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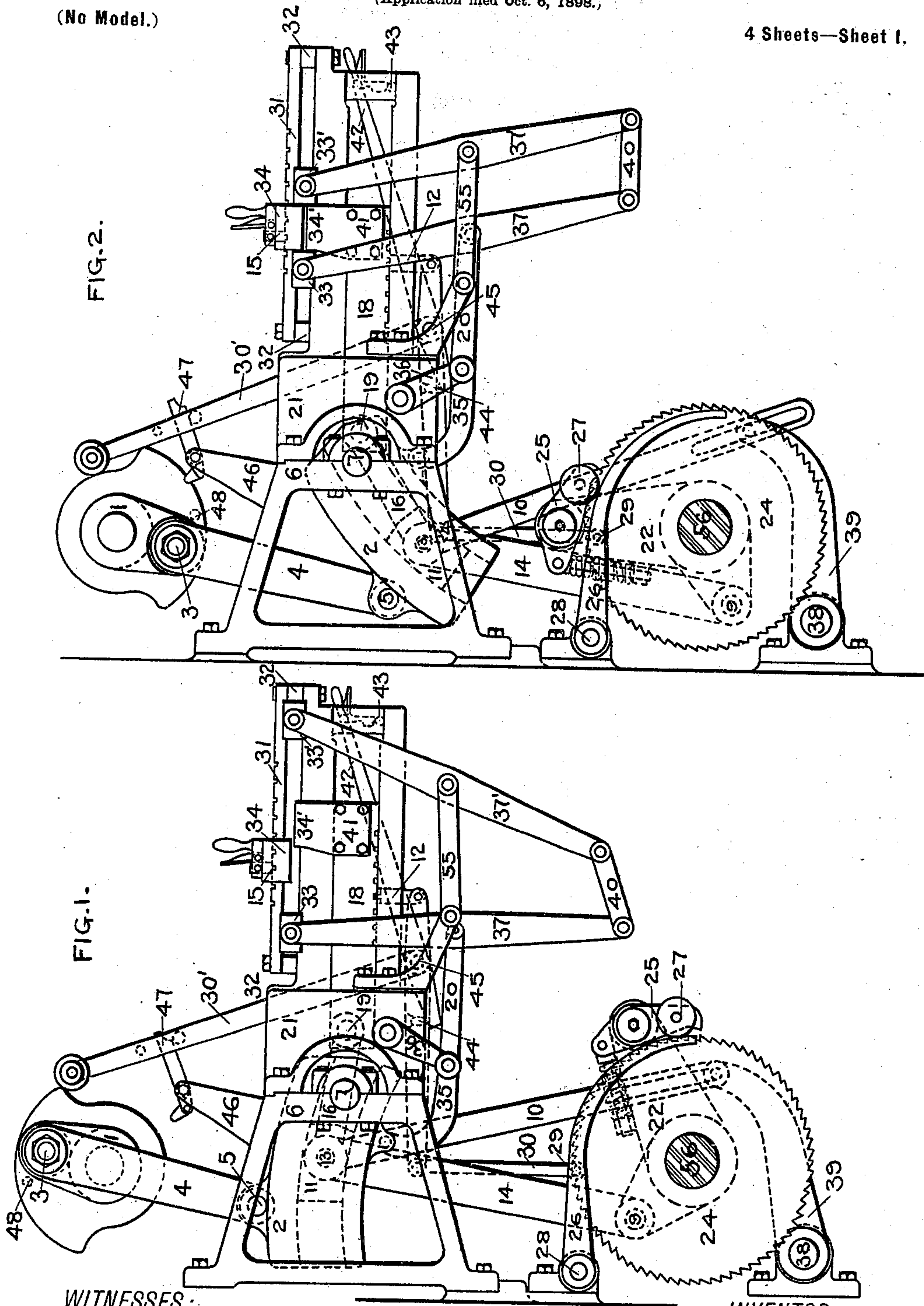
Patented Jan. 10, 1899.

J. S. BANCROFT.
SPACING MECHANISM.

(Application filed Oct. 8, 1898.)

(No Model.)

4 Sheets—Sheet 1.



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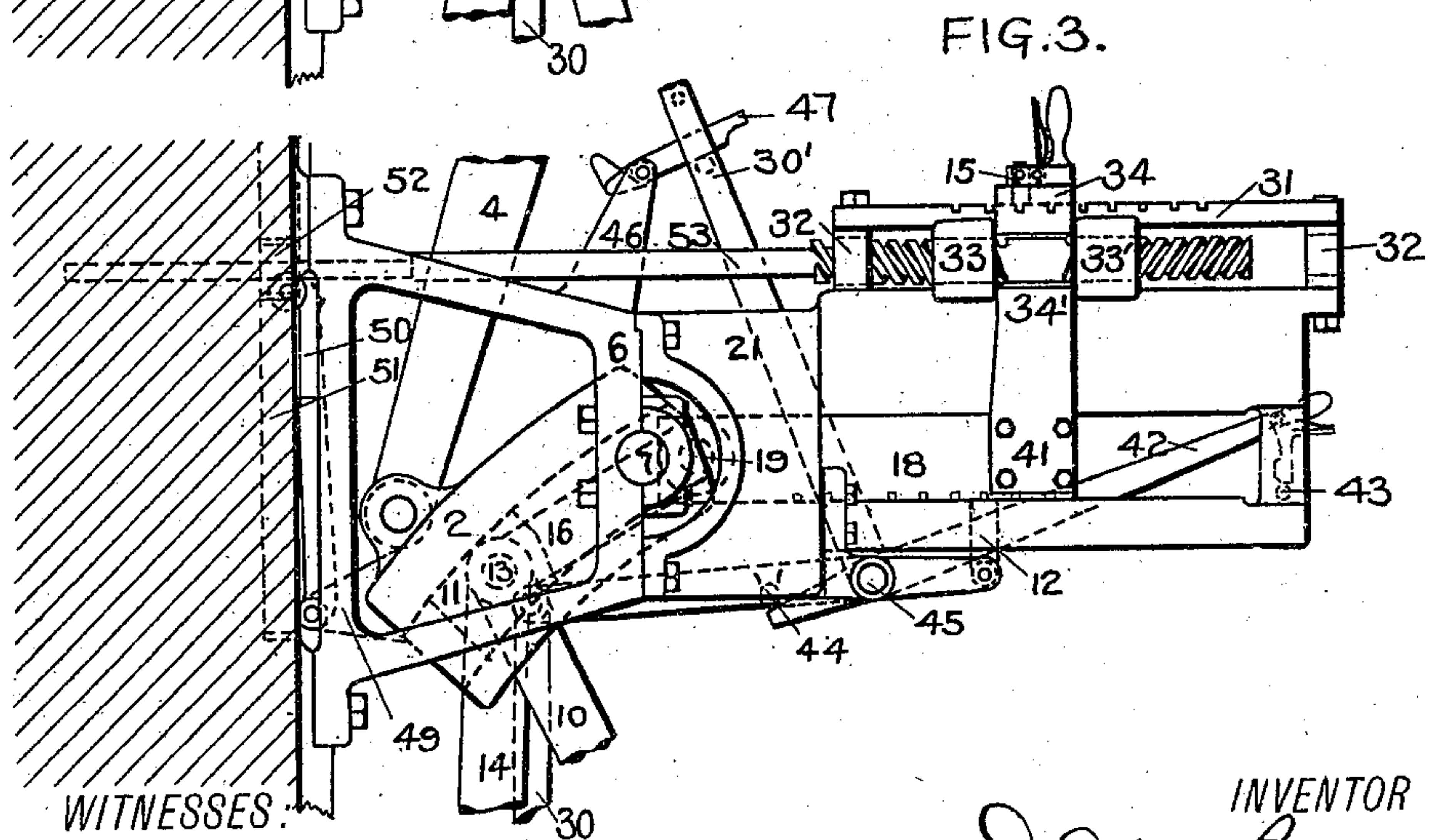
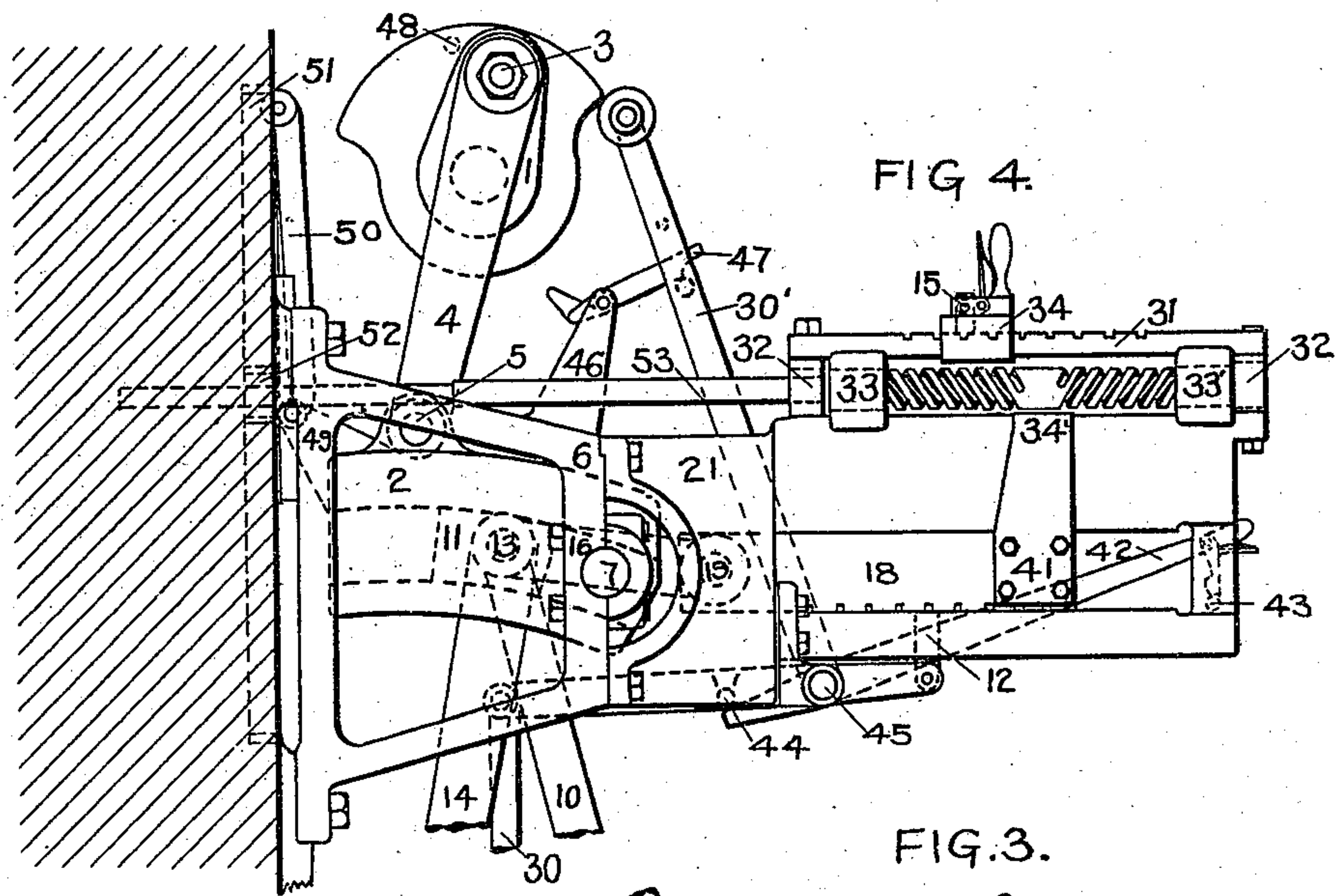
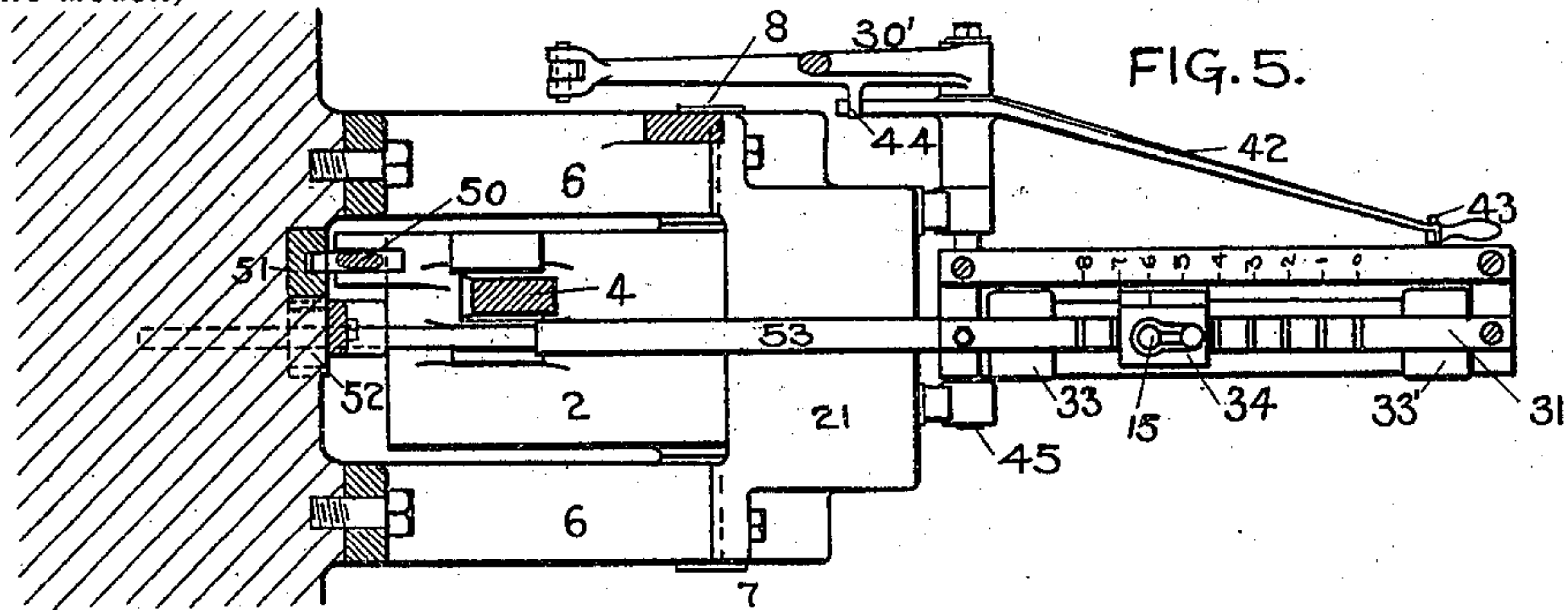
Patented Jan. 10, 1899.

J. S. BANCROFT.
SPACING MECHANISM.

(Application filed Oct. 6, 1898.)

4 Sheets—Sheet 2.

(No Model.)



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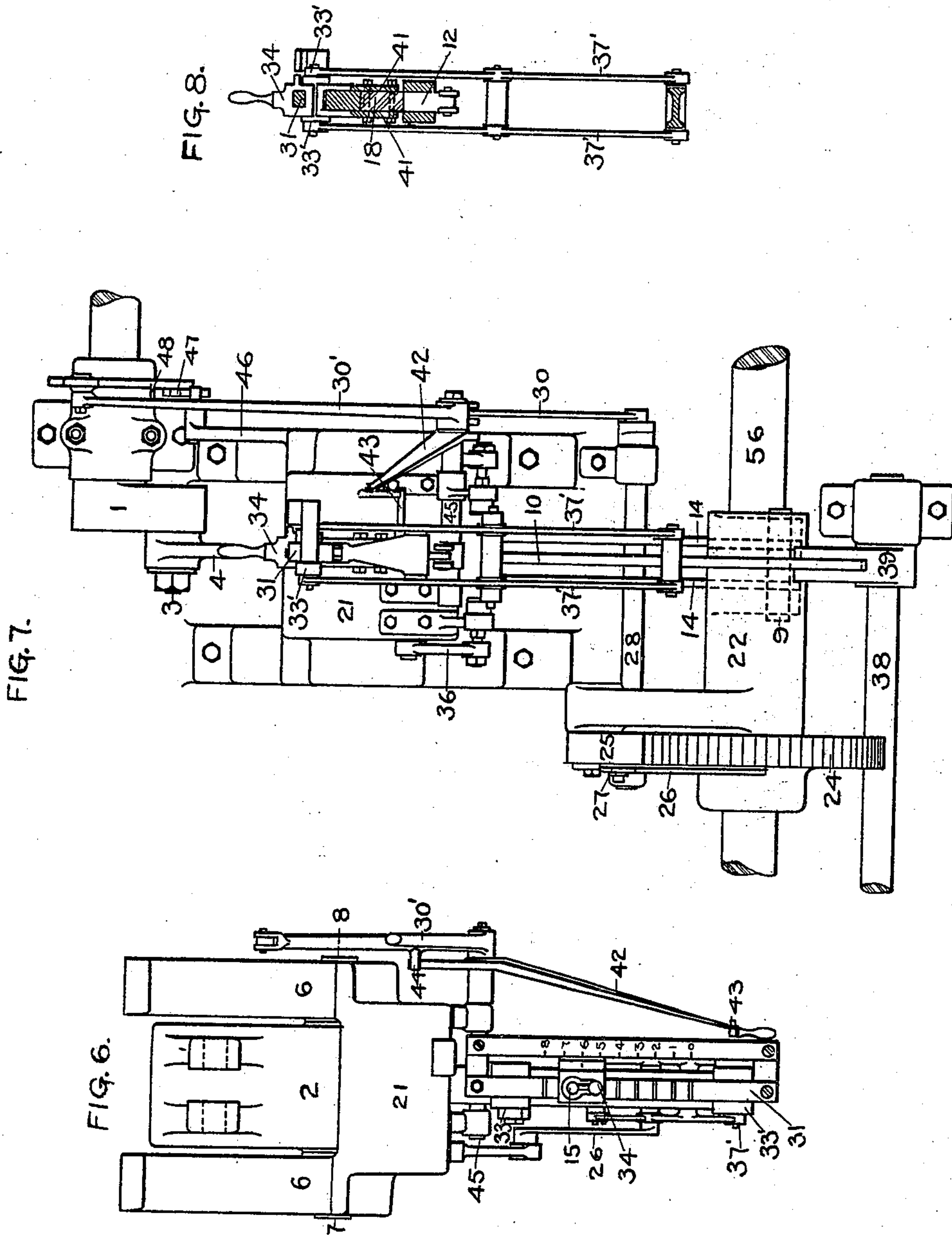
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4 Sheets—Sheet 3.



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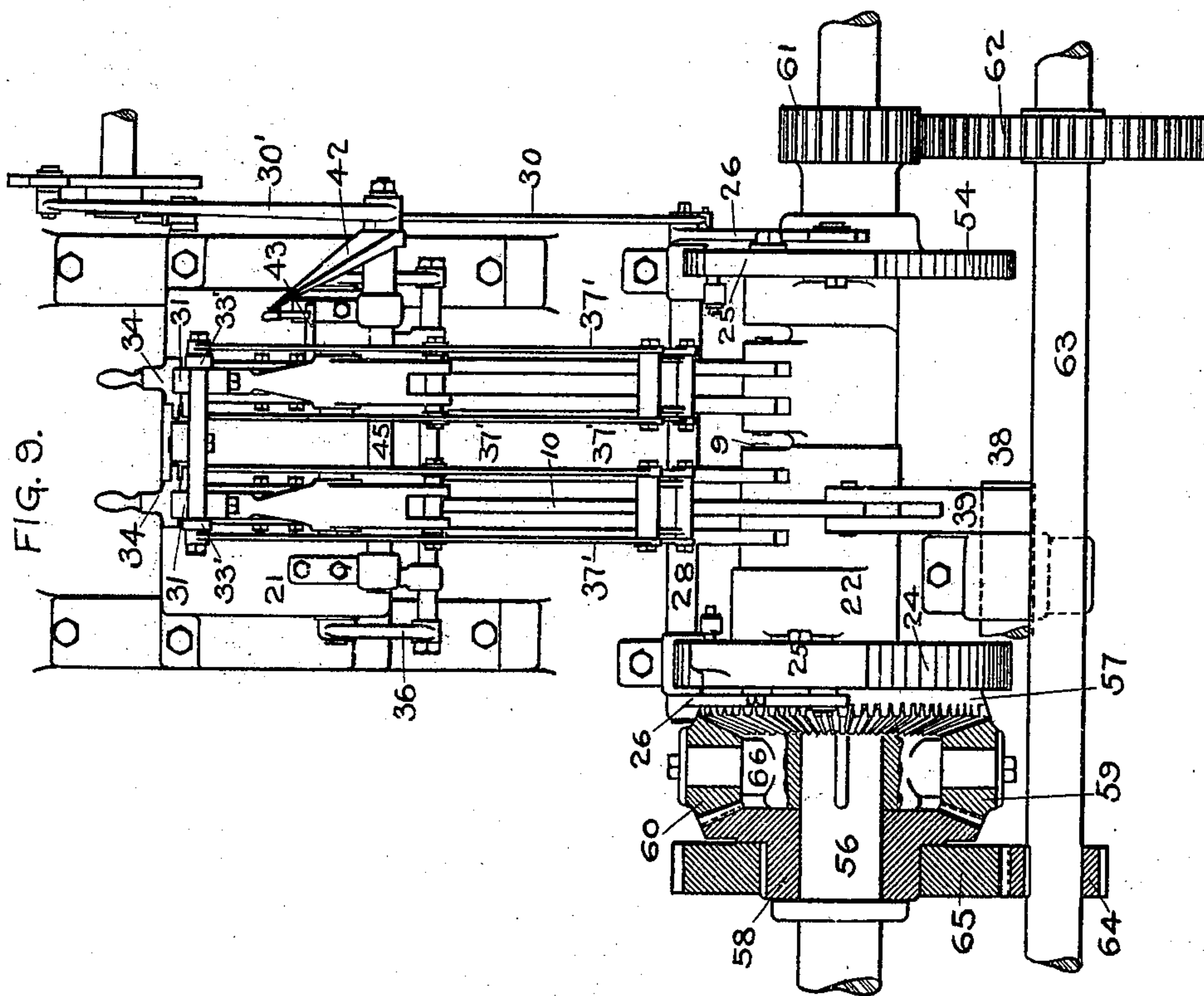
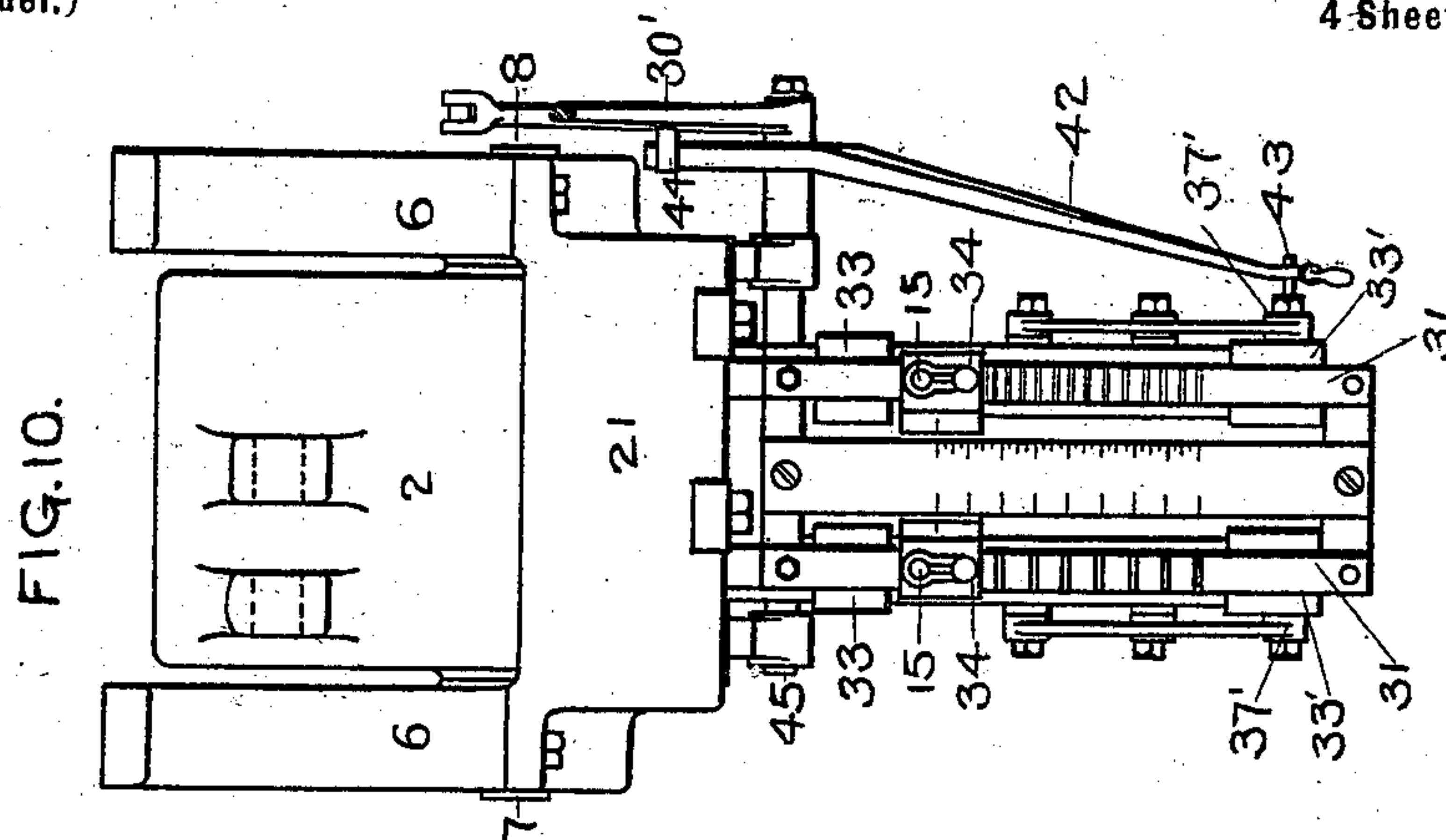
Patented Jan. 10, 1899.

J. S. BANCROFT.
SPACING MECHANISM.

(Application filed Oct. 6, 1898.)

(No Model.)

4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

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SPACING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 617,551, dated January 10, 1899.

Application filed October 6, 1898. Serial No. 692,809. (No model.)

To all whom it may concern:

Be it known that I, JOHN SELLERS BANCROFT, of the city and county of Philadelphia and State of Pennsylvania, have invented
5 certain new and useful Improvements in Spacing Mechanism, of which the following is a specification.

My invention may be applied to a variety of purposes, such as marking or stamping at
10 various required intervals of space; but as it is particularly well adapted to punching metal plates, angles, beams, &c., required for structural work where the intervals vary frequently I have accordingly illustrated it as
15 applied to the spacing mechanism shown and described in the patent granted August 24, 1897, No. 588,799.

In the above-cited patent the variation in the distance traveled by the spacing-table is
20 produced by adjusting the hand-lever, which controls the position of the sliding block 11 12 and pin 13 in the vibrating arm 2, to a new position on the notched bar 21, a rider 36 being provided to facilitate adjustment in one
25 direction. This movement of the lever and pin 13 is arranged to be made by hand, and as it sometimes requires considerable force to make this movement promptly and with certainty to the required position the speed
30 of the machinery is in many cases limited by the interval required to make this adjustment, which can be done only during the return stroke of the spacing-pawl if the machine is not to lose a stroke whenever the
35 spacing is changed. The rider-block 36 is intended to be placed in the proper position on the notched bar for the stroke required, and at the proper point in the revolution of the machine the operator would unlatch the
40 hand-lever and move it along the bar, thus forcing the pin 13, with its attachments, to its new position in the vibrating arm 2 until stopped by the rider, when the lever would be latched to the notched bar and the rider
45 again adjusted for the next change. As shown, the rider can be used for change in one direction only; but this could be remedied by providing another rider on the opposite side of the lever to limit movement in the opposite
50 direction. The operator would then ad-

just the rider on the side to which he desired to move the hand-lever. The two riders and the movement of the sliding block would give the operator considerable work to do in a very short time and may frequently result in
55 the loss of a useful stroke and perhaps a hole in the wrong place. In such machines the length of the division is often considerable, while it is frequently desirable to make them quite minute; but this latter is limited to
60 that of a single tooth in the ratchet-wheel 24, which must be strong enough to perform the work of moving the spacing-table with its appurtenances and the material to be punched. To meet these opposing conditions, it is im-
65 possible to obtain the minute divisions required and also the maximum divisions desirable upon the machine described in the aforesaid patent.

It is one object of my invention, therefore,
70 to effect the movement of the sliding block by the machine itself, and thereby limit the work of the operator to the adjustment of a stop which shall determine the position to which the machine shall move the sliding
75 block and pin in the vibrating-arm.

It is a further object of my invention to divide the spacing movement into two or more parts, which shall be united into one spacing
80 movement upon the completion of the movement of its divisions, so as thereby to provide for both coarse and fine spacing.

To these ends my invention consists in two opposing jaws; an adjustable stop which determines the closed position of the jaws, a bal-
85 ancing connection through which either jaw may become the abutment for moving the other, and a spacing-block movable by the opposing jaws to the closed position of the jaws.
90

It further consists in two opposing jaws, an adjustable stop which determines the closed position of the jaws, a balancing connection through which either jaw may become the
95 abutment for moving the other, a spacing-block movable by the opposing jaws to the closed position of the jaws, and a device for locking the spacing-block in this position; and it further consists in an adjustable stop
100 which determines one portion of a spacing

movement, an adjustable stop which determines another portion of the same spacing movement, and means for combining these two portions into one spacing movement.

5 To more fully describe my improvements, reference will now be had to the drawings which form part of this specification, in which—

Figure 1, Sheet 1, is a side elevation of one
10 form of my improved spacing mechanism attached to the side of a punching-machine, as shown in Fig. 1 of the hereinbefore-mentioned patent, the sliding block 34 clamped at about half-stroke, the opposing jaws movable in a fixed path and open, and the adjustable stop moved to the position required for the next spaced position. Fig. 2 shows the same parts as shown in Fig. 1, but with the jaws closed and the sliding block 34 adjusted
15 to the position determined by the adjustable stop. Fig. 3, Sheet 2, is a side elevation of another arrangement for guiding and operating the jaws in a fixed path without the levers used in Figs. 1 and 2. Fig. 4 shows the same parts as shown in Fig. 3, but with the jaws open to permit the movement of the adjustable stop to any new position. Fig. 5 is a plan of the parts shown in Figs. 3 and 4. Fig. 6, Sheet 3, is a plan of the upper portion
20 of the frame and adjustable stop shown in Figs. 1 and 2. Fig. 7 is an end elevation of the parts shown in Figs. 1 and 2. Fig. 8 is a vertical section of Fig. 6 in front of the handle shown in the plan. Fig. 9, Sheet 4, is an end view of two spacing mechanisms like that shown in Fig. 1 so united as to produce one spacing movement of the table; and Fig. 10 is a plan of the parts shown in Fig. 9, omitting the ratchet-wheels and the gearing.

40 In Figs. 1, 2, and 4 is a crank-disk 1, driven from the eccentric or the cam-shaft of the punching-machine to make one revolution for each stroke of the punch, as fully described in the before-mentioned patent.

45 2 is a vibrating arm connected to the crank-pin 3 by the link 4 and pin 5. It is provided with a slot formed in a circular arc to carry the sliding block 11, with its pin 13, to which the bell-crank 22 is connected by the link 14 and pin 9. The radius of the circular arc in the arm 2 is equal to the length of the link 14 from center to center, as shown in Fig. 1, the pin 9 being at the center of this circular arc and the crank in disk 1 at the top of its stroke. The arm 2 is pivoted in the stand 6
50 on the pins 7 8 in the arc traversed by the pin 13, and, as shown in Fig. 1, the axes of the pins 13 7 8 are in line. The pin 13 also carries the slotted link 10, which connects with the brake-lever 39, and the double link 16 17, which connects with the bar 18 by the pin 19. This bar takes the place of the hand-lever 18 in the before-mentioned patent to determine the position of the sliding block 11 and the
55 pin 13 in the circular arc in the arm 2. The bar 18 is supported by and moves freely longitudinally in the frame 21, the end of which

frame forms the caps of the bearings which support the pins 7 8, on which the arm 2 vibrates. The under side of the bar 18 is provided with a series of notches properly spaced, each space corresponding to the smallest division required in the work to be punched, into which notches a tongue formed upon the upper end of the pin 12 can enter and lock
60 the bar 18 and the sliding block 11 in any desired notch. The pin 12 is pivoted to the end of a short arm keyed upon the shaft 45, and upon the same shaft is keyed the long arm of a bell-crank lever provided with a roller at its end, which rests upon the periphery of the crank-disk 1. The shorter arm 30' projects backward toward the crank-disk and is connected to the shield which lifts the spacing-pawl. This disk is cam-shaped, as shown, to move the pin 12 to lock and to release the bar 18 at the proper times. On the upper side of the frame 21 is provided an index-bar 31, securely fastened at each end through distance-blocks 32 32 to the frame to form guiding-surfaces for the jaw-blocks 33 and 33'.
65 On the upper side of the index-bar 31 a series of notches properly spaced are cut, each space corresponding to the smallest division required in the work, and a block 34 is fitted to slide freely thereon. A handle provided with a spring bell-crank lever is fitted on the top of the block, the short end of the bell-crank entering the plug 15, so that when the upper end of the bell-crank is compressed against the handle the plug will be raised. The lower end of this plug is fitted to enter the notches on the upper side of the index-bar, so that when the bell-crank is released the spring will force the end of the plug into one of the notches, when the block 34 is moved along the index-bar, and thereby lock the block firmly to the bar. An index is cut on the upper side of the index-bar to enable the operator to determine the spacing which the movement of the block will effect. The movement of the bar 18, which effects a change in the spacing by its control of the block 11 in the circular arc of the vibrating arm 2, is effected through the curved link 35, pivoted at one end to the under side of the vibrating arm 2 and at the other to the end of the swinging arm 36, the other end of which is pivoted to any convenient part of the fixed frame above it midway between the extreme movement horizontally of the end of the curved link 35, which this swinging arm supports. On each side of and pivoted to the jaw-block 33 is suspended a lever-arm 37, the two arms forming one lever, and midway of its length preferably a link 20 is pivoted by one end, while the other end vibrates about the pin in the swinging arm 36, to which the curved link 35 is attached. As thus arranged the movement of the arm 2 will produce a corresponding movement of the link 20 and the lever-arm 37. On each side of and pivoted to the jaw-block 33' is suspended a lever-arm 37', and midway of its length preferably, but at the same distance

below the point of suspension as in lever-arm 37, a link 55 is pivoted by one end, while the other end is pivoted to a stand secured upon the fixed frame 21, so that the links 20 and 55 shall be approximately parallel. The two lever-arms 37 and 37' are united by the balancing connection 40, which in this case is a link pivoted at each end to the lever-arms 37 and 37', respectively. On each side of the bar 18 a plate 41 is secured, which extends upward toward the block 34. These plates are joined together below the block, which they do not quite touch, so as not to interfere with the movement of the block or of the bar 18. The upper ends of the plates are dressed off, as shown, to form a spacing-block 34' the width of the block 34. When the machine is in operation, the fulcrum of lever 37' is fixed, while that of 37 is moved by its connection to the vibrating arm 2, the effect of such movement being to produce a vibration of both levers about their midway pivots. The amount of this movement will be determined by the distance from the center, about which the arm 2 vibrates to the pivot on this arm, and about which the curved link 35 vibrates. This distance is such that the jaw-blocks 33 and 33' will approach each other at their closest position to a distance equal to the width of the block 34. The position of this block on the index-bar 31 will determine the position along this bar where the jaw-blocks 33 and 33' will finish their movement toward each other, because whichever jaw-block reaches this position first will be arrested by the block 34 and will thus become the abutment to compel the other jaw-block to close against the opposite side of the block 34. In this movement of the jaw-blocks toward each other if one of them comes in contact with the spacing-block 34', which is fixed upon the bar 18, the movement of this jaw-block will be arrested and become the abutment to compel the other jaw-block to move until its movement is arrested by the block 34. This will then become the abutment to compel the other jaw-block to move, carrying with it the spacing-block 34' and the bar 18 until the movements of both jaw-blocks terminate on opposite sides of the block 34. The position then of the block 34 determines the position of the bar 18 and consequently that of the block 11 in the circular arc which determines the length of the spacing. The power required for moving the block 11 is thus afforded by the machine, and the operator has only to determine the times when change of spacing is required, for which purpose he has all the time at his disposal in which the bar 18 is locked by the pin 12, while the power he must exert in this time is only that required to slide the block 34 along the index-bar from one position to another.

The operation of changing the spacing is illustrated in Figs. 1 and 2. In Fig. 1 the bar 18 is shown locked for a spacing just finished and the cam 1 is just ready to unlock it. The block 34 is moved to a new position in Fig. 2.

The jaw-blocks 33 and 33' have closed against opposite sides of the block 34, carrying with them the plate 41 and the bar 18 to the new position, in which it is now locked by the movement of the cam 1, as shown on the drawings.

As the spacing is effected by the operation of the machine and this cannot be arrested instantly, provision must be made for arresting the spacing while the motion of the machine continues. This is accomplished by the hand-lever 42, pivoted loosely on shaft 45 and provided with a hook pivoted near the handle and forced from the handle by a spring, which is compressed by grasping the handle, so as to draw back the hook from the pin 43, on which the outer end of the hook rests to support the lever in the position shown. When the hook is withdrawn, the lever can be pushed down until it rests upon the pin 43, and upon releasing the hook the spring will restore its position and the hook will pass under the pin 43 and lock the lever on the pin. This hand-lever 42 is extended a convenient distance beyond shaft 45 to pass under a lug 44 on the side of the bell-crank lever 30', so that when the hand-lever 42 is pressed down and hooked to pin 43 the wiper 26 will be raised and will lift the pawl out of its ratchet-wheel and stop the spacing movement instantly. To prevent starting the spacing movement at an improper time, a stand 46 is carried up from the frame of the apparatus to afford support for the pawl 47, which is pivoted upon stand 46 and extends through or alongside the long arm of bell-crank lever 30', which is provided with a pin, upon which the pawl rests, so that when this arm is raised by the hand-lever 42 the pawl will drop behind the pin and prevent it from descending again until the pawl is raised. For this purpose the pawl extends beyond the pivot upon which it vibrates, and upon this extension is pivoted a short tailpiece extending alongside the crank-disk 1, so that the pin 48 in the crank-disk will strike it and raise the pawl 47 at the proper moment. (See Figs. 1 and 2.) The tailpiece is pivoted on the extension to permit it to raise and let the pin pass it in case the crank-disk should be turned backward. Figs. 3 and 4 show a mode of working the jaw-blocks without the use of levers. In this case the vibrating arm 2 is provided at its extreme end and on its upper side with a projection 49, to which is pivoted the connecting-rod 50, the other end of which is pivoted to the rack-bar 51, supported in the frame of the punching-machine. (See Fig. 5.) The rack-teeth are cut in the edge of this bar, and meshing with it is the pinion 52, supported upon the shaft 53, which passes freely into and is supported by the frame of the punching-machine, which supports all of the apparatus hereinbefore described. This shaft is provided with a keyway, into which a key in the pinion 52 is fitted, so that the shaft may play freely longitudinally through the pinion, but must turn with the pinion. The other

end of this shaft is provided with a right and a left handed screw, which approach each other within a distance somewhat less than the width of the block 34, and on these screws the jaw-blocks 33 and 33' are respectively fitted as nuts. The vibratory movement of the arm 2 will cause the pinion 52 and shaft 53 to rotate back and forth and the jaw-blocks 33 and 33' to move toward and from each other. The amount of this movement will be determined by the diameter of the pinion, which is driven by the rack-bar 51, the travel of this bar, and by the pitch of the right and left hand screws. The movement must be such that the jaw-blocks will approach each other to a distance equal to the width of the block 34. The position of this block on the index-bar 31 will then determine the position along this bar where the jaw-blocks 33 and 33' will finish their movement, because when the rotation of the shaft 53 has drawn one of the jaw-blocks against the block 34 the movement of this jaw-block will be arrested. The shaft 53, continuing to revolve, will be forced by its thread in the jaw-block to slide through the pinion 52 until this pinion ceases to revolve in that direction, which will occur when the other jaw-block is in contact with the opposite side of the block 34. In this movement of the jaw-blocks toward each other if one of them comes in contact with the spacing-block 34', which is fixed upon the bar 18, the movement of this jaw-block will be arrested and become the abutment to compel the other jaw-block to move, carrying with it the spacing-block 34' and the bar 18, until the movements of both jaw-blocks terminate on each side of the block 34. The adjustment of the bar 18 will then have been effected for the next spacing, the same as in the lever arrangement for operating the jaw-blocks. In this case the shaft 53 becomes the balancing connection, as it serves the same purpose as the link 40 in the lever arrangement hereinbefore described.

Figs. 9 and 10 show the apparatus for dividing the spacing movement into two parts and for uniting these divisions into one spacing movement, in which Fig. 9 is a front elevation, and Fig. 10 is a plan of the same. For this purpose the vibrating arm 2 is widened to contain two circular arcs side by side, each circular arc carrying a duplicate of the sliding block 11, each block 11 with a duplicate of pin 13, and to each pin 13 is attached a duplicate of link 14 with its pin 9, each of which pins is attached to a bell-crank and each of which bell-cranks operates a spacing-pawl and wheel in the manner fully described in the before-mentioned patent. Fig. 10 shows in plan two index-bars side by side, each of which is provided with its block 34 and its handle for operating and locking, the same as hereinbefore described. In fact from the block 34 down to the spacing-wheels there are two sets of spacing apparatus side by side, each of which is operated as hereinbe-

fore described and as described in the before-mentioned patent, and each is entirely independent of the other. To combine these two spacing apparatus so as to produce one spacing movement which shall be the sum of the two independent movements, one movement is connected to one member of an epicyclic train and the other movement is connected to another member of the same train, as shown in Fig. 9, in which 54 is the ratchet-wheel for the fine divisions and 24 is the ratchet-wheel for the coarse divisions. The shaft which transmits the spacing movement from the spacing apparatus to the spacing-table is 56 and corresponds to shaft 23 in the before-mentioned patent. This shaft extends across and serves to support the ratchet-wheels 54 and 24 and the bell-cranks and pawls which operate them, as also the epicyclic train, composed of four bevel-wheels 57, 58, 59, and 60. Of this train, 57 and 58 are in one piece and revolve freely about the shaft 56. The ratchet-wheel 54 is connected to the wheel 58 of the epicyclic train by the pinion 61, wheel 62, shaft 63, pinion 64, and wheel 65, which is mounted upon and firmly secured upon the wheel 58, which revolves freely about the shaft 56. Between the wheels 57 and 58 are the bevel-pinions 59 and 60, which revolve freely upon pivots formed upon opposite sides of the hub 66, which is firmly secured upon the shaft 56. The effect of this arrangement is that each ratchet-wheel transmits its entire movement to one side of the epicyclic train, and these two movements are combined into one by the bevel-pinions 59 and 60, the pivots of which are rotated by the combined movement of the other two members of the train and impart this rotary movement to the shaft 56 and through this shaft to the spacing-table.

The two portions of the spacing movement above described have their respective movements in the same time; but they may be made consecutively with the same apparatus, if required—as, for example, in case the operator fails to move more than one adjustable stop at the proper time when he should move both. In that event he should instantly throw the punch out of gear, allow the one portion of the spacing movement to complete itself, then move its adjustable stop to zero, adjust the other stop to the proper division, and allow its spacing movement to be completed, when the punch may be thrown into gear.

I have shown and described an epicyclic train for combining the two portions of the spacing movement into one spacing movement as the best for the particular kind of machine which I have adopted to illustrate my invention; but there are other mechanical movements that will accomplish the same result, which may be used more advantageously for other purposes than punching metals, and as my invention simply provides a means for employing the power of the machine itself to modify the spacing of the spacing apparatus which the machine operates I do not limit my

invention to the use of an epicyclic train or to the spacing apparatus described in this specification and in the before-mentioned patent; but

5 What I claim as new, and desire to secure by Letters Patent, is—

10 1. Two opposing movable jaws, an adjustable stop which determines the closed position of the jaws, a balancing connection through which either jaw may become the abutment for moving the other, and a spacing-block movable by the opposing jaws to the closed position of the jaws.

15 2. Two opposing movable jaws, an adjustable stop which determines the closed position of the jaws, a balancing connection

through which either jaw may become the abutment for moving the other, a spacing-block movable by the opposing jaws, to the closed position of the jaws, and a device for locking the spacing-block in this position. 20

3. An adjustable stop which determines one portion of a spacing movement, an adjustable stop which determines another portion of the same spacing movement, and 25 means for combining these two portions into one spacing movement.

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Witnesses:

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