuttles are carried along the ways upon the bars 12 by means hereinafter explained, and the oscillatory arm 17 of each shuttle is actuated, as also hereinafter explained, to cause the longitudinal slotted shaft and needles to drop onto each of the warp-wires 30 in succession when the shaft 22 and needles are rotated to wind the bobbin or woof-wires thereon. The warp-wires are fed into the machine and lie in the forked ends of the studs 35, which are fixed in the cross-bars 12 and which hold said wires firmly in place during the operation of weaving. To allow of the dropping of the slotted shaft and needles upon said wires in succession, the track-rails are notched, as shown at 36, to receive the ends of the needle-shaft as the arm 17 is oscillated to carry said shaft onto each of the warp-wires which are in succession received in the longitudinal slot of said shaft and which lie therein as the shaft is rotated to cause the needles to wrap the

bobbin or woof wires onto the warp-wires. After the operation of wrapping the bobbin-wires onto the longitudinal wires the oscillatory arm is actuated to raise the slotted shaft and needles from the notches in the track members to enable the shuttle to pass to the succeeding wire.

As the shuttles follow each other in succession through the machine and repeat consecutively the same operation, a description of the operation of one of the shuttles will answer for all. Assuming that one of the shuttles is in the initial position at the back of the machine or loom and that the reel or cylinder upon which the shuttles are mounted is being rotated, said shuttle as it is carried upwardly by the rotation of the reel will present its needles in the path of the rotary arms 37, which carry a finger and trigger adapted to pick the bobbins from the hopper and place them upon the spools of the needles, as shown in Fig. 12. These arms 37 are mounted upon shafts 38, suitably journaled in the frame, each shaft carrying at one end a gear-wheel 39, adapted to mesh with the larger gear 40, mounted upon the main shaft 5 and turning continuously with the loom. The size of the gears 39 is such that the shafts 38 are caused to make one complete revolution while the drum or cylinder of the loom is moving a distance equal to the space between the transverse bars 12, carrying the shuttles, the parts being so timed that the bobbins are properly presented to the spools of the needle as the shuttle is carried under said arms at the moment they are describing the lower arc of their circle. The bobbin-feeding arms are supplied with bobbins from the vertical hoppers 41, which are properly supported, so that the lower ends depend in the path of said arms and are adapted to receive the wound bobbins 28 one upon the other, so that the tails or projecting ends 42 of said bobbins will extend through a vertical guide-slot 43 in said hoppers, whereby said projecting ends are presented in a uniform direction. The operation of the rotary feeding-arms in extracting the bobbins from the hoppers and presenting them to the spools of the needles will be described with reference to one of said arms and more especially to the parts shown in Figs. 13 to 17, inclusive. Each of said arms 37 is provided with a laterally-extending portion 44, in which is formed a slot 45. Pivoted to the inner face of said arm is a trigger 46, having a right-angled stem 47, which is adapted to engage the face of a cam-plate 48, fixed to the frame and to traverse the face of said plate as the arm 37 swings in the arc of a circle through the rotation of the shaft 38. The opposite end of the trigger 46 projects through the slot 45 in said arm and lies adjacent to the finger 49, projecting from the margin of the lateral portion 44. At the

lower end of the hopper 50 are the opposed jaws 51 and 52, which are adapted to receive the bottommost bobbin 28 in said hopper and hold it in the path of the trigger 46 and finger 49, which pass between said jaws as the arm 37 is describing the upper arc of its circle. It will be seen that the cam-plate 48 is eccentric to the axis upon which the feeding-arm swings and that as said arm is passing the lower arc of its circle the stem 47 of said trigger engaging said cam will swing the trigger upon its pivot against the tension of the spring 53 and cause the end thereof which passes through the slot 45 to move away from the finger 49 and hold it away until the stem of the trigger shall have passed from the rear end of said cam-plate, when the spring 53 will cause said trigger to swing against the inner wall of the coil of the bobbin at the time the finger 49 has engaged the outer wall thereof, thereby clamping the bobbin between the trigger and finger and causing the arm 37 to carry the bobbin from the confining jaws 51 and 52 into position to be forced upon the spools of the needles as they pass into proper relation therewith.

In order to prevent the bobbins crowding downwardly into the delivery-jaws and becoming tangled with the lower bobbin, which is carried therefrom by the feeding-arm, there are provided reciprocatory spiders 54 and 55, which enter the opposite sides of the hopper and between the strands of the bobbin-coil therein. These spurs are actuated through the pivot-arms 56 and 57, to which they are attached, respectively, there being upon the arm 56 a depending end portion 58, having an inclined slot 59 therein, in which engages a pin 60, projecting from the upper end of a vertically-movable slide 61, carrying the confining-jaws 51 and 52 and adapted to be actuated through the projecting studs 62 and 63 thereon, which are alternately encountered by the pin 64, projecting from a collar 65, fixed to the shaft 38. The pin 64 as said shaft rotates will engage the upper stud and raise the slide, causing the pin 60 to travel upwardly in the inclined slot in the arm 56, thereby swinging said arm upon its pivot and withdrawing from the hopper the spur 54 and at the same time also withdrawing the spur 55, owing to the pivotal union at 66 between the arms 56 and 57, thereby releasing the lowermost bobbin and causing it to drop into the jaws 51 and 52. A further rotation of the shaft 38 will cause the pin 64 to engage the lower stud 63 on said slide and carry it downwardly, causing the pin 60 to actuate the arms 56 and 57 to again throw the spurs inwardly and lock the lower bobbin in the hopper, and at the same time the downward movement of said slide allows the hinged jaw member 52 to swing inwardly through the action of the spring 65^a upon the pin 66^a, which is confined between the outer

end of the hinged jaw, through which said pin passes, and the face of the slide as the end of the hinged jaw is released by the inclined part 67, and at the same time drawn downwardly from the bobbins above, so as to be free therefrom. The upward movement of the slide 61 throws the hinged jaw outwardly through the engagement with the inclined part 67, so as to free the bobbin when engaged by the finger and trigger of the delivery-arm. By this arrangement the bobbins are properly presented to the feeding-arm in a manner to be removed from the hopper by said arms and forced onto the spools of the needles. The position of the cam-plate 48 is such that immediately the bobbin is placed upon the spool of the needle the trigger is caused to move away from said bobbin, so as to release it and enable the bobbin to be carried away on the spool as the shuttle moves forward through the rotation of the loom. The shuttle when receiving the bobbins is guided by the parallel track-bars 68, between which the antifriction-roller 69 is directed, said roller being mounted on the stem 70, which is fixed in the shuttle 16, and which passes through a slotted opening 71 in the reciprocatory shuttle-arm 17. At the time the shuttle is in said position it is beyond the line of the marginal longitudinal wire 30, so as to allow said wire to drop into the longitudinally-slotted shaft 72, which is journaled in the track members 13 on the bar 12, which are transversely slotted, as at 73, to allow said wire to enter said slotted shaft, whose initial position is such as to cause the slot 74 therein to register with the slots 73 in said track members. While the marginal wire of the longitudinal wires 30 is drawing into the slot of the shaft 72, the other longitudinal wires are directed into the slotted upper ends of the pins 35. After the longitudinal wires have been drawn into the machine by the rotation thereof, so as to lie in the notches 36 of the track members between the supporting-pins 35 below the plane of the horizontal travel of the shuttle between said tracks, and the marginal wire of the longitudinal wires has taken its proper position in the slotted shaft 72 the shuttle, with the bobbins upon the ends of its needle, is returned into operative position in the machine by the engagement of the antifriction-roller 69 on said shuttle with the sinuous guide-track 75, which is suitably supported by the transverse bars 2, connecting the opposite ends of the frame, and onto which said roller is directed from the curved upper end of the track 68, whereby the shuttle is caused to move longitudinally of its track, so as to present the projecting ends of the bobbin-wire 27 across the marginal wire of the longitudinal wires 30, adjacent the rotary heads 76, upon the ends of the slotted shaft 72, at which time said projecting ends of the bobbin-wires

are carried downwardly and caused to spring under the projecting lips 77 upon the faces of said heads, by means of the curved fingers 78, the connecting straight portion of which is journaled in the track members 13, and which are adapted to be actuated through a crank-arm 79, mounted on said connecting straight portion and having pivoted thereto a rod 80, whose outer end carries an antifriction-roller 81, adapted to engage a fixed inclined plane 82, (shown more clearly in Fig. 9,) whereby the rod 80 is moved longitudinally to carry the hooked terminals 83 of said fingers onto the projecting ends of the bobbin-wires and press them downwardly under the lips 77 on the faces of the heads 76 across the longitudinal wire, at which time the shaft 72 is rotated through the medium of the pinion 84 thereon, which meshes with the longitudinally-movable rack 85, mounted in the cross-bar 12 and carrying at its outer end an antifriction-roller 86, which engages the face of the inclined plane 87 as the loom revolves, thereby moving said rack longitudinally and causing such a rotation of the heads 76 as to wrap the ends of the bobbin-wires once around the marginal longitudinal wire 30, as shown in Figs. 18 and 19, whereby the ends of the bobbin-wires are fastened to the marginal wire in a manner to enable the bobbin-wires to be strung across the longitudinal wires of the fabric as the shuttle is carried across the loom coincident with the rotary travel thereof.

It will be understood that the rotary movement of the loom is continuous and that as a consequence each shuttle is continuously describing the arc of a circle while it is being reciprocated. During the operation of attaching the ends of the bobbin-wires to the marginal wire the antifriction-roller 69 of the shuttle is traversing the short straight portion 88 of the track 75. At the completion of the initial fastening of the ends of the bobbin-wires said roller encounters the curved part 89 of said track, which has sufficient deflection to move the shuttle longitudinally of the track members 13 until the slotted needle-shaft 22 is presented over the succeeding longitudinal wire, when the antifriction-roller 19 upon the end of the oscillatory arm 17 of the shuttle will ride onto the curved track member 90, which is suitably supported on the frame and which tilts said oscillatory arm so as to depress the head 20 at the forward end thereof and carry the needle-shaft onto the succeeding longitudinal wire, which enters the slot 22 in said shaft and projects through the outer end of the opposed needles 24 on the ends thereof, said shaft lying in the notches 36 in the track members 13, which serve as bearing for said shaft as it is rotated to wrap the bobbin-wires around the longitudinal wire passing there-through, as clearly shown in Fig. 4. The

needle-shaft is rotated through the medium of a pinion 91, which as the head of the oscillatory arm is depressed to place the slotted needle-shaft upon the longitudinal wire is carried into engagement with the teeth of the reciprocatory rack-bar 92, which is mounted to slide in the cross-bar 12 and is driven through the medium of a crank-arm 93, mounted upon one end of a short shaft 94, journaled in a suitable support at the end of the cross-bar 12 and carrying in addition to said arm a pinion 95, which meshes with a fixed gear-ring 96. Connected to the crank-arm 93 is a pitman 97, which is pivoted at its opposite end to the rack-bar 92, the movement of said pitman being so timed as to slide the rack-bar at the moment when the pinion of the needle-shaft is caused to mesh therewith, whereby the needle-shaft is rotated and the bobbin-wire is wrapped around the longitudinal wire passing through said shaft. After the bobbin-wires shall have been wrapped around the longitudinal wire the rotary movement of the loom carries the antifriction-roller 19 into contact with the short curved track 98 above the track 90, which is so shaped as to depress said roller and raise the head 20 on the opposite end of the oscillatory arm, thereby withdrawing the needle-shaft from the longitudinal wire and carrying the pinion 91 from engagement with the rack 92, so that the return movement of said rack does not cause a rotation of the needle-shaft. When the needle-shaft has been raised from the longitudinal wire around which the bobbin-wire has been wrapped, a further rotary movement of the loom will cause the antifriction-roller 69 to engage one of the short deflecting track members 99, whereby the shuttle is moved longitudinally of its supporting-track such distance as to present the needle-shaft to the succeeding longitudinal wire, when another of the tracks 90 is encountered by the roller 19 on the oscillatory arm of the needle and said needle-shaft depressed so as to engage the succeeding longitudinal wire therein, when the needle-shaft is again rotated through the operation of the sliding rack 92 to wrap the bobbin-wires upon said longitudinal wire, the operation being repeated for each of the longitudinal wires until the shuttle has been carried completely across the loom and has attached the bobbin-wires to each of the longitudinal wires of the fabric.

In explaining the operation of the machine from the time of receiving the bobbins upon the needles of the shuttle until said wires have been completely woven upon the longitudinal wires of the fabric it was stated that the initial ends of the bobbin-wires were partially wrapped around the marginal longitudinal wire through the operation of the rotary heads 76 by a movement of the rack 85 in engagement with a pinion on the shaft

carrying said heads. To finish the wrap of the initial ends of the bobbin-wires upon the marginal longitudinal wire, the rack 85 at the end opposite to that carrying the roller 86 is provided with a projecting post 100, which extends into the path of the shuttle and is adapted to be engaged by the end of said shuttle, whereby as the shuttle is moved transversely of the machine through the engagement of the roller 69 with the last deflecting-track 101 the rack 85 is carried longitudinally, thereby rotating the shaft 72, so as to complete the wrap of the ends of the bobbin-wires around the marginal longitudinal wire, as shown in Fig. 25, Fig. 24 illustrating the initial wrap of the end of the bobbin-wire and Fig. 23 the bobbin-wire lying across the longitudinal wire, as in Fig. 18.

To return each shuttle to the initial end of the loom after it has passed transversely thereof in the operation of weaving the transverse wires upon the longitudinal wires, an inclined track 102 is employed, which is located at the rear of the machine and which is adapted to engage the antifriction-roller 69, carried by the shuttle, as the loom revolves and cause the shuttle to slide back longitudinally of the bar 12 in position to again receive the bobbins upon the needles thereof, the inclined track 102, leading into the guideway formed by the track members 68, as clearly shown in Fig. 10. In this manner the shuttles follow each other in succession in their travel across the machine and in their return to the point of starting, so that a number of the shuttles are always in action, rendering the machine very rapid in its operation, especially in view of the fact that each shuttle carries two bobbins and simultaneously weaves two of the transverse strands into the fabric as it moves across the longitudinal strands.

In order to hold the needle-shaft 22 from rotating while the shuttle is passing from one longitudinal wire to another and the bobbin-wires are winding upon the spools on the needles, there is employed a friction-arm 103, which is fulcrumed at 104 upon the head 20 of the oscillatory arm 17 and provided at one end with a coiled spring 105, which is confined between the end of said friction-arm and the upper face of said head, the opposite end of said arm bearing upon the collar 106 on the needle-shaft, whereby said shaft is held from rotating until it has dropped into the notches 36 in the track members 13, when the transverse member 107, carried by said arm, will strike at its opposite ends upon the margins of the notches in one of the track members and raise the end of said friction-arm against the action of the spring 105, thereby permitting the shaft 22 to rotate freely when its pinion 91 is brought into engagement with the rack 92.

It has been stated that in order to com-

plete the operation of wrapping the ends of the bobbin-wires around the marginal longitudinal wires, as shown at 108 in Fig. 25, a movement of the rack 85 is accomplished through the engagement of the end of the shuttle with the post 100 at the end of said rack. To return said rack to its normal position after this operation, there is attached to the post 109, mounted on said rack, and which carries the roller 86, a plate 110, having a return-bend 111, (see Fig. 4,) which lies in the groove 14 of the track member 13 in position to be engaged by the end of the shuttle as said shuttle is returned to its initial position through the medium of the inclined track 102, whereby said rack 85 is caused to slide longitudinally in its supporting-way into position for a succeeding operation.

It will now be understood that through the rotation of the reel or loom the shuttles in succession are supplied with bobbins and the bobbin-wires woven upon the longitudinal wires of the fabric through the operation of the rotary needles carried by the shuttles which are moved across the transverse wires by the guiding-tracks, which impart an intermittent movement to the shuttles as they travel from strand to strand of the longitudinal wires, and said needles are rotated through the actuation of the reciprocatory rack-bar, making continuous the operation of weaving the woof-wires onto the warp-wires and applying two woof-strands at a single operation of each needle.

The longitudinal wires 30 enter on the rear side of the rotary cylinder, as shown by dotted lines in Fig. 2, and the woven fabric passes from the lower arc of said cylinder, as shown by dotted lines 112 in said figure, said fabric being drawn over a suitable roller 113 and carried to a reel, (not shown,) upon which it is wound.

Having thus fully set forth my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a wire-fence loom, the combination with the means for carrying the longitudinal wires continuously into the machine, of the shuttle adapted to travel across the longitudinal wires, said shuttle carrying a rotary needle adapted to embrace the longitudinal wires and provided with the means at each end for holding a bobbin, whereby as the needle is rotated two bobbin-wires are simultaneously wrapped around the longitudinal wires as the shuttle passes across the loom.

2. In a wire-fabric loom, the combination with the means for carrying the longitudinal wires into the machine, of means for simultaneously introducing two stay-wires, stringing said stay-wires transversely of the longitudinal wires and simultaneously weaving the stay-wires to the longitudinal wires as said stay-wires are carried across the fabric.

3. In a wire-fabric loom, the combination of the rotary cylindrical member around which the longitudinal wires are adapted to pass, of a rotary needle adapted to travel across said longitudinal wires mounted upon said rotary cylinder, said needle being adapted to embrace each of said longitudinal wires in succession and having means for carrying a bobbin-wire at each end, means for rotating said needle to wind the bobbin-wires simultaneously onto the cross-wires as said needle is successively presented to said wires in its passage across the machine.

4. In a wire-fabric loom, the combination of the continuously-rotatable cylinder carrying the warp-wires upon the periphery thereof, of the shuttle mounted upon said cylinder and movable longitudinally thereof across said warp-wires, a slotted rotary needle-shaft carried by said shuttle, a needle at each end of said shaft adapted to carry a bobbin, means for rotating said needle and for dropping it upon and raising it from the longitudinal wires during the passage of the shuttle across the warp-wires.

5. In a wire-fabric loom, the combination of the rotary cylinder carrying the longitudinal wires thereon, of a shuttle movable longitudinally of the cylinder across said longitudinal wires, said shuttle carrying a rotary needle-shaft slotted longitudinally to receive said longitudinal wires, a needle upon each end of said shaft adapted to carry a transverse wire in the form of a coiled bobbin, fixed track members in the path of said shuttle adapted to engage and carry the shuttle from strand to strand of the longitudinal wires to present the needle thereto, means for actuating the needle to carry it onto and raise it from said strands, and for rotating it to cause it to wrap the transverse wires around the longitudinal wires in succession as the shuttle moves across said longitudinal wires.

6. In a wire-fabric loom, the combination of the rotary cylinder-like member onto which the longitudinal wires are drawn by the rotation thereof, a shuttle mounted upon said cylinder member to slide longitudinally, a slotted needle carried by the shuttle adapted to successively embrace said longitudinal wires, said needle being adapted to carry a bobbin-wire and wrap said bobbin-wire successively around the longitudinal wires, and means independent of said rotary member for directing the shuttle to carry the needle successively to each of said longitudinal wires as said rotary member is turning.

7. In a wire-fabric loom, the combination of the rotary cylinder member onto which the longitudinal wires are adapted to be drawn, of a plurality of shuttles carrying rotary needles adapted to weave the transverse wires onto the longitudinal wires, means for driving said shuttles onto the longitudinal

wires, means for driving said shuttles and needles, a hopper adapted to contain the transverse wires in the form of coiled bobbins and suspend them above the path of the needles carried by said shuttles, and means for automatically removing the bobbins from the hopper and placing them in succession upon the needles as the needle passes thereunder.

8. The combination of the rotary loom adapted to carry the longitudinal wires thereon, of needles adapted to weave the transverse wires onto the longitudinal wires while said longitudinal wires are carried around the loom during the rotation thereof, said needles being adapted to carry the transverse wires in the form of bobbins, means for actuating said needles to wrap the transverse wires around the longitudinal wires, a hopper for the bobbin-wires located above the path of the needles at the initial end of the loom, means for automatically separating the bobbins in the hopper and feeding the bobbins successively from the lower end of the hopper and forcing them upon the spools of the needles in position for weaving into the fabric.

9. In a wire-fabric loom, the combination of the rotary cylinder onto which the longitudinal wires are wound, rotary needles adapted to carry the transverse wires in the form of bobbins and weave them upon the longitudinal wires, means for actuating said needles, means for supplying bobbins to the spools upon said needles, and means for automatically attaching the initial ends of the bobbins to the marginal longitudinal wire as said bobbins are carried by the needles into position for weaving.

10. In a loom for weaving wire fabric, the combination of the rotary agent which receives the warp-wires, of the shuttles and needles carried by said agent, means for supplying the bobbins to the needles as the agent revolves in drawing the warp-wires thereon, and means for securing the end only of each of the bobbin-wires to the selvage-wire as said agent rotates.

11. In a machine for weaving wire fabric, the combination with the rotary agent adapted by its movement to draw the warp-wires thereon, of the shuttles and needles carried by said agent, means for reciprocating said shuttles and rotating said needles, and means for feeding the bobbin-wires to the needles as said needles pass into operative position.

12. In a machine for weaving wire fabric, the combination of the rotary agent adapted to draw the warp-wires thereon, a series of shuttles movable transversely of said agent across the warp-wires, means for carrying the shuttles across the machine and immediately returning them to their initial position, a ro-

tary needle carried by each shuttle adapted to weave the woof-wire onto the warp-wires, means for rotating said agent, and means for reciprocating the shuttles and rotating the needles.

13. In a loom for weaving wire fabric, the combination with the rotary agent upon which the warp-wires are drawn, of shuttles upon said agent carrying a needle adapted to receive a warp-wire, means for actuating said needle to wind the bobbin carried thereby onto the warp-wires, and means carried by the needle to hold the bobbin from fliriting when the needle is rotated.

14. In a loom for weaving wire fabric, the combination with the means for feeding the warp-wires into the loom, of a shuttle carrying a needle adapted to weave the bobbin-wire upon the warp-wires, and a finger upon the needle adapted to engage the bobbin-wire as the needle rotates and restrain it from fliriting.

15. In a loom for weaving wire fabric, the combination of the loom and means for feeding the warp-wires into the loom, a shuttle adapted to travel across the warp-wires, a rotary needle carried by said shuttle adapted to wrap the bobbin-wire upon the warp-wires, a spool upon the needle adapted to receive the bobbin, and a spring-actuated detent in the spool having a projecting shoulder which engages the strands to hold the bobbin from fliriting as the needle rotates.

16. In a loom for weaving wire fabric, the combination with the means for feeding the warp-wires into the loom, of the shuttles carrying rotary needles, means for feeding coils of bobbins into the machine, and means for presenting the bobbins in the path of the needles and threading them thereon.

17. In a machine for weaving wire fabric, the combination with the wire-feeding mechanism and the shuttles for weaving the wire strands together, of the bobbin-feeding device comprising a holding-tube, a movable arm having an engaging hook adapted to grasp a bobbin and by its movement present the bobbin in the path of the needle of the shuttle.

18. In a loom for weaving wire fabric, the combination with the means for feeding the warp-wires into the loom, of a shuttle carrying a rotary needle, said shuttle being adapted to travel transversely of the warp-wires and weave the stay-wire thereon, a pivoted arm in which the needle is journaled, a gear-wheel adapted to drive said needle, also journaled in said arm, and means for actuating said arm on its pivot and rotating said gear-wheel.

19. In a wire-fabric loom, the combination of a cylinder rotatable about its axis around which the longitudinal wires pass, means for

introducing a stay-wire successively to the longitudinal wires on said cylinder, and means for wrapping the stay-wire sequentially around the longitudinal wires as said
5 stay-wire is strung transversely of the longitudinal wires on said cylinder during the rotation thereof.

In testimony whereof I sign this specification in the presence of two witnesses.

GEORGE A. RAYMOND.

Witnesses:

R. B. ROBBINS,
CHAS. H. LARDS.