No. 755,719. PATENTED MAR. 29, 1904.

J. W. SNEDEKER.

WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 1.

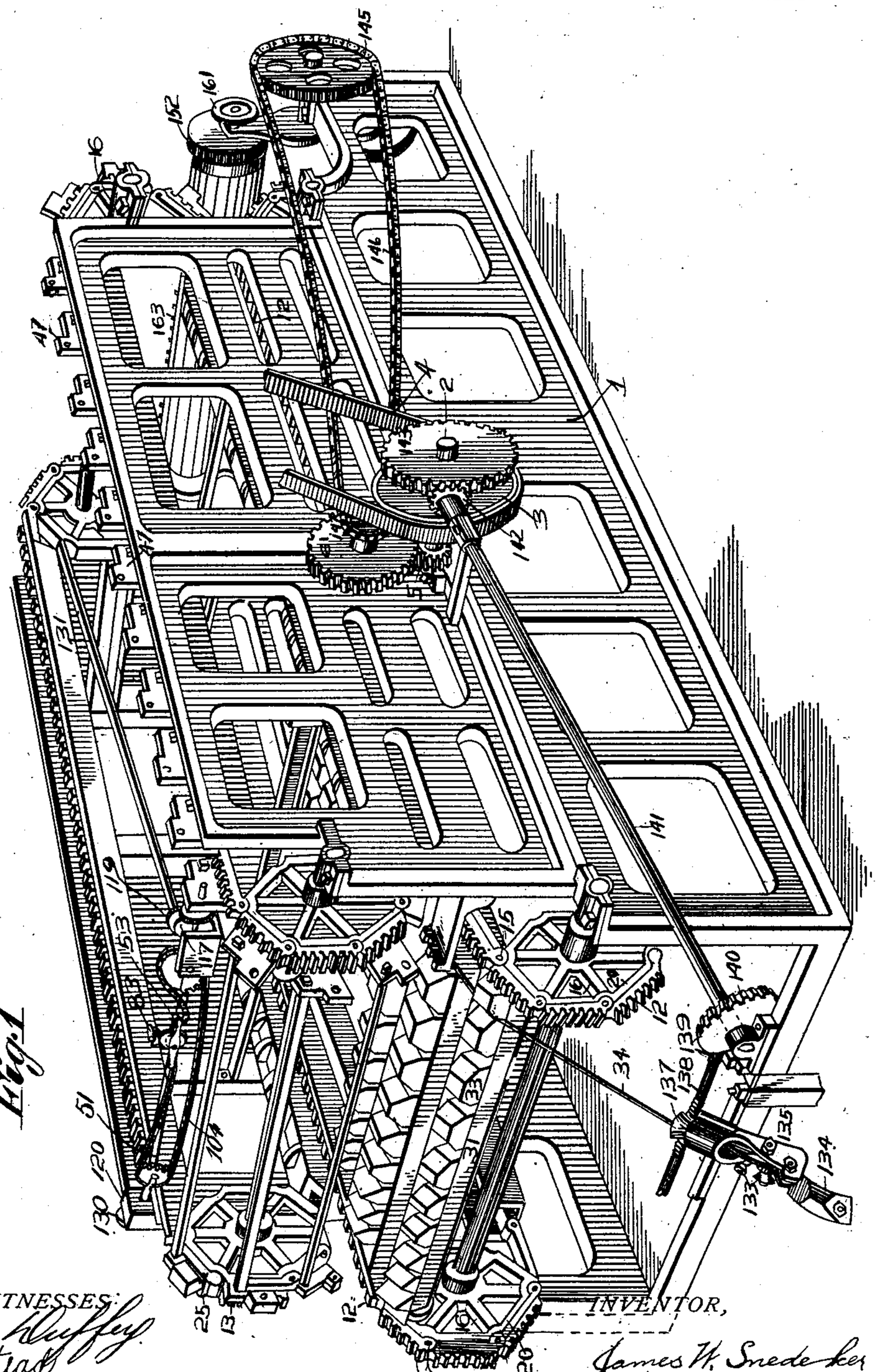

Fig. 1

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No. 755,719. PATENTED MAR. 29, 1904.

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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 2.

Fig. 2

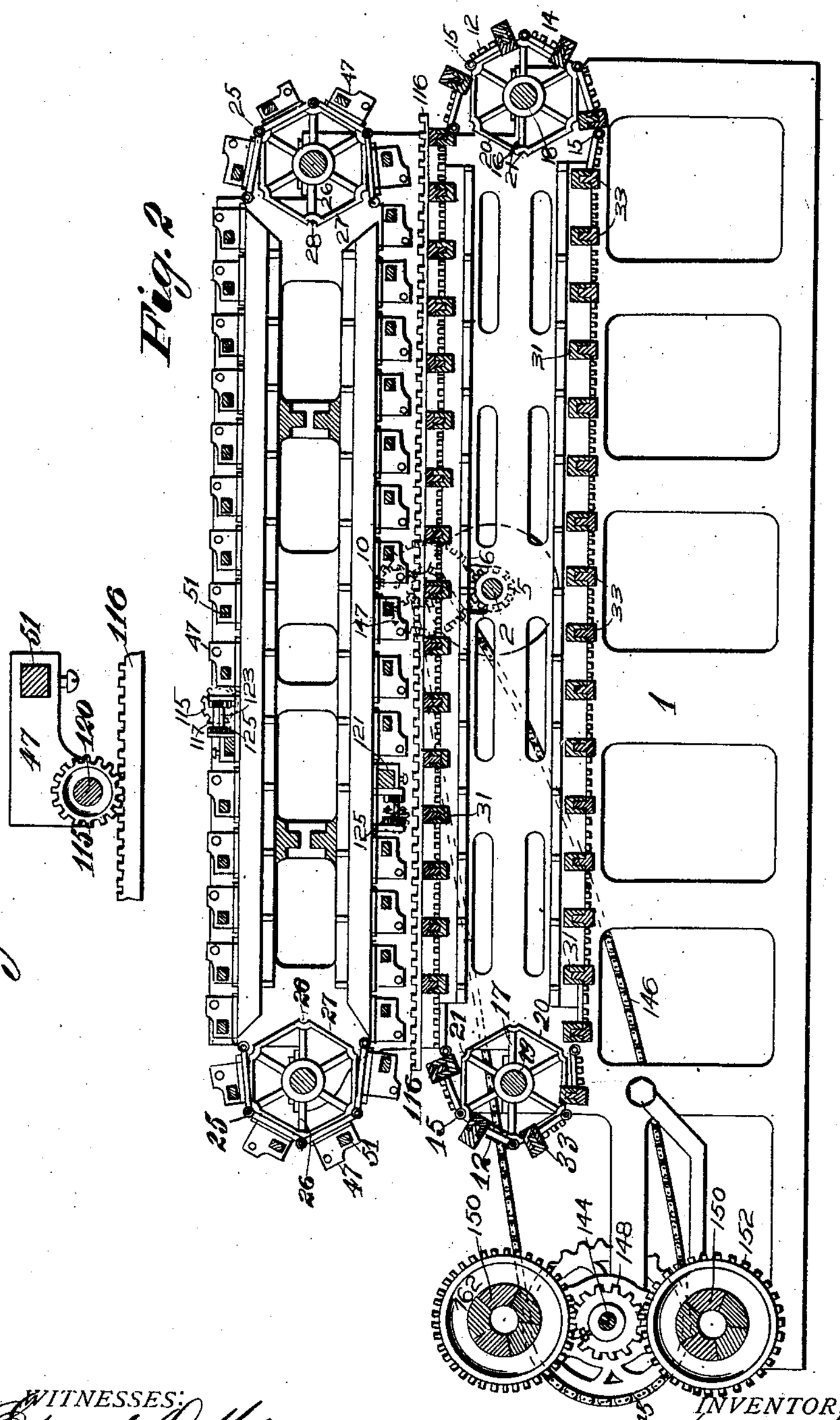

Fig. 3

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No. 755,719. PATENTED MAR. 29, 1904.

J. W. SNEDEKER.

WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 3.

Fig. 4

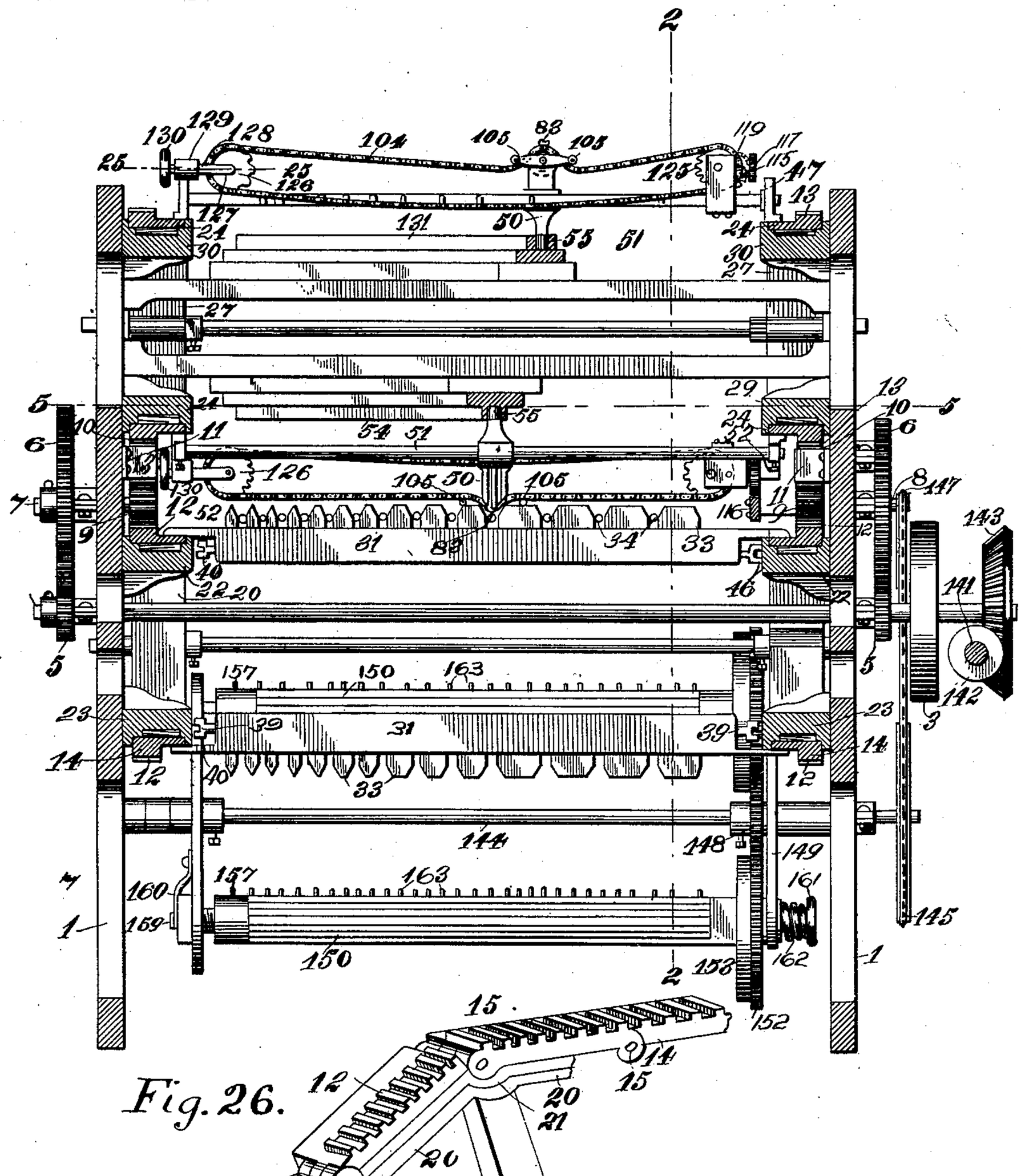

Fig. 26.

WITNESSES:
C. Edw. Duffey.
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No. 755,719. PATENTED MAR. 29, 1904.

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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 4.

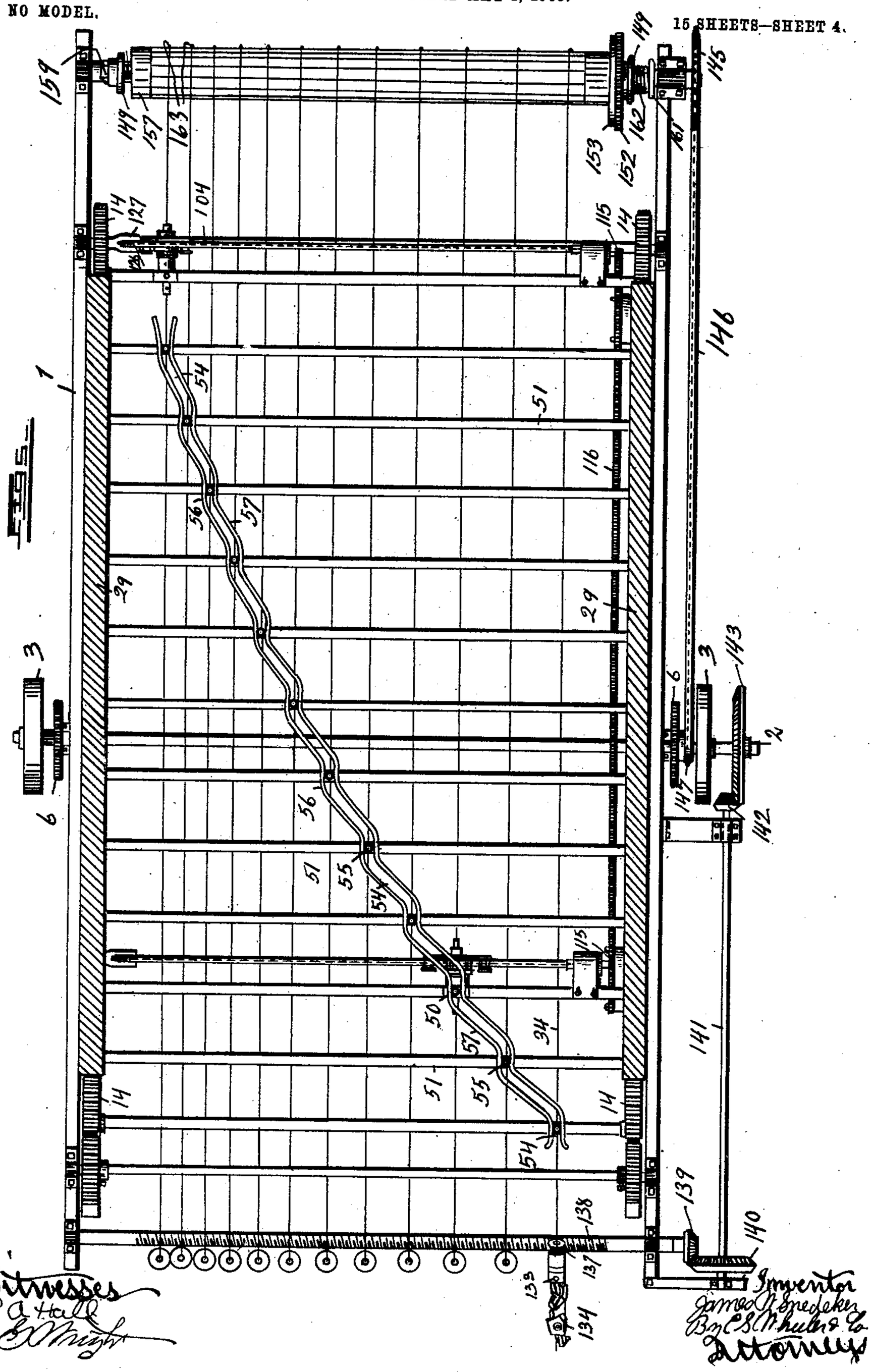

FIG. 5.

Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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WIRE FABRIC LOOM.

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NO MODEL. 15 SHEETS—SHEET 5.

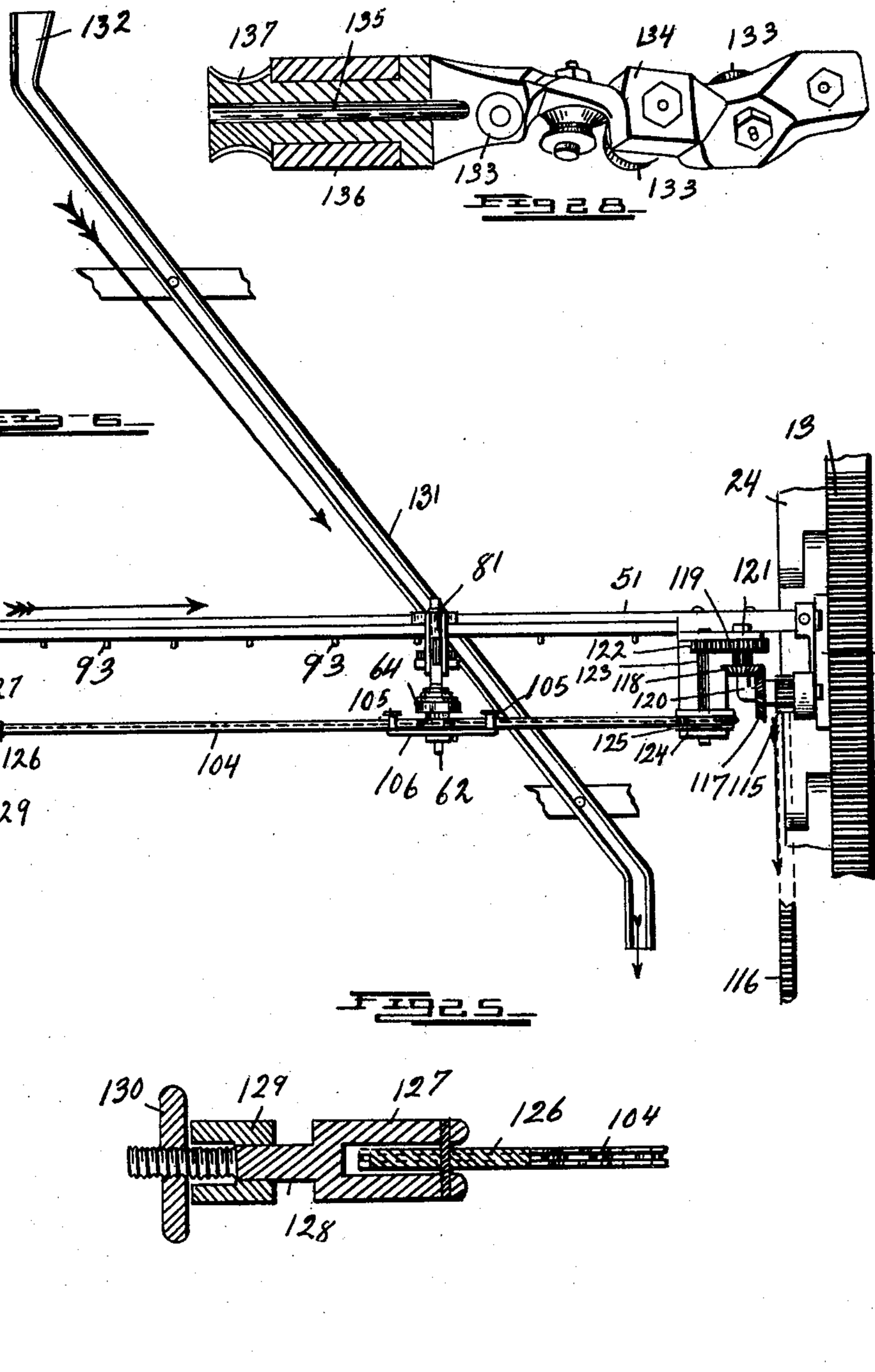

FIG 8.

FIG 6.

FIG 5.

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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 6.

FIG. 7.

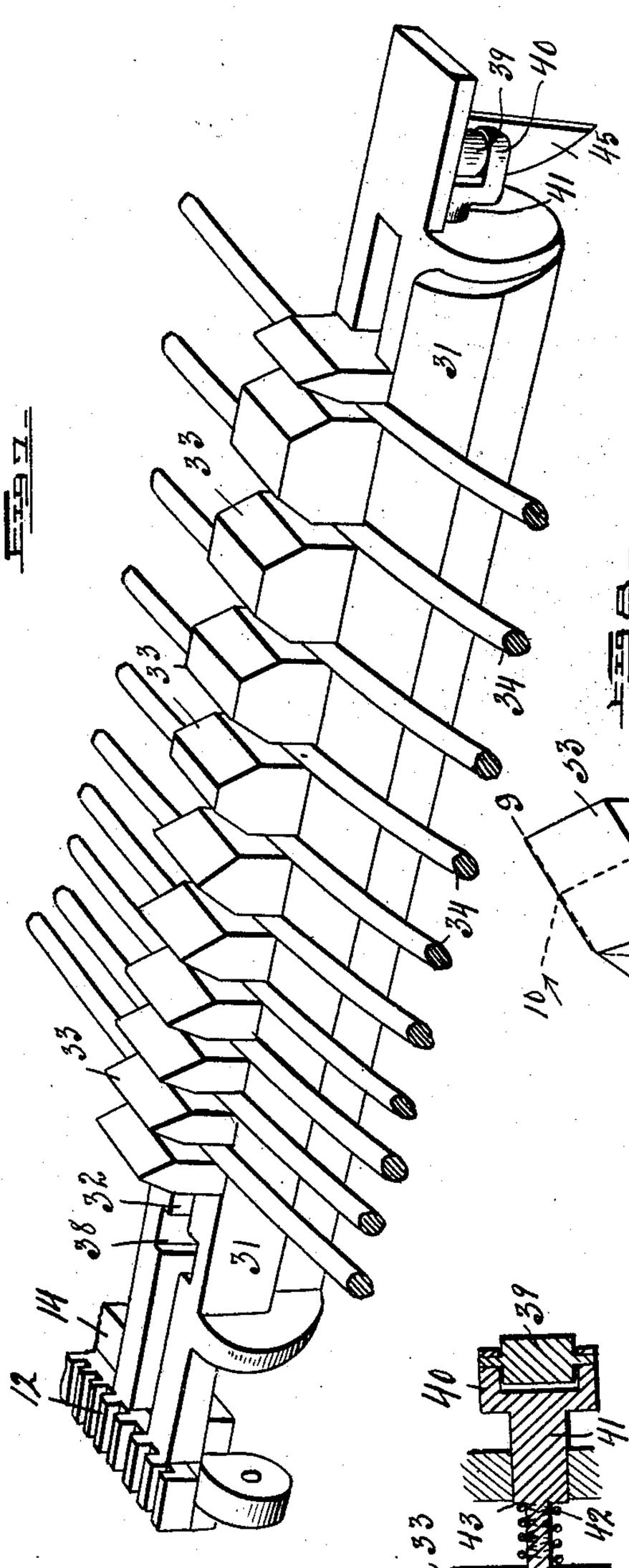

FIG. 9.

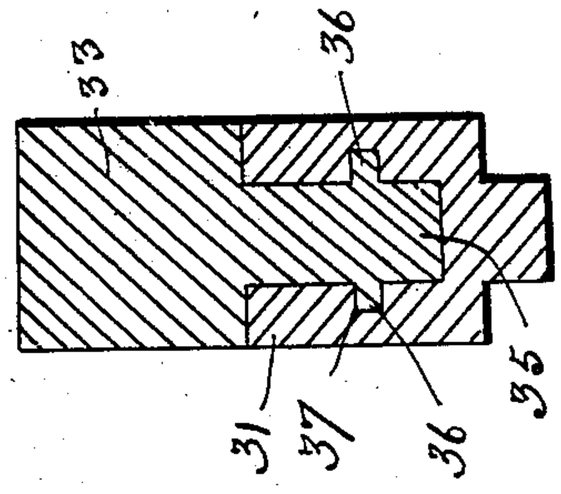

FIG. 8.

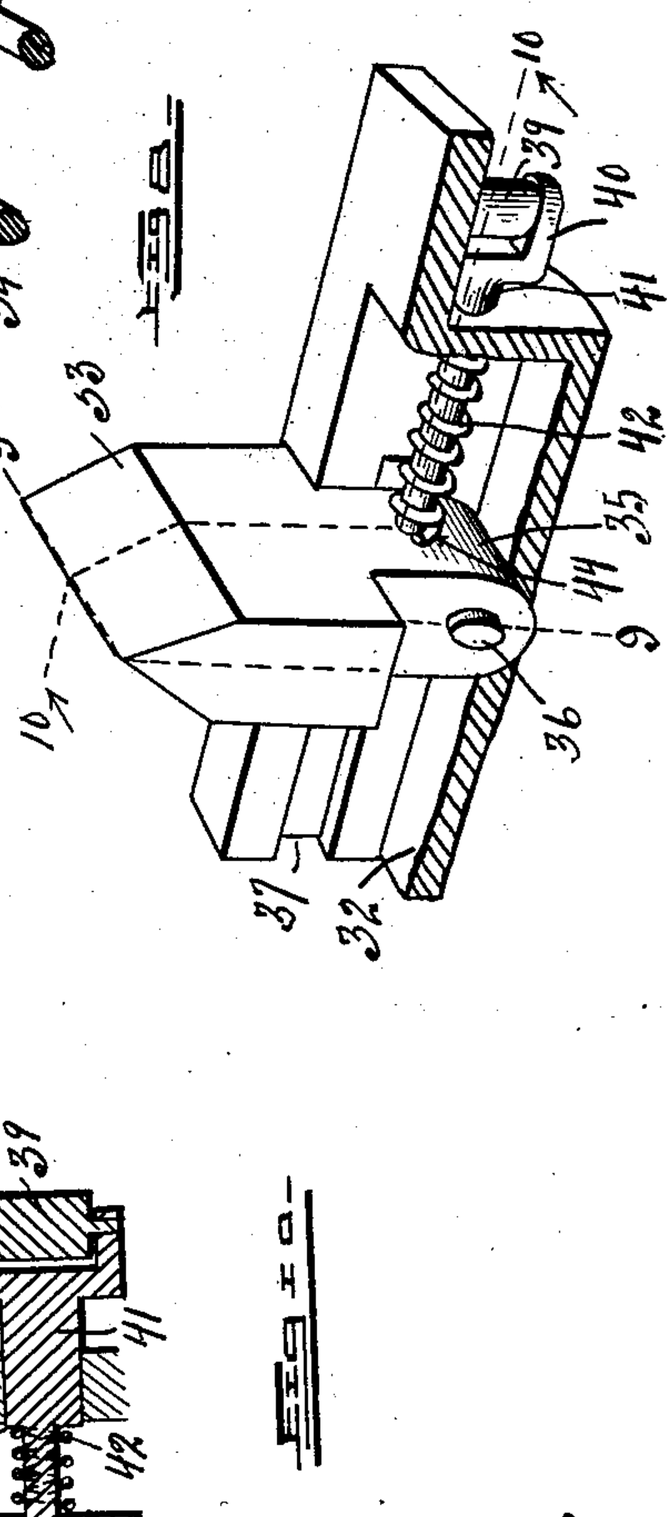

FIG. 10.

Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 7.

Fig 12

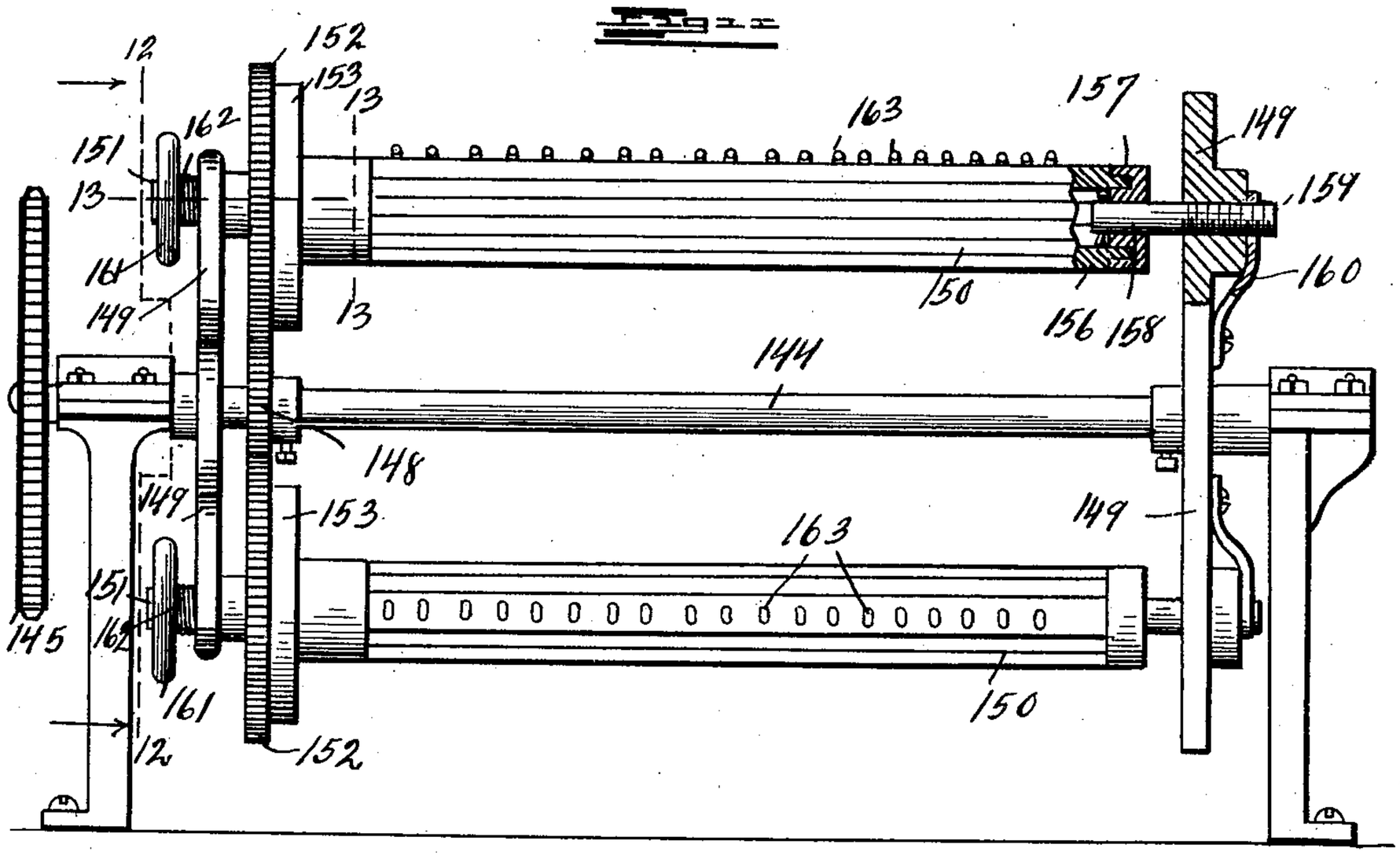
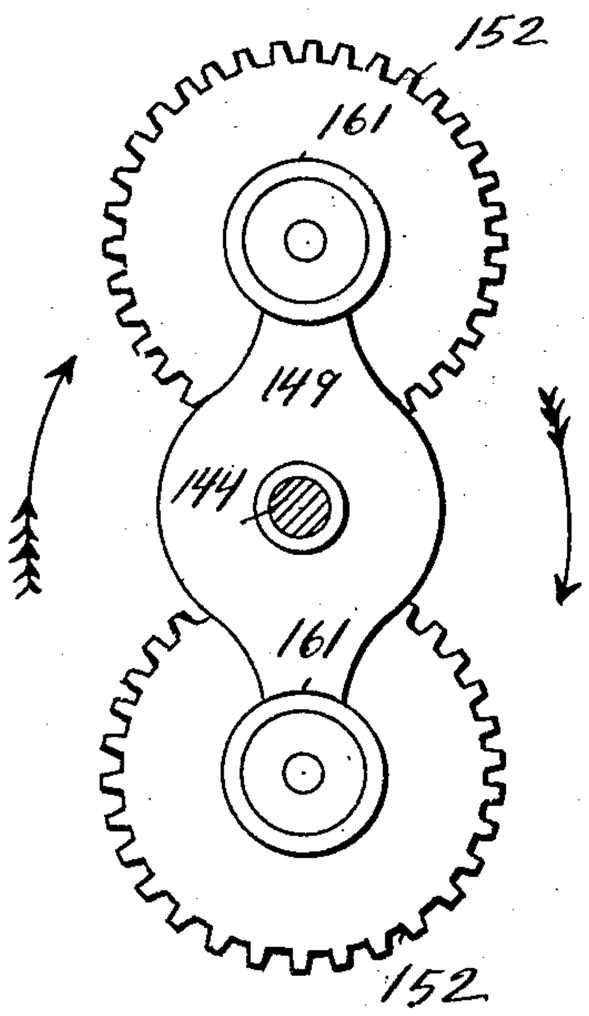
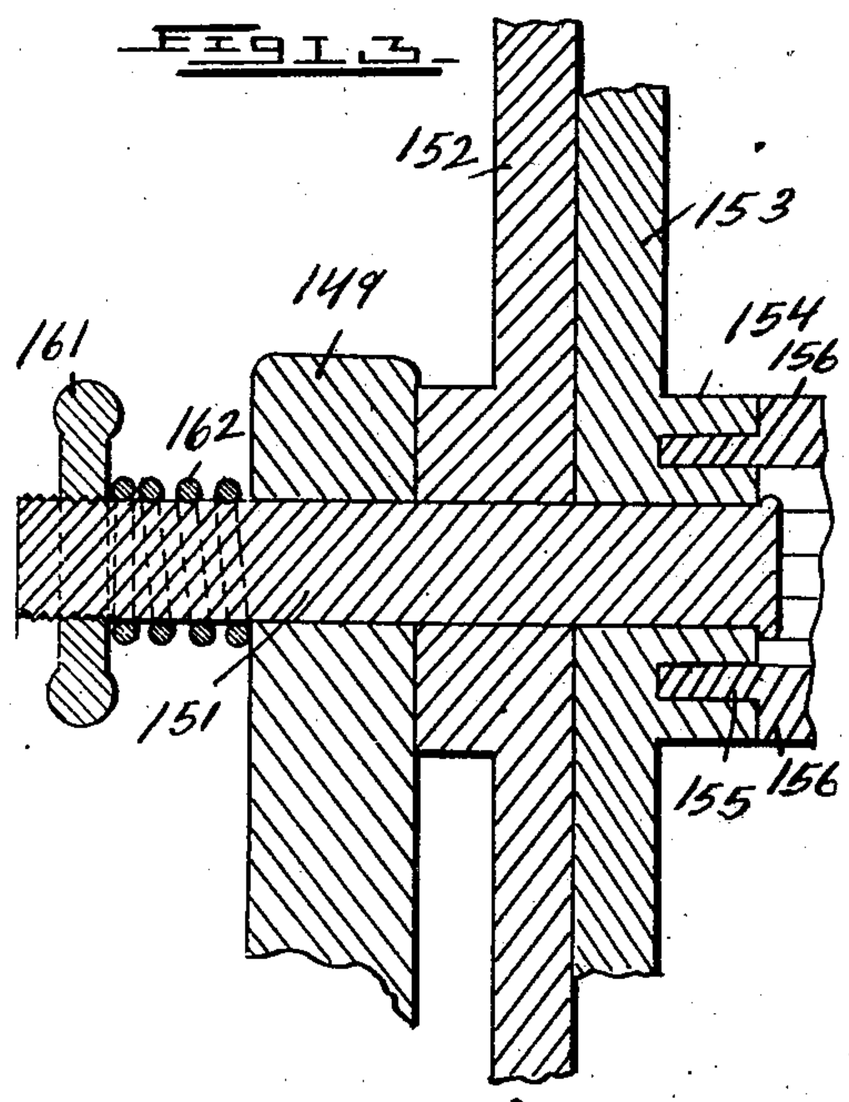


Fig 13





Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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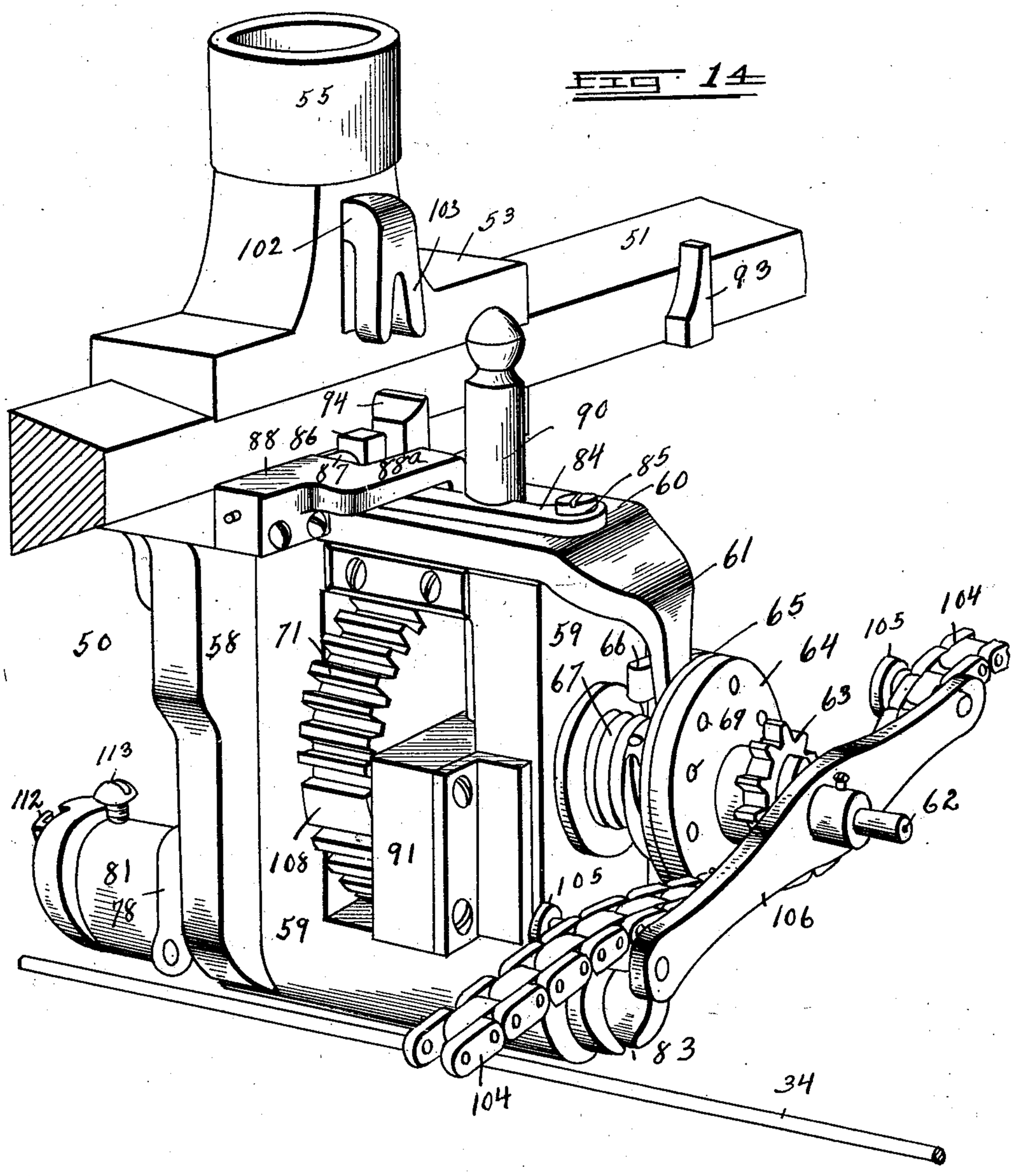
WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 8.

FIG. 14



Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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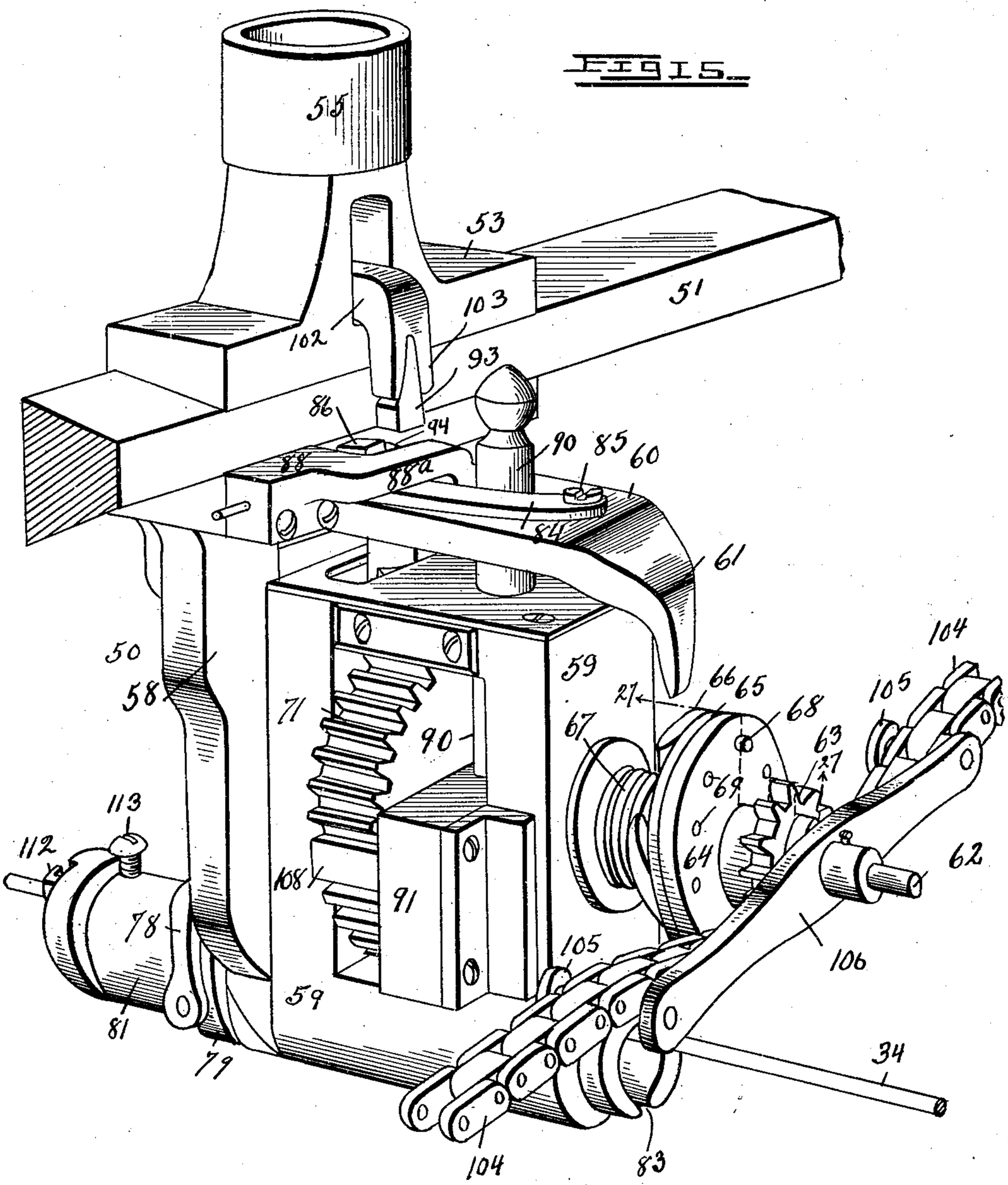
WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 9.

FIG 15.



Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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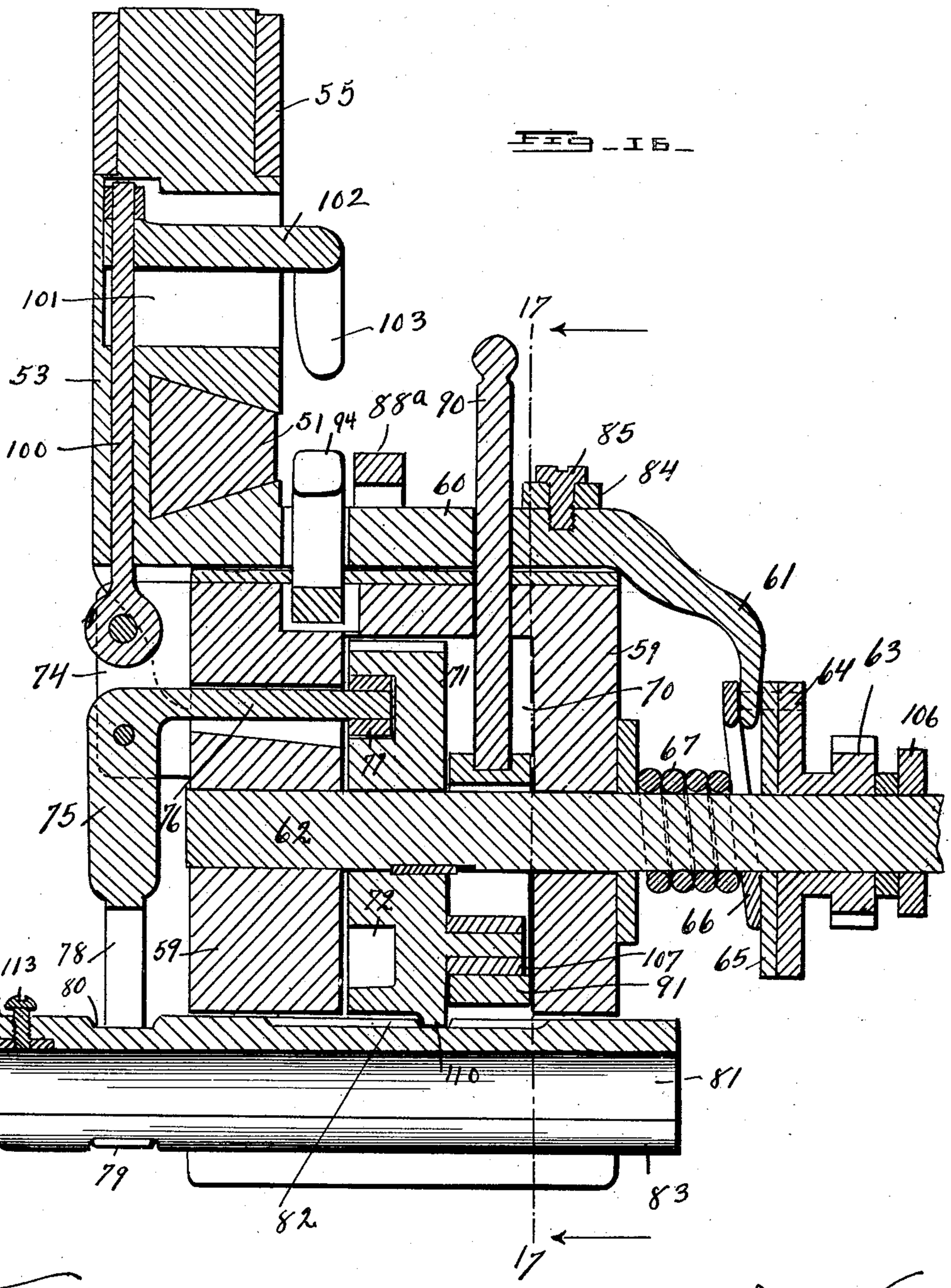
WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 10.

Fig. 16.



Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 11.

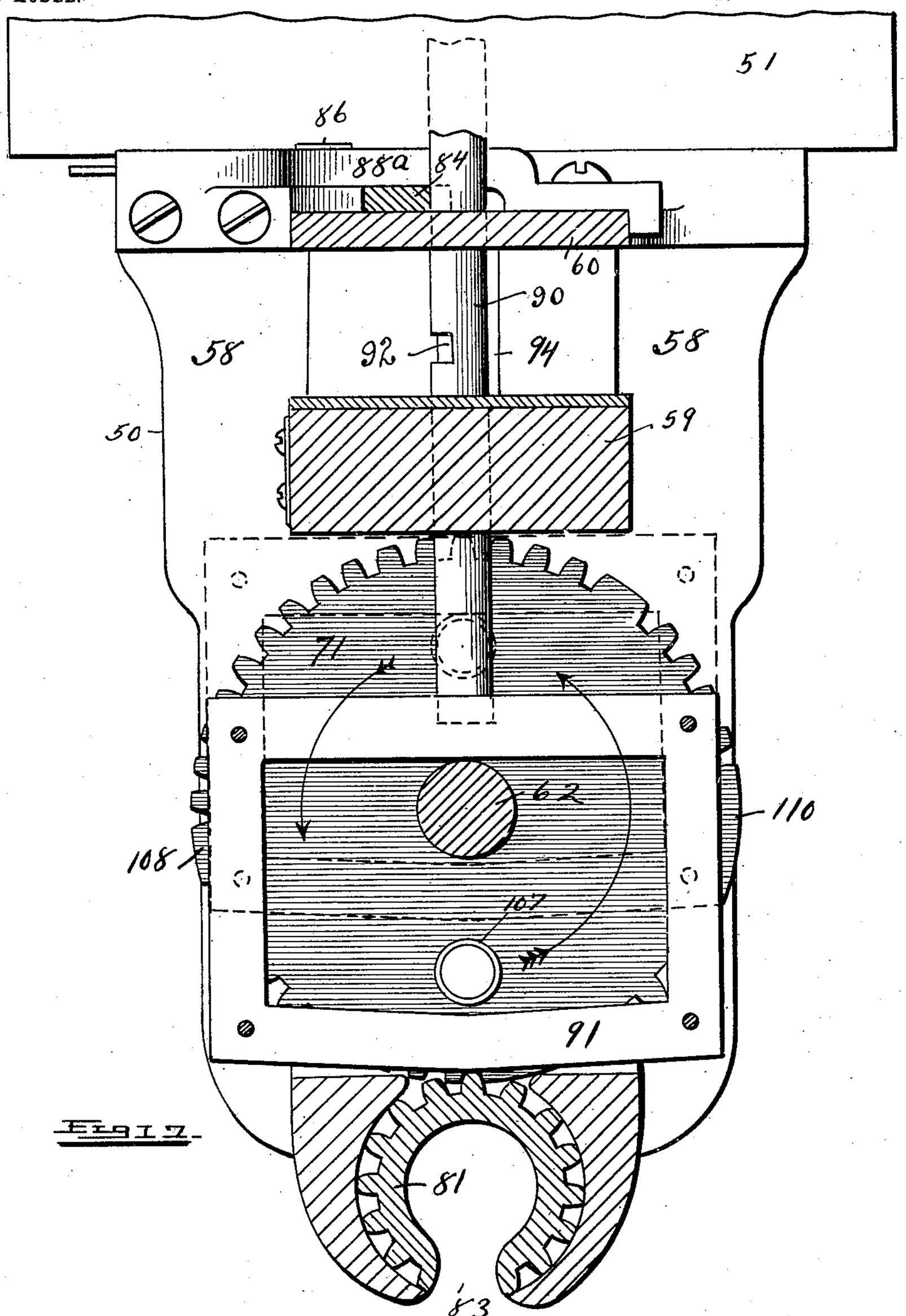

Fig 17.

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PATENTED MAR. 29, 1904.

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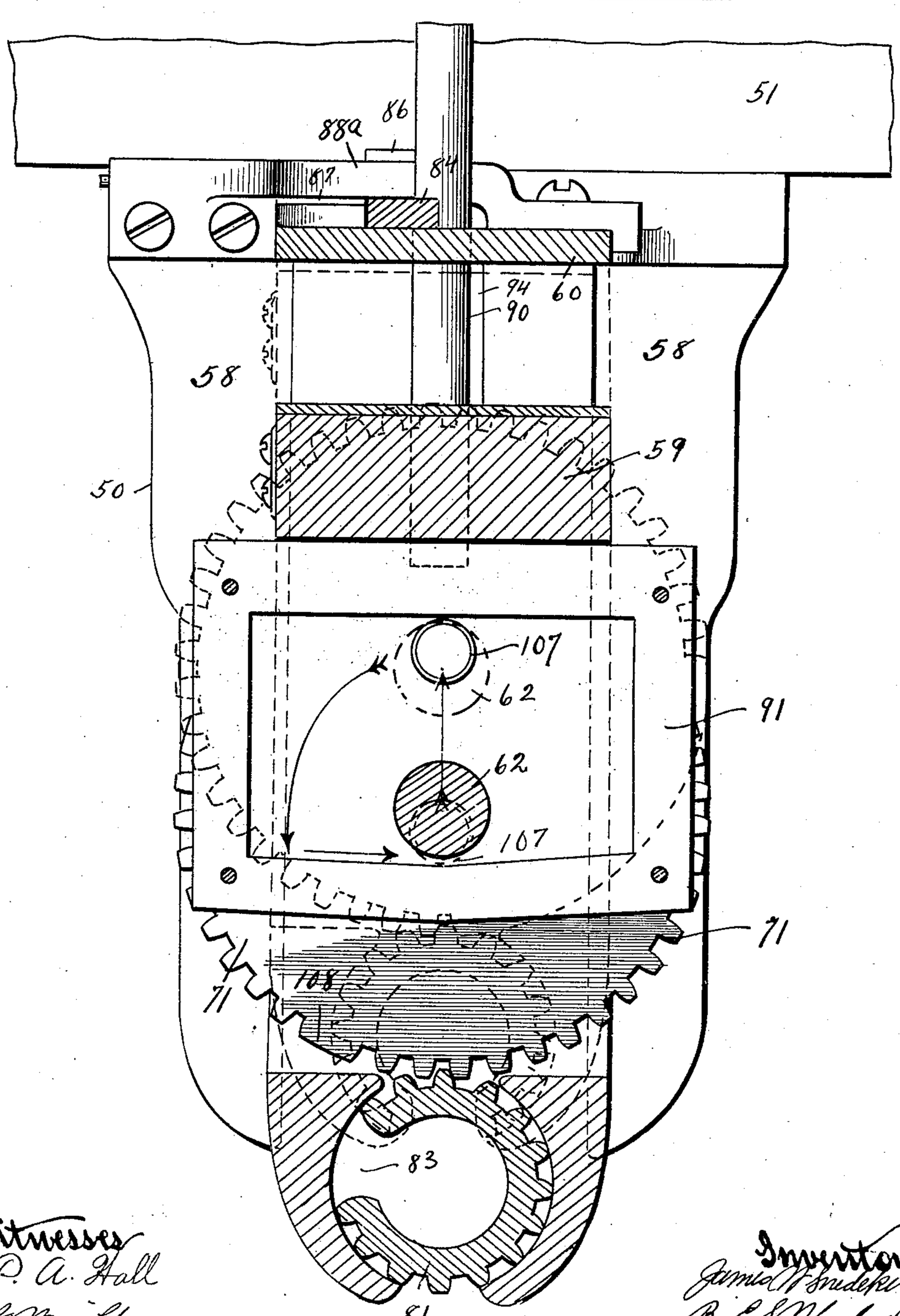
WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL.

15 SHEETS—SHEET 12.

Fig 18.



Witnesses
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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 13.

Fig 19.

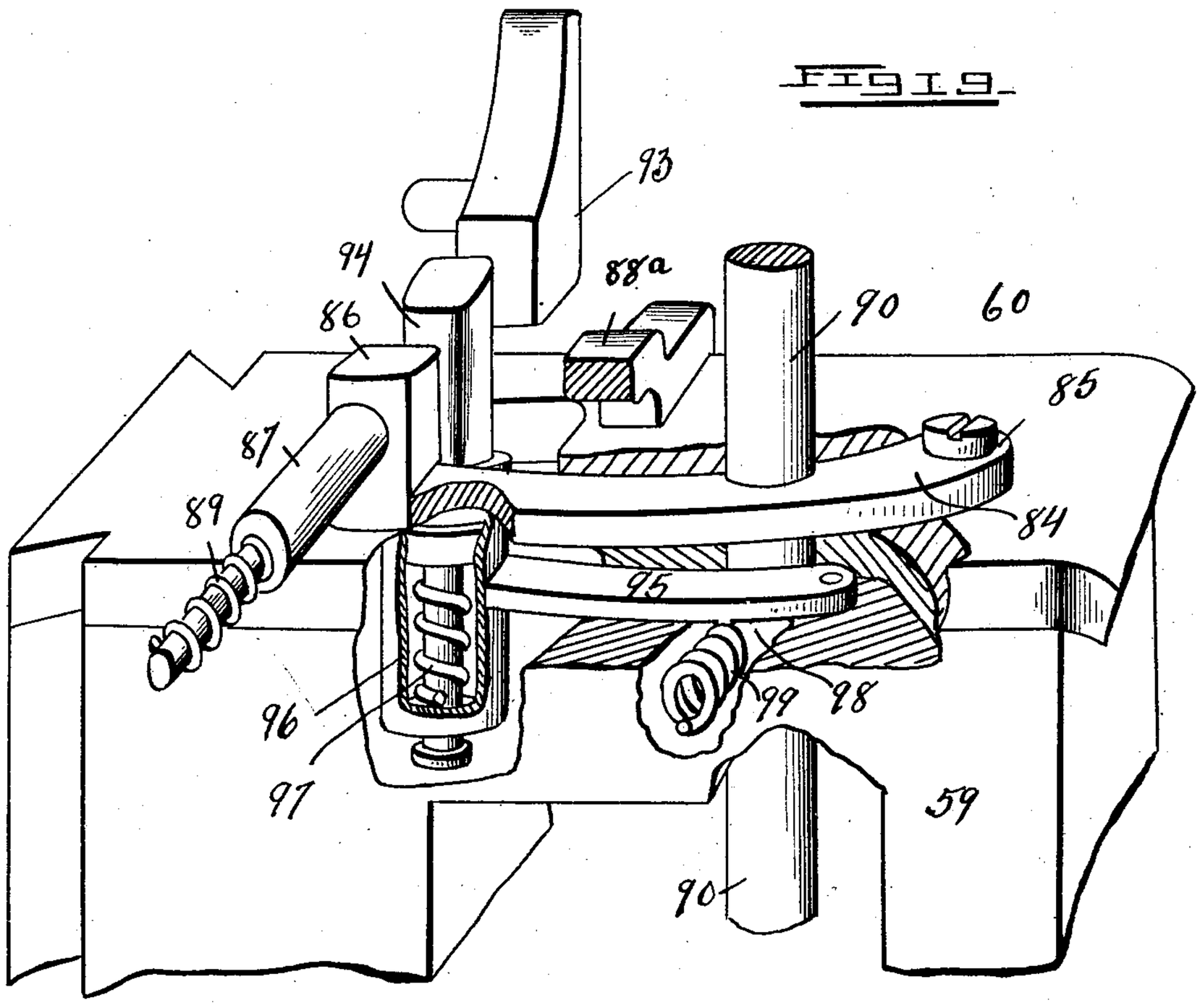


Fig 24.

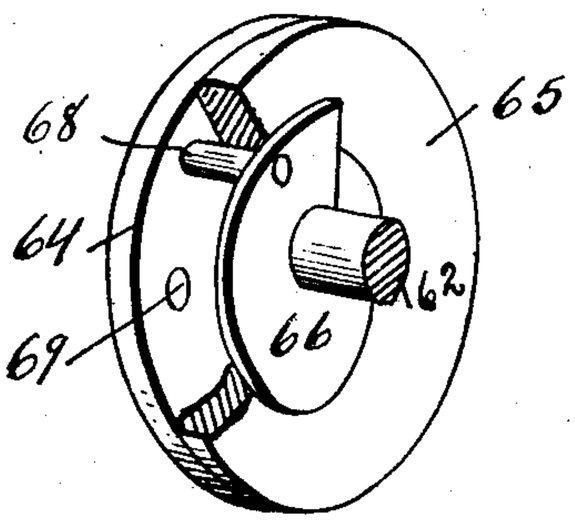
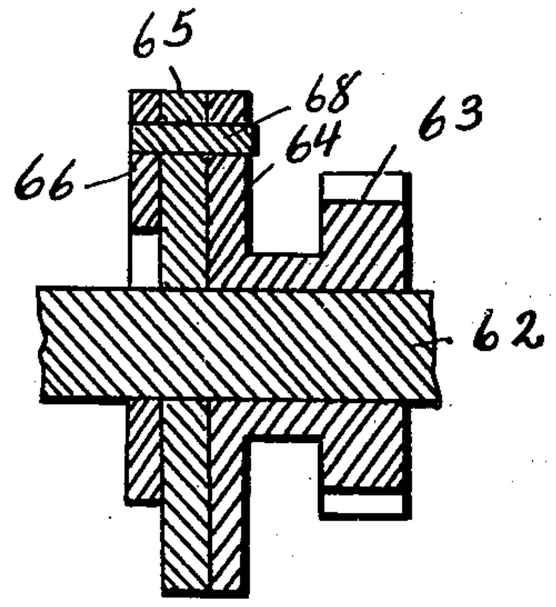


Fig 27.



Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

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WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 14.

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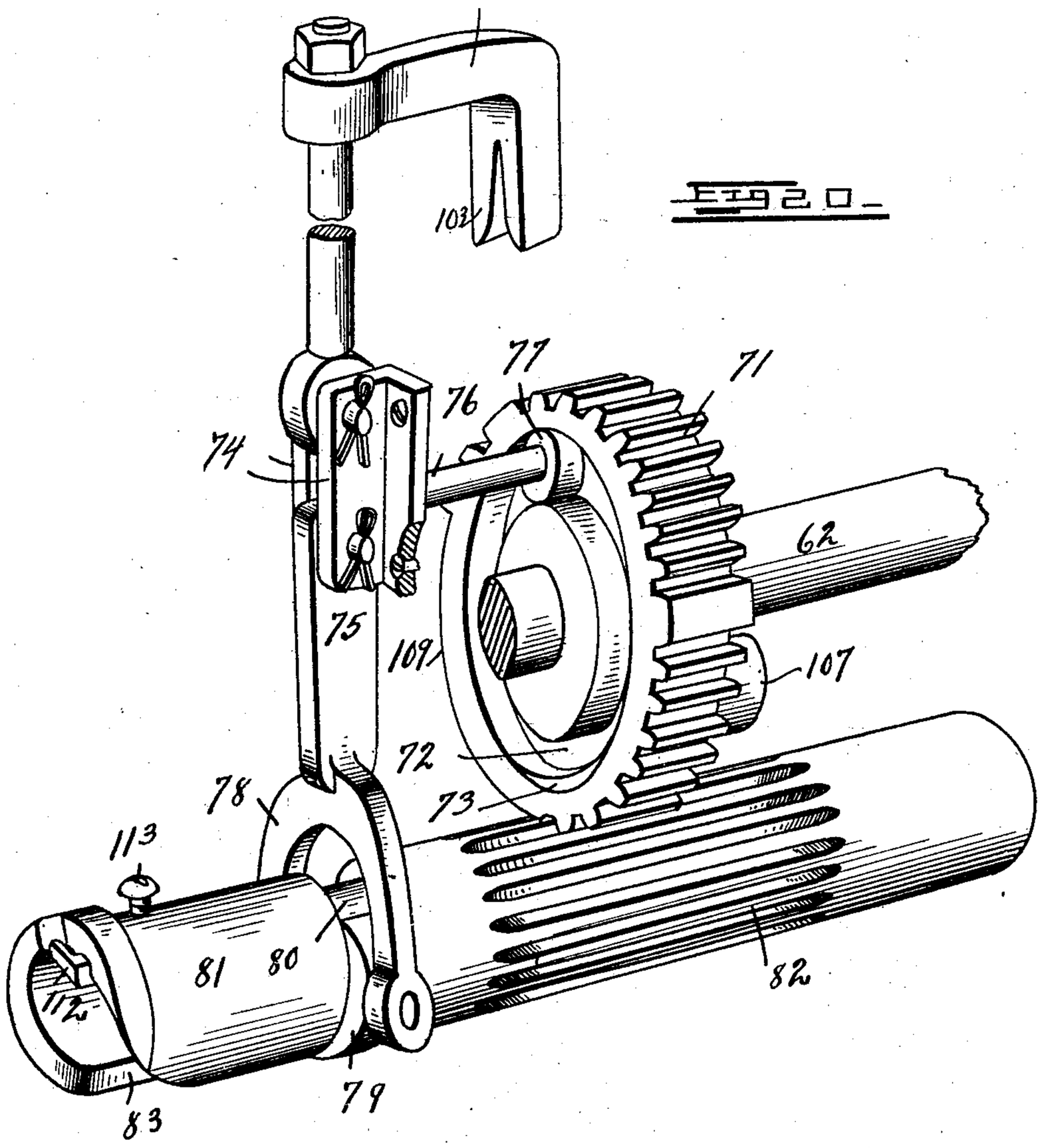

Fig 20.

Witnesses
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No. 755,719. PATENTED MAR. 29, 1904.

J. W. SNEDEKER.

WIRE FABRIC LOOM.

APPLICATION FILED MAY 4, 1903.

NO MODEL. 15 SHEETS—SHEET 15.

Fig 21

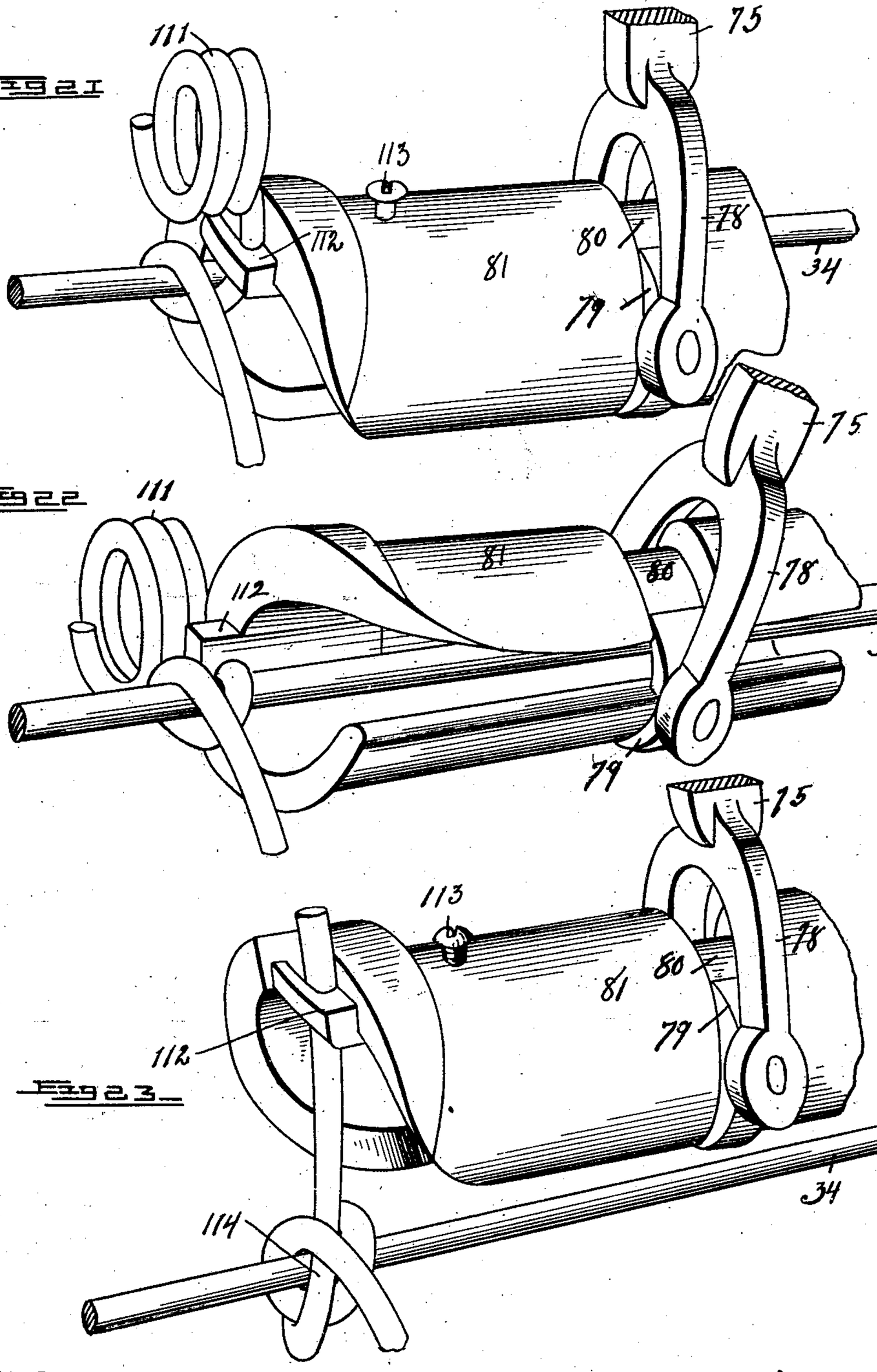

Fig 22

Fig 23

Witnesses
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Attorneys

No. 755,719. Patented March 29, 1904.

UNITED STATES PATENT OFFICE.

JAMES W. SNEDEKER, OF ADRIAN, MICHIGAN.

WIRE-FABRIC LOOM.

SPECIFICATION forming part of Letters Patent No. 755,719, dated March 29, 1904.

Application filed May 4, 1903. Serial No. 155,635. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. SNEDEKER, 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 Looms; 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 loom for weaving wire fabric, more especially designed for the weaving of wire fencing; and it consists in the construction and arrangement of parts hereinafter fully set forth, and pointed out particularly in the claims.

The objects of the invention are to provide a loom of the character described in which the arrangement is such as to enable the weaving of the fabric while moving continuously through the machine, as distinguished from the intermittent movement of the fabric incident to looms in common use, where an actual weaving together of the strands of the fabric is accomplished.

A further object is to provide for carrying the bobbins which form the woof-strands upon shuttles, whereby they are made to travel across the warp-strands of the fabric and are wound therearound in the operation of weaving the fabric, the shuttles carrying the bobbins being moved longitudinally of the machine and transversely thereof and dropped upon the warp-wires and raised therefrom alternately, while the needle of each carrying the bobbin is intermittently driven to wind or weave the woof-wires into the fabric.

A further object is to provide means for carrying the shuttles longitudinally of the machine in the operation of weaving and returning them into position for a succeeding operation, the arrangement being such that a number of shuttles are always in operation while the machine is running.

A further object is to provide for feeding the warp-wires into the machine and spacing them the requisite distance apart, at the same time securely clamping said wires, so as to prevent them from slipping and insuring a uniform length of all of the longitudinal wires of the fabric.

A further object is to provide for spirally coiling the wires as they enter the machine, so as to give longitudinal elasticity to the fencing.

A further object is to provide for rolling the woven fabric into a suitable bundle at the tail of the machine and to provide for rotating said bundle in a manner to compensate for the gradual increase in its diameter, so as to avoid unduly straining the wires of the fabric.

All of the foregoing objects are accomplished by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of a machine embodying this invention. Fig. 2 is a longitudinal section therethrough as on dotted line 2 2 of Fig. 4. Fig. 3 is an enlarged detail in section of parts hereinafter referred to. Fig. 4 is a transverse section through the machine. Fig. 5 is a horizontal section through the machine as on line 5 5 of Fig. 4. Fig. 6 is a fragmentary plan view of a portion of the machine Fig. 7 is an enlarged detail in perspective of one of the clamping-bars carrying the movable clamping-blocks between which the warp-wires of the fence are held in their passage through the machine. Fig. 8 is a fragmentary view in perspective of one of the clamping-bars in which the jaws are mounted, parts being broken away. Fig. 9 is a transverse section through one of the jaws and the clamping-bar in which it is seated as on line 9 9 of Fig. 8. Fig. 10 is a sectional view as on line 10 10 of Fig. 8. Fig. 11 is a rear view of the take-up or reel upon which the bundle is wound at the tail of the machine, parts being in section. Fig. 12 is a sectional view as on line 12 12 of Fig. 11. Fig. 13 is a sectional view as on line 13 13 of Fig. 11. Fig. 14 is an enlarged perspective view of the shuttle and a portion of the bar upon which it is mounted to slide, showing the shuttle in its normal position when traveling from one wire to another. Fig. 15 is a like view showing the shuttle dropped upon the wire so as to cause said wire to lie in the needle of the

shuttle preparatory to winding the woof-wire around the warp-wire of the fabric. Fig. 16 is an enlarged sectional view through the shuttle in its normal position. Fig. 17 is a sectional view through the shuttle as on line 17 17 of Fig. 16. Fig. 18 is a similar view showing by dotted lines the movement of parts. Fig. 19 is a perspective view in detail of the shuttle, parts being broken away to show arrangement and construction. Fig. 20 is a perspective view in detail of a portion of the driving-gear of the shuttle and the needle which receives motion from said gear. Figs. 21, 22, and 23 are perspective views in detail of a portion of the needle, showing the manner of carrying the bobbin and of wrapping it about the longitudinal wires of a fence. Fig. 24 is a fragmentary view in perspective of the spring-clutch forming a part of the gearing of the shuttle and controlling the rotation of the needle carried thereon. Fig. 25 is a sectional view as on line 25 25 of Fig. 4, through the adjustable fork which supports one of the sprocket-wheels which carry the chain for driving the shuttle, showing means for adjusting said fork to place the proper tension on said chain. Fig. 26 is a fragmentary view in detail of a portion of one of the angle-faced pulleys over which the chains carrying the rack-sections travel, showing the links of said chains and the rack-sections mounted thereon. Fig. 27 is a sectional view through the clutch mechanism as on line 27 27 of Fig. 15. Fig. 28 is a view, partly in section, of one of the rotary spiral coilers.

Referring to the characters of reference, 1 designates a suitable frame in which the mechanism is mounted. Passing through the frame transversely and journaled therein is the main shaft 2. Upon one of the projecting ends of said shaft is fixed the drive-pulley 3, adapted to carry the belt 4 by means of which the machine is driven from any suitable source of power. Upon the projecting ends of the shaft 2 adjacent the frame of the machine are the pinions 5, which are fixed thereon and mesh with the pinions 6, fixed to the short countershafts 7 and 8, journaled in opposite sides of the frame. Said shafts 7 and 8 extend through the frame and carry upon their inner ends the pinions 9 that mesh with like pinions 10, journaled in brackets 11, supported from the frame. These pinions 9 and 10 are of equal diameter, and each engages the teeth of an endless rack adapted to travel horizontally in suitable ways in the frame. The pinions 9 engage the upper side of the lower racks 12, while the pinions 10 engage the lower side of the upper racks 13. The racks 12, as will be seen on referring to Fig. 26, comprise short sections mounted upon the face of the flat links 14, united by a hinged joint 15, forming endless chains located on each side and extending longitudinally of the frame, said chains passing around the pulleys 16 and 17, respectively, mounted upon the transverse shafts 18 and 19, crossing the frame transversely and journaled at their opposite ends. These pulleys are provided with the angle-faces 20, upon which the flat links 14 are adapted to lie, and with the curved peripheral recesses 21, in which the rounded hinge 15 between the links is adapted to engage. These chains carrying the endless racks 12 are adapted to travel in the horizontal ways 22 and 23, mounted upon and projecting laterally from the inner face of the frame, whereby said chains are guarded in their travel and the racks carried thereby are held to their work. The upper racks 13 are in like manner mounted upon the flat links 24 of the upper chains, the links of which are united by the joints 25 and are adapted to pass around the pulleys 26, mounted upon shafts journaled at the front and rear of the machine, said pulleys having the angle-faces 27, upon which said links are adapted to lie and having the curved peripheral recesses 28, which receive the joints 25 of said links. The chain-links carrying the upper racks, like those carrying the lower racks, are adapted to travel in the ways 29 and 30, extending laterally from the inner face of the frame, whereby they are confined in place and directed in their work.

It will now be apparent that the lower racks 12 are driven through the pinions 9 and that the upper racks 13 are driven through the pinions 10 and that both of said racks are driven in unison and at equal speed. Extending between the links 14, which carry the racks 12, are the clamp-bars 31, whose opposite ends are secured to the faces of said links. These clamp-bars are provided with a channel 32 therein, (see Figs. 7 and 8,) in which are seated the movable jaws 33, between which the warp or longitudinal wires 34 of the fence or fabric are adapted to lie and are securely clamped as they pass into the machine. The jaws 33 are provided with reduced stems 35, which enter the channel 32 and which are provided with the laterally-projecting lugs 36, that engage the undercut channels 37 in the way 32, whereby said jaws are allowed to move longitudinally, but are held against being lifted from said way. To allow of the introduction of the jaws into said way, the clamp-bar at one end is provided with an enlargement 38 of the way 32 to accommodate the lugs 9, which enlargement communicates with the undercut channels 37, thereby enabling the jaws to be inserted in said bar.

To provide for clamping the wires between the jaws 33 in the clamp-bars, an antifriction-roller 39 is journaled in a fork 40, mounted upon the end of a reciprocatory rod 41, which passes through the end of said bar and carries upon its inner end a coiled spring 42, which is confined between a shoulder 43 on said bar and the face of the adjacent jaw 33, the inner end of said rod lying in a recess 44 in said

jaw. As the chains upon which the clamp-bars are mounted travel into the machine the antifriction-roller 39 passes into engagement with an inclined plate 45, leading from the end of one of the ways 22, which carry said chains, so that the rod 41 is crowded inwardly and caused to exert a great pressure upon the spring 42, whereby said spring is compressed and its tension is exerted against the adjacent jaw 33, and its compressing force imparted to the other jaws through the interposed wires, thereby firmly clamping said wires while they are passing through the machine, the tension of said spring being maintained by the contact of the roller 39 with the side 46 of the way 22 during the passage through the machine of said bar, which tension is released when the bar passes beyond the side 46 of said way after reaching the opposite end of the machine, thereby releasing the jaws and permitting the wires to pass therefrom. It will be understood that each of the clamp-bars is equipped in the manner above described and that the jaws in each of said bars will in turn clamp the wires which are fed into the machine and hold them in a clamped position, the tension upon the clamping-jaws being maintained during the passage of each bar through the machine, as will be understood. The clamp-bars being mounted upon the links 14 of the endless chains, said bars are successively presented at the front of the machine and pass rearwardly therethrough with the jaws clamping the wires, said bars returning upon the lower side to the forward end of the machine for a succeeding operation.

Mounted in the opposed brackets 47, which are secured to the links 24 of the upper chains, are the bars 51, upon which the shuttles 50 are mounted to slide longitudinally. These shuttles carry the rotary needles that weave the woof-wires onto the warp-wires as they pass through the machine, said shuttles being driven by means of sprocket-chains which pass over sprocket-wheels also supported by the brackets on the links 24 and receiving motion from a train of gears, as hereinafter stated. There will be as many of these shuttles in operation at a time as there are longitudinal or warp wires in the fence or fabric, and the machine will contain a sufficient number of shuttles to keep them constantly supplied at the feed end thereof, so as to make continuous the operation of weaving as the fabric passes therethrough, each shuttle arriving in turn at the starting-point in the operation of weaving and continuing said operation during its passage through the machine, so that all of the shuttles carried by the lower side of the chains are in simultaneous operation, while those carried by the upper side of said chains are returning to the point of starting for a succeeding operation.

The bars 51 are secured at their opposite ends in the brackets 47, carried by the links 24, by means of the set-screws 52, to enable said bars to be removed from the brackets for the purpose of placing the shuttles thereon. Each of the shuttles 50 is provided with a head 53, (see Figs. 14 and 15,) which receives the bar 51, upon which said head slides, as the shuttle travels transversely through the machine. The course described by each of the shuttles in its passage through the machine during the operation of the weaving is zigzag, as illustrated in Fig. 5, in which 54 designates a diagonal zigzag way in which the antifriction-roller 55, projecting from the head of the shuttle, engages and which directs the shuttle in its travel during the operation of weaving. It will be noted that in most fencing the bars or longitudinal wires are of greater distance apart at the top than at the bottom, and the bends or deflections, therefore, in the diagonal zigzag way 54 are arranged to accommodate this variation between the wires of the fence. It will also be noted that said way is composed of alternate straight and oblique portions, that the straight portions 56 are all of the same length, and that the oblique portions 57 vary in length as the space between the wires of the fence vary from the top to the bottom. It will also be observed that the straight portions 56 of said way are parallel with the direction of movement of the fabric through the machine, and with the warp-wires 34, while the oblique portions 57 are at an angle to said direction of movement and to said wires. As the antifriction-roller 55 of each of the shuttles enters the forward end of the way 54 said shuttles are brought into operative relation with the top wires of the fence, around which the bobbin carried by said shuttle is wound while said shuttle is traveling through the first straight portion of said way. After the bobbin has been wound around the top wire the shuttle is disengaged therefrom and is directed by the succeeding oblique portion of the way, after which the shuttle is again deflected to the succeeding or third wire of the fabric, and so on. The operation continues upon the passage of each shuttle through the machine, said shuttles starting in at the forward end of the machine upon the first wire, which for convenience we will term the "top" wire of the fence and ending upon the last or bottom wire before passing from engagement with the zigzag way. The shuttles follow each other in succession through the machine and those in operation work simultaneously, there being twelve shuttles in continuous operation when weaving a fence or fabric containing twelve bars, as shown in Fig. 5. It will be observed that the travel of the shuttles through the machine is at the same rate of speed as that of the travel of the fabric and that while the shuttles pass obliquely from one longitudinal wire to the other the bobbin which constitutes the woof-wire of the fabric is drawn

straight between the warp-wires, and that when finally completed each woof-wire is wound upon the warp-wires at right angles thereto and that said woof-wires constitute the vertical or stay wires of the fence.

To explain more fully the operation of the shuttle in the act of weaving the woof-wire upon the warp-wires of the fabric, reference will be had to Figs. 14 to 24, inclusive. To the head 53 of the shuttle are attached the depending sides 58, forming a way between which is mounted the vertically-movable needle-block 59. Also attached to said head is the laterally-projecting plate 60, which extends over the top of the movable block and carries the depending finger 61. Journaled in the block 59 is the shaft 62, which has loosely mounted upon the outer end thereof a sprocket-wheel 63. Formed integral with the hub of said wheel is a disk 64. Fixed to the shaft 62, adjacent to said disk, is a second disk 65. Mounted upon said shaft to slide thereon is a split clutch-collar 66, adapted to be normally held against the fixed disk 65 by means of the coiled spring 67. In the split collar is a fixed pin 68, (see Fig. 24,) which passes through an opening in the disk 65 and is adapted to enter one of the apertures 69 in the disk 64 on the hub of the sprocket-wheel, whereby said wheel becomes locked to the shaft and will cause the shaft to rotate therewith. When the split collar is moved away from the disk 65, so as to withdraw the pin from one of the apertures in the disk 64, the sprocket-wheel becomes loose on the shaft and may be rotated without imparting movement thereto. Within the center of the vertically-movable block 59 is a recess or chamber 70. Fixed to the shaft 62 within said recess is a mutilated gear-wheel 71, having in one face thereof a camway 72, (see Fig. 20,) having an eccentric portion 73. Journaled between the brackets 74, on the rear face of the vertically-movable block, is the bell-crank lever 75, carrying upon the inwardly-projecting arm 76 thereof a roller 77, which travels in said camway and is adapted to be actuated by the eccentric portion 73 as the gear-wheel 71 is rotated to operate the lever 75 for purposes hereinafter described. The lower end of the lever 75 is bifurcated, as at 78, and journaled in the sides of said forked portion are the bearing-lugs 79, which lie in the annular channel 80 in the periphery of the needle 81, forming a connection between the needle and lever, which allows said needle to rotate. Upon the periphery of the needle are formed the longitudinally-extending gear-teeth 82, which mesh with the teeth of the gear 71, by means of which an intermittent rotary movement is imparted to said needle. The needle 81 is supported to rotate within the lower portion of the vertically-movable block 59 and is hollow from end to end thereof, being provided with an open channel 83 in its under face adapted to allow the warp-wire to enter and lie in said needle when the needle drops thereon preparatory to winding the bobbin-wire therearound.

The vertical movement which is imparted to the block 59, whereby the needle is dropped onto the longitudinal wire and is raised therefrom, is controlled by certain mechanical devices carried in said block and mounted on the plate 60, projecting from the head of the shuttle.

The movable block 59 is held locked in the raised position by means of a locking-arm 84, pivoted at 85 to the plate 60 and carrying upon its opposite end a block 86, (see Fig. 19,) having a projecting plunger 87, which enters and reciprocates in a housing 88, the end of which carries a coiled spring 89, which is confined between the wall of the housing and the enlarged portion of said plunger, whereby the tension of the spring 89 is exerted to crowd the arm 84 over into contact with the pin 90, which passes freely through the plate 60 and the top of the block 59 and is seated at its lower end in the rectangular frame 91, which occupies a portion of the space of the chamber 70 within said block adjacent to the gear-wheel 71. Within the side of said pin is formed a notch, as clearly shown at 92 in Fig. 17, in which the pivoted locking-arm 84 is adapted to engage when the vertically-movable block carrying the needle is raised to the normal position, as shown in Fig. 14, in which position said parts are supported wholly by engagement of the arm 84 with said pin 90. Projecting from the housing 88 and extending across the locking-arm 84 is a guard 88^a, which serves to confine said arm in place while allowing the necessary movement thereof. To provide for disengaging the arm 80 from said pin in order to allow the block to drop, so as to enable the needle to embrace the longitudinal wire of the fabric, a lug 93 is secured to the face of the bar 51, so as to project into the path of the upper end of the latch-bolt 94, which is mounted in the upper end of the block 59 upon the pivoted arm 95, carrying at its free end a vertical housing 96, in which the latch-bolt 94 is seated. The lower end of said bolt within said housing is reduced and carries a coiled spring 97, which returns said bolt after being depressed. Attached to the arm 95 is a projecting finger 98, carrying a coiled spring 99, confined in a recess in the upper end of the block 59 and whose tension is normally exerted to swing the arm 95 so as to maintain the latch-bolt 94 pressed forward in the opening through the plate 60, in which it reciprocates. By means of this arrangement as the shuttle is moved along the bar 51 the latch-bolt 94 will strike the lug 93, when said bolt will be forced back against the block 86 and move said block against the action of the spring 89 to carry the arm 84 free from the notch in the pin 90, when said pin will be released and will allow

the block 59 to drop to the limit of its downward movement, which downward movement is arrested by the vertically-movable bolt 100, which is secured at its lower end to the brackets 74, mounted on the face of the block 59, and which passes through the head 53 into the recess 101 in the upper end thereof, the upper end of said bolt being secured in the arm 102, which projects laterally from the recess 101 and carries the depending fork 103 at its outer end adapted to embrace the lug 93 to lock the shuttle from movement while the needle is in the weaving position upon the wire, which position of parts is illustrated in Fig. 15. When in position upon the longitudinal wire 34, the needle is rotated to wind the stay or woof wire thereon, as hereinafter explained, after which the needle is raised from the wire, so as to enable the shuttle to pass to the succeeding wire of the fabric. The rotation of the needle is accomplished through the gear-wheel 71, mounted upon the shaft 62, which, as before explained, is driven through the medium of the clutch connected with the sprocket-wheel 63. Said sprocket-wheel is continuously rotated while the shuttle is passed through the machine by means of the sprocket-chain 104, which is held in contact with said sprocket-wheel by the idle rollers 105, journaled in the outer ends of the cross-bar 106, mounted on said shaft adjacent said sprocket-wheel, said chain being driven by suitable gearing hereinafter explained. When the block 59, carrying the needle and its driving mechanism, drops so as to place the needle upon the wire, the clutch-collar 66 passes from engagement with the finger 61, allowing the spring 67 to throw the pin 68, carried by said collar, through the aperture in the disk 65 and into one of the apertures 69 in the disk 64, thereby locking the disks 65 and 64 together and causing the shaft 62 to turn with the sprocket-wheel 63. This rotation of the shaft turns the gear-wheel 71 and imparts a rotary movement to the needle, whereby the bobbin carried by said shuttle is caused to wrap around the wire 34. Projecting from the face of the gear-wheel 71 is an antifriction-roller 107, which extends into the frame 91, in which the pin 90 is seated, so that as the gear rotates said roller is carried into contact with the upper side of said frame, which is raised thereby, as shown in Fig. 18 and by dotted lines in Fig. 17. This vertical movement of said frame carries the notch 92 in the pin 91 into the path of the locking-arm 84, which springs into said notch and locks said frame in the raised position. This movement brings the lower side of the frame 91 into the path of the roller 107, so that a further rotation of the gear-wheel 71 will cause said roller to engage the bottom of said frame, and thereby raise the block 59, carrying the needle and its operative mechanism. The vertical movement of the needle raises it from the wire 34 after it has completed the winding of the bobbin thereon, and to prevent a further rotation of the needle the upward movement of said block carries the clutch-collar 66 into engagement with the finger 61, whereby the rotary movement of said collar will cause said finger to wedge between it and said disk 65, as clearly shown in Fig. 14, withdrawing the pin from one of the apertures 69 in the disk 64, when the shaft 62 will cease to rotate and the gear 63 will run idly thereon, in which condition the parts remain while the shuttle is passing from one wire to the other in its travel through the zigzag way 54, as before explained. It will be noted that as the block 59 is raised by the operation just described the bolt 100 is moved vertically through the head of the shuttle, raising the arm 102 and carrying its fork from engagement with the lug 93, whereby the shuttle is rendered free to continue its travel along the bar 51. When a succeeding wire is reached in the passage of the shuttle, the latch 86 will again be tripped by contact of the succeeding lug 93, (there being as many of said lugs upon the shuttle-bar as there are longitudinal wires in the fabric,) when the block will again fall so as to place the shuttle upon said wire and disengage the clutch-collar to again impart movement to the shuttle through the gear-wheel, as before described, which operation is repeated at each of the longitudinal wires in the fabric by each of the shuttles in its passage through the machine.

It will be noted that the gear-wheel 71 carries a wide tooth 108 and that the teeth are omitted from a portion of its periphery, as shown at 109, and instead of gear-teeth a bearing-flange 110 is substituted, (see Fig. 16,) which is adapted to have bearing on the periphery of the shuttle at a point where the gear-teeth 82 are cut away. The purpose of this arrangement is to provide against rotation of the shuttle at the time when it is being raised from the wire after having wound the bobbin thereon, the parts being so associated that the needle ceases its rotation at the time the roller 107, carried by the gear-wheel 71, engages the upper side of the frame 91 to raise the block carrying the needle, so that the rotary movement of said gear-wheel necessary to raise said parts does not impart at that time a rotation to the needle. As each of the shuttles in turn enters the machine to assume an operative position therein the needle of each shuttle is supplied with a coiled bobbin of wire 111. (See Fig. 21.) There is sufficient wire in the bobbin to constitute the stay or woof wire to be woven into the fabric, and said wire is formed into a coil, as shown, which is mounted upon the end of the needle by securing the end of the coil under the hook 112, carried at the forward end of the needle and fastened in place by the screw 113.

In wrapping the bobbin or stay wire around the longitudinal wires of the fabric it is de-

sirable to cross the wrapped strands in order to prevent the wrapped portion from extending too far along the longitudinal wire and to produce in the wrapped portion more of a compact appearance in the form of a knot. This result is accomplished by giving to the needle a longitudinal reciprocatory movement while it is revolving in the operation of wrapping the bobbin-wire onto the longitudinal wire. The desired movement is imparted to said needle through the operation of the bell-crank lever 75, as before described, and illustrated in Figs. 21, 22, and 23. When one wrap around the longitudinal wire has been accomplished, as shown in Fig. 21, the lever 75 is actuated by contact of the roller 77 with the eccentric portion 73 in the gear-wheel 71 to depress the end carrying said roller and to swing outwardly the bifurcated end, as shown in Fig. 22, which movement shifts the needle longitudinally and causes the strand of the bobbin to cross over the strand already wound upon the wire 34 and to cross back over said strand as the lever 75 is returned by the passage of the roller 77 from the eccentric portion 73 of the camway, forming a knotted wrap around the longitudinal wire, as shown at 114 in Fig. 23, in which view the needle is shown raised from the wire after forming the wrap preparatory to passing to the succeeding wire.

Motion is imparted to the endless chain 104, which operates the shuttle, by means of a train of gears (shown in Fig. 6) and carried by one of the brackets 47, which are mounted on the links of the chain 24. This gearing comprises a pinion 115, adapted to mesh with a stationary rack 116, mounted on the side of the frame. Fixed to said pinion is a beveled gear 117, which meshes with a like gear 118, carrying a gear-wheel 119. Said pinion and gear-wheels are mounted upon an angle-shaft 120, supported in the bracket 47 and in the upright 121, carried by the shuttle-bar 51. With the gear-wheel 119 meshes a pinion 122, fixed to the shaft 123, which is also supported in said upright 121 and in the upright 124. Upon the shaft 123 is a sprocket-wheel 125, over which passes the endless chain 104. The opposite end of said chain is carried by a sprocket-wheel 126, journaled in a fork 127, carried by a square stem 123, (see Fig. 25,) which slides in a suitable support 129, carried by each of the brackets 47 on the links of the opposite chain 24. The end of said stem which projects through said support is threaded and receives the hand-wheel 130, whereby said stem may be drawn upon to place the requisite tension upon the chain 104.

As the shuttles are carried into the machine by the endless chains or carriers upon which they are mounted the pinion 115, carried by the brackets supporting each of the shuttle-bars 51, will pass into engagement with the stationary rack 116, whereby movement is imparted to each of the shuttle-actuating chains as soon as the shuttle enters into operative position in the machine, which relation continues as long as said pinion remains in engagement with said rack or until each of the shuttle-bars by the travel of the chains upon which they are mounted passes the rear of the machine and over the rear rollers 26 preparatory to their return upon the upper side of the chains 24 into working position. In order to slide each of the shuttles to the opposite end of its supporting-bars to that which it occupied when passing from the machine, so as to bring the shuttles into position to again enter the forward end of the zigzag way 54, the oblique guideway 131 is employed, which is mounted upon the top of the machine and provided with a flaring end 132, into which the antifriction-roller 55, carried on the sliding head of each of the shuttles, is directed as said shuttles come to the top of the machine on the return side of the chains, whereby each of the shuttles in turn is caused to slide back across its supporting-bar as it travels from the rear to the forward end of the machine, as clearly illustrated in Fig. 6, so that the shuttles are successively presented in line with the initial end of the zigzag way 54.

When the shuttles are returned into position for a succeeding operation, the needle-block 59 is raised and the latch-bolt 94 is in its elevated position in the path of the lugs 93 upon the shuttle-bar. In order to allow the latch-bolt to pass those lugs, its upper end is beveled, as shown, and its reduced lower end is surrounded by a coiled spring 97, (see Fig. 19,) which normally supports said bolt in its raised position, but which will yield to permit of the depression of said bolt when passing the lugs 93.

In order to give the requisite longitudinal elasticity to the fence or fabric after it is woven, the warp or longitudinal wires as they are fed into the machine are spirally crimped. This spiral crimping of the wires is accomplished by passing them between the staggered rollers 133, journaled in a rotary arm 134, carried by a hollow shaft 135, journaled in a supporting-block 136 and carrying on its outer end a worm-gear 137, which meshes with the worm-shaft 138, journaled at its opposite ends in suitable bearings at the forward end of the frame and carrying at one end a beveled pinion 139, which meshes with a beveled gear 140 on the shaft 141, journaled at the side of the frame and carrying a beveled pinion 142, which meshes with the beveled gear-wheel 143 on the end of the main shaft 2, whereby the requisite rotary motion is imparted to the worm-shaft to rotate the arm 134 about a center concentric with the shaft 135, imparting the requisite spiral crimp to wires before passing into the machine. To provide for taking up the woven fabric at the rear of the machine and forming it into a bundle, there is employed at the discharge end of the machine a transverse

shaft 144, journaled in suitable bearings and carrying upon its outer end a sprocket-wheel 145, over which passes an endless chain 146, leading from a small sprocket-wheel 147 on the outer end of the counter-shaft 8, whereby movement is imparted to the shaft 144. Fixed to said shaft at one end is the pinion 148. Journaled upon the opposite ends of the shaft 144 are the laterally-extending arms 149, between the ends of which are journaled the sectional drums 150. Passing through the ends of one of said arms are the short shafts 151, which are adapted to move longitudinally and which carry the gear-wheels 152 loose thereon. Also mounted upon the said short shafts 151 are the friction-disks 153, adjacent the inner face of the gear-wheels 152. The hubs 154 of said friction-disks serve as sockets in which the reduced ends 155 of the slats which form said drums are secured. The inner end of each of the shafts 151 is secured in the hub of the disk 153; but said hub is permitted to turn thereon, as clearly shown in Fig. 13. The slats 156, which form the drums, are supported at their opposite ends in an embracing socket 157, in which is swiveled the inner end of the screw 158, which is threaded in the end of the arm 149 and has a square end 159 projecting therefrom, adapted to be engaged by a spring-detent 160 to lock the screw against rotation. By disengaging the detent the screw may be turned to draw the socket 157 off of the ends of the slats and release them, so that the bundle may be dropped after being completed.

The gear-wheels 152 mesh with the pinion 148, fixed to the shaft 144, whereby a rotary movement is imparted to said gear-wheels, which is in turn transmitted to the disks 153 and to the respective drums. It will be observed that the contact between the gear-wheels and the disks 153 is purely frictional, the degree of friction being determined by the hand-wheel 161, which screws onto the projecting end of the shaft 151 against the coiled spring 162, interposed between said hand-wheel and the face of the arm 149 through which the shaft passes, whereby the tension of said spring is exerted to hold the friction-disk 153 against the face of the gear-wheels 152 with such force as to cause said disks and the drums mounted in the hubs thereon to turn with said gears.

It is designed that the shaft 144 shall be driven at such speed as to turn the gears 152 faster than will be necessary in order to wind the fabric upon the drums as fast as it passes from the machine. The purpose of this is to always keep the fabric taut as it is being wound into a bundle, at the same time providing for a slip between the frictional faces of the disks and gears to prevent an undue strain upon the wires should the gradually-increasing size of the bundle tend to draw with too much force upon the fabric, obviating the breaking of the gearing or driving mechanism.

The arms 149, which carry the drums, are balanced upon the shaft 144, so that when one drum becomes filled it is swung downwardly by a rotary movement of said arm and the empty drum brought into position to receive the run of fabric, thereby obviating the necessity of stopping the machine when a bundle becomes filled or completed. Each of the drums is provided with a series of hooks 163, which engage the longitudinal wires of the fabric, so that the fabric may be rolled onto the drum as the drum is rotated. The arms 149 will be locked by suitable means (not shown) to prevent them from turning while the fabric is being wound onto the drums.

It will now be understood that by means of the machine shown and described the operation of weaving the wire fabric is made continuous by means of the endless carriers upon which the shuttles are mounted, whereby the shuttles after their passage through the machine, wherein each is caused to wrap the woof-wire transversely of the warp-wires of the fabric, are returned automatically to the point of starting in position to again take up in turn the work of weaving an additional strand into the fabric as it passes through the machine. This continuous operation of weaving wherein a number of shuttles are simultaneously employed renders the loom very rapid, enabling it to produce a greatly-increased product over the intermittently-operated looms in common use.

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

1. In a loom for weaving wire fabric, the combination with the means for feeding the longitudinal wires continuously into the machine, of the longitudinally and transversely movable shuttles adapted to weave the transverse wires onto said longitudinal wires, and means for driving said shuttles.

2. In a loom for weaving wire fabric, the combination with the means for feeding the longitudinal wires continuously through the machine, of the shuttles carrying the bobbins which form the transverse wires, means for carrying said shuttles through the machine coincident with the movement of the fabric, means for moving the shuttles transversely of the fabric across the longitudinal wires, and means for driving said shuttles to cause them to wrap the transverse wires around the longitudinal wires.

3. In a machine for weaving wire fabric, the combination with means for carrying the longitudinal wires through the machine, of means for successively introducing the cross-wires into the machine and stringing them transversely of the longitudinal wires, and means

for wrapping the transverse wires around the longitudinal wires while said longitudinal wires are moving through the machine.

4. In a machine for the purpose set forth, the combination with the continuously-moving clamp-bars having jaws for clamping the longitudinal wires, of the shuttles adapted to move longitudinal with the movement of the fabric and to cross the fabric transversely, said shuttles being adapted to wrap the transverse wires around the longitudinal wires between said clamp-bars during the continuous passage of the fabric through the machine.

5. In a machine for weaving wire fabric, the combination with the continuously-moving endless carriers adapted to engage and carry the longitudinal wires through the machine, of the continuously-moving endless carriers carrying the shuttles traveling in unison with the carriers which carry the wires, means for directing the shuttles to the longitudinal wires in succession as said wires and shuttles pass through the machine, and means forming a part of each shuttle for wrapping the transverse wires, carried by the shuttles, around each of the longitudinal wires to form the woven fabric.

6. In a machine for the purpose set forth, the combination with the continuously-moving carriers having means for conveying the longitudinal wires into the machine, a series of shuttle-bars also mounted upon continuously-moving carriers, shuttles adapted to slide upon said bars, each of said shuttles having a rotary needle adapted to carry and wrap the transverse wire around the longitudinal wires, means for directing the shuttles to each of the longitudinal wires during the passage thereof through the machine, and means for returning each of the shuttles to its initial position at the forward end of the machine.

7. In a machine for the purpose set forth, the combination with the simultaneous movable upper and lower endless racks, means for driving said racks, clamps adapted to engage the longitudinal wires attached to and traveling with said lower racks whereby said wires are carried into the machine, shuttle-bars attached to and moving with the upper racks, shuttles adapted to carry the lateral wires mounted to slide upon said bars, means for causing said shuttles to successively engage each of the longitudinal wires and wrap the transverse wires therearound, and means for returning each of the shuttles to the initial position at the forward end of the machine.

8. In a machine for the purpose set forth, the combination with the continuously-movable carriers adapted to convey the longitudinal wires into the machine, of a series of shuttles movable through the machine with said wires, a zigzag way adapted to direct said shuttles to each of said longitudinal wires during their passage through the machine and to present the needles of said shuttles over each of said wires, means for operating the shuttles and driving their needles to wrap the lateral wires around the longitudinal wires, and means for returning each of the shuttles to its initial position at the forward end of the machine.

9. In a machine for the purpose set forth, the combination with the superimposed carriers, of the means for driving said carriers, the lower carriers having means for clamping and conveying the longitudinal wires into the machine, the upper of said carriers carrying the transverse wires and the means for weaving said transverse wires with said longitudinal wires, means also carried by the upper carriers for operating the weaving device whereby said wires are woven into an integral fabric in their passage through the machine.

10. In a machine for weaving wire fabric, the combination with the endless carriers comprising hinged rack-sections adapted to pass around supporting-pulleys, a pinion engaging said rack-sections for driving them, clamping-bars extending between said racks and secured thereto, movable clamping-jaws in said bars adapted to receive the longitudinal wires between them, means for compressing said jaws to clamp said wires as they are fed into the machine, and means for weaving the lateral wires upon the longitudinal wires between said clamping-bars.

11. In a machine for the purpose set forth, the combination with the means for carrying the longitudinal wires into the machine, of a series of shuttles adapted to travel longitudinally of the machine with said wires and transversely thereof, each of said shuttles carrying a rotary needle adapted to embrace the longitudinal wires and wrap the transverse wires thereon, means for dropping said needle onto the longitudinal wires and raising it therefrom, and means for rotating said needles when embracing said wires.

12. In a machine for the purpose set forth, the combination with a traveling conveyer adapted to engage and carry the warp-wires into the machine, of a shuttle adapted to move into the machine with said wires and to cross the machine diagonally in its passage therethrough, said shuttle having a rotary needle adapted to embrace said warp-wires and carrying the woof-wire, means for dropping said needle upon each of the warp-wires and rotating it in that position to wrap the woof-wire therearound, means for raising the needle successively from each of the warp-wires preparatory to its passage to the succeeding wire, and means for rotating said needle only when embracing a warp-wire of the fabric.

13. In a machine for weaving wire fabric, the combination with the means for carrying the warp-wires into the machine, of a shuttle adapted to move longitudinally through the machine with said wires and to cross the machine transversely during said longitudinal movement, a rotary needle in said shuttle,

means for lowering and raising said needle and imparting an intermittent rotation thereto.

14. In a machine for the purpose set forth, the combination with the means for conveying the warp-wires into the machine, of a shuttle adapted to travel longitudinally through the machine with said wires and transversely thereof during said longitudinal movement, means for moving the shuttle longitudinally and transversely of the machine, said shuttle having a rotary needle adapted to embrace the warp-wires, means for successively dropping the needle onto said wires and raising it therefrom, a rotary shaft for operating said needle, a drive-wheel upon said shaft, an endless driving agent passing over said wheel, supporting-pulleys at its opposite ends, one of said pulleys being connnected with suitable driving-gears whereby motion is imparted to said driving agent.

15. In a machine for the purpose set forth, the combination with the means for carrying the warp-wires into the machine, of a traveling shuttle for weaving the woof-wires onto the warp-wires, said shuttle having a rotary needle adapted to carry the woof-wire in the form of a bobbin and to embrace the warp-wire when winding the bobbin thereon, means for lowering and raising said needle and means for imparting a rotary movement and a simultaneous longitudinal reciprocation thereto.

16. In a machine for weaving wire fabric, the combination with the means of carrying the warp-wires into the machine, of the traveling shuttle adapted to carry the woof-wire, said shuttle having a rotary needle adapted to wind the woof-wire around the warp-wires, a rotary shaft in the shuttle for driving the needle, a driving-wheel upon said shaft, an endless driver passing over said wheel, wheels supporting the ends of the said endless driver, a traveling pinion geared to one of said wheels, and a stationary rack in the path of said pinion.

17. In a machine for weaving wire fabric, the combination with the means for carrying the warp-wires into the machine, of the endless conveyer carrying the shuttle-bars, shuttles mounted to slide upon said bars, a rotary needle in each shuttle adapted to carry the bobbin which forms the woof-wire and to wind said bobbin around the warp-wires, means for raising and lowering the needle to enable it to successively pass between and engage the warp-wires, means for holding the needle in the raised position, a trip for disengaging said needle-holding means to allow the needle to fall, and a series of lugs upon the shuttle-bar adapted to successively engage said trip as the shuttle moves along said bar.

18. In a machine for weaving wire fabric, the combination with the means for feeding the warp-wires into the machine, of a shuttle adapted to move longitudinally with the warp-wires and to travel transversely of the machine across said wires, a vertically-movable needle-block in said shuttle, a needle journaled at the lower end of said block having a longitudinal channel for the reception of the warp-wires, means for raising the needle-block to carry the needle above the warp-wires, means for causing the needle-block to drop at predetermined intervals to place the needle upon each of the warp-wires, means for rotating the needle in that position and means for preventing the rotation of the needle when in a raised position.

19. In a machine for weaving wire fabric, the combination with the means for carrying the warp-wires into the machine, of a shuttle adapted to travel longitudinally of the machine and transversely of the warp-wires, a vertically-movable needle-block in said shuttle, a rotary needle in said block adapted to carry a bobbin forming the woof-wire and to weave said bobbin upon the warp-wires, a shaft journaled in the needle-block for driving said needle, a driving-pulley upon said shaft, a clutch interposed between the pulley and the needle and means for automatically disengaging said clutch when the needle-block is raised and engaging the clutch when the needle-block falls.

20. In a machine for weaving wire fabric, the combination with the means for carrying the warp-wires into the machine, of a shuttle-bar extending transversely of the machine, movable carriers attached to the ends of said bar for conveying it through the machine, a shuttle mounted to slide upon said bar, a movable needle-block in said shuttle, a rotary needle in the needle-block adapted to carry the woof-wire in the form of a bobbin and to wrap said woof-wire around the warp-wires as the shuttle travels through the machine, a shaft journaled in the needle-block for driving said needle, a sprocket-wheel on said shaft, an endless chain passing over one side of said wheel, sprocket-wheels carrying the ends of said chain mounted upon brackets supported by the movable carriers carrying the ends of the shuttle-bar, means for driving said chain to rotate the gear-wheel on the shuttle-shaft, as the shuttle moves through the machine, and means for taking up the slack of said driving-chain.

21. In a machine for the purpose set forth, the combination with the means for carrying the warp-wires into the machine, of a movable shuttle adapted to travel across said wires, said shuttle carrying a rotary needle, means for raising and lowering said needle, means for rotating said needle intermittently and means for reciprocating the needle longitudinally during its period of rotation.

22. In a machine for weaving wire fabric, the combination of a shuttle adapted to travel with the fabric, a vertically-movable needle

in said shuttle and means for imparting an intermittent rotation to said needle.

23. The combination in a machine for weaving wire fabric, of a take-up or reel at the tail of the machine comprising lateral arms journaled upon a shaft, drums journaled in the ends of said arms, friction-disks on the ends of said drums, gear-wheels mounted contiguous thereto, a pinion on the shaft meshing with said gear-wheels, and means for crowding said gear-wheels and disks together to impart motion to said drums through said gears.

24. In a machine for the purpose set forth, the combination with the movable clamp-bars, jaws carried by said bars for clamping the longitudinal wires, shuttles disposed between said clamp-bars adapted to move longitudinally with the fabric and to cross the fabric transversely, said shuttles being adapted to wrap the transverse wires around the longitudinal wires between said clamp-bars.

25. In a loom for weaving wire fabric, the combination with the means for feeding the longitudinal wires through the machine, of the shuttles carrying the bobbins which form the transverse wires, means for carrying said shuttles through the machine coincident with the movement of the fabric and for simultaneously moving the shuttles transversely of the longitudinal wires, and means for driving said shuttles to cause them to wrap the transverse wires around the longitudinal wires.

26. In a machine for weaving wire fabric, the combination with means for feeding the longitudinal wires into the machine, of a shuttle-bar adapted to travel with the longitudinal wires, a shuttle adapted to travel upon said bar, said shuttle having a rotary needle adapted to carry and wrap the transverse wire around the longitudinal wires, means for directing the shuttle along said bar to each of said longitudinal wires, means for driving the shuttle to wrap the transverse wire around each of the longitudinal wires, and means for returning the shuttle to its initial position at the forward end of the machine.

27. In a machine for weaving wire fabric, the combination with the means for carrying the warp-wires into the machine, of a shuttle adapted to move through the machine with said wires and to cross the machine transversely, a rotary needle in said shuttle, means for lowering and raising said needle, and means for imparting rotation thereto.

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

JAMES W. SNEDEKER.

Witnesses:
GEO. L. BENNETT,
L. M. WHITMORE.