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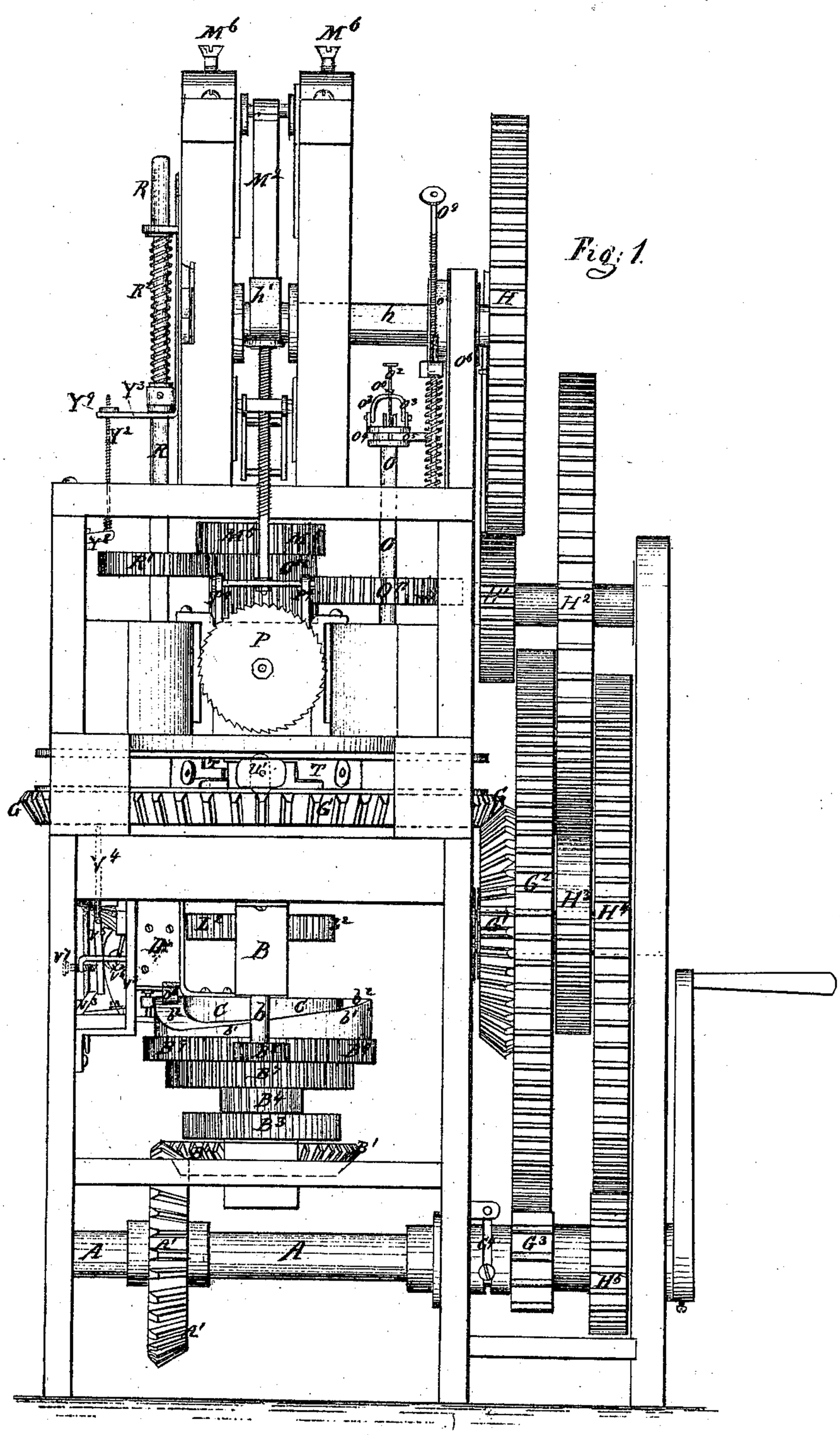
C. A. Rodney,

Manf. Wood Screws.

No. 97,230. Patented Nov. 23. 1869.

Fig: 1.



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A Ruppert.

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Inventor
by
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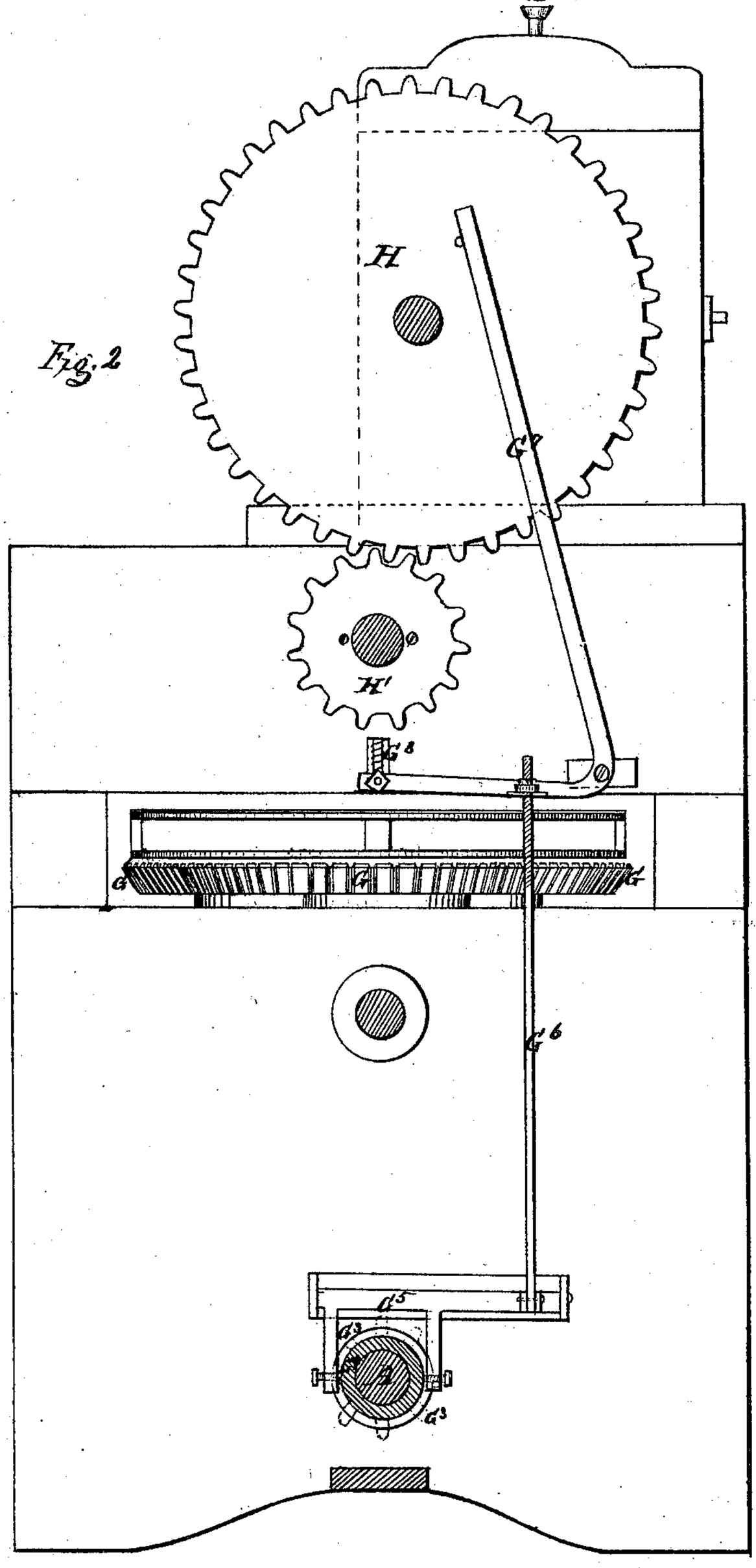
Fig. 2



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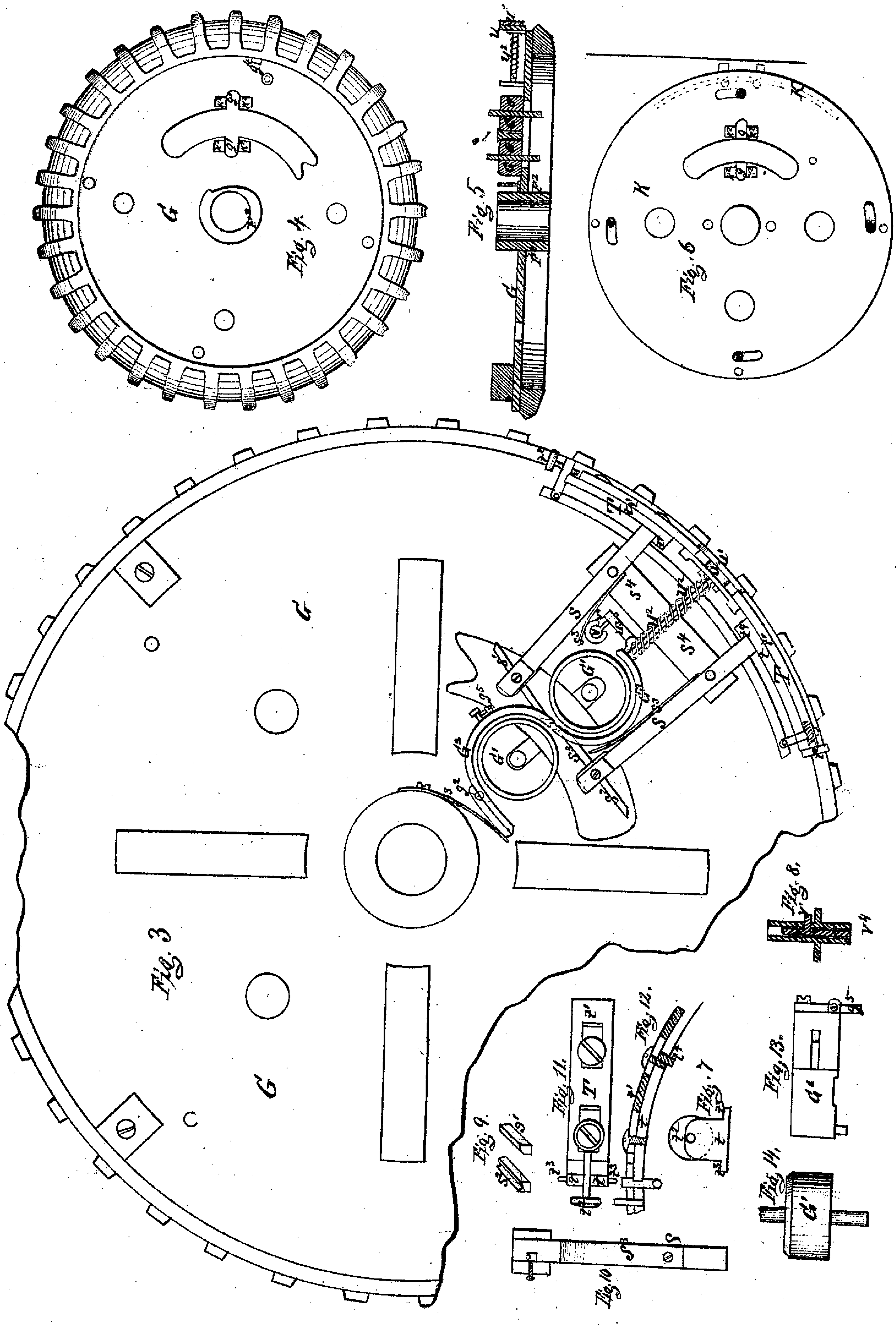

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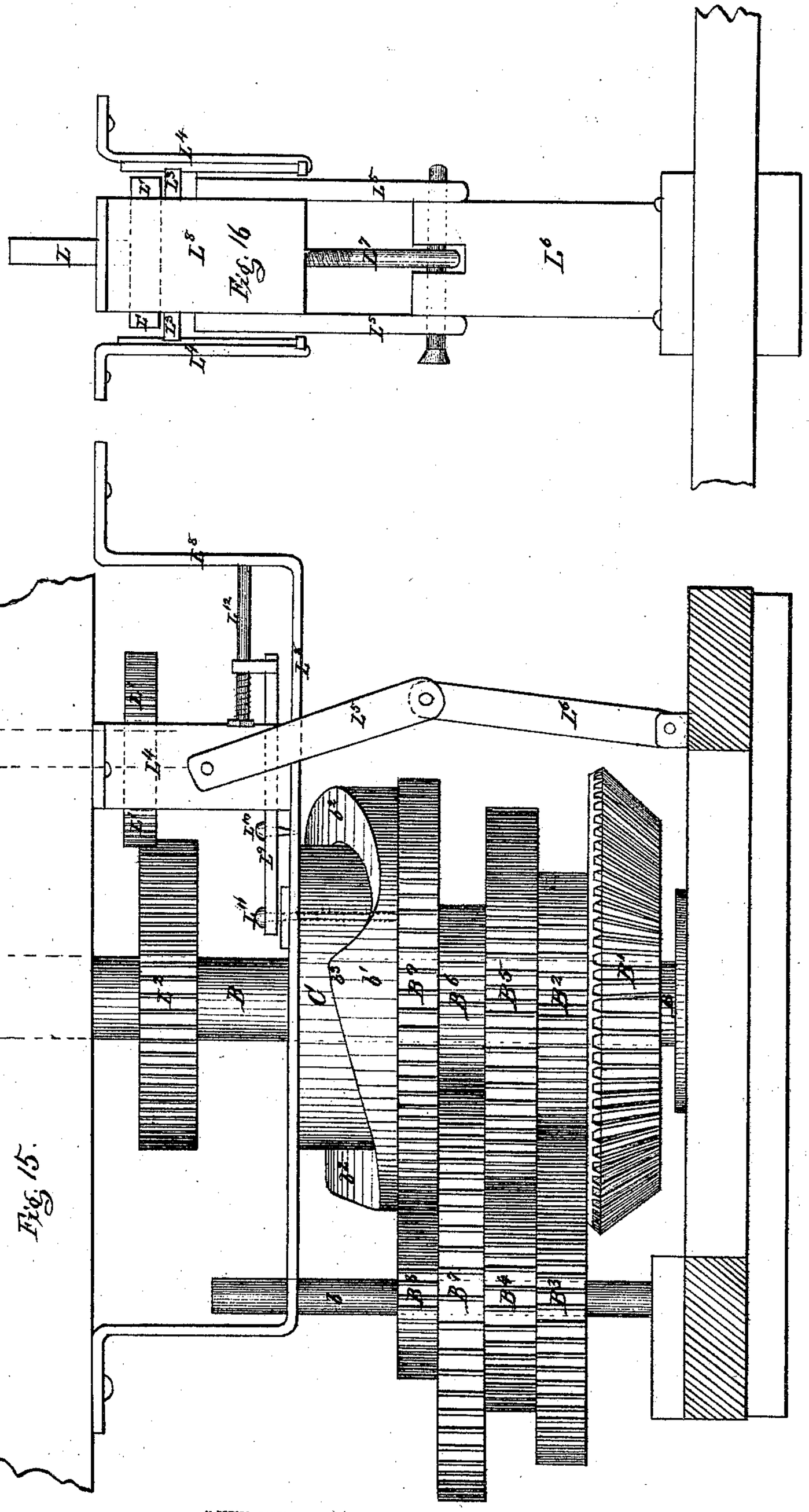

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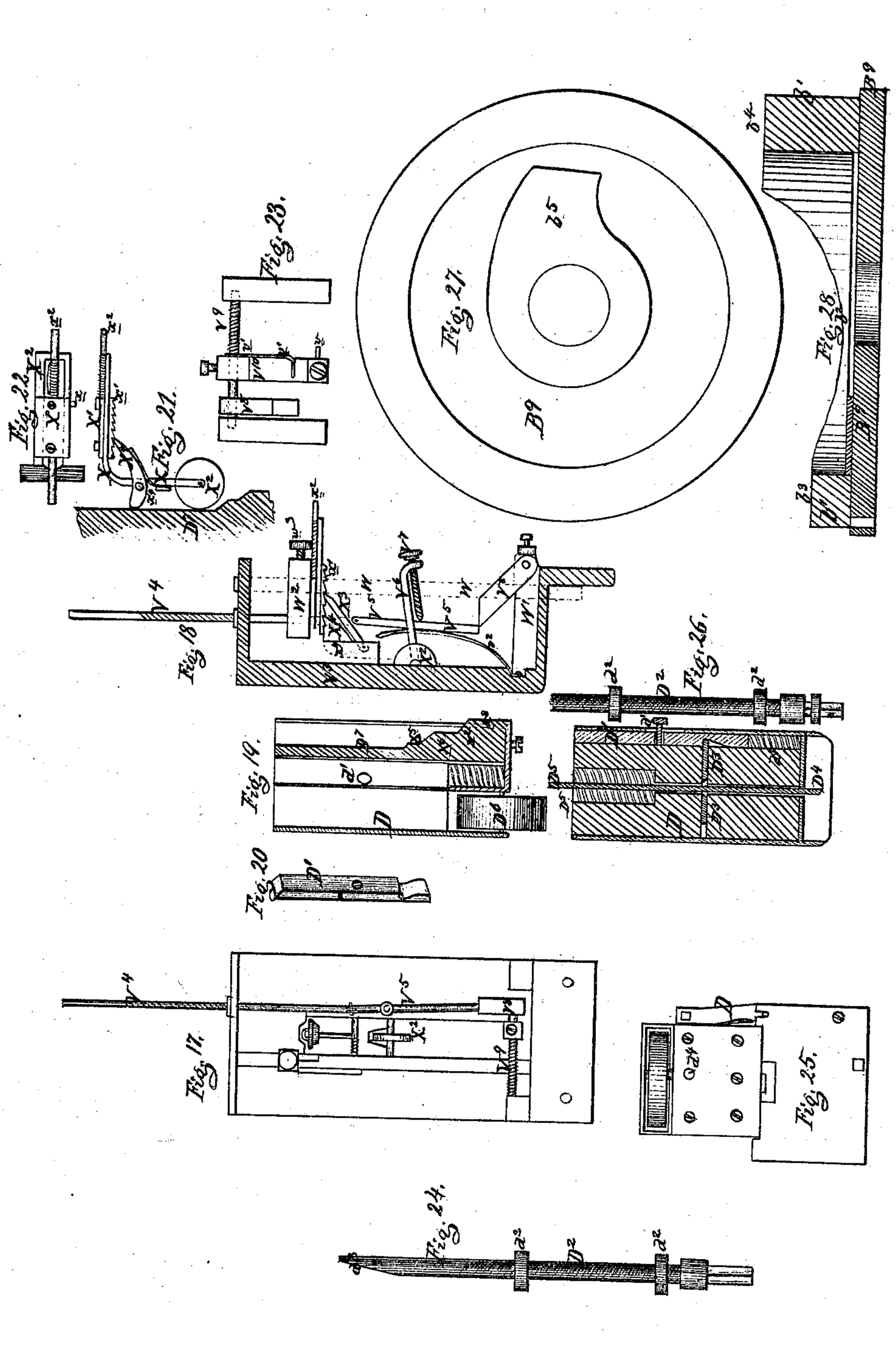

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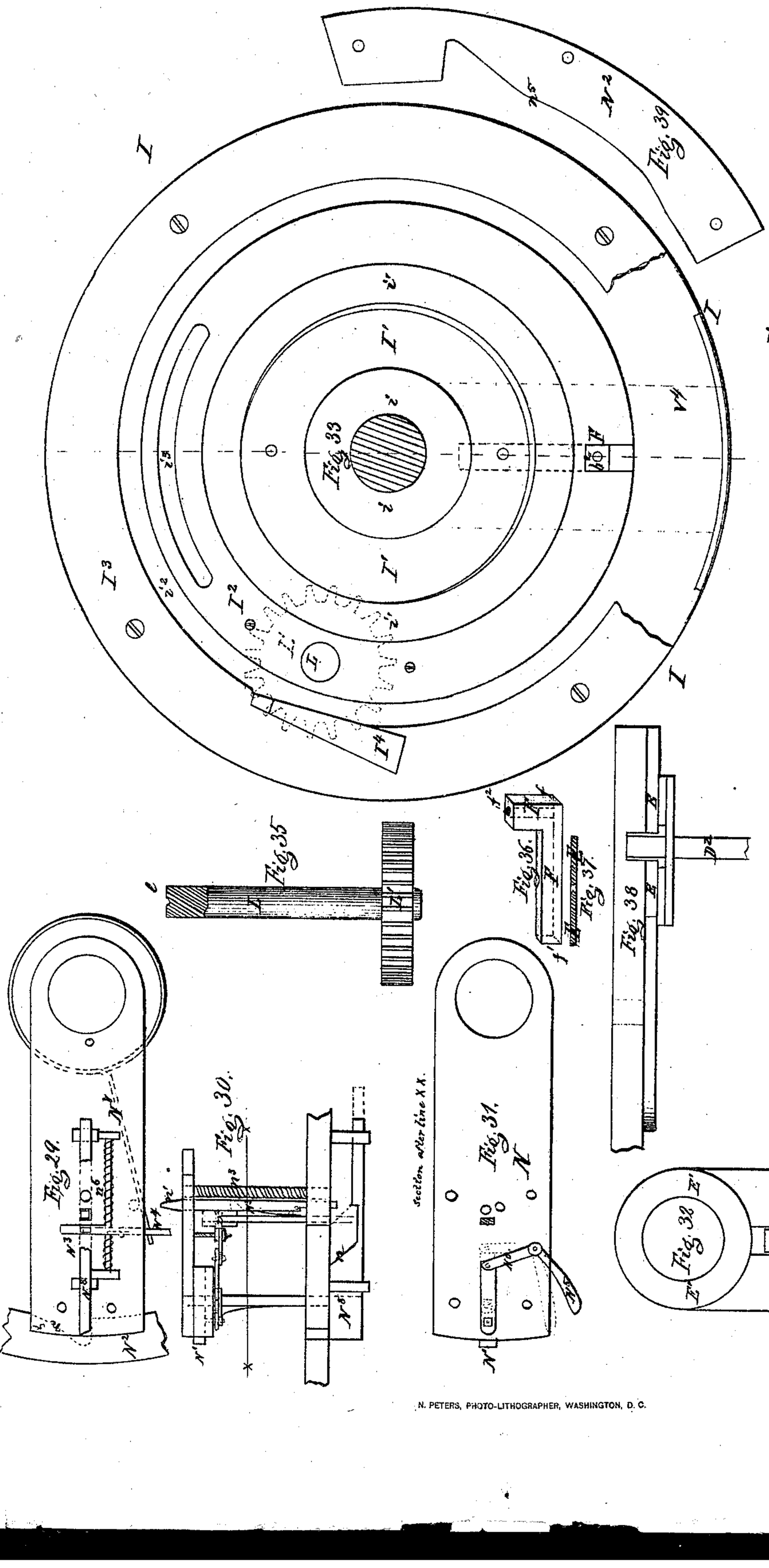

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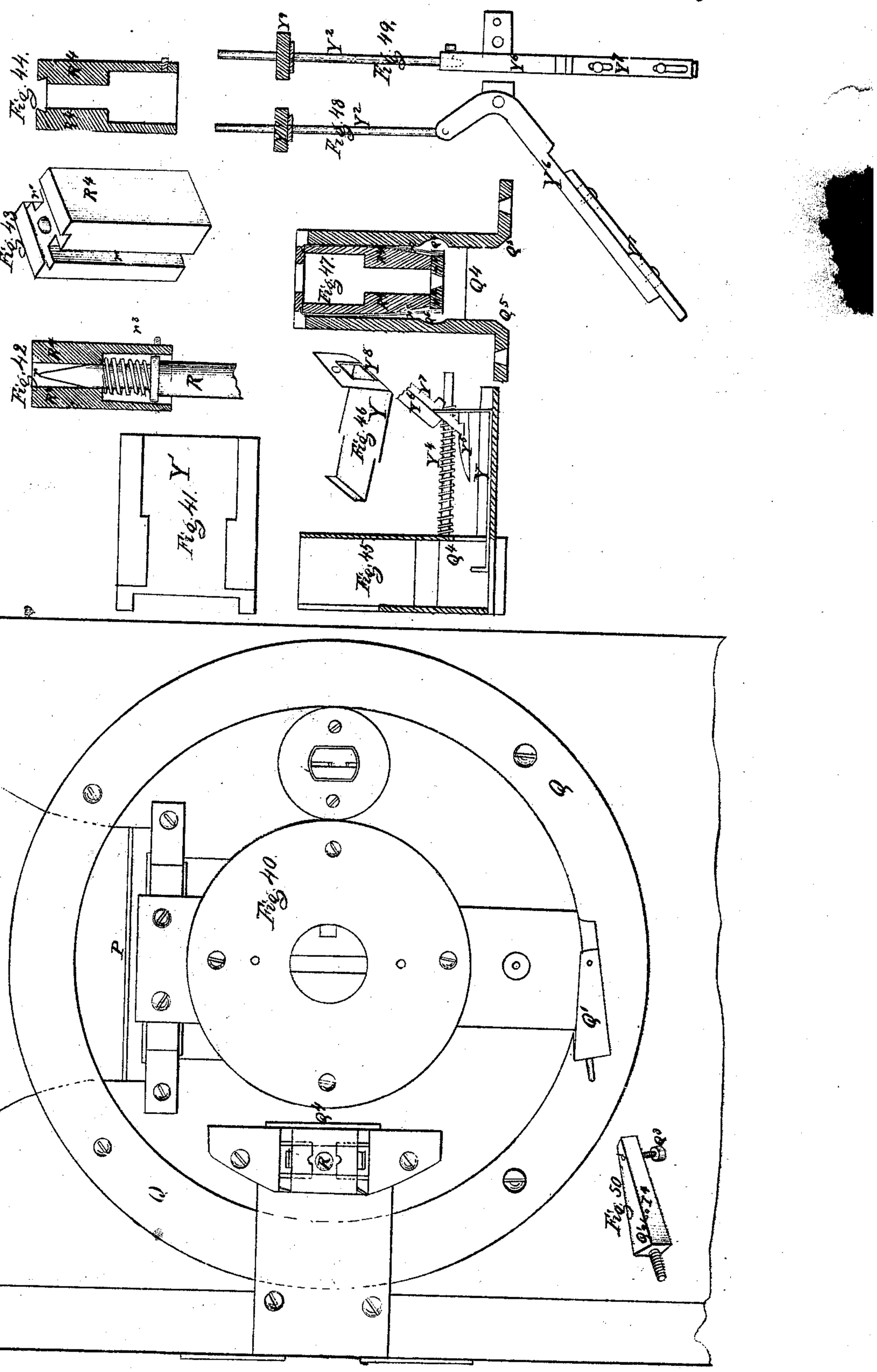

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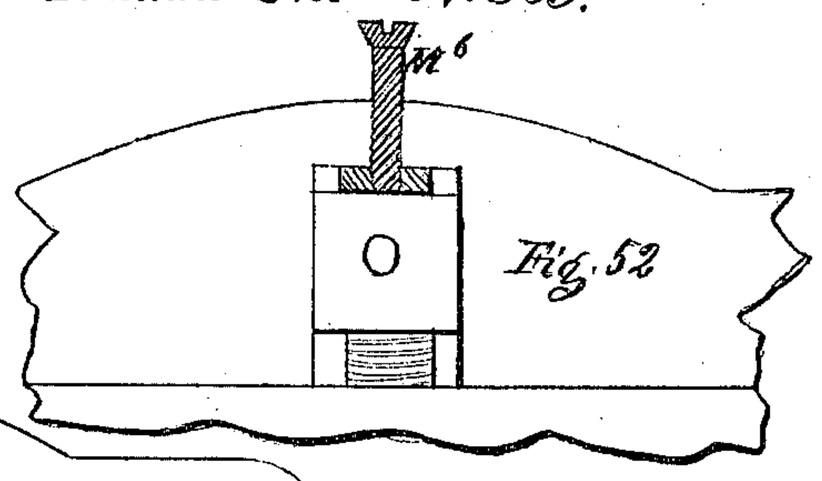

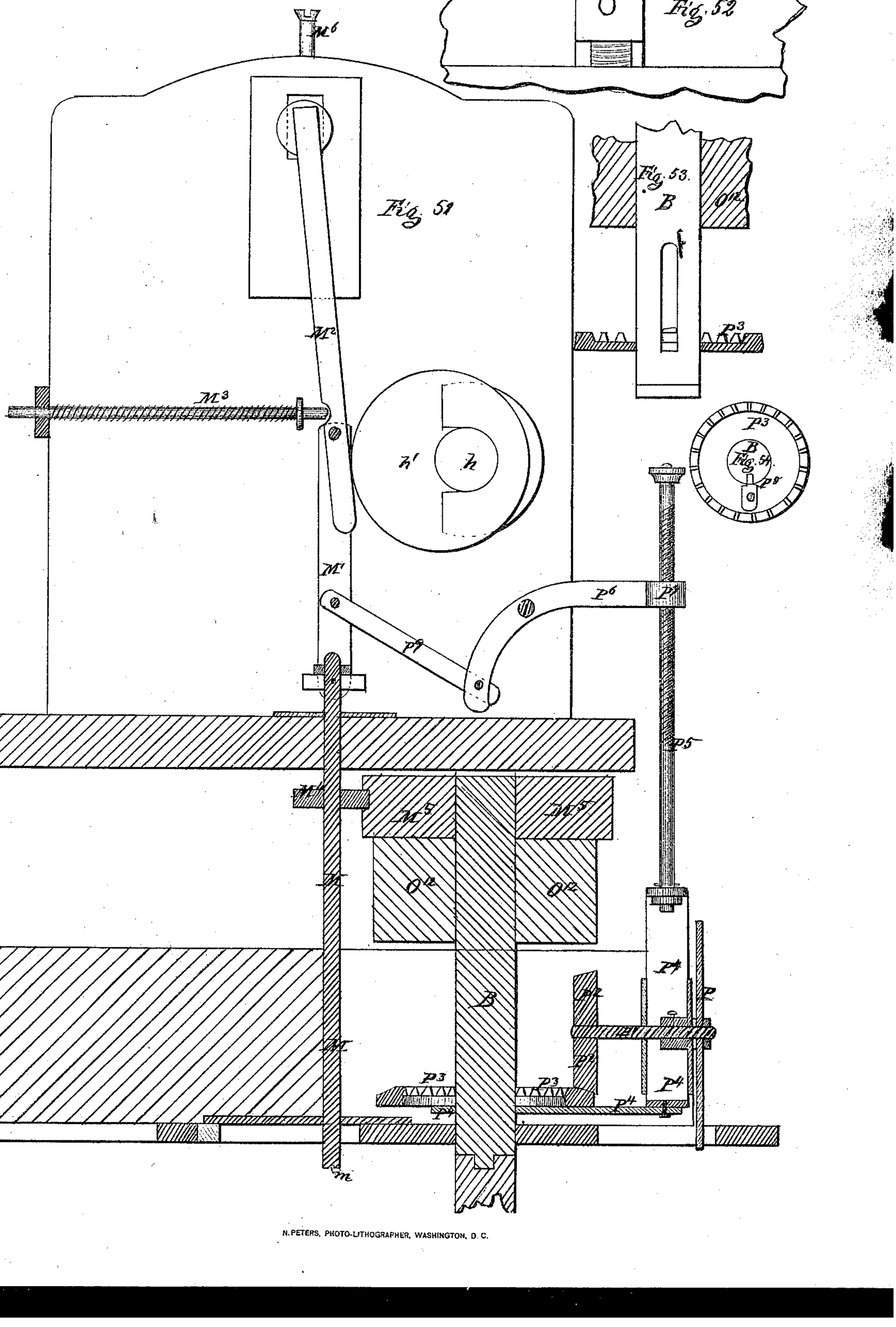

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C. A. Rodney,

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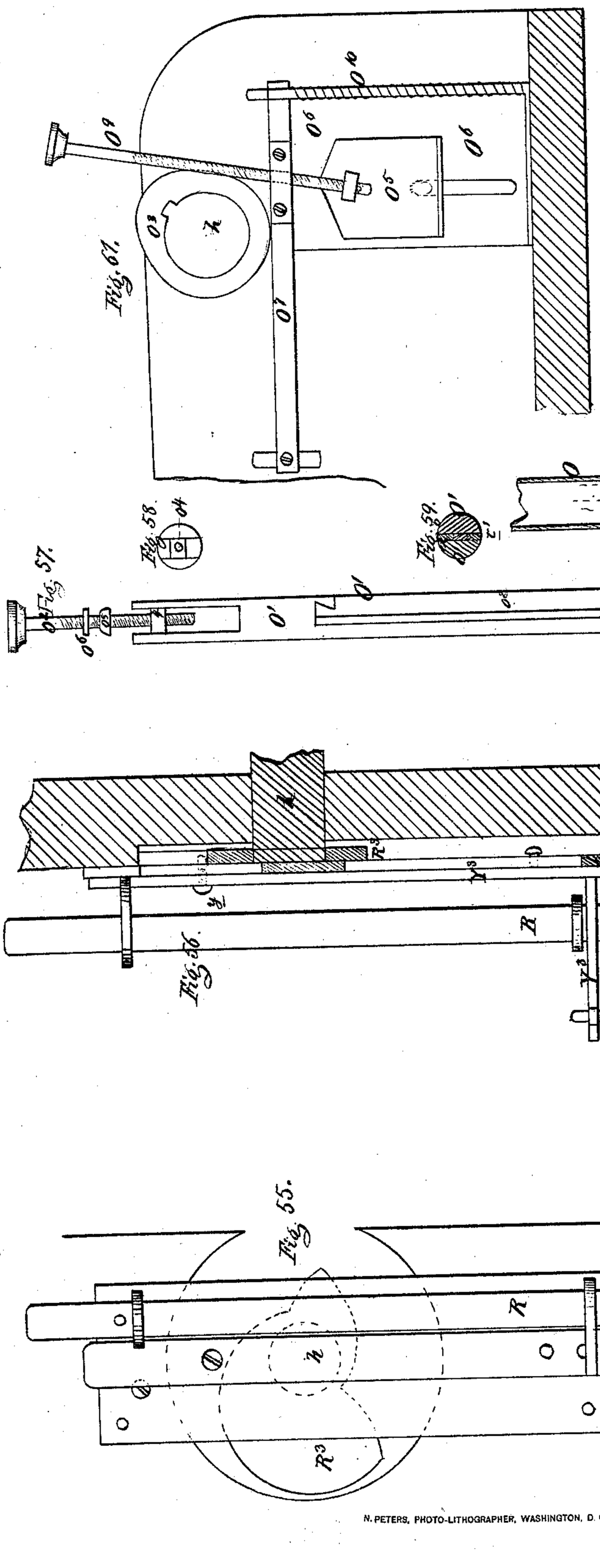

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Manf. Wood Screws.

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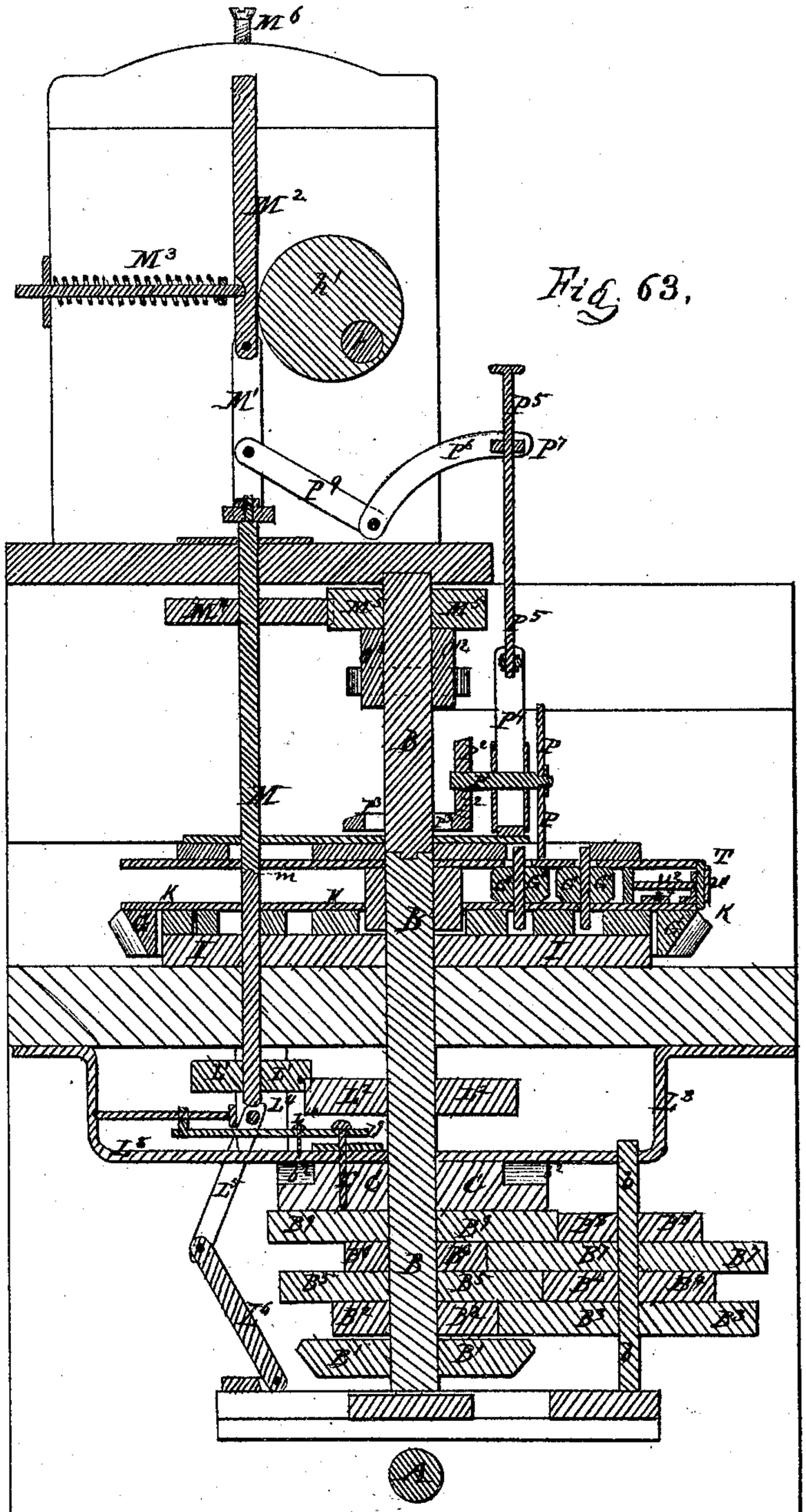

Fig. 63.

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United States Patent Office.

CÆSAR A. RODNEY, OF WILMINGTON, DELAWARE.

Letters Patent No. 97,230, *dated November* 23, 1869.

IMPROVED MACHINE FOR MAKING WOOD-SCREWS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, CÆSAR A. RODNEY, of Wilmington, in the county of New Castle, and State of Delaware, have invented new and useful Improvements in Machines for Cutting Wood-Screws; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings, making part of this specification, in which—

Figure 1 is an elevation of the entire machine;

Figure 2 is a side elevation of the machine, as seen with portions of the d iving-mechanism removed; and

The remaining figures, from 3 to 62, inclusive, are views or sections of different portions of the working-mechanism, to be hereinafter specially described and referred to.

Figure 63 is a vertical section of the machine, showing the connection of the several parts.

The same letters in all the figures are used to indicate the same parts.

My invention relates to a machine for making wood-screws, in which the entire operation of making the screw is carried on in one machine, the wire being fed into the machine at one point, and the successive operations being performed, a completed screw is delivered from another part of the machine.

The peculiar characteristics of my invention will be hereinafter indicated in the body of the specification, and in the claims.

The power is applied to the shaft A, which turns in suitable bearings in the frame of the machine, and which carries the bevelled driver A^1.

The driver A^1 meshes into the bevelled wheel B^1, on the vertical driving-shaft B, to which it is attached.

The spur-pinion B^2 is cast with the wheel B^1, and it drives the spur-wheels B^3 and B^4, cast in one piece, and turning loosely on the counter-shaft *b*.

The pinion B^4 meshes into the wheel B^5, cast with the pinion B^6, both turning on the shaft B.

The pinion B^6 meshes into the loose spur-wheel B^7, which is cast with the pinion B^8, the latter meshing into the spur-wheel B^9, which turns freely upon the shaft B.

The object of the intermediate gearing is to reduce the motion of the wheel D^9, which is required to move at a comporatively slow speed. This arrangement of gearing is shown in figs. 1 and 15.

Cast with the wheel B^9, as shown in the same figures, and in fig. 28, is a solid rim, b^1, having inclined surfaces b^2, which terminate in alternate projections, b^3 and b^4, of different altitudes. In the case illustrated, two such projections are shown. In large working machines, more would be introduced, depending upon the number of cuts intended to be employed in forming a screw; but, where more than two elevations are used, only one increased elevation, b^4, is used, all the others being of the same altitude.

The height of the elevation b^3 is that intended for the length of the thread to be cut on the screw, and that of b^4 is the entire length of the screw, plus the amount of wire necessary to form the head.

The screws are cut from a wire, which is drawn from a coil, and carried into the reciprocating feed-box D. (See figs. 1, 20, 19, 25, and 26.)

This feed-box slides between ways attached to the frame-work of the machine. It is a metallic box, enclosing the clamping-mechanism, and draws the wire up from the coil through the hole d^4, fig. 25.

This mechanism consists of the following parts:

A reciprocating bar, D^1, which is shaped as clearly shown in fig. 20 in perspective, and in section in fig. 26, fits loosely into the feed-box. It has an inclined surface, which bears against a sliding horizontal plate, D^3, extending across the feed-box, with a hole through it, through which the wire, represented by D^4, passes.

As the reciprocating bar D^1 is raised, the inclined surface of the notch, bearing against the end of the plate D^3, forces it against the body of the box, so as to clamp it firmly.

The box rests upon the surfaces b^2, and, as the wheel B^9 revolves, it will be raised and lowered, as each elevation b^3 b^4 passes under it.

The stud-pin d^1 projects through a slot in the case of the feed-box, and, as it is attached to the bar D^1, the latter is independently operated by the contact of the stud-pin d^1 with the collars d^2 on the vertical reciprocating rod D^2.

As the feed-box D descends on the track b^2, the stud-pin will strike against the lower collar d^2, and the bar D^1 will be raised.

The inclined surface will force the bit D^3 against the wire, and clamp it. As the box ascends, it will carry up the wire D^4, until the stud-pin strikes against the upper collar d^2. It first raises the rod, until the point d^3, fig. 24, operates to close the upper clamp, to be presently described.

When the rod D^2 can rise no higher, the stud-pin will hold the bar D^1 while the feed-box ascends, and thus disengage the clamp D^3 from the wire, so that as the box descends, the wire suspended upon the upper clamp will be drawn through the feed-box.

The collars d^2 are screwed on to a thread cut on the rod D^2, so that by raising and lowering them, the machine may be adjusted to cut more or less wire.

The height of the upper collar must be sufficient to enable all the lower projections, b^2, to pass under the feed-box without the stud-pin d^1 being brought into contact with the upper collar, which is only intended

to operate upon the bar D^1 when the screw has been completed, and it is to be expelled to make room for a section of wire to form another blank.

The spring D^5 may be used to force down the feed-box, but it is not believed to be necessary, as its own gravity will be sufficient.

The spring d^5 is intended to support the weight of the bar D^1.

The friction-roller D^6 is placed under the feed-box to traverse the track b^2.

The upper clamp, which holds the wire after the lower clamp D^3 has been released, is operated as follows:

A perforated clamping-plate, E, figs. 32, 37, and 38, constructed like the plate D^3, is placed over the feed-box, being attached to a plate, E^1, attached to or forming a part of the frame-work.

The bevelled point d^3, of the rod D^2, as shown in fig. 24, when the rod is raised by the stud-pin, is forced against the edge of the plate E, forcing it against the wire passing through a hole, immediately below f^2 in the shear-head, and clamping it precisely in the same manner that the plate D^3 has done, and thus sustaining it while the feed-box is descending, until the stud-pin d^1 strikes against the lower collar d^2, and, drawing down the rod D^2, disengages the upper clamp E, and fastens the lower one, D^3, at the same time.

In case the friction of the point d^3 should not be sufficient to sustain the weight of the rod D^2, it may be supported by a compensating spring.

At this stage of the operation, a length of wire sufficient to form a blank, is projecting above the feed-box, and the next operation is to shear off the wire intended to form the blank. This is done by the following mechanism:

The shear is shown in figs. 36 and 33, and its operating-mechanism is shown in figs. 4, 5, and 32.

f is the head of the shear, which has, through it, a vertical hole, f^2, into which the wire passes from the hole in the clamping-plate E, immediately below it.

The other end, f^1, bears against the cam F^2, turning around the shaft B.

This cam is formed as part of the hub of the wheel G, and, by its pressure, it bears against and projects the shear, which is retracted, when relieved from the pressure of the cam, by the pressure of the spring F^1, fig. 32. When the wire has been cut off, it remains in the hole f^2. As represented in the drawing, the cam F^2 will project the shear F only once while the wheel G is making an entire revolution; but in large machines, the cam will be so formed as to project the shear as many times as there are sets of clamps attached to the wheel G, as will be further explained hereafter.

The wheel G is a large horizontal bevel-wheel, shown in figs. 1, 2, 3, 4, and 5. It does not have a continuous revolution, but has an intermittent motion, derived through the following-described mechanism:

It is driven by the wheel G^1, fig. 1, which is cast with or attached to the spur-pinion G^2, which derives its motion from the loose pinion G^3, on the shaft A.

G^4 is a clutch, sliding on the shaft A, on a feather.

It revolves with the shaft, and is alternately engaged with the pinion by a yoke fastened to the oscillating shaft G^5, (see fig. 2,) which is oscillated by a rod, G^6, attached to an arm on the shaft G^5.

The upper end of the rod G^6 is attached to the short arm of a bell-crank lever, G^7. The long arm of the latter is moved, periodically, by a wrist-pin, projecting from the side of the wheel H.

The short arm of the bell-crank lever G^7, projecting beyond the rod G^6, is attached to the head of a pin, G^8, which enters holes shown in the plate K, fig. 6, by which the wheel G is held, so that it cannot move until the pin is disengaged, which occurs at the same time that the clutch is thrown into gear with the pinion G^3.

The wheel H is so geared as to have the same number of revolutions with the wheel B^9, and the cam b^2 attached thereto. It is driven by a system of spur-wheels, H^1, H^2, H^3, and H^4, and pinions H^5, on the driving-shaft A, as clearly shown in fig. 1, the intermediate gearing being arranged on the same principle as the system of intermediate wheels B^2, B^3, B^4, B^5, B^6, B^7, B^8, and B^9, already described, and resulting in the same diminution of motion, so that the shear shall cut the rim every time the wheel B^9 makes a complete revolution.

The piece cut from the wire to form a blank remains in the hole f^2, in the shear-head, while the wheel B^9 is making the next revolution, and when the wire is again forced up by the high cam b^4, it expels the piece from the shear-head, by forcing it upward into clamping-mechanism on top of the wheel G, which will be presently described.

In figs. 33, 34, and 63, I have shown, in plan and in section, a bed-plate, attached to the main frame, and marked I. In the centre of this plate is a recess, i, to receive the cam F^2. Surrounding this is an annular bearing, I^1, which has an eccentric plate on its face, the purpose of which will be hereinafter described. Surrounding this is a recess, i^1, and next in order is the elevated annular surface I^2, containing the segmental slot i^3.

The face of the head of the shear F is flush with the surface of this ring. It is surrounded by a recess, i^2, and this, again, by the annular surface I^3, which has a recess cut in its inner edge to receive the piece I^4, which is a triangular block of metal, the purpose of which will be hereafter explained. The upper face of this block is, in form, a right angle, or a truncated right angle, its vertical face being at a right angle to the radius of the bed-plate.

The wheel G is shown in fig. 3, which is a top view; in fig. 4, which is a bottom view; and in fig. 5, which is a section. This wheel carries four sets of clamps, (one only being shown,) which receive the pieces of wire as they are successively forced up from the head of the shear. This clamping-mechanism is constructed as follows:

G^1 G^1 are two cylindrical rollers, turning freely on short journals above and below, and having their bearings below in the slots g^1 g^1 in the wheel G, and above in the slots g g, in the plate K, fig. 6, which is attached to and covers the wheel G, resting upon the projecting bearing-surfaces shown in figs. 3 and 5;

G^2 is a movable jaw, pivoted at g^2, and pressed forward by a spring, g^3; and

G^3 is a fixed jaw attached to the wheels G.

These jaws are respectively arranged in relation to the rollers G^1, and to one another, as clearly shown in fig. 3.

As the wire is forced from the shear, it is received between the wheels G^1 and the points of the jaws G^3 G^2, where it is held, and is carried with the revolution of the wheel G, until the latter has made one-fourth of a revolution, when it stops, the wire resting immediately above the upper end of the shaft L, figs. 33 and 35.

The wheel G is so geared as to make one-fourth of a revolution while the wheel B^9 is making one entire revolution, so that a wire is being held in position over the said shaft L, to be headed, while another section is being carried through the feed-box, to be cut off.

The shaft L is in continuous revolution, deriving its motion from the wheel L^1, which meshes into the wheel L^2 on the main shaft B, as shown in figs. 1 and 15.

A recess, l, fig. 35, is formed in the centre of the head

of the shaft L, to give a slight tapering point to the screw-blank, as it is being headed in the manner to be next described.

The shaft L is stepped upon a cross-head, L^3, fig. 16, which slides freely up and down between ways L^4 suspended from the main frame.

The cross-head is raised and lowered by means of a toggle-joint, L^5 L^6, the lower arm L^6 of which is pivoted to a cross-brace of the main frame.

This toggle-joint is operated by means of a rod, L^7, which passes through the horizontal portion of the brace L^8, and is attached to a horizontal reciprocating bar or plate, L^9, fig. 15.

This plate is slotted, and the bolt L^{10} acts as a guide, while the bolt L^{11}, passing down through the hub C in the centre of the rim b^1 of the wheel B^9, as seen in fig. 15, terminates in the cam-shaped recess b^5 in the wheel B^9, as shown in fig. 27, thus giving a reciprocating motion to the said bar L^9, and operating the toggle-joint. The spring on the rod L^{12} draws back the toggle-joint.

In fig. 51, M is the upset, being a vertical rod, which, when forced down, upsets the end of the wire projecting above the rims of the cylindrical rollers G^1, to form the head upon the screw-blank. This upset is operated by a toggle-joint, M^1 M^2, placed between vertical frames, forming the top of the frame of the machine, as shown in fig. 1. This toggle-joint is extended by the revolution of the eccentric h^1, placed on the shaft h of the wheel H, and is bent back by the opposite pressure of the spring M^3 bearing against the opposite side of the angle.

The pressure of the toggle-joint may be adjusted by the set-screws M^6, shown in figs. 1, 51, and 52, bearing upon the adjustable boxes of the journal upon which the upper arm of the toggle-joint turns. These boxes may be raised or lowered by the set-screw.

As the wheel H revolves at the same speed with the wheel B^9, it makes four revolutions to one of the wheel G, so that the upset will be forced down as the wires are successively brought under its point.

The upset has a depression, m, in its lower face, to form a centre on the blank opposite the point formed by the recess l. The upset M also revolves at the same speed with the shaft L, deriving its motion from the pinion M^4, meshing into the spur-wheel M^5 on the main shaft B.

The upper edges of the cylinder G^1 are bevelled, as shown in figs. 3 and 14, and as the upper and lower rods M and L revolve, they will carry with them the blank, and as it revolves, the head will be swelled into proper form, its under side conforming to the bevel of the rollers G, which, revolving, will prevent the formation of fins on the head, as it is upset.

The wheels H and B^9 having the same revolution, the downward action of the upset and the upward action of the shaft L will occur at the same time.

As the wire is carried from the point where it is cut off, to the point where the head is formed, the roller G^1 nearest the periphery of the wheel G, has its journal extending downward through the slots g, and received into the depression i^2 in the bed-plate, and bearing against the inner edge of the annular surface I^3, so that when it reaches the surface of the piece I^4, fig. 33, which is perpendicular to the radius of the wheel, the journal will be forced toward the centre, so as to hold the roller more strongly against the wire while the head is being formed, so as to cause the roller to revolve.

When the wheel revolves further, after the head is formed, this pressure will be relaxed as soon as the head passes beyond the piece I^4.

As the recess in the rim I^3 is longer than the piece I^4 therein placed, as shown in fig. 33, the piece I^4 may be adjusted so as to give a greater or lesser pressure to the journal of the roller, as circumstances may require.

A ring, Q, shown in fig. 40, is placed immediately over the ring I^3, containing a similar block, Q^1, (see fig. 50,) held in place by a bolt, Q^3, the head of which is on the upper side of the ring, to sustain the bolt passing through a slot in the ring Q. This block presses the upper journal of the outer roller toward the centre, at the same time that the block I^4 acts upon the lower journal.

In order to give increased bearing-surface to the journals of the rollers, the thickness of the plate K, and also of the wheel G, where the journals of the rollers G^1 pass through them, is increased, as shown at K^2 in figs. 4 and 6, by swells on the upper surface of K, and the lower surface of G, around the slots through which the journals pass. This increased thickness also aids in preventing cuttings from entering the slots.

These projections K^2 fit down into the grooves in the bed-plate, and also into the upper plate Q, and as they sweep around in the grooves in the bed-plate, they carry the shavings, falling into the grooves upon them, and sweep them into holes left for their escape through the bed-plate.

When the head has thus been formed, immediately on being relieved from the pressure of the upset, the wheel G will be rotated another fourth of a revolution, carrying with it the blank held between the rollers G^1, when the projections g^4, in fig. 4, on the inner edge of the rim of wheel G, comes in contact with the bolt N^1, projecting from the outer end of a swinging frame, N, figs. 29, 30, 31, and 34, placed under the segmental slot i^3, fig. 33, in the bed-plate I.

The swinging frame turns on the shaft B, as a centre, and is held nearest to the side from which the blank approaches, as the wheel G revolves with it, by the stress of a spring, N^7, which is coiled around the shaft B, in a recess in the bed-plate, and has an arm projecting outward, and pressing against the oscillating frame.

The blank shown in fig. 5, at D^6, is carried between the cylinders G^1, its head resting upon the bevelled edges.

In order that the head may be turned off, it must be raised above the roller G^1.

This is done by means of the pointed rod N^3, figs. 29 and 30, which is forced up under the blank, through the segmental slot i^3, fig. 33, in the following manner:

A cam-plate, N^2, is fastened under the bed-plate I, (see figs. 29 and 39,) the edge of which is formed as shown by the line n^5.

A bolt or slide, N^8, rests against this edge, being pressed outwardly by a spring, n^6.

Now, when the bolt N^1, engaging the projection g^4, has caused the swinging frame N to turn, the cam N^2 will press back the slide N^8, and pressing the inclined face n thereof against the toe of a vertical rod, N^3, will force it upward, the point n^1 passing through the slot i^3, and pressing against the blank D^6, fig. 5, cause the head thereof to be raised above the rollers.

When the bolt N^8 is opposite to the point indicated by the letter n^5, fig. 39, the revolution of the wheel, and consequently the movement of the swinging frame, ceases, until the head is turned off by mechanism, to be hereinafter explained.

In order that the cutting-tools may take effect on the head, it is necessary that the blank shall be held firmly without turning. This is accomplished in the following manner:

The eccentric plate I^1, fig. 33, is so placed, that as the swinging arm raises the blank, the eccentric shall press upon the arm g^5, figs. 3 and 13, on the movable jaw G^2, which extends down through a slot in the wheel G, and press the jaw G^2 with great force against the blank, and hold it so that it cannot turn, while its head is subjected to the action of the cutters.

As the rod N^3 is suspended at n^2, so as to swing freely when its lower end is struck by the bar N^4, it

will be pushed from the slide N^8, and fall by its own gravity, or by the force of the spring n^3.

When the arm N^5 strikes against the bed-plate, the other arm, N^6, of a bell-crank lever, will throw back the bolt N^1, disengaging it from the projection g^4, on the wheel G, and the spring N^7 will immediately force the swinging frame with, its mechanism, back to the side from which it came.

The pressure of the cam I^1 continues to confine the blank during the movement of the wheel through the next stage of the operation.

The mechanism for turning the heads of the blanks is seen on figs. 1, 57, 58, 59, 60, 61, and 62.

O is a hollow arbor, in which the stock O^1 of the cutters is inserted.

This stock is formed of two pieces, the piece o^2 being separable, and the steel cutters being placed between them, and secured by a screw, o^3.

The cutter o is designed to turn off the top of the head, and the cutter o^1 is used to turn off the edge of the head.

It is not necessary to turn off the bevelled sides of the blank, as that has been already smoothed by the rotation of the bevelled roller G^1, when the head was formed.

When the cutters have been inserted in the stock, the latter is pressed into the arbor, by the screw O^2, acting on the oscillating base o^4, and sustained upon the oscillating yoke O^3, which holds the screw between the collars o^5 and o^6.

By turning the screw O^2, the bevelled point of the stock is forced into the converging extremity of the arbor, so that these inclined parts operate to compress the point of the stock very firmly upon the cutters, and so hold them rigidly in place.

The arbor is suspended on the yoke O^5, which embraces the grooved collar O^4, so as to permit the arbor to turn freely.

The arbor and cutting-tools are turned by a spur, O^{11}, on the arbor, which meshes into the pinion O^{12}, (see figs. 1 and 51,) on the main vertical shaft B.

The face of this wheel O^{12} is long enough to allow the arbor to be moved up and down, by the action of the eccentric O^8, which presses upon the oscillating lever O^7, pivoted at one end, and sustained at the other upon a spiral spring, O^{10}, which surrounds a guide-rod passing through the lever.

The yoke-plate O^5 is bent at right angles, as shown in fig. 62, and slides up and down on the slotted plate O^6, being held in place by a stud-pin passing through the slot, and having a nut on the other side of the plate O^6. It is connected with the lever O^7 by a set-screw, O^9, by turning which, the yoke-plate, arbor, and cutters may be raised or lowered.

When the eccentric O^8 forces down the cutting-tool with the revolution of the shaft h, the cutters are brought into action upon the blank-head, and when relieved from the pressure of the eccentric, the tube is raised by the spring O^{10}.

When the head has been turned off, the wheel G is carried forward another fourth part of a revolution, to bring the head of the blank under the edge of the saw, which cuts the nick in the head of the screw, the screw-blank remaining firmly compressed in the jaws, by the continued action of the cam I^1 upon the arm g^5, fig. 3.

The saw, and mechanism for operating it, are shown in figs. 1, 51, 53, 54, and 40.

P is the saw, which cuts the nick. It is overhung upon the mandrel P^1, which has its bearings in the cross-head P^4, and is turned by a bevel-wheel, P^2, meshing into a bevel-wheel, P^3, which slides upon the vertical shaft B, by means of the cross-head P^4, and being made to turn with the shaft B, by the point P^3 on the wheel P^3, fig. 54, catching in a groove in the shaft B, shown in fig. 53, or by means of a feather on the shaft, engaging a notch in the eye of the wheel.

The cross-head P^4, shown in figs. 1 and 51, slides up and down on suitable ways, fastened to the main frame, and the saw is elevated and depressed by the adjustable connecting-rod P^5, passing through an oscillating shaft, P^7, having its journals in the parallel arms P^6, pivoted to the main frame, and operated by an arm, P^9, which is pivoted to the lower arms of the toggle-joint M^1, which operates the upset, so that as the arm M of the toggle-joint oscillates, in bringing down the upset, it at the same time, drawing upon the rod P^7, presses down the saw P to act upon the head of the screw, held in the wheel G, at a point opposite to the upset.

The blank has now its head perfectly formed, and it only remains to cut the thread to finish the screw.

To accomplish this operation, the wheel G again revolves the fourth part of a revolution. The cam I^1 releases the jaw G^2, and leaves the screw loosely held between the rollers G^1.

By the last motion of the wheel, the blank is brought back to its original position over the feed-box.

The screw being cut by stationary cutters, it is necessary that the screw itself shall be turned, and elevated and depressed, by independent mechanism.

This is done in the following manner, as shown in figs. 1, 55, 56, 40, 42, 43, 44, 45, and 47, in which R is a screw-driver, the pointed head r of which is engaged with the nick in the head of the blank.

The screw-driver is pressed down by a spiral spring, R^2, and its vertical motion is controlled by the cam R^3 on the shaft h, and it is rotated by the spur-wheel R^1, meshing into the cogs of the wheel O^{12}, which drives the mechanism for turning off the head.

The head of the screw-driver is supported, when not in action, within the block R^4, placed within the well Q^4, (see figs. 40, 45, and 47,) resting upon the coiled spring r^3, fig. 42, which sustains its weight, until it is forced down by the cam R^3.

There are vertical grooves, r^1, in the opposite sides of the block R^4, in which are placed springs, r^2, which, extending downward along the length of the block, have their tension outward, and are bent on the lower ends, to sustain the nipping-jaws r^4, which slide in a dovetailed recess, formed in the bottom of the block R^4, as shown in fig. 43, where said block is represented turned bottom-side up.

The block, moving up and down in the well Q^4, when the driver forces it down, until the jaws r^4 reach the bevelled mouth of the well at Q^5, the springs will draw the jaws asunder, and allow the point r^1 to emerge between them, to catch into the nick in the blank-head, which it will cause to revolve with its own rotation.

The mechanism for cutting the thread upon the screw, while it is being turned by the screw-driver, is shown in figs. 1, 3, 7, 8, 9, 10, 11, 12, 17, 18, 19, 21, 22, and 23.

The cutters are stationary when in operation, and the screw is moved vertically, so as to traverse with that portion of the blank upon which the thread is being cut, along the points of the cutting-tools.

The blank, having been brought to the point from which it started, will be held by the rollers G^1 immediately over another section of wire, which has been cut off by the shear, and remains in the hole f^2, in the shear-head f, figs. 33 and 36, the wire uncut remaining in the feed-box, and having its upper end bearing against the portion cut off and remaining in the shear-head.

As the feed-box moves up and down, with the motion given to it by the projections b^3, on the cam b^1, it will cause the wire in the shear-head to press up the blank.

As the elevations b^3 are equal in altitude to the length of the thread on the screw, the wire would elevate the screw-blank the whole distance, but, as its point would interfere with the tool in cutting

the tapering point of the screw at the end thereof, it is necessary that the blank should be operated in part of its course, independently of the wire below it.

This is accomplished by the jaws r^4, fig. 47, which, when the screw-driver and blank are raised, are closed by the pressure of the sides of the well Q^4, as soon as the block R^4 has been drawn up, so that the jaws r^4 are raised above the bevelled lips Q^5, and compressed, so as to enclose the screw-blank immediately below the head.

From this point the screw is controlled by the driver and jaws alone, the cams on the cam-wheel R^3 corresponding with the projections b^3 and b^4, on the cam b^1, of the wheel B^9.

In the drawings but one elevation, b^3, and another, b^4, are shown.

On a machine, such as has been described, there would be several projections b^3, and one, b^4, and the same number of projections on the cam R^3, and one longer one, so that the motions of the screw-driver, in raising and lowering, shall precisely correspond with those of the feed-box.

The cutters are attached by set-screws to the oscillating levers S S, fig. 3.

These cutters are shown at S^1 S^2. They pass through slots in the jaws G^2 G^3, shown in fig. 13; and if the rollers G^1 interfere with their action, a groove must be cut around the rollers to receive the points of the cutters.

One of these cutters, S^1, (see fig. 9,) has a cutting-point for cutting out the metal between the thread, and the other, S^2, cuts the sides of the thread on its bevelled cutting-edges. Other forms may, however, be used.

The levers S S, which are the stocks of the cutters, are pivoted upon pins projecting from the plate S^4, so as to have their short arms outside of the pivots, in order that the stocks may be turned on their pivots, so that the short arms, in turning, may clear the rock-shaft U^2, and the cutters may be brought to the outside of the machine to be removed from the stocks.

The feed-motion is communicated to the stocks and cutters from the rock-shaft U^2, fig. 3, through the adjustable connecting-plates T. These plates are placed at the end of each stock S.

They are formed in two pieces, t t^1, (figs. 3, 11, and 12,) connected by screws, passing through slots in the one, into the other.

The short arm of the stock rests against a shoulder, t^4, and, by turning the set-screw t^2, the length of the connecting-plate may be changed, so as to regulate the position of the cutters.

The tension of the spring S^3 is applied to the long arm, so as to maintain the short arm in contact with the shoulders t^4.

There are journals on the end-plate of the piece t, through which the set-screw t^2 passes, which are received in grooves cut, below, in the top of the wheel G, and above, in the lower surface of the plate K, (fig. 6,) which is fastened to the wheel G.

The other end of the connecting-plate t^1 rests against a cam, U, on the outer end of the rock-shaft U^2, being secured in place by a button, U^1, pivoted on the outer surface of the cam U. By turning this elongated button vertically, the ends are freed, and may be turned out, the plate swinging on the journals t^3, and thus, by sliding the journals toward the cam, an open space is left, through which the cutters may be swung outside of the periphery of the wheel and plate K, to be removed or replaced.

The cutters are forced toward the screw-blank by the pressure of the cam U upon the connecting-plate T, and through said plate outwardly against the short arm of the stocks S.

The action of the cam U is regulated by the oscillation of the rock-shaft U^2, turning on its bearings, and oscillated by the arm U^3 and coiled spring, surrounding the rock-shaft, and pressing the arm U^3 down, when it is released by the dropping of the elevator V, figs. 3 and 8.

The elevator V is placed in a slotted tubular guide, bolted to the top of the wheel G.

It is a short vertical shaft extending downward to the bottom of the wheel G, and having above the wheel a horizontal arm, V^1, projecting through the slotted tube, and under the arm U^3, so that the rock-shaft is turned in one direction by raising its arm U^3, and in the other by the spiral spring surrounding it.

The elevator is raised by the rod V^4, figs. 1, 17, and 18, which passes through the bed-plate at V^4, fig. 33, and is pressed down by a spiral spring placed in a recess in the bed-plate.

The elevator V is carried around with the wheel G, and when the latter stops, is immediately over the point of the rod V^4.

The lower end of this rod is fastened by a joint-bolt to the rod V^5, which hangs within a slotted guide-arm, V^6, projecting from a frame, V^3, which is fastened to the main frame, and forms also a guide for the feed-box D, placed on the opposite side thereof,

The rod V^5 rests in front against an adjusting set-screw, V^7, and behind against a spring, v^2, which presses it against the point at the set-screw.

The toe of the rod V^5 stands on a tripping-arm, V^8, which raises it with the oscillation of the rock-shaft V^9, fig. 23.

The rock-shaft is raised by the arm V^{10}, and depressed, when the arm is released, by the downward pressure of a spring, v^1, coiled around the rock-shaft, and carried forward at the end to bear upon the upper face of the arm V^{10}.

The tripping-arm V^8 will raise the rod V^4 and elevator V slowly, so as gradually to compress the cutters S^1 S^2, and when the cutters have reached the point of the screw, the end of the tripping-arm slides from under the rod V^4 V^5, and it falls instantly, so that the elevator V falls, and, with it, the cam is released from compression upon the ends of the connecting-plates T, and the cutters are immediately withdrawn entirely from the screw by the pressure of the spring S^3, so that the screw-blank may drop with the rapid action of the cams acting upon the feed-box and screw-driver, and a new cut be commenced.

The oscillation of the arm V^{10}, of the rock-shaft V^9, is effected by the horizontal foot W^1 of the rod W, fig. 18.

This rod receives a vertical reciprocating motion from the plate X acting upon the arm W^2, adjustably attached to the rod W by a set-screw, W^3.

This plate X is bent at a right angle, the vertical portion being pivoted to lugs upon the frame-plate V^3, at a point shown at x^4, in figs. 18 and 21, so as to permit the plate to oscillate upon this centre.

The upper arm has upon its upper face a sliding plate, X^1, placed over a slot in X, and having on its under side a rack, x^1, which projects downward through said slot to receive the points of two pawls, X^3 and X^4. The former is pivoted to the same lugs on the frame V^3, below the centre of oscillation of the plate X, and is independent of it. The latter has the same centre of oscillation as the plate X.

On the lower end of this plate is placed a friction-wheel, X^2, which bears upon the edge of the cam-track D^7 on the feed-box D.

As the feed-box D is raised, by the cams b^3 successively acting upon it, as already described, the plate X will be caused to oscillate according to the irregularities in the track D^7.

Thus, when the wheel X^2 is thrown forward by the inclined surface x^5, the cutters, by the action of the intermediate mechanism, will be gradually forced against the blank, to form the entering cut for the

thread of the screw. While the wheel traverses the vertical part of the track, at x^6, the cutters will be cutting the straight part of the thread. As the track x^7 begins to press the wheel X^2, the cutters will be still more forced upon the screw, to cut it gradually away to a sharp point, to form the gimlet-point of the screw, and when the wheel reaches the vertical portion of the track x^8, the tripping-lever V^8 will throw off the cutters, which will have reached the point of the screw.

The gradual feed of the cutters, to cause the increased cut at each successive motion of the screw, is derived from the action of the pawls X^3 and X^4 on the sliding plate.

As the pawl X^3 is independent of the plate X, it follows, that as the horizontal portion of the plate is swung upward, the point of the pawl X^3 will catch a notch deeper upon the rack x^1, on the sliding plate X^1, but as the pawl X^4 has a common centre with the plate, it will not be affected by its oscillation, but will hold the plate X^1, while the pawl X^3 is being drawn back. When the plate has reached its highest point of oscillation, and begins to swing back, the point of the pawl X^3 will press the plate forward, so as to extend the point x a little further from the fulcrum, under the arm W^2, and consequently, as the lever formed by the horizontal plate, has a little longer arm, it will raise the rod W a little more rapidly, and consequently the cutters will be brought to act sooner and more deeply upon the screw.

When the wheel X^2 rises upon the track x^8, the short arm of the pawl X^4 will be brought against the base of the first inclined surface of the track, and throw the pawl X^4 out of gear with the rack, and its long end pressing on the top of the pawl X^3, will force it out of gear also, and the spring upon the stem x^2, of the plate X^1, will force it back to its original position, the screw having now been finished.

As the mechanism for cutting the screws is operated by the cams on the wheel B^9, it follows that the number of projections, b^3, must be regulated, so as to give the number of cuts necessary to form the thread. They must be more or less numerous, according to the size of the screws. Large screws, having deeper threads, will require a greater number of cuts than small ones. A blank will be cut off, and another one finished, at each revolution of the wheel B^9, and four screws will be completed at each revolution, (after the first,) of the wheel G.

The screw having been completed, it will only remain to expel it from the machine. This is effected in the beginning by the projection b^4 on the cam b^1, which forces the section of wire that has been sheared off, from the head of the shear into the clutch in the wheel G, thereby pushing up the screw therefrom.

The long point of the cam R^3 is elongated more than the other points, so that the screw driver is raised yet higher, and so as to lift the screw, held in the jaws r^4, entirely above the wheel G, and into the chamber of the well Q^4.

When the jaws are opposite the depressions Q^6, fig. 47, formed in the opposite faces of the well Q^4, the jaws will be expanded by the outward tension of the springs r^2, and the screw-head released from the gripe of the jaws, and the screw drops into the sliding pan Y.

This pan slides upon a plate, Y^1, placed immediately above the ring Q, fig. 40.

The pan and plate, and mechanism operating the pan, may be seen in figs. 1, 41, 45, 46, 48, 49, 55, and 56.

The pan is introduced through a hole in the frame of the machine, and is operated by the bell-crank lever Y^6, rod Y^2, and plate Y^3.

The latter part is bent at right angles, and has on its back a stud-pin, y, which, passing through a slot in a guide-plate, shown in fig. 56, rests on the top of the cam R^3.

The arm of the plate Y plays freely up and down on the rod Y^2, which passes through it, as the shorter projections are raising the screw-driver, but when the longest projection of the cam R^3 raises the screw-driver to its highest elevation, to lift the finished screw into the well Q^4, the adjustable nut Y^9, on the rod Y^2, is caught by the arm Y^3, and the rod Y^2 is raised, carrying up the short arm of the bell-crank lever Y^5, and throwing forward its long arm.

The extension Y^7 is attached to the long arm of Y^6 by headed bolts passing through slots in the latter, which permit it to move freely.

The point of the extension-arm Y^5 engages in a notch cut in the pin Y^1, attached to the vertical end of the drawer Y, and, as the lever Y^6 is turned, it forces the drawer forward through an opening in the side of the well Q^4, into the chamber under the screw held in the jaw r^4, as explained before.

A slight increase in the elevation of the lever Y^6 draws the point of the extension Y^7 out of the notch in the pin Y^5, and disengages the drawer, which is drawn instantly back by the action of the spring Y^4, fig. 45, its quick motion, when suddenly stopped, throwing the screw out of the pan, through the opening Y^8, to the outside of the machine.

As the pan is drawn back, the rod Y^2 and lever Y^6 are released by the cam, and the bevelled point of the pin Y^5, shown in fig. 45, forces up the extension Y^7 until it is received into the notch, and the mechanism is rearranged to catch another screw, when brought up by the screw-driver and jaws r^4, as before.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of the reciprocating feed-box D, containing the mechanism for clamping the wire, and the mechanism for clamping the wire above the feed-box, by which the wire is suspended. and drawn through the feed-box when released by the latter, substantially as set forth.

2. The combination of the feed-box D, bar D^1, rod D^2, collars d^2, and perforated plate D^3, respectively, constructed substantially as and for the purpose set forth.

3. The combination of the pointed bar D^2 and plates E and E^1, arranged to operate substantially as and for the purpose set forth.

4. The wheel B^9, constructed with projections b^3 and b^4, of different altitudes, in combination with the feed-box, substantially as set forth.

5. The shear F, with a perforated head, f, in combination with the cam F^2 and the clamps for holding the end of the wire D^4 against the lower end of the wire which has been cut from the coil, and is retained in the hole f^2, substantially as set forth.

6. The shear f, when so constructed that the length of the hole f^2 shall be equal to the throw of the elevating-mechanism, which projects the length of wire necessary to form a headed screw-blank.

7. The wheel G, when so constructed that its hub F^2 shall form a cam for operating the shear F, substantially as described.

8. The wheel G, in combination with the mechanism for clamping the screw-blank, and with the mechism for giving to it an intermittent motion, substantially as set forth.

9. The combination of the wheel H and stud-pin, bell-crank lever G^7, rod G^6, rock-shaft G^5, clutch G^4, and pinion G^3, with the intermediate wheels for giving the intermittent motion to the wheel G, substantially as described.

10. The clutching-mechanism attached to the wheel G, consisting of the rollers G^1 and jaws G^2 G^3, by which the blank is held, while subjected to the successive operations of heading and finishing, substantially as set forth.

11. In combination with the wheel G, an upper

plate, K, which forms bearings for the journals of the rollers G^1, substantially as set forth.

12. The plate K and wheel G, when constructed with swells K^2, to form bearings for the journals of the rollers G^1, and when those on the wheel are arranged to sweep cuttings from the grooves in the bed-plate I, substantially as set forth.

13. In combination with the rollers G^1, a stationary jaw, G^3, and an oscillating jaw, G^2, the latter having an arm, g^5, which, by the action of a cam-plate, I^1, may be made to compress or release the screw-blank, substantially as and for the purpose set forth.

14. The jaws G^2 and G^3, when constructed with slots, to permit the action of the cutters S^1 upon the screw-blank.

15. The rollers G^1, when bevelled upon their edges, to give form to the under side of the head of the screw, substantially as set forth.

16. The blocks I^4 and Q^1, in the plates I and Q, for compressing the journals of the roller, substantially as and for the purpose set forth.

17. The shaft L, when used for supporting the blank, and having both a vertically-reciprocating and rotary motion, in combination with a device for upsetting the head, substantially as and for the purpose set forth.

18. The combination of the shaft L, the toggle-joint, with the cam b^5, in the wheel B^9, and the intermediate connecting parts, substantially as set forth.

19. The arrangement of the reciprocating shaft L, pinion L^1, and wheel L^2, upon the shaft B and toggle-joint and cross-head L^3, so as to give a continuous rotary and intermittent reciprocating motion to said shaft L, substantially as set forth.

20. The combination of the pinions M^5 and M^4, upset M, toggle-joint M^1 M^2, eccentric h^1, and spring M^3, for giving a continuous rotary and intermittent reciprocating motion to the upset M, substantially as and for the purpose set forth.

21. The combination of the shafts L and M, when each has both a rotary and reciprocating motion, and respectively constructed with indentations l and m, substantially as and for the purpose set forth.

22. The combination of the shafts L and M and rollers G^1, when the former compress the head of the blank upon the latter, and at the same time give to it a rotary motion, substantially as set forth.

23. The combination, in a screw-cutting machine, of mechanism for causing the blanks to revolve, with other mechanism for compressing the head at the same time, substantially in the manner set forth.

24. The combination of the wheel G with a projection, g^4, and the bolts N^1, oscillating frame N, cam-plate N^2, slide N^8, and pointed rod N^3, for throwing up the blank, substantially as and for the purpose set forth.

25. In combination with the oscillating frame N, slide N^8, and rod N^3, the rod N^4, for tripping the rod N^3, when the rod N^4 encounters the frame, substantially as set forth.

26. The combination of the frame N, spring N^7, and levers N^5 and N^6, for detaching the bolt N^1 from the projection g^4, and causing the frame to return to its original position, substantially as set forth.

27. The hollow revolving arbor O, containing the cutters o o^1, for turning off the top and edge of the head of the blank, substantially as set forth.

28. The combination of the arbor O, rod O^2, oscillating yoke O^3, grooved collar O^4, and yoke O^5, connected with the cam O^8, for bringing the revolving cutters into action upon the head of the screw-blank, substantially in the manner set forth.

29. In combination with the cam O^8, lever O^7, and yoke-plate O^5, the adjustable connecting-screw O^9, arranged substantially as and for the purpose set forth.

30. The combination of the hollow tapering-pointed arbor O, bevel-pivoted stock O^1, and cutters o o^1, substantially as and for the purpose set forth.

31. The arrangement of the shaft B, sliding bevel-wheel P^3, bevel-wheel P^2, mandrel P^1, saw P, and reciprocating frame P^4, substantially as and for the purpose set forth.

32. The combination of the reciprocating frame P^4, carrying the saw P, and the adjustable rod P^5, lever P^6, connecting-rod P^7, and toggle-joint M^1 M^2, substantially as and for the purpose set forth.

33. The combination of the cam R^3 and spring R^2, for giving a reciprocating motion to a screw-driver, R, which turns the screw-blank, and a corresponding cam, b^1, which simultaneously raises and lowers the blank while subjected to the action of cutters forming the thread, substantially as set forth.

34. The combination of the screw-driver R, block R^4, well Q^4, jaws r^4, and springs r^2, when respectively constructed and arranged to operate substantially as set forth.

35. The cutters S^1 and stocks S, in combination with the adjustable connecting-plates T and cam U, substantially as set forth.

36. The connecting-plates T, when held in place by a button, U^1, or equivalent device, and pivoted, at t, in grooves in the wheel G and plate K, so as to permit their displacement to swing the cutters outside of the periphery of the wheel and plate, substantially as set forth.

37. In combination with the cam U, rock-shaft U^2, and arm U^3, the elevator V, and arm V^1, when the elevator is attached to the wheel, and revolves with it, substantially in the manner set forth.

38. In combination with the elevator V, the rods V^4 and V^5, and tripping-arm V^8, attached to the rock-shaft V^9, arranged to operate substantially as and for the purpose set forth.

39. The combination of the plate X, sliding plate X^1, ratchet x^2, pawls X^3 and X^4, for giving a gradually-increasing motion to the rod W, which operates the rock-shaft, and through it, by intervening mechanism, the cutters for regulating the feed of the latter, substantially as set forth.

40. The combination of the reciprocating feed-box D, to which is attached the cam-track D^7, oscillating plate X, and suitable intermediate mechanism for controlling the action of the cutters, according to the form of the track, substantially as set forth.

41. The well Q^4, when constructed with an opening to receive a reciprocating pan, Y, and with depressions Q^6, to permit the fall of the screw from the jaws of the driver, substantially as set forth.

42. The combination of the pan Y, pin Y^5, sliding extension Y^7, lever Y^6, rod Y^2, and reciprocating plate Y^3, operated by the cam R^3, substantially in the manner and for the purpose set forth.

43. In such a machine the combination of the following groups of elements; a feed-mechanism which feeds the wire to be cut into lengths proper to form a blank; a revolving wheel which carries the wire after being cut off, and has an intermittent motion during the pauses in which the blank is, by successive operations submitted to the action of mechanism, by which the head is upset and trimmed, the nick in the head cut, and the thread formed, and the screw finally delivered from the machine in a completed state, substantially as set forth.

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

C. A. RODNEY.

Witnesses:
WM. B. WIGGINS,
CHARLES A. WIGGINS.