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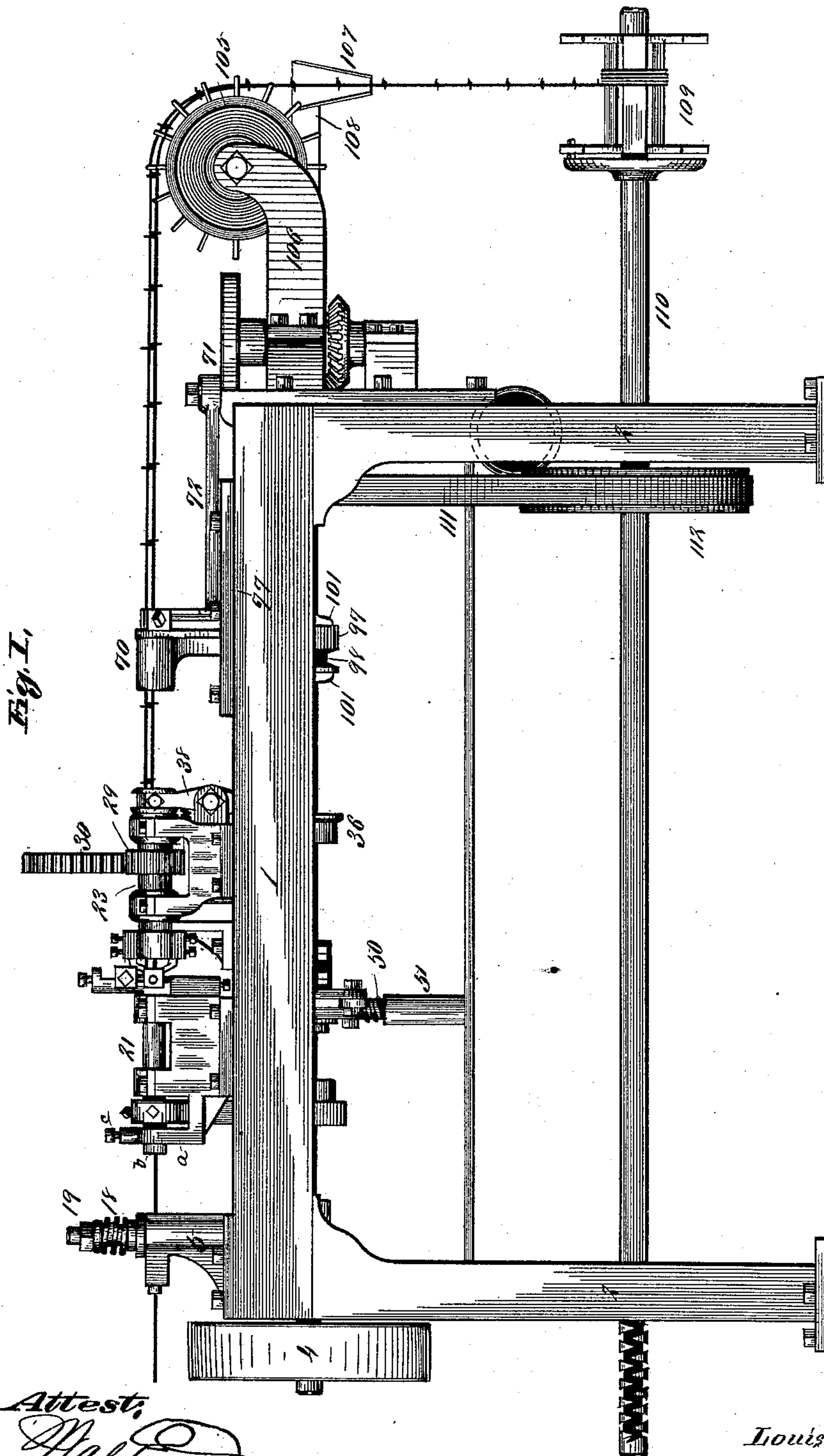
11 Sheets—Sheet 1.

L. J. CRECELIUS.

BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest:
Walter M. Alderson
F. L. Middleton

Inventor:
Louis J. Crecelius.
By *Ellis Spear*
att'y.

(No Model.)

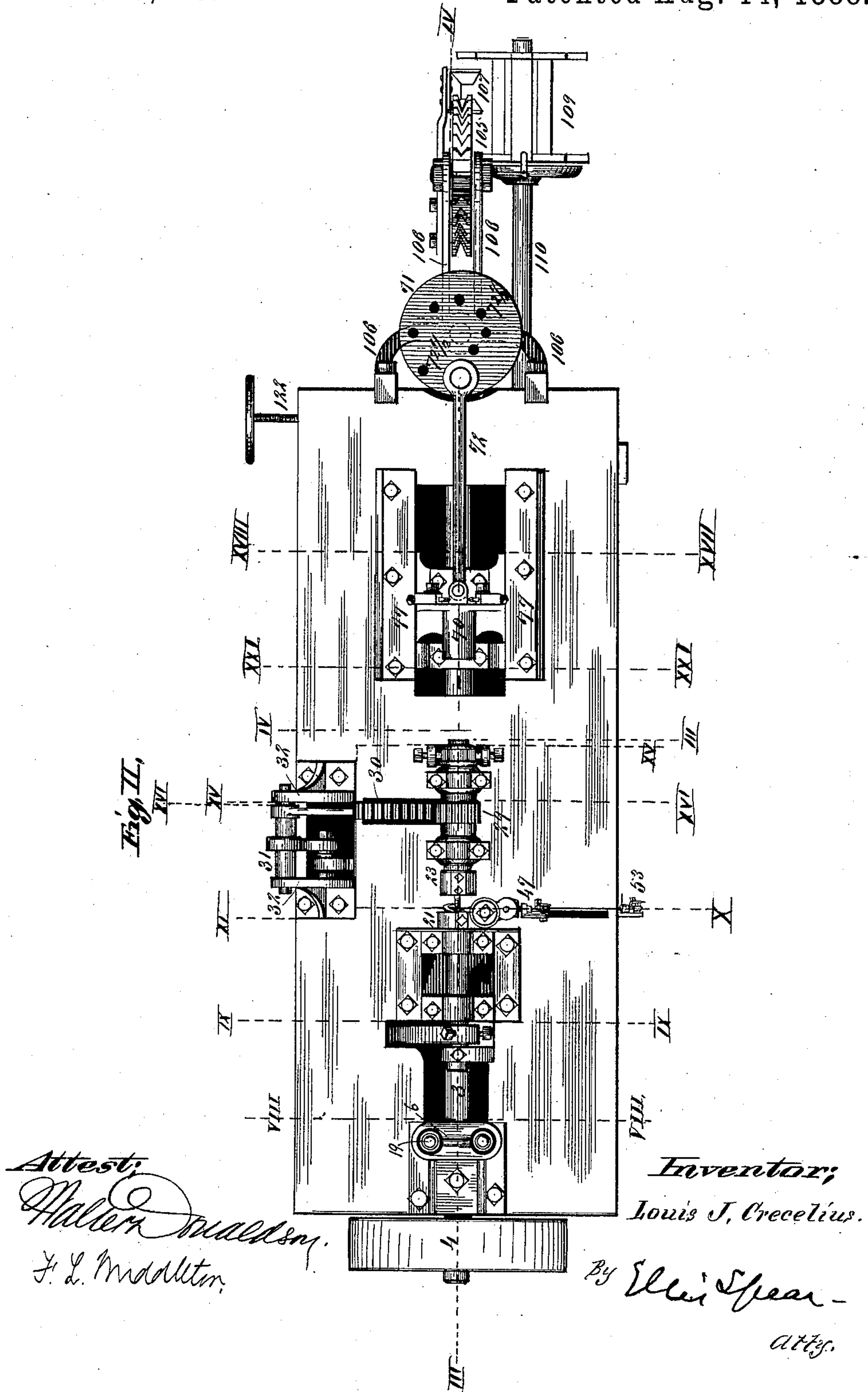
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BARB WIRE MACHINE.

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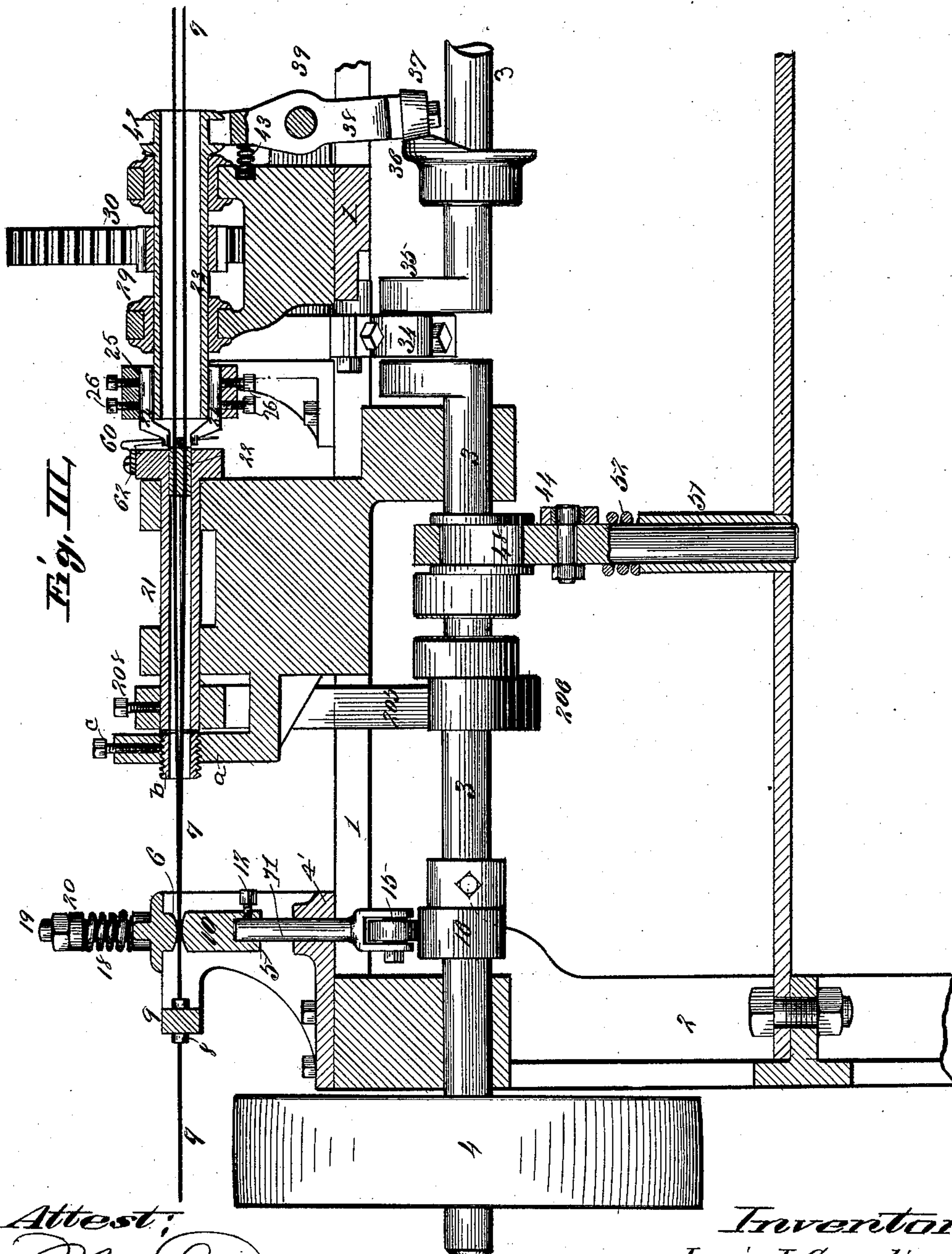
11 Sheets—Sheet 3.

L. J. CRECELIUS.

BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest:
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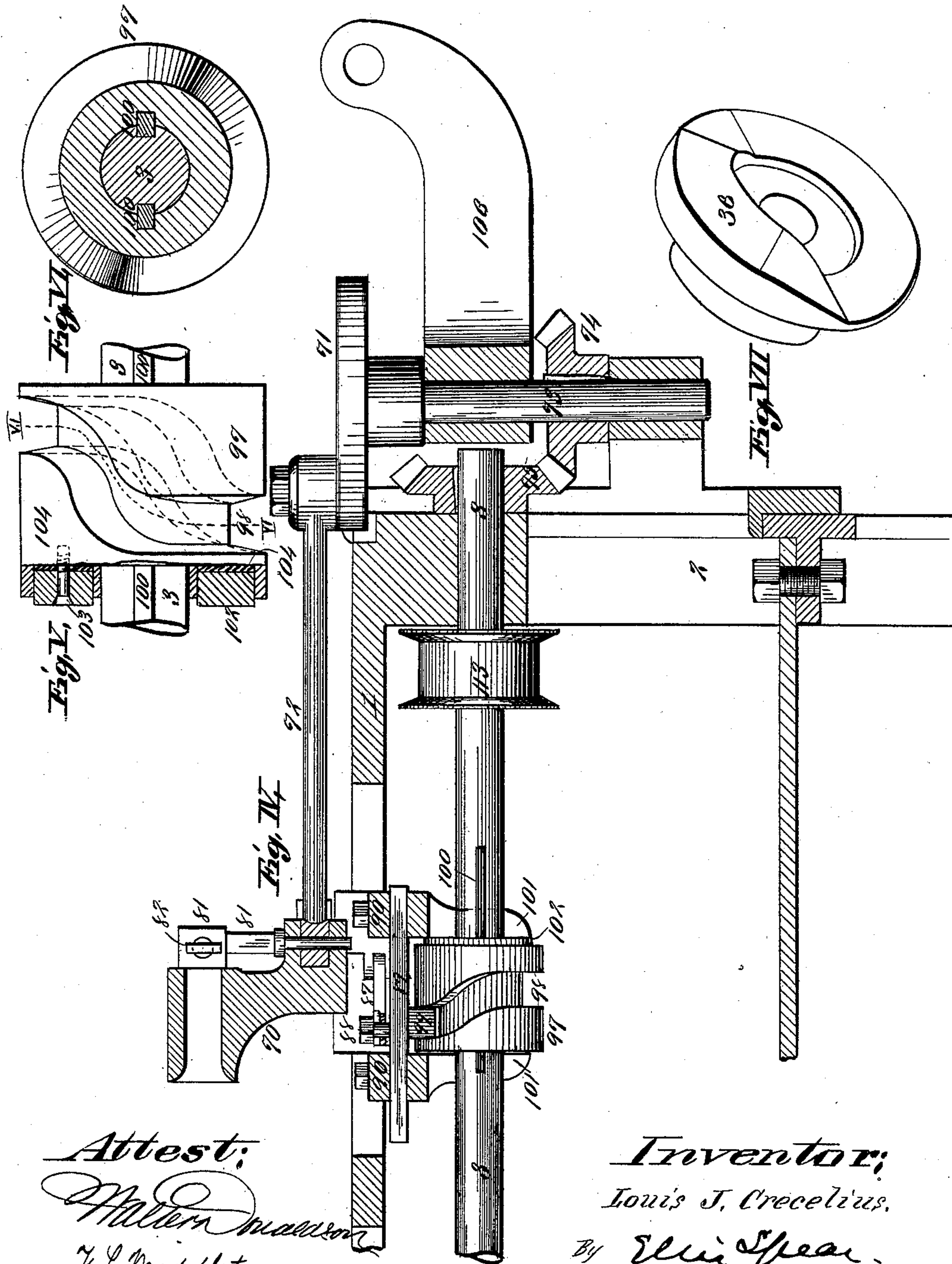
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11 Sheets—Sheet 4.

L. J. CRECELIUS.
BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest:
Walter Madison
F. L. Middleton.

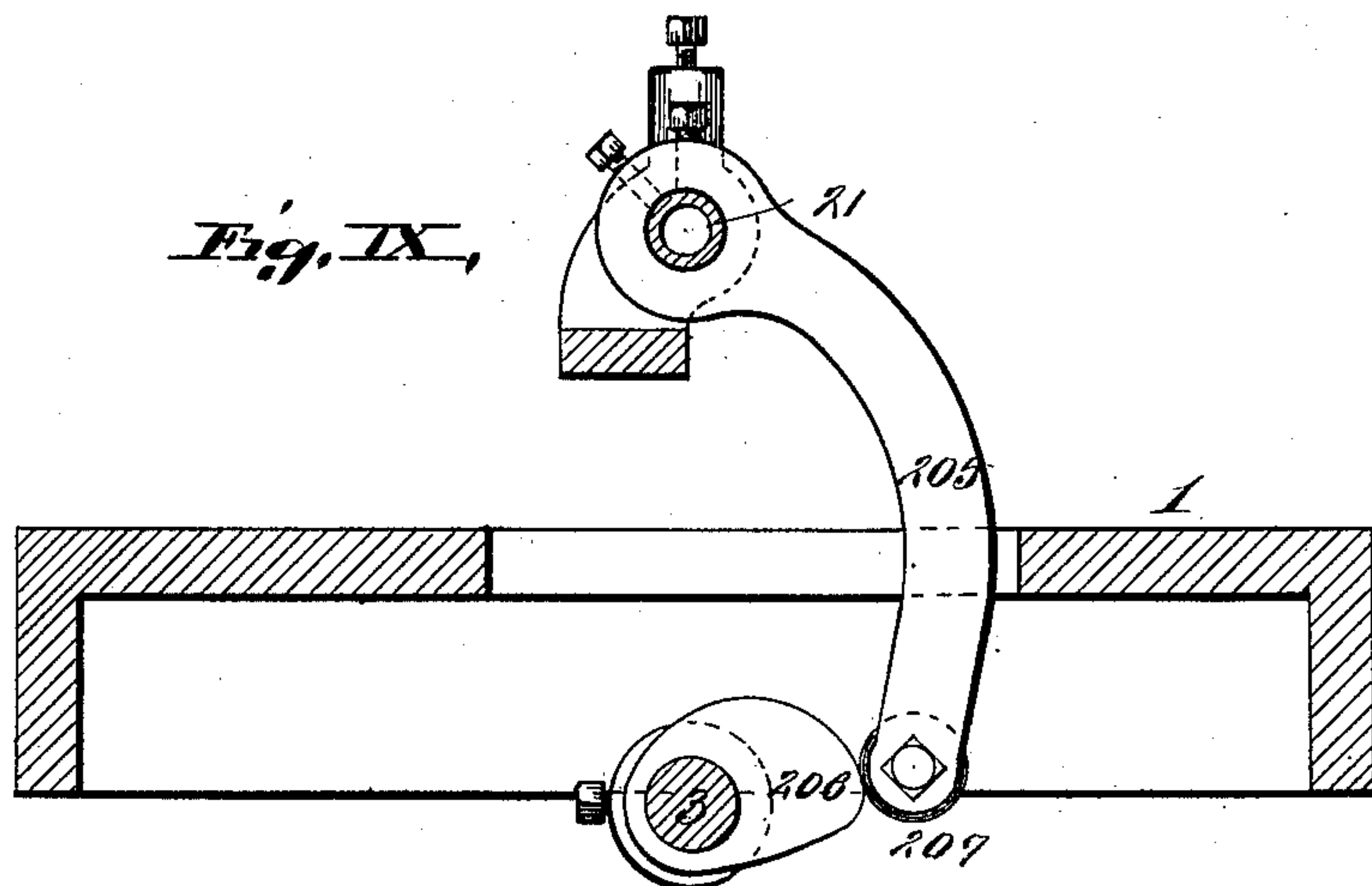
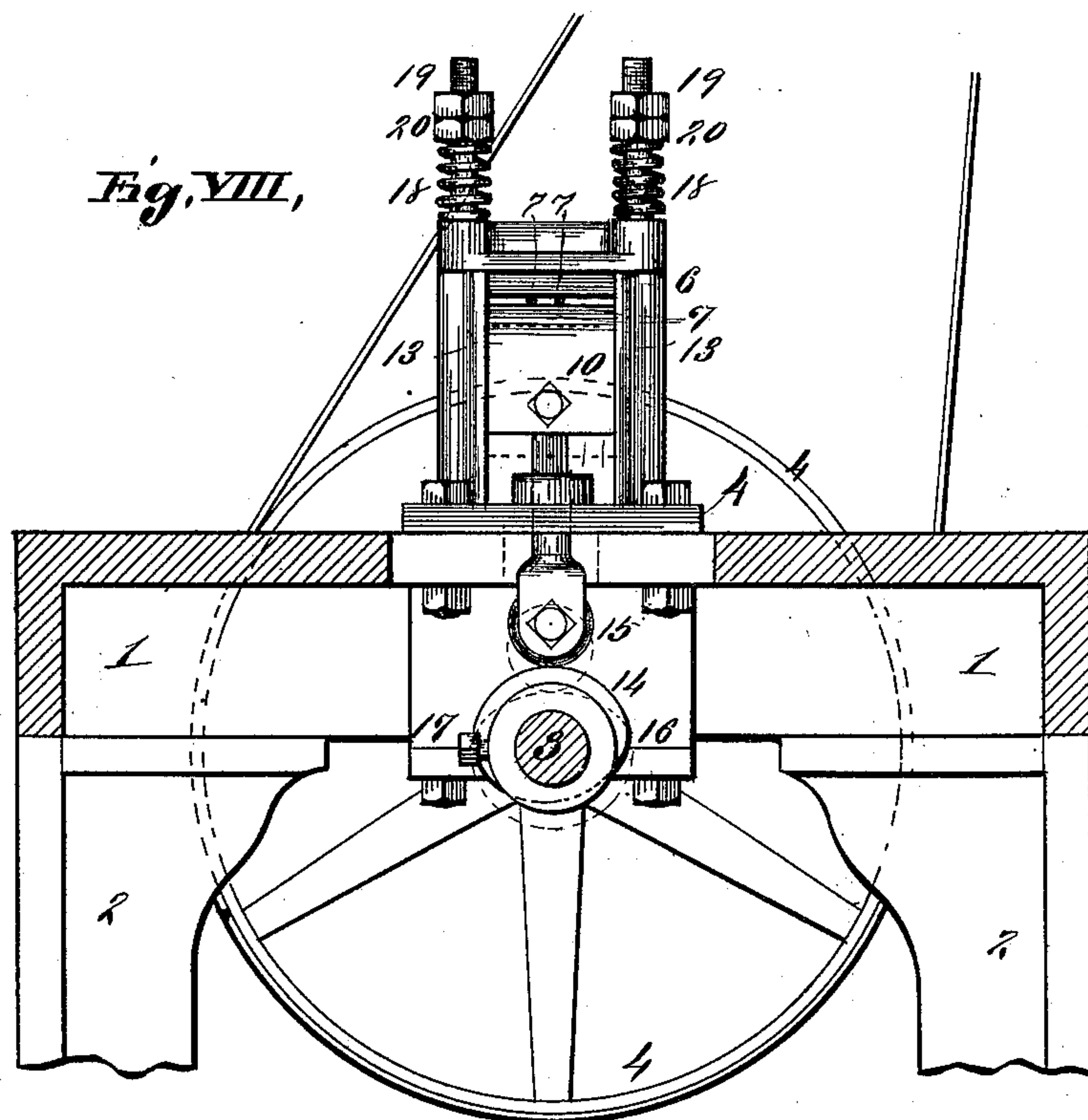
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L. J. CRECELIUS.

BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest;

Walter Middleton
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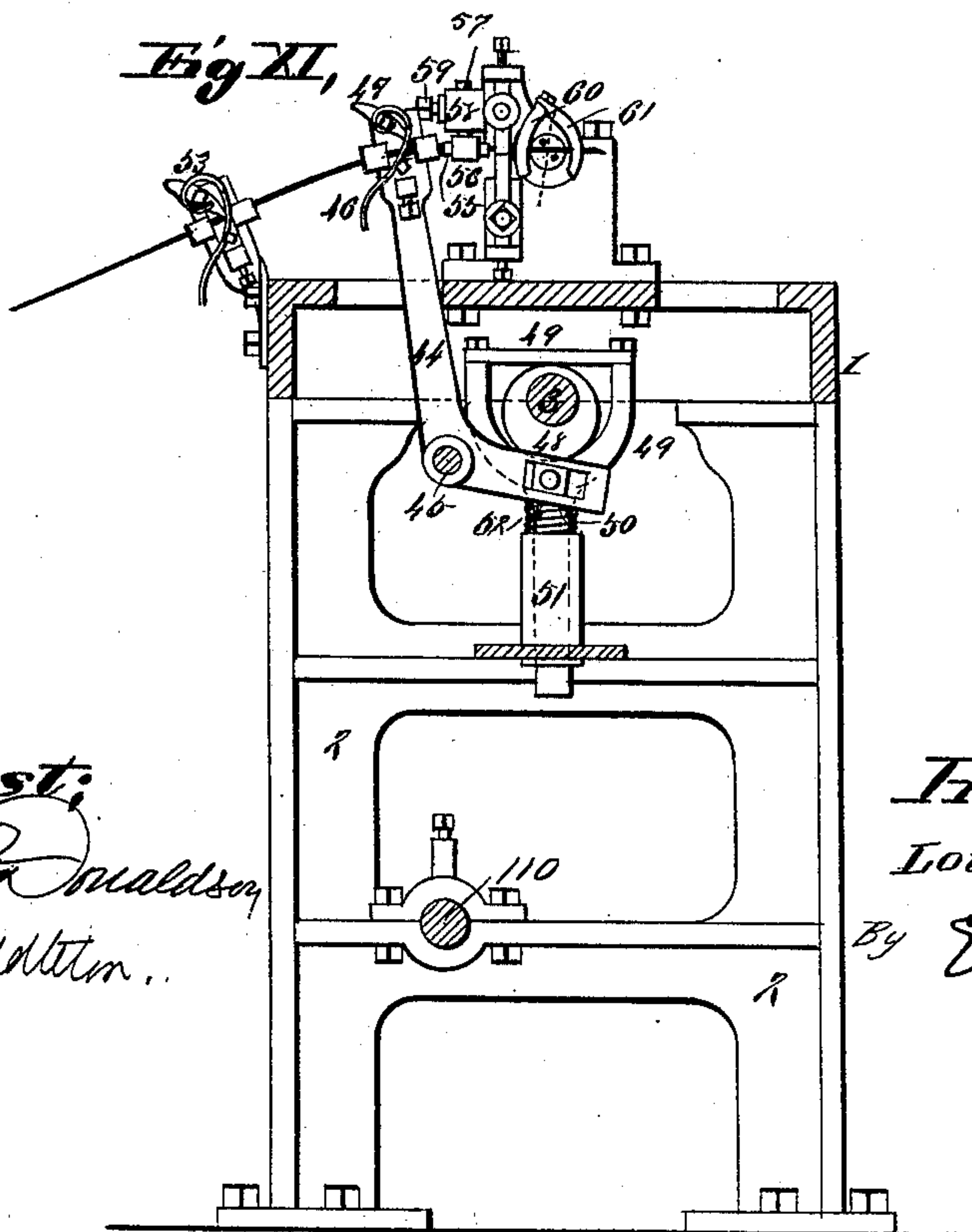
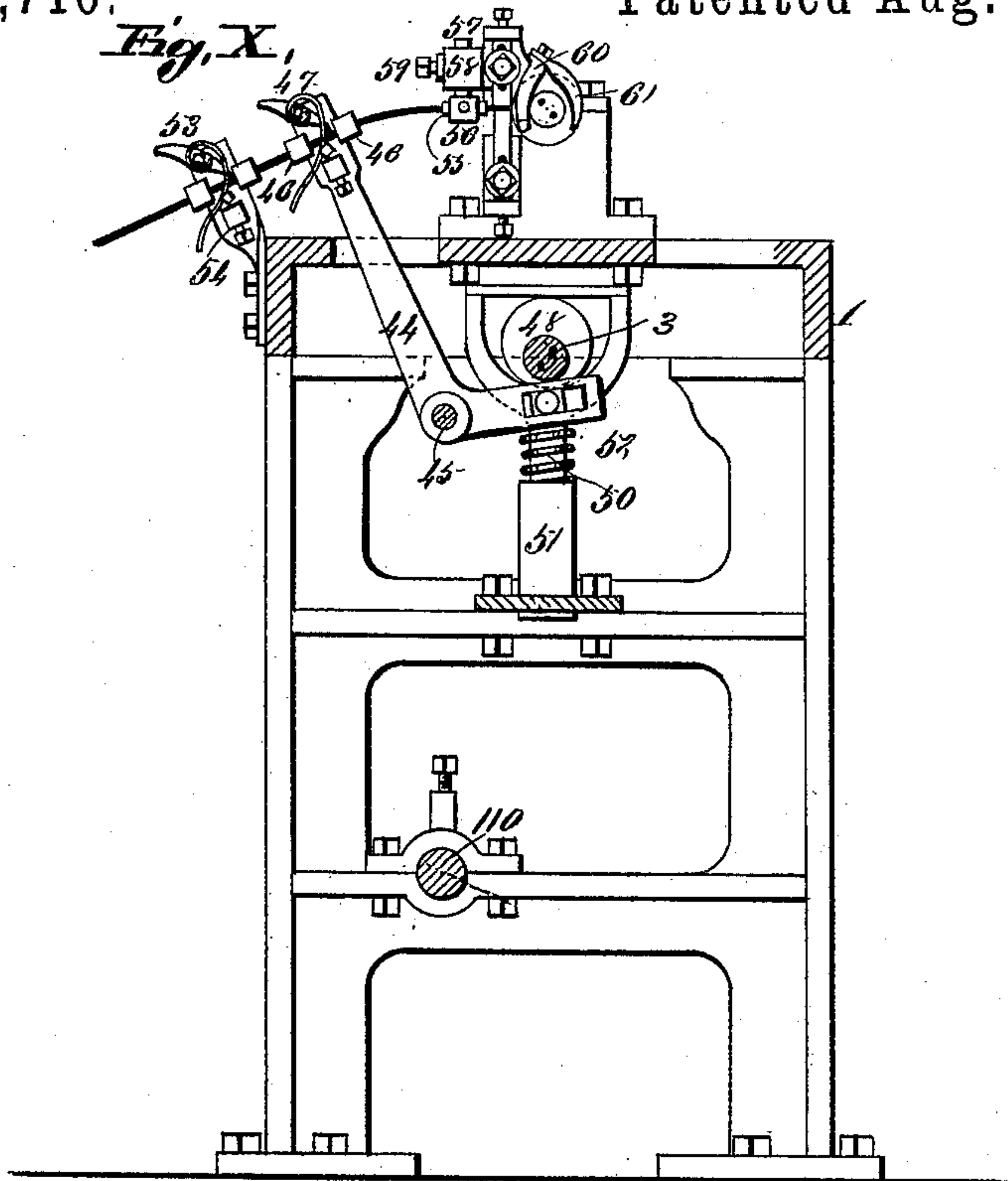
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L. J. CRECELIUS.

BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest;
Walter M. Madsen
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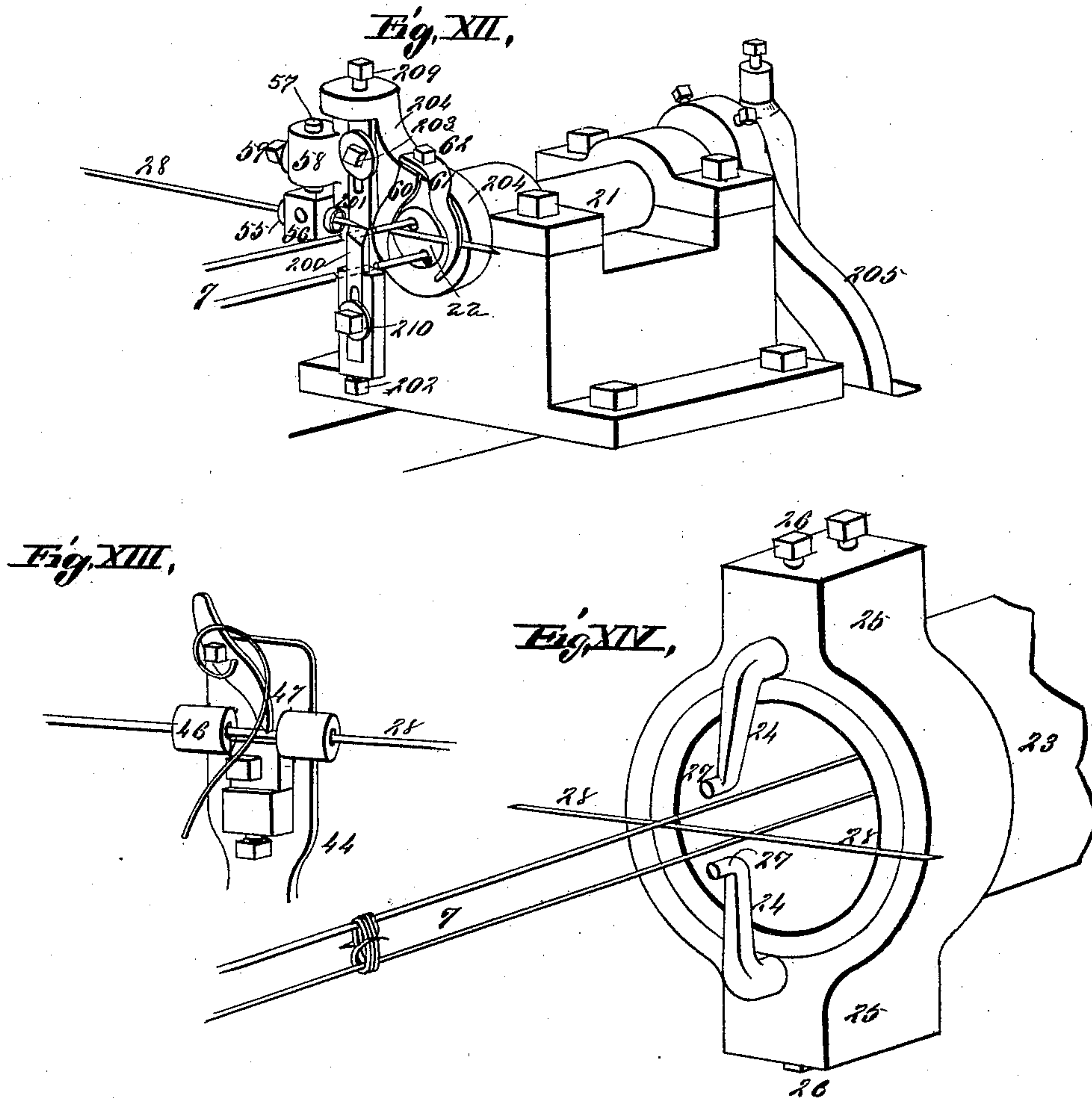
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L. J. CRECELIUS.
BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



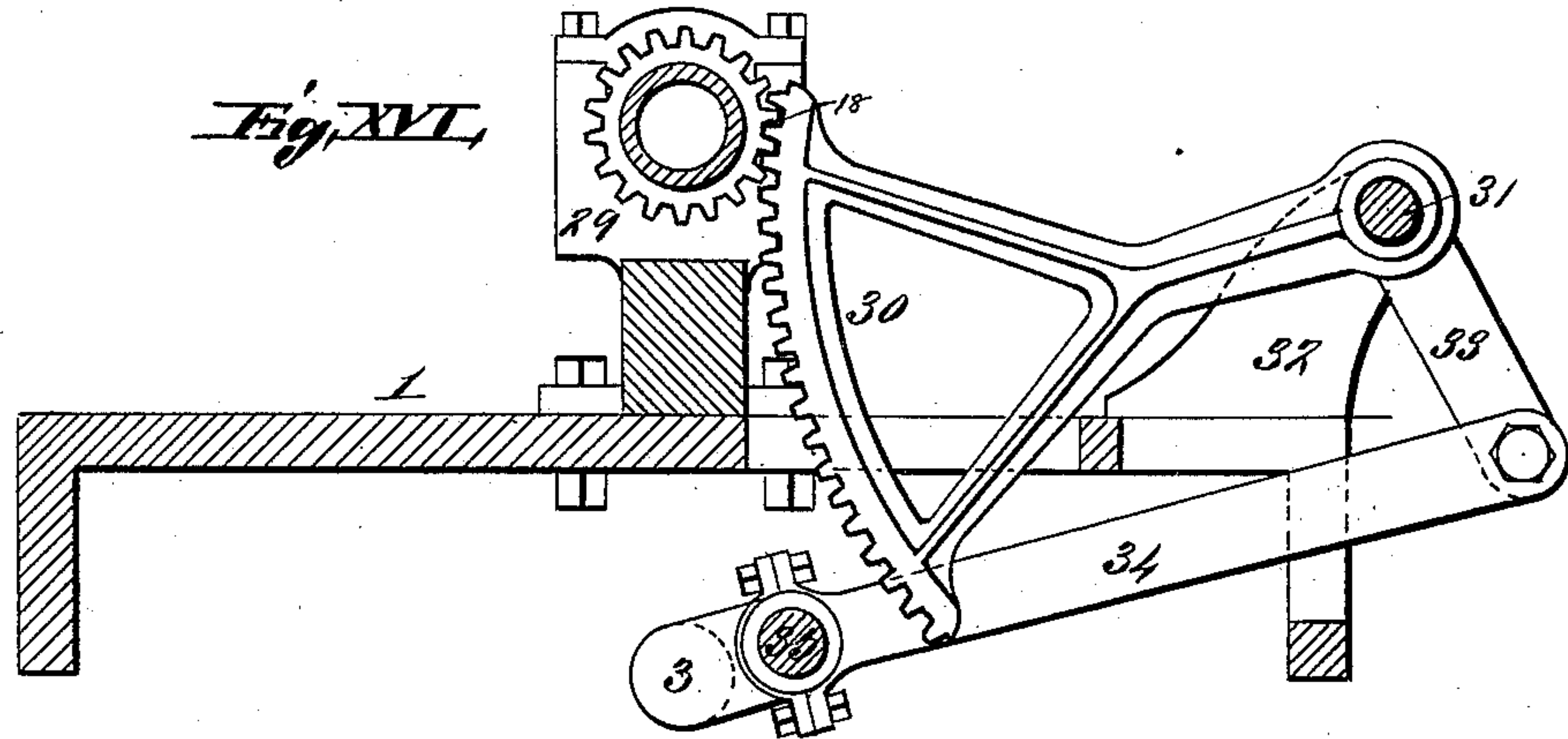
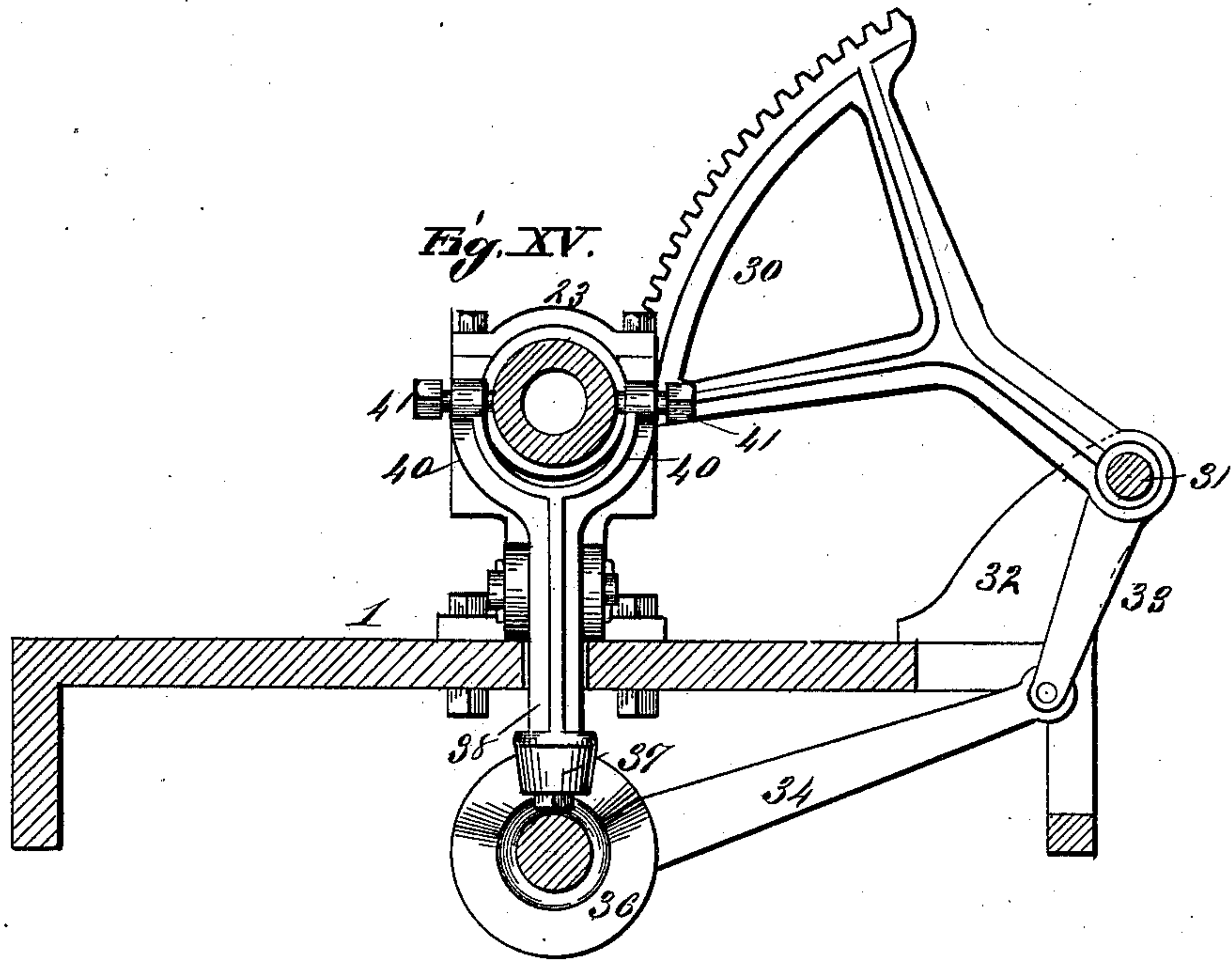
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11 Sheets—Sheet 8.

L. J. CRECELIUS.
BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest;

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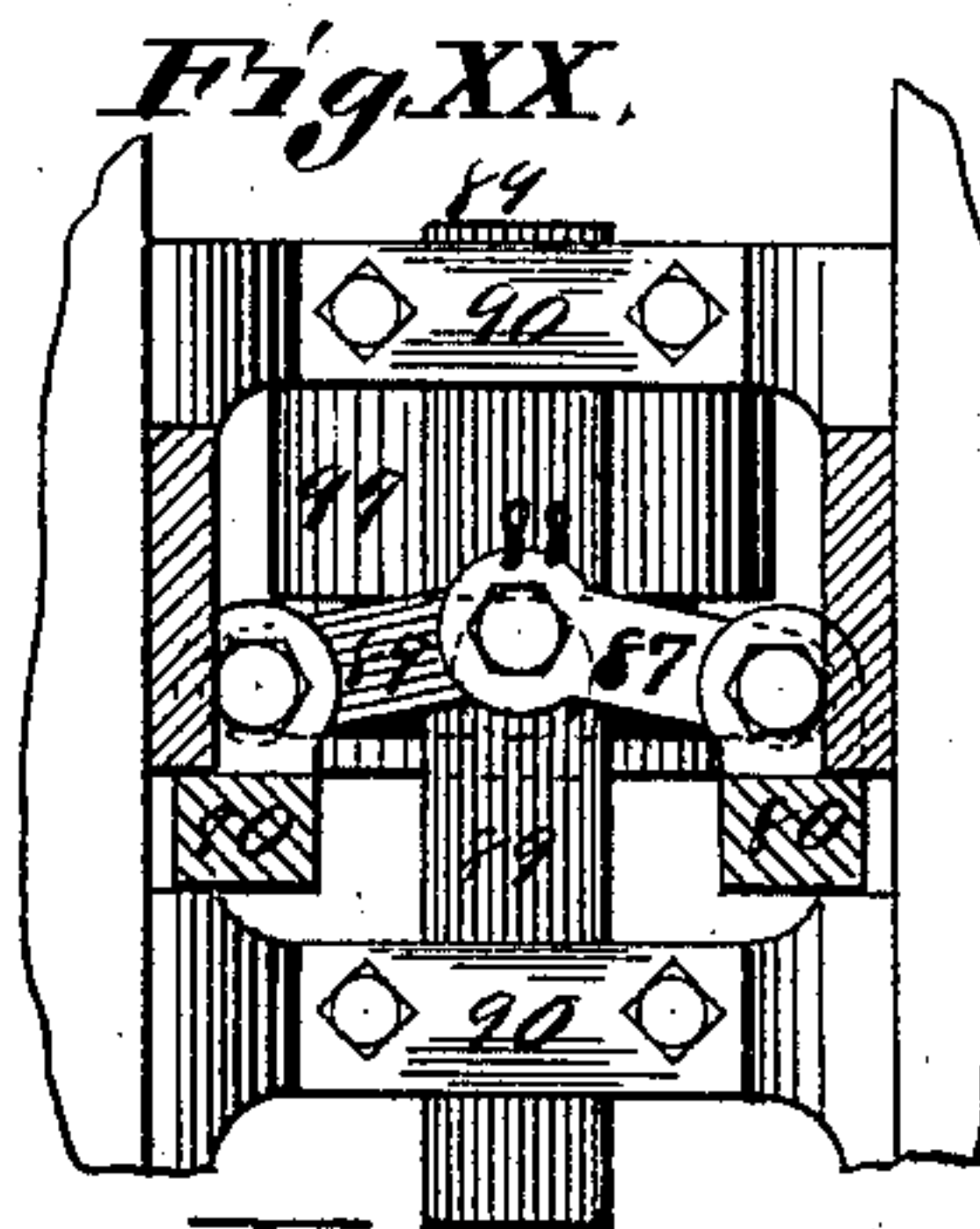
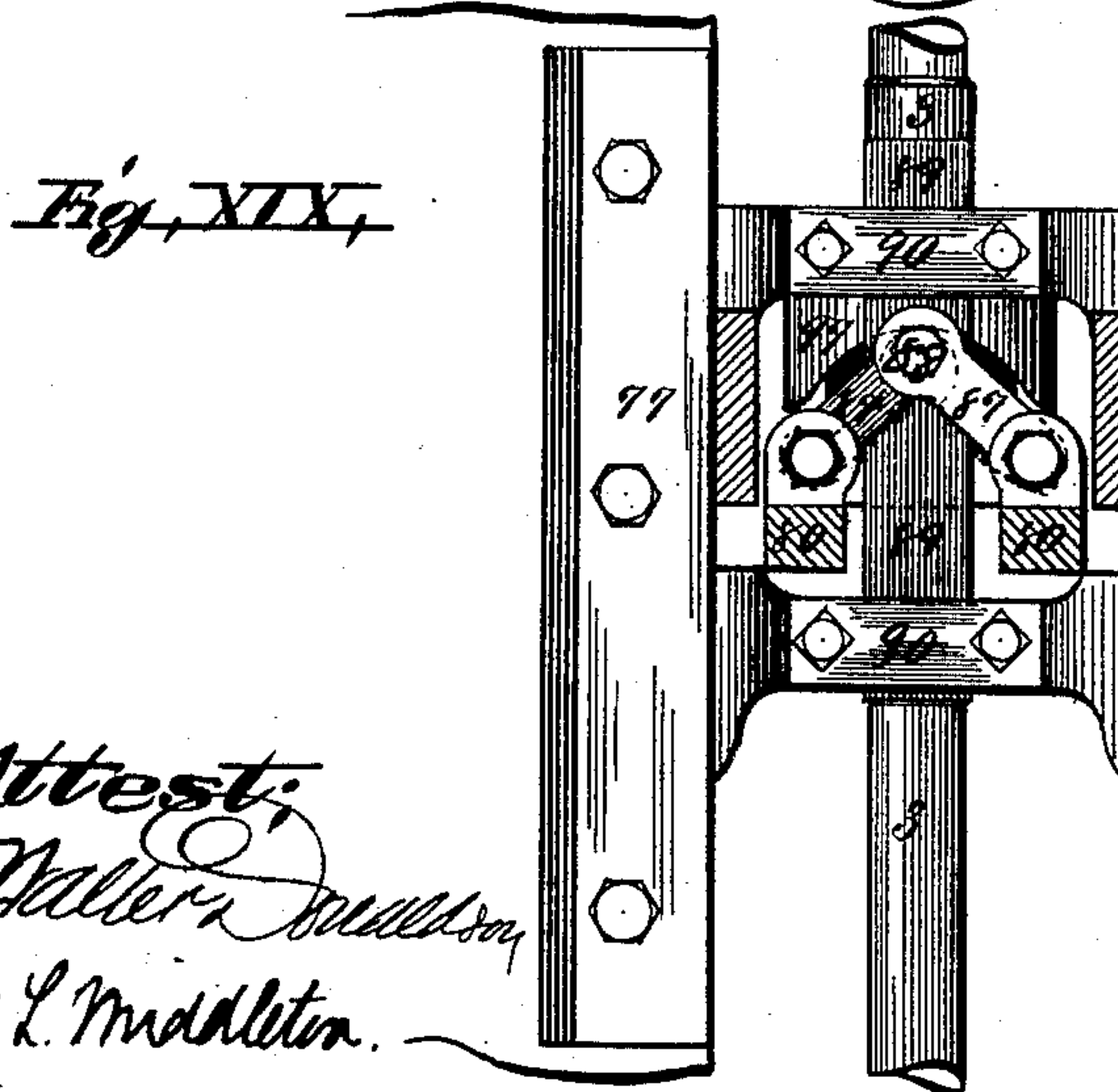
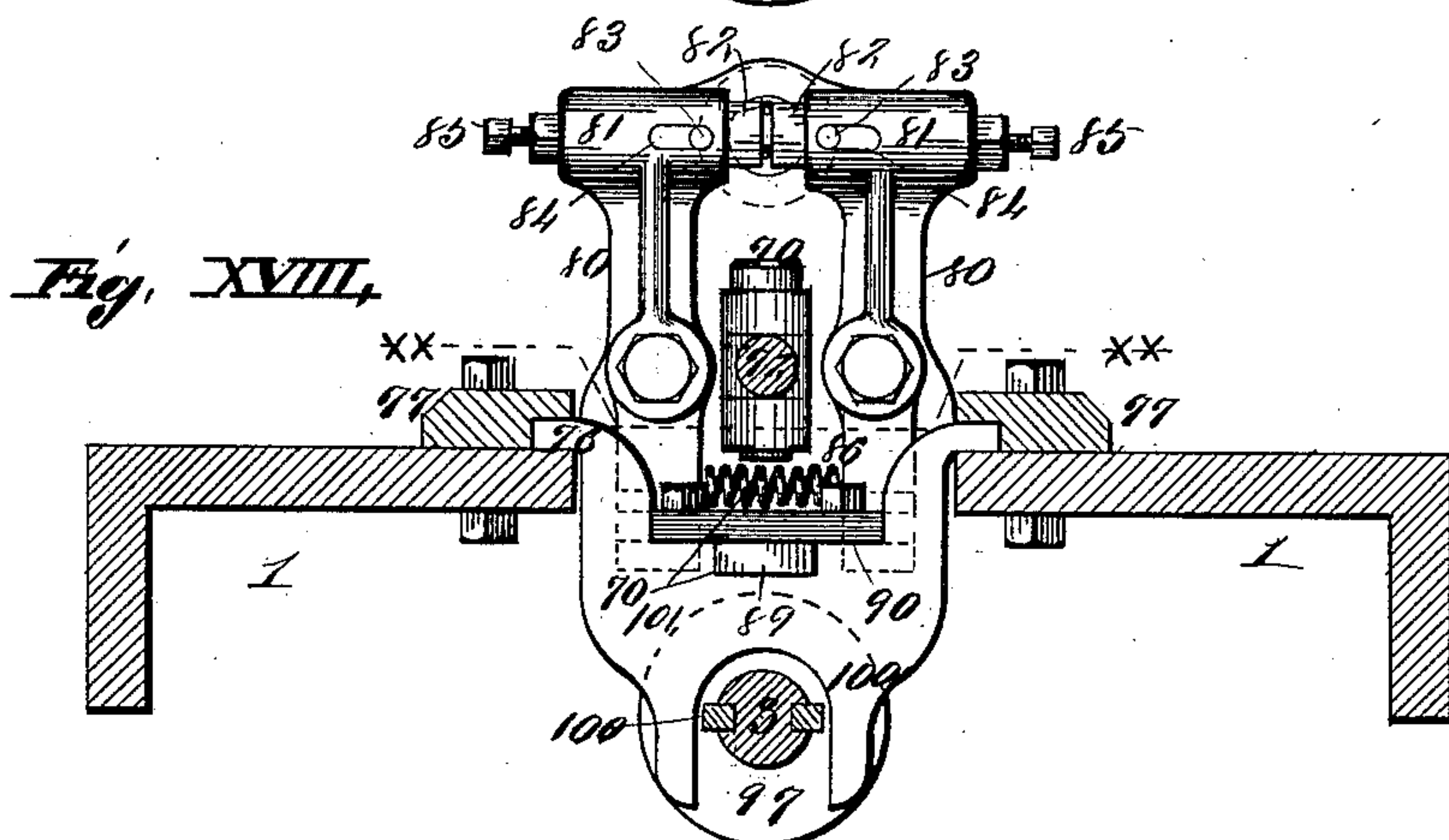
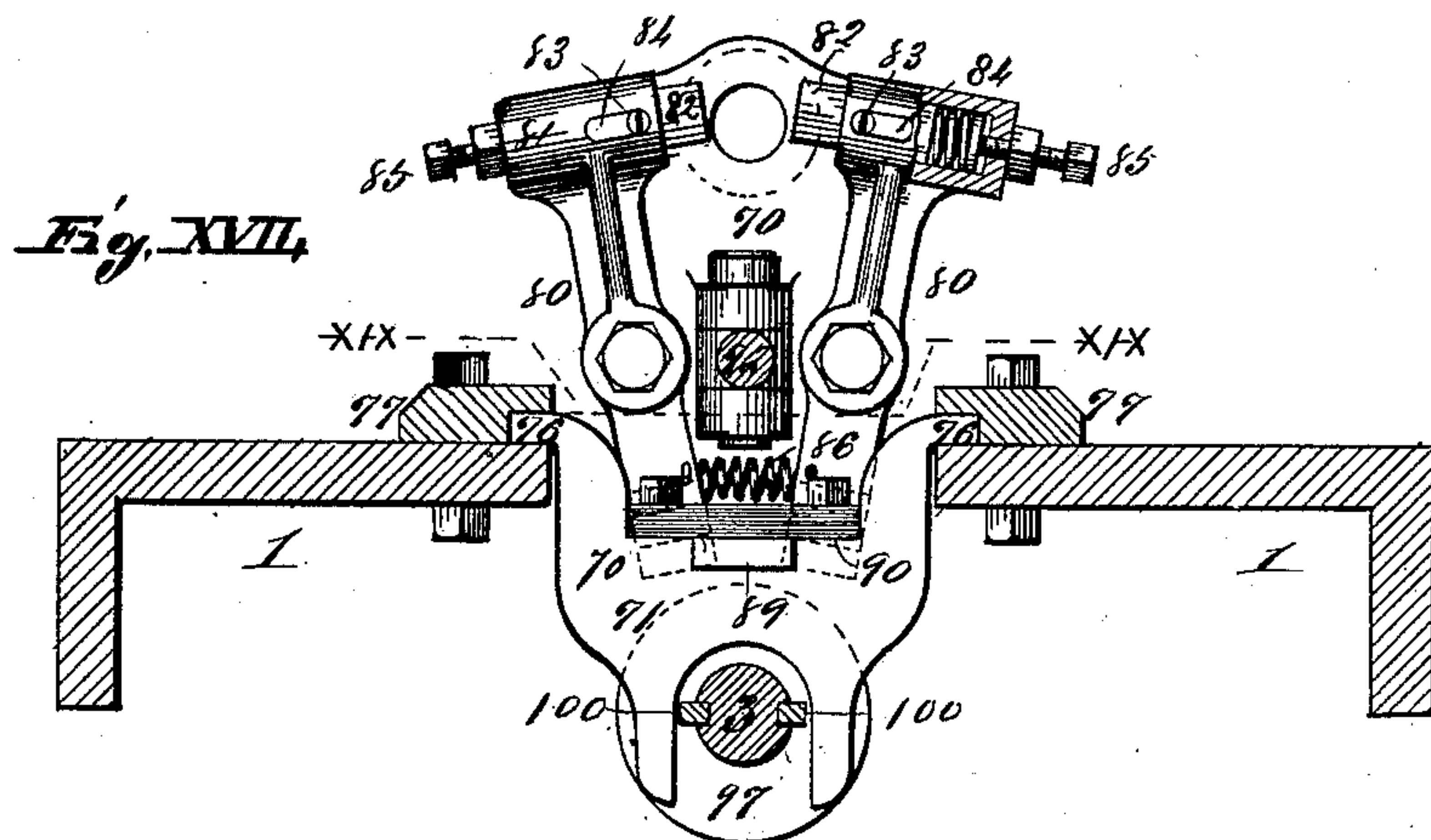
By Ellis Spear—
att'y.

L. J. CRECELIUS.

BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest;
Walter Middleton
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Inventor;
Louis J. Crecelius,
By Eli Spear
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(No Model.)

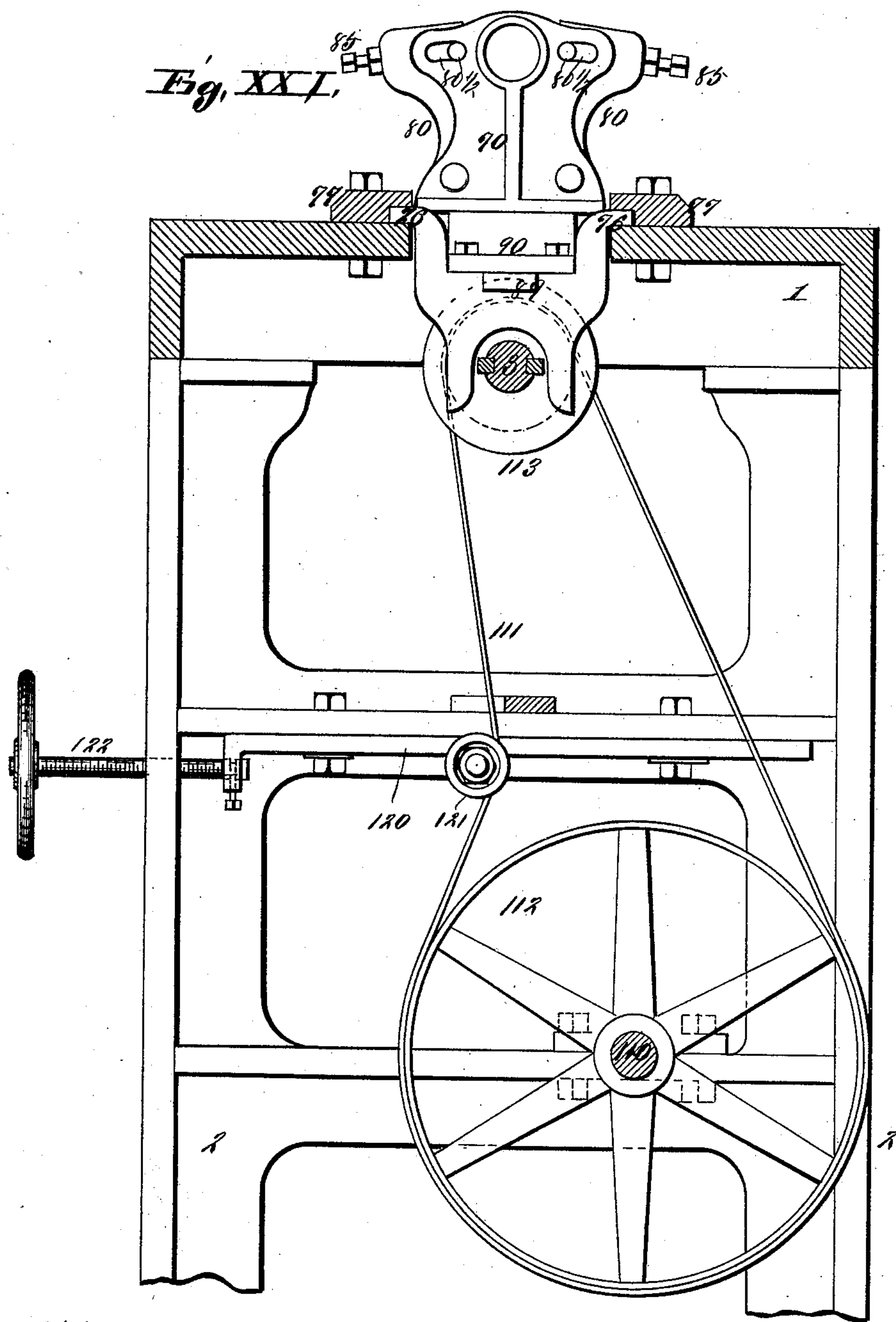
11 Sheets—Sheet 10.

L. J. CRECELIUS.

BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest:
Wm. L. Middleton.
F. L. Middleton.

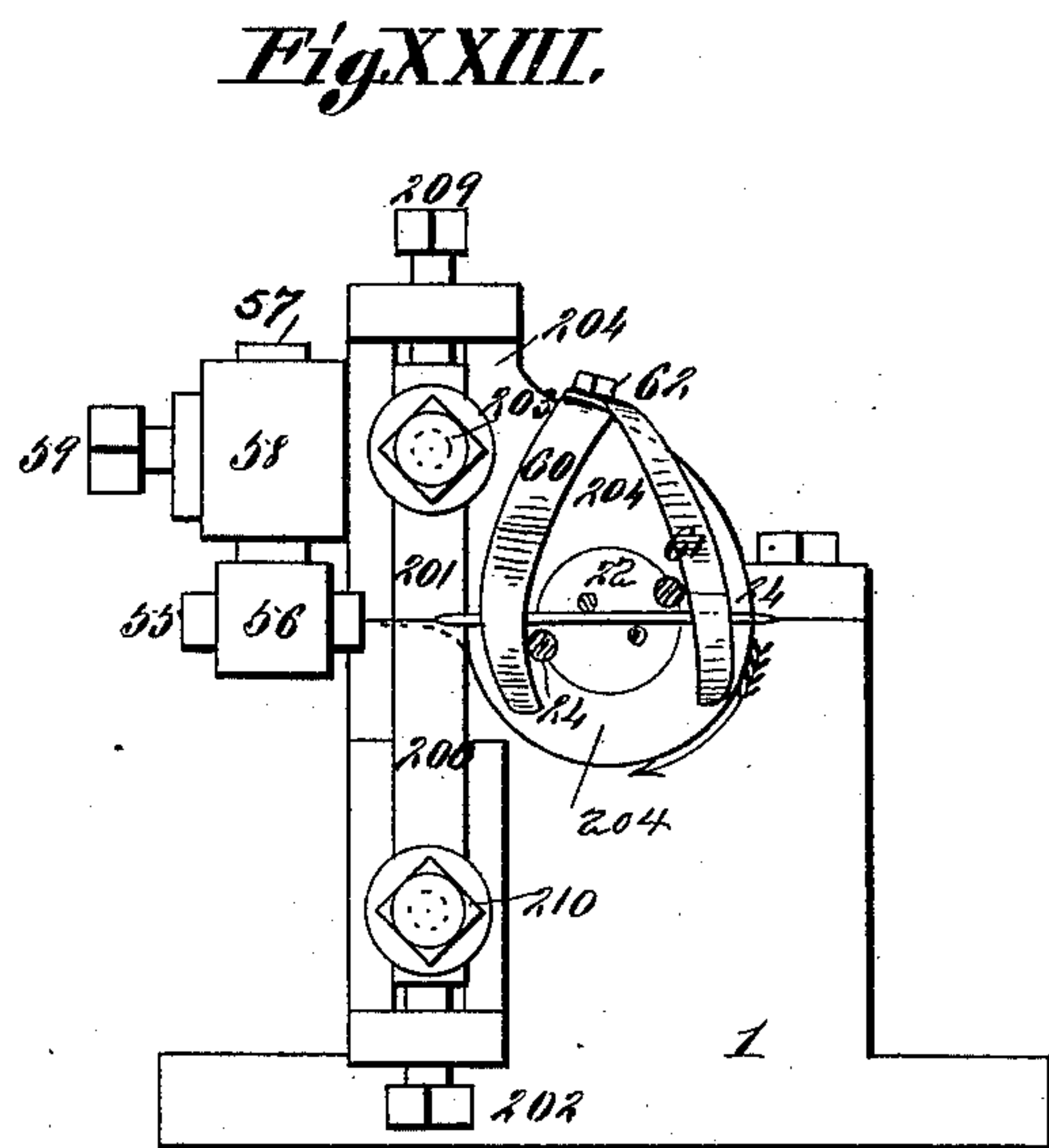
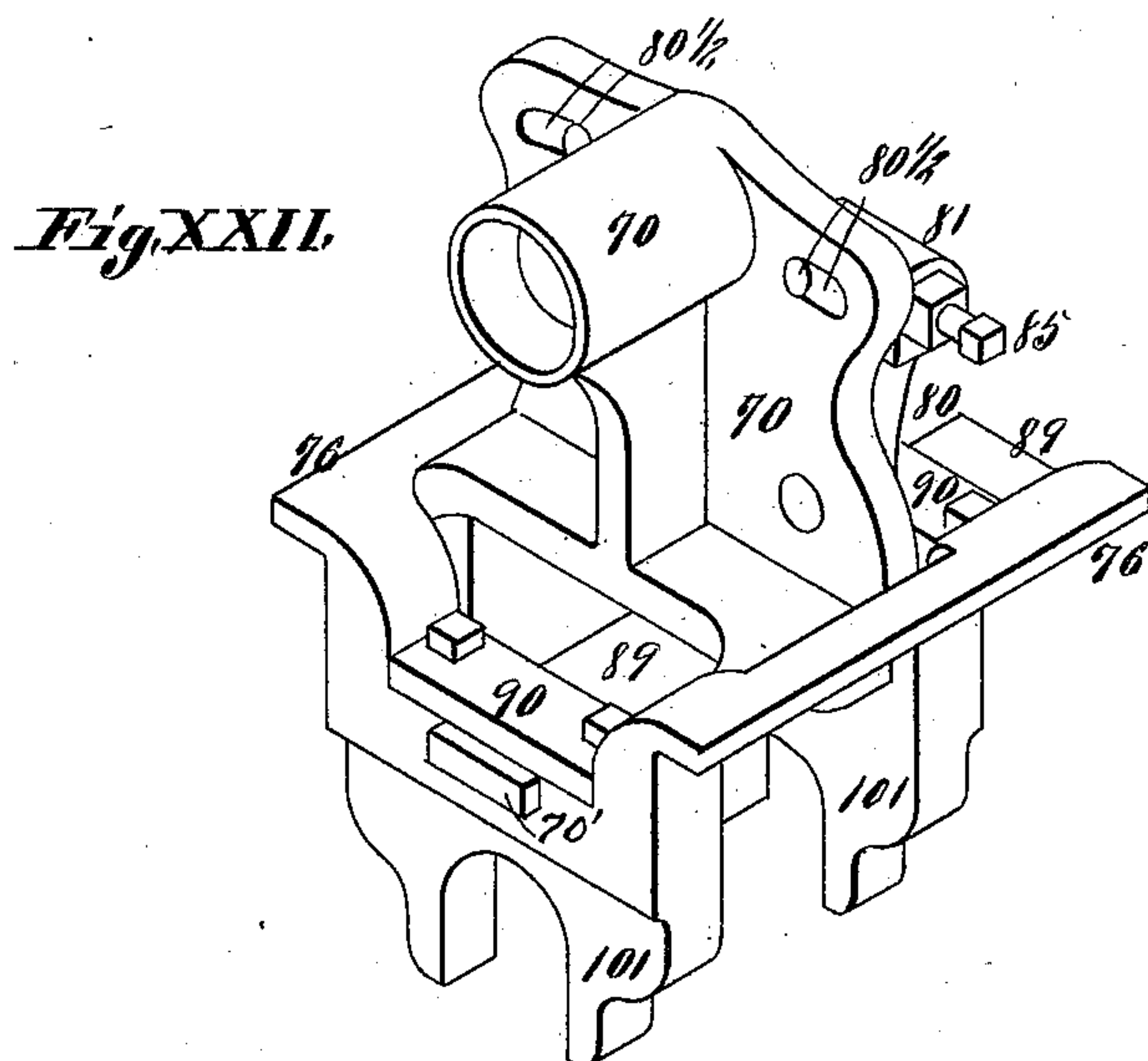
Inventor:
Louis J. Crecelius.
By *Ellis Spear-*
att'y.

L. J. CRECELIUS.

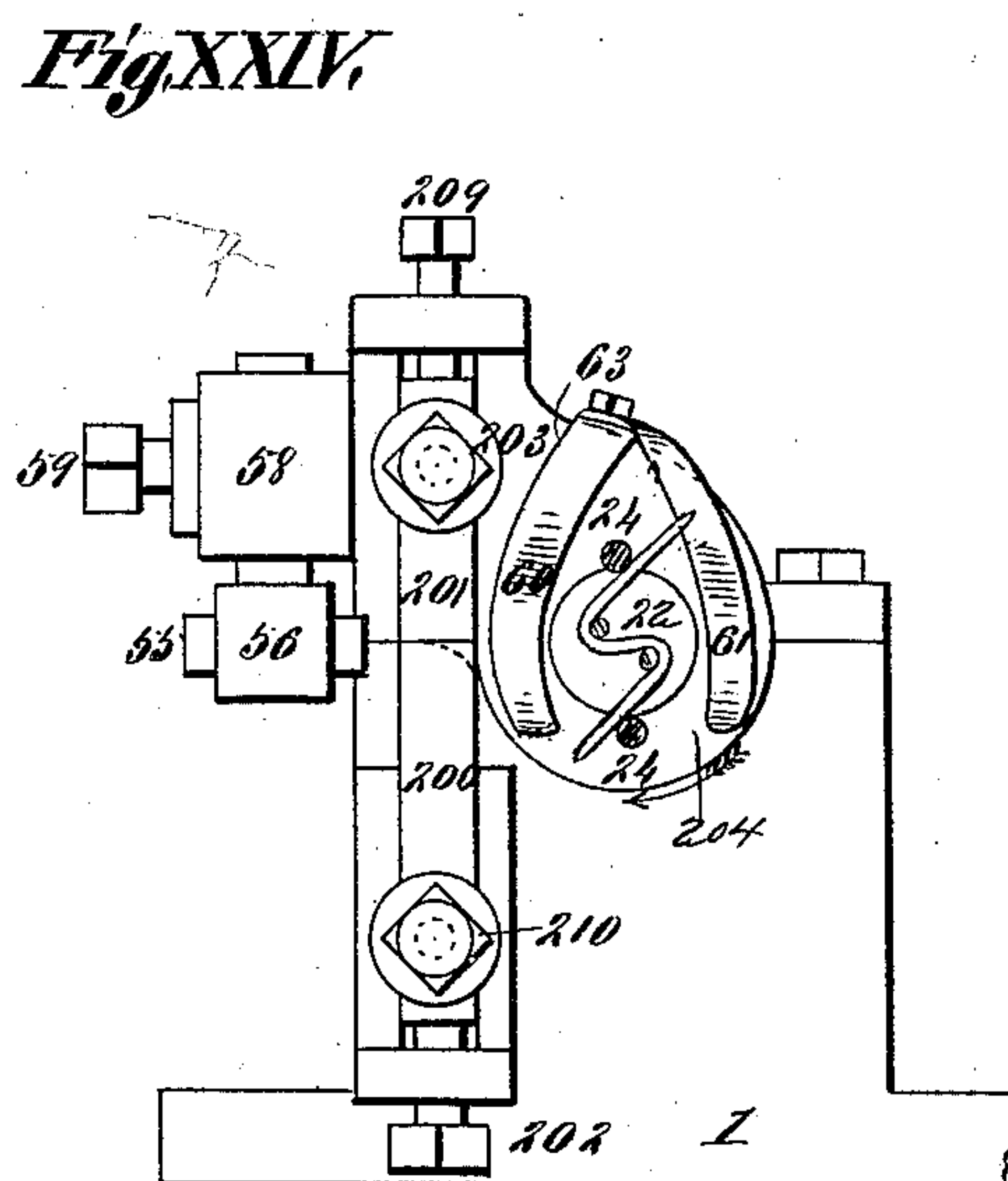
BARB WIRE MACHINE.

No. 387,710.

Patented Aug. 14, 1888.



Attest:
Walter Madison
F. L. Middleton.



Inventor:
Louis J. Crecelius.
By Eli Spear
att'y.

UNITED STATES PATENT OFFICE.

LOUIS J. CRECELIUS, OF ST. LOUIS, MISSOURI.

BARB-WIRE MACHINE.

SPECIFICATION forming part of Letters Patent No. 387,710, dated August 14, 1888.

Application filed November 21, 1887. Serial No. 255,808. (No model.)

To all whom it may concern:

Be it known that I, LOUIS J. CRECELIUS, of the city of St. Louis, in the State of Missouri, have invented a new and useful Improvement in Barb-Wire Machines; and I do hereby declare that the following is a full, clear, and exact description of the same.

Figure I is a side elevation of my improved machine. Fig. II is a top view. Fig. III is a detail vertical longitudinal section taken on line III III, Fig. II. Fig. IV is a similar view to Fig. III, taken on line IV IV, Fig. II. This figure is a continuation of the part of the machine shown in Fig. III. Fig. V is an enlarged side view of the cam-drum for operating one pair of the clamping-jaws. Fig. VI is a section taken on line VI VI, Fig. V. Fig. VII is a perspective view of the cam for giving to the coiling-head its longitudinal movement. Fig. VIII is a vertical transverse section taken on line VIII VIII, Fig. II. Fig. IX is a similar view taken on line IX IX, Fig. II. Figs. X and XI are similar views taken on lines X XI, Fig. II. Fig. XII is a perspective view of the head attachment for making two-point wire. Fig. XIII is an enlarged perspective view of the barb-feeder. Fig. XIV is an enlarged perspective view of the barb-former. Fig. XV is a vertical transverse section taken on line XV XV, Fig. II. Fig. XVI is a vertical transverse section taken on line XVI XVI, Fig. II, these two last-mentioned figures showing the mechanism for rotating the barb-forming head. Figs. XVII and XVIII are vertical transverse sections taken on line XVII XVIII, Fig. II, showing in different positions the device for feeding the strand-wires and for holding them on one side of the barb-former while the barbs are being applied. Fig. XIX is a horizontal section taken on line XIX XIX, Fig. XVII. Fig. XX is a like view taken on line XX XX, Fig. XVIII. Fig. XXI is a vertical transverse section through the bed-plate, showing the strand-wire-feed mechanism and the other parts of the machine in elevation. Fig. XXII is a perspective view of the strand-wire-feed mechanism which holds the strand-wires on one side of the barb-former while the barbs are being made. Figs. XXIII and XXIV are elevations showing the head attachment for making two-point wire, with the section ends

of the barb-forming fingers in different positions.

This invention relates to certain improvements upon the machine shown and described in Letters Patent No. 350,413, issued to myself and Henry G. Sachleben October 5, 1886, and where features of this invention have their counterparts in the patent mentioned reference will be made to such patent for an understanding of such parts.

Referring to the drawings, 1 represents the bed-plate of the machine, and 2 the supporting-base.

3 represents the main driving-shaft, supported in bearings on the under side of the bed-plate, and 4 represents the driving-pulley.

At one end of the machine is the mechanism for holding the strand-wires on one side of the barb-forming mechanism, and at or near the other end of the machine is the mechanism for holding the strand-wires on the other side of the barb-forming mechanism. The broad principles of these two mechanisms for holding the strand-wires while the barbs are being formed are shown, described, and claimed in the patent referred to. The constructions of these devices and mechanisms in this application somewhat differ from those in the patent mentioned. The first-mentioned one is composed of a head or clamp, 4', secured to the bed-plate of the machine and having a projection, 6, (see Figs. III and VIII,) under which the strand-wires pass from a guide-tube, 8, held in an arm, 9, projecting from the head or clamp 5.

Beneath the projection 6 is a sliding bar or head, 10, secured to the upper end of a pin or rod, 11, by a set-screw, 12. The bar or head works in guides 13 on the head 5, and it moves vertically from the position shown in full lines in Fig. VIII to the position shown in dotted lines. When in the former position, it clamps and holds the wires between it and the projections 6, and when in the latter position it releases the wires and permits them to be drawn or moved forward. This bar or head 10 is operated automatically through means of an eccentric cam, 14, on the shaft 3, there being a friction-roller, 15, on the lower end of the rod 11, which bears against the cam. After the bar or head 10 has been raised by the eccentric cam,

it is held in its vertical position the desired length of time while the eccentric cam is moving from 16 to 17 under the roller 15. The block then falls by gravity and the strand-wires are released.

To prevent the necessity of too nice an adjustment and to avoid danger of the strand-wires being mashed or flattened out in this holder, the top of the head 5 (on which the projection 6 is formed) is made in a separate piece from the sides of the head and rests on the sides. Above this piece are placed springs 18, surrounding screw-threaded rods 19, secured to the sides of the head 5 and passing through the top piece on which the projection 6 is formed. Above the springs on the rods 19 are nuts 20. The springs are located between the nuts 20 and the top of the head upon which the projection 6 is formed. It will thus be seen that the projection 6 will (while being held down with a sufficient amount of pressure) yield to excessive strain and prevent the necessity of too accurate an adjustment or movement of the parts and will avoid danger of the strand-wires being mashed. From this holding device the strand-wires pass through a hollow spindle, 21, supported on the bed-plate of the machine and provided on its inner end with a bushing, 22, provided with small holes or eyelets for the passage of the wires. From the spindle 21 the wire passes through the barb-forming spindle 23, which has imparted to it both a rotary and a longitudinal reciprocating movement. To the end of this spindle, next to the spindle 21, the barb-formers 24 are secured.

The spindle 23 has a head, 25, in which the formers are held by set-screws 26. The shape of the formers is shown in Fig. XIV. They have at their inner ends short horizontal extensions 27, which come in contact with the barb-wire and form the barbs upon the strand-wires. A portion of the barb-wire is shown in Fig. XIV, indicated by the numeral 28.

In making the barbs the forming-fingers 24 are turned from the position shown in Fig. XXIII to the position shown in Fig. XXIV, and beyond that position—that is to say, only part of their rotary movement is shown to have taken place in Fig. XXIV. They are thus turned by a rotary movement being imparted to the spindle 23, and this rotary movement is procured through means of a cog-wheel, 29, on the spindle, which is engaged by a segmental rack, 30, pivoted at 31 to standards 32 on the bed-plate of the machine. (See Figs. XV and XVI.) To this rack or segment, or to the shaft 31, which pivots it to the arm 32, is secured a crank, 33, the lower end of which is connected by a pitman, 34, to a crank, 35, on the shaft 3. It will thus be seen that as the shaft 3 is turned the segment or rack will be moved from the position shown in Fig. XV to the position shown in XVI, and vice versa, thus giving to the spindle its respective movements for the purposes of forming the barbs

upon the strand-wires. As the barbs are being formed it is desirable to have a slight longitudinal movement imparted to the spindle 23 to prevent the strands of the barbs being lapped upon each other, the forming-fingers 24 retreating as the barbs are being formed upon the strand-wires 7. This longitudinal movement is given to the spindles through means of a cam, 36, on the shaft 3 (see Fig. III) bearing against a friction-roller, 37, on the lower end of a lever, 38, pivoted at 39 to the bed-plate of the machine. The upper end of the lever 38 has arms 40, (see Fig. XV,) through which pass screws 41, entering a groove, 42, (see Fig. III,) in the spindle 23. The lever by these screws is connected to the spindle.

Located between the upper end of the lever 38 and the bed-plate is a spring, 43. Now, when the proper time comes, the spindle 23 has imparted to it a slight longitudinal movement away from the spindle 21 by means of the spring 43 and lever 38. Then, when the barb is completed, the spindle 23 is moved back to its forward position by means of the cam 36 and lever 38. Before the spindle 23 is moved to its forward position by the cam 36 the spindle 23 has been moved by the segment 30 to bring the forming-fingers into the position shown in Fig. XXIII, so that when the spindle is moved to its forward position by the cam 36 the forming-fingers are in the proper position to engage the barb-wire, and just at this time they commence to revolve again in the direction indicated by the arrow in Figs. XXIII and XXIV. The cam and other parts are so disposed that before the spindle is moved forward the fingers are in the proper position to engage the barb-wire, as stated. Then the spindle commences to rotate to form the barbs upon the strand-wires. At the same time the spindle commences to retreat to allow the barb-wire to be coiled upon the strand-wires, and when the barb is completed the spindle starts back to its normal position, and as it is doing so the spindle moves forward again, and thus the operation goes on.

The barb-wire is fed between the strand-wires by means of a bell-crank lever, 44, pivoted at 45 to the bed-plate of the machine, and provided at its upper end with short guide tubes 46, through which the wire passes, and also provided with a spring-dog, 47, for gripping the barb wire and preventing it from slipping through the tubes 46 as the upper end of the lever 44 is moved forward, but which slips over the barb-wire when the upper end of the lever is moved in the other direction, thus allowing the barb-wire to slip through the tubes the distance of each barb.

The lever is operated by means of the eccentric cam 48 on the shaft 3, the cam being connected to the lever by means of a yoke, 49, to which the lower end of the lever is connected, the yoke having a stem, 50, passing through a guide-tube, 51. I prefer to place a spring, 52, around the stem between the yoke and guide-

sleeve, (see Figs. III, X, and XI,) the office of which is to keep the yoke continually bearing against the cam to prevent the jarring of the lever 44.

5 53 represents a fixed spring-dog secured to the bed-plate of the machine by an arm 54. The office of this dog is to prevent the wire from being moved back by the lever 44 in its retrograde movement. When the wire is being moved forward by the lever 44, the dog 53 slips over the wire.

15 56 represents a holder for the tube 55, through which the barb-wire passes just before reaching the former. This holder is provided with a stem, 57, passing through a support, 58, the stem being held in the support by means of a set-screw, 59. (See Figs. XXI, XXIII, and XXIV.) By this arrangement the tube may be adjusted at an angle or vertically to insure the direction of the barb-wire in between the strand-wires and provide for making any length barb desired.

From the tube 55 the barb-wire passes behind spring-holders 60 and 61. These are shown most clearly in Figs. XXIII and XXIV. They are secured to the bed-plate of the machine at 62 and extend downward from this point. One holder is located on one side of the extension 204 of the spindle 21 and the other on the other side of it, and both press against the end of it. The barb-wire being fed forward is passed between the end of the spindle 21 and these holders, and is held from falling (it being cut off before being formed upon the wire) until the former begins to bend it around the strand-wires. As the former bends the barb upon the strand-wires, the ends of the barbs are drawn from behind the holder, as shown in Fig. XXIV, one end of the barb passing from behind the plate 60 of the holder at about the point designated by 63 in Fig. XXIV, and the other point passing from behind the lower end of the plate 61 of the holder. The first-mentioned point, after leaving the plate 60 of the holder, passes outside of the plate 61 of the holder, as shown in Fig. XXIV, and the other point of the barb passes outside of the plate 60 of the holder. It will thus be seen that this device, while it prevents the pieces of wire from which the barb is to be formed from dropping before the forming-fingers take hold of it, does not interfere with the bending of the barbs upon the strand-wires. Each time the barb-wire is fed forward a piece of sufficient length to form the barb is cut off by means of a stationary knife, 200, (see Figs. XII, XXIII, and XXIV,) and a movable knife, 201. The stationary knife may be adjusted by a set-screw, 202, if desired. The movable knife is secured by a bolt, 203, to an arm, 204, secured to the inner end of the spindle 21. (See Fig. XII.) At the proper time the knife 201 approaches the knife 200 and severs the wire. This is done by a slight rotary movement of the spindle 21, the movement being imparted to the spindle through a lever, 205, immediately secured to it, the lower end of

which bears against the cam 206 on the shaft 3. (See Figs. III and IX.) The movement of the knife 201 is very slight, and consequently the rotary movement of the spindle 21 is very slight, so as not to interfere with the operation of the holders 60 61. The lower end of the lever 205 may be provided with a friction-roller, 207, that bears against the cam 206. I have shown the lever secured to the hollow spindle by means of a set-screw, 208. (See Fig. III.) The knife 201 may be adjusted, if desired, by means of a set-screw, 209. The stationary knife may be held from movement by means of a screw, 210. (See Figs. XII, XXIII, and XXIV.)

In order to provide for any slight adjustment of the spindle 21 which may be required to bring the movable and stationary knives into proper relative position, I form a bracket on the frame, as shown at *a*, extending upwardly in line with the feed of the strands, and in a screw-threaded opening formed therein I place a threaded hollow sleeve, *b*, of the same diameter as the spindle 21 and in line therewith, and adapted to be moved forward to adjust the same when desired. A set-screw, *c*, holds the sleeve in place after its adjustment.

From the barb-former spindle 23 the strand-wires pass through a hollow reciprocating head, 70. This head is moved back and forward at the proper time toward and away from the hollow spindle by means of a crank, 71, to which it is connected by a pitman, 72. The crank 71 is secured to a shaft, 73, (see Fig. IV,) on which is a gear-wheel, 74, meshing into a similar wheel, 75, on the shaft 3. The crank 71 preferably consists of a circular disk with a wrist pin which connects the pitman 72 to the disk, as shown. The pin may fit in any one of a number of holes, 72 $\frac{1}{2}$, different distances from the center of the disk, and thus the throw of the head may be regulated. The sliding head 70 has flanges 76 (see Figs. XVII and XVIII) and is held to the bed of the machine by strips 77. This construction permits the head to reciprocate back and forth in a horizontal plane, but does not allow it to move vertically. Secured to this head is the device which holds the strand-wires on the opposite side of the forming mechanism to the device which has already been described. This mechanism corresponds in its functions to the mechanism G G², &c., of the patent mentioned. The construction, however, in this case is somewhat different. It consists of two vertical arms or levers, 80, having hollow heads 81 on their upper ends, in which fit blocks 82, held in the heads by pins 83, fitting in slots 84 in the heads. The inner ends of the blocks 82 bear against springs, which in turn bear against disks, against which bear set-screws 85, passing through the outer ends of the heads 81, the function of the set-screws being to adjust the blocks through the springs, so that they will grasp the strand-wires with proper tension. The strand-wires pass between the blocks 82,

as shown in Fig. XVIII. The levers 80 are susceptible of being moved from the open position (shown in Fig. XVII) to the closed position, (shown in Fig. XVIII,) and vice versa. They are opened by a spring, 86, located between their lower ends, and the tendency of which is to pull the lower ends together. They are closed by toggle-bars 87, connected to them at their outer ends, (see Figs. XIX and XX,) and connected together at their inner ends by a pin, 88. The pin 88 is secured to a sliding plate, 89. As the plate and toggle-bars are moved from the position shown in Fig. XIX to the position shown in Fig. XX, the outer ends of the levers 80 are forced apart and the blocks 82 are made to grasp the strand-wires, and as the plate and toggle-bars move in the other direction the levers move back to the open position. (Shown in Figs. XVII and XXII.) The plate 89 (see Figs. XVII and XVIII) fits in a recess, 70', made in the head to receive it, and is held from vertical movement by a bar, 90. The plate 89 is moved back and forth by means of a cam, 97, on the shaft 3, the cam having a suitable groove, 98, Fig. V, in which a pin, 99, Fig. IV, on the plate 89 fits. The cam 97 must of course reciprocate with the head 70, and as it has to turn with the shaft 3 it is connected thereto by means of a feather and groove, the groove being in the cam and the feather 100 being on the shaft. The feather is elongated, so as not to be disengaged from the cam when the latter is moved back and forth.

The object of reciprocating the head 70 is to feed the strand-wires between each barb.

The holding mechanism which I have just described continues to grasp the strand-wires while the head 70 is making its movement away from the spindle 23, and before the head begins to move toward the spindle again the holder relieves the strand-wires. The cam 97 fits between depending arms 101 of the head 70, so that it will be seen that it can turn with the shaft 3 without the head interfering with it.

To prevent any lost motion between the head and the cam incident to wear, I locate a ring, 102, in a groove made in one end of the cam (see Fig. V) and hold the ring in place by means of a screw, 103. Between the ring 102 and the cam may be placed washers 104. As the parts wear, the ring 103 may be taken out and washers inserted to compensate for the wear. From the head 70 the barb-wires pass over a suitable wheel, 105, supported on arms 106, projecting from the bed-plate of the machine. From the wheel 105 the wires pass through a guide funnel, 107, secured on the outer end of an arm, 108, and from here the wires pass to a spool, 109, secured to a shaft, 110, connected to the shaft 3 by means of a belt, 111, pulley 112 on the shaft 3, and pulley 113 on the shaft 3.

The upper ends of the levers 80 may have slot-and-pin connection 80½ with the head 70, as shown in Fig. XXI, for the purpose of guiding their upper ends.

In Fig. XXI I have shown a tightener for the belt 111, consisting of a slide, 120, carrying a pulley, 121, which bears against the belt, the slide being adjusted by means of a regulating-screw, 122.

I claim as my invention—

1. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism for holding the wires on each side of the barb-forming mechanism, one of said holders consisting of a head, 5, having a projection, 6, movable head 10, a stem or rod on the movable head, a cam for operating the movable head, and springs 18, located above the projection 6, substantially as and for the purpose set forth.
2. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism for holding the wires on each side of the barb-forming mechanism, one of said holders consisting of pivoted levers 80, blocks or plates 82, secured to the upper ends of the levers, and means for opening and closing the upper ends of the levers, substantially as and for the purpose set forth.
3. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism for holding the wires on each side of the barb-forming mechanism, one of said holders consisting of pivoted levers 80, adjustable blocks 82 in the upper ends of said levers, and means for closing the upper ends of said levers, consisting of toggle-arms connected to the levers and cams for moving the arms, substantially as and for the purpose set forth.
4. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, holders on each side of the barb-forming mechanism, one of said holders consisting of pivoted levers 80, blocks secured to the upper ends of the levers, and means for closing the upper ends of the levers, consisting of toggle-arms and means for operating the arms, substantially as and for the purpose set forth.
5. In a barb wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism on each side of the barb-former for holding the strand-wires, one of said holders consisting of pivoted levers 80, blocks on the upper ends of said levers, and means for closing the upper ends of the levers, consisting of toggle-arms, a sliding plate to which the toggle-arms are connected, a pin on the plate, and an eccentrically-grooved cam in which the pin fits, substantially as and for the purpose set forth.
6. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism for holding the wires on each side of the barb-former, one of said holders consisting of pivoted levers 80, blocks 82 in the upper ends of the levers, springs 86, for opening the arms, toggle-arm 87, sliding plate 89, pin 88, and eccentrically-

grooved cam 97, substantially as and for the purpose set forth.

7. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, a holding and feed device consisting of a sliding head, levers pivoted to and carried by the head, and means for opening and toggle-levers for closing the levers at the proper time, substantially as and for the purpose set forth.

8. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism for holding the strand-wires on one side of the barb-former and for feeding the strand-wires, said mechanism consisting of a sliding head, levers pivoted to the head, blocks in the upper ends of the levers, means for opening and closing the levers, and means for reciprocating the head, substantially as and for the purpose set forth.

9. In a barb-wire machine, in combination with mechanism for forming the barbs upon the strand-wires, mechanism for holding the strand-wires on one side of the formers, consisting of a sliding head, levers pivoted to the head, blocks in the upper ends of the levers, means for opening and closing the levers, consisting of a sliding head, an eccentrically-grooved cam, toggle-arms, a sliding plate, a pin on the plate entering the groove in the cam, and means for reciprocating the head, consisting of a pitman, disk, adjustable wrist-pin in the disk, shaft to which the disk is secured, and means for turning the shaft, substantially as and for the purpose set forth.

10. In a barb-wire machine, the combination of the mechanism for forming the barbs upon the strand-wires, hollow spindle 21, through which the strand-wires pass, means for feeding the barb-wire forward, and means for cutting off the barb-wire, consisting of a stationary knife, an arm secured to the said spindle and to which the movable knife is secured, a lever secured to the spindle, and a cam for operating the lever to turn the spindle and operate the movable knife, substantially as and for the purpose set forth.

11. In a barb-wire machine, in combination with mechanism for feeding the barb-wire forward, mechanism for forming the barbs upon

the wire, consisting of a reciprocating longitudinally-movable spindle, fingers 24 on the spindle bent inwardly toward the path of the wire and provided with extensions 27, and means, substantially as described, for imparting to the spindle a longitudinal movement, as specified.

12. In a barb-wire machine, the combination of mechanism for forming the barbs upon the strand-wires, said mechanism consisting of fingers and a reciprocating longitudinally-movable spindle and cam 36, lever 38, and spring 43, whereby the spindle is moved backward to and forward from its initial position, substantially as and for the purpose set forth.

13. In a barb-wire machine, in combination with means for feeding the barb-wire forward, mechanism for forming the barbs upon the wire, and spring-holders for the barb-wire before it is wound around the strand-wires, substantially as set forth.

14. In a barb-wire machine, the combination of mechanism for feeding the barb-wire forward, mechanism for forming the barbs upon the strand-wires, and mechanism for holding the barb-wire after it is cut off and before it is formed upon the strand-wires, consisting of plates 60 61, free at their lower ends and formed as shown and described, substantially as and for the purpose set forth.

15. In a barb-wire machine, in combination with means for forming the barbs upon the strand-wires, mechanism for feeding the barb-wire forward, consisting of a pivoted bell-crank lever, a dog carried by the free end of the lever, and means for operating the lever, consisting of a yoke to which one end of the lever is secured, a cam fitting in the yoke, a stem on the yoke, a guide, 51, through which the stem passes, and spring 52 surrounding the stem, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LOUIS J. CRECELIUS.

Witnesses:

JOSEPH LLOYD,
EDWARD V. RINGO.