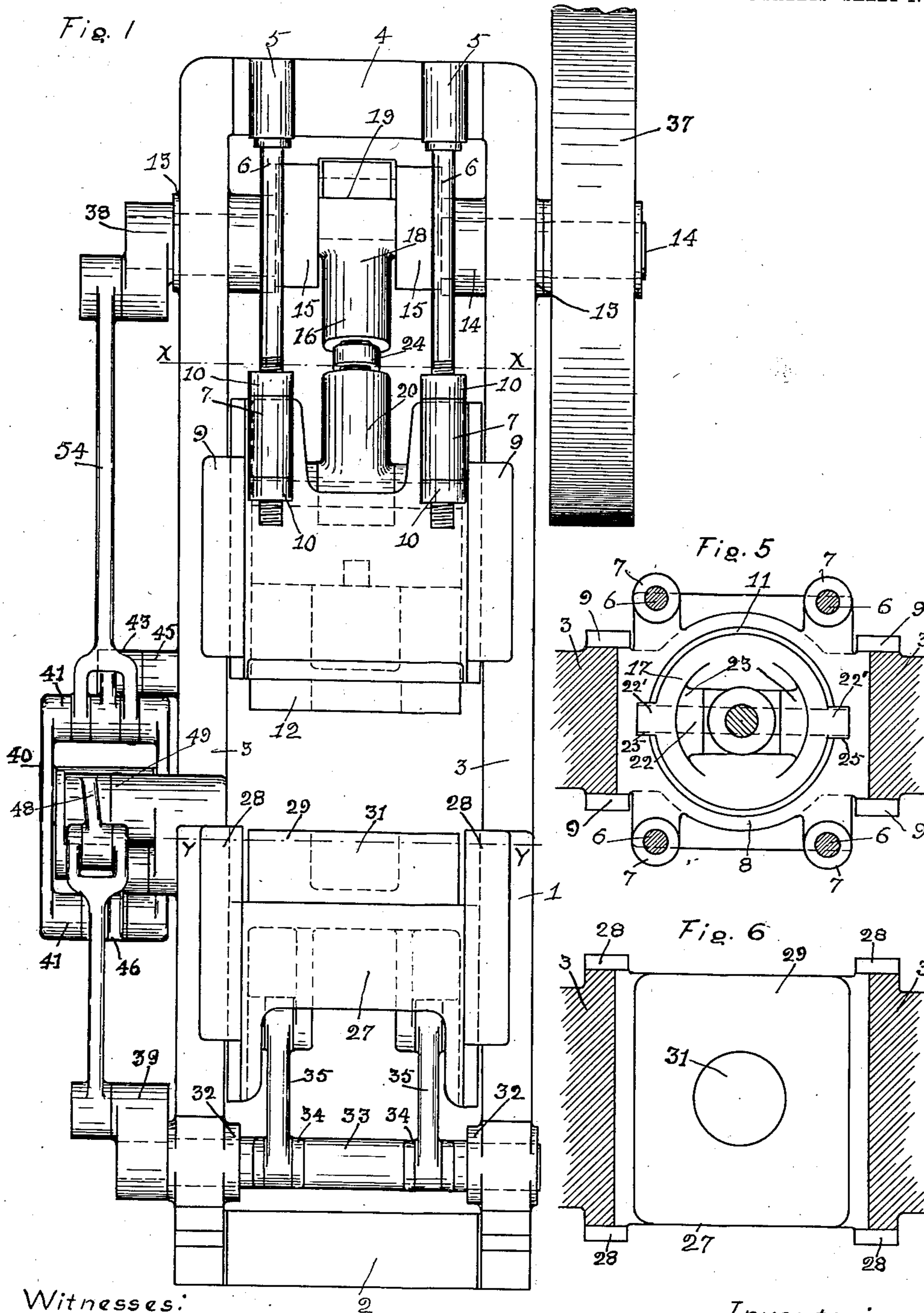


No. 883,813.

PATENTED APR. 7, 1908.

P. M. H. LANGE.
DRAWING PRESS.
APPLICATION FILED DEC. 31, 1906.

5 SHEETS—SHEET 1.



Witnesses:
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5 SHEETS—SHEET 2.

Fig. 2

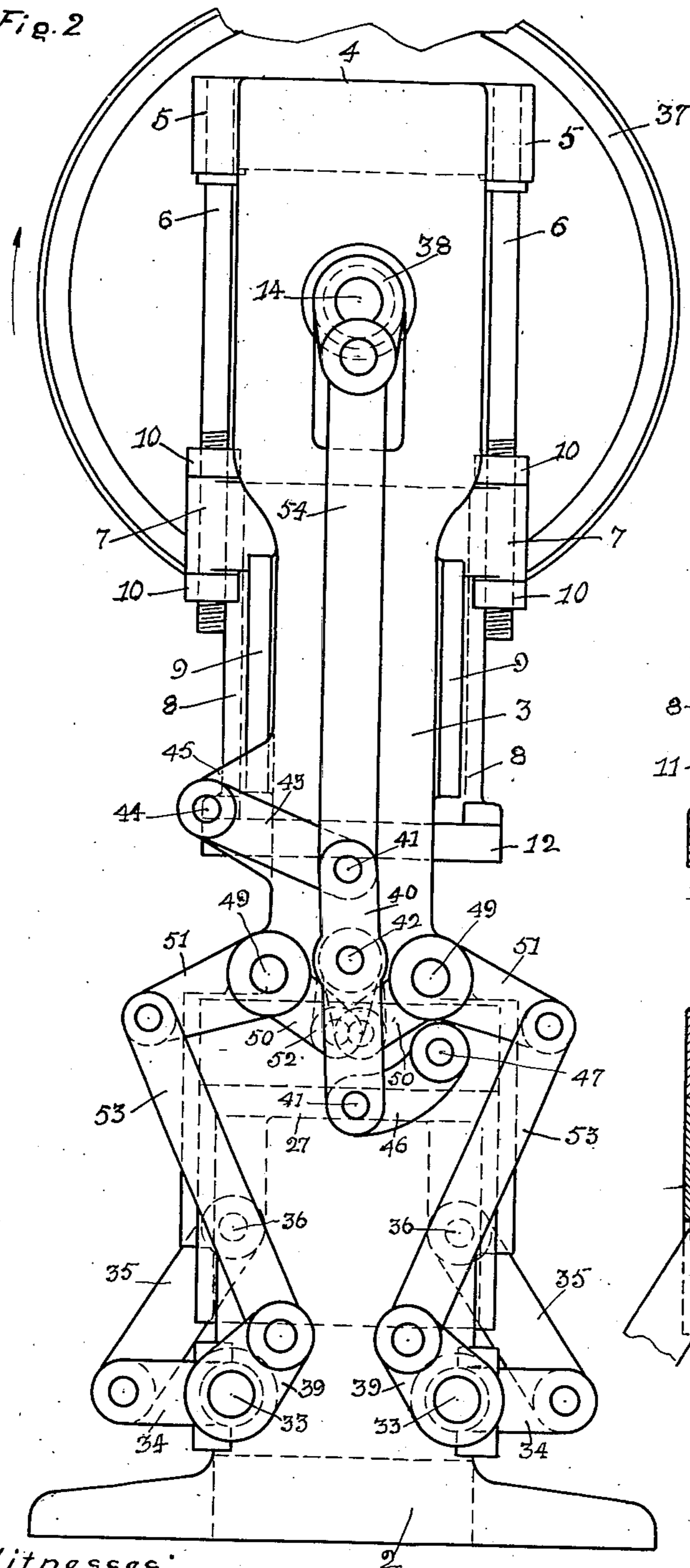
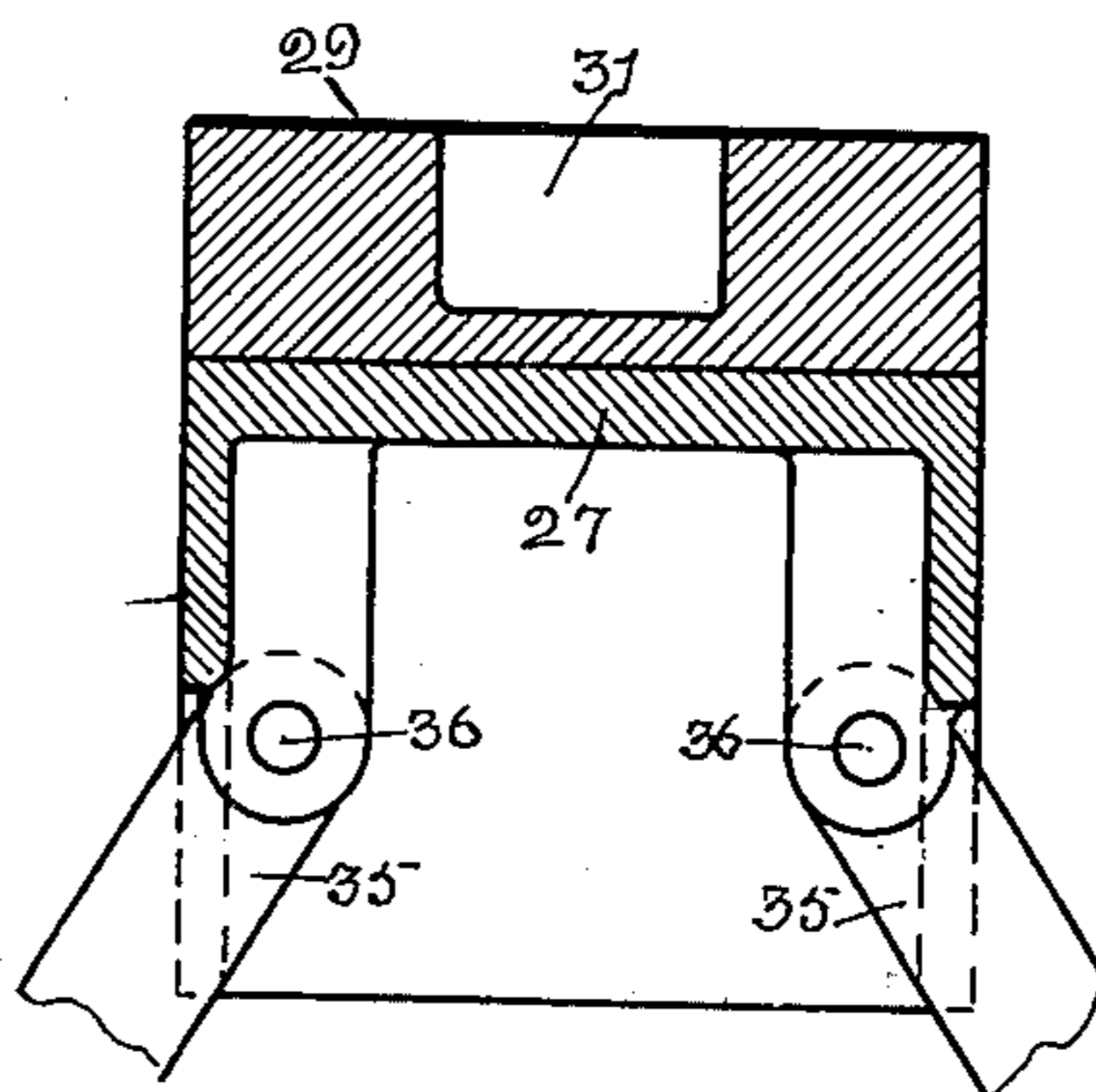
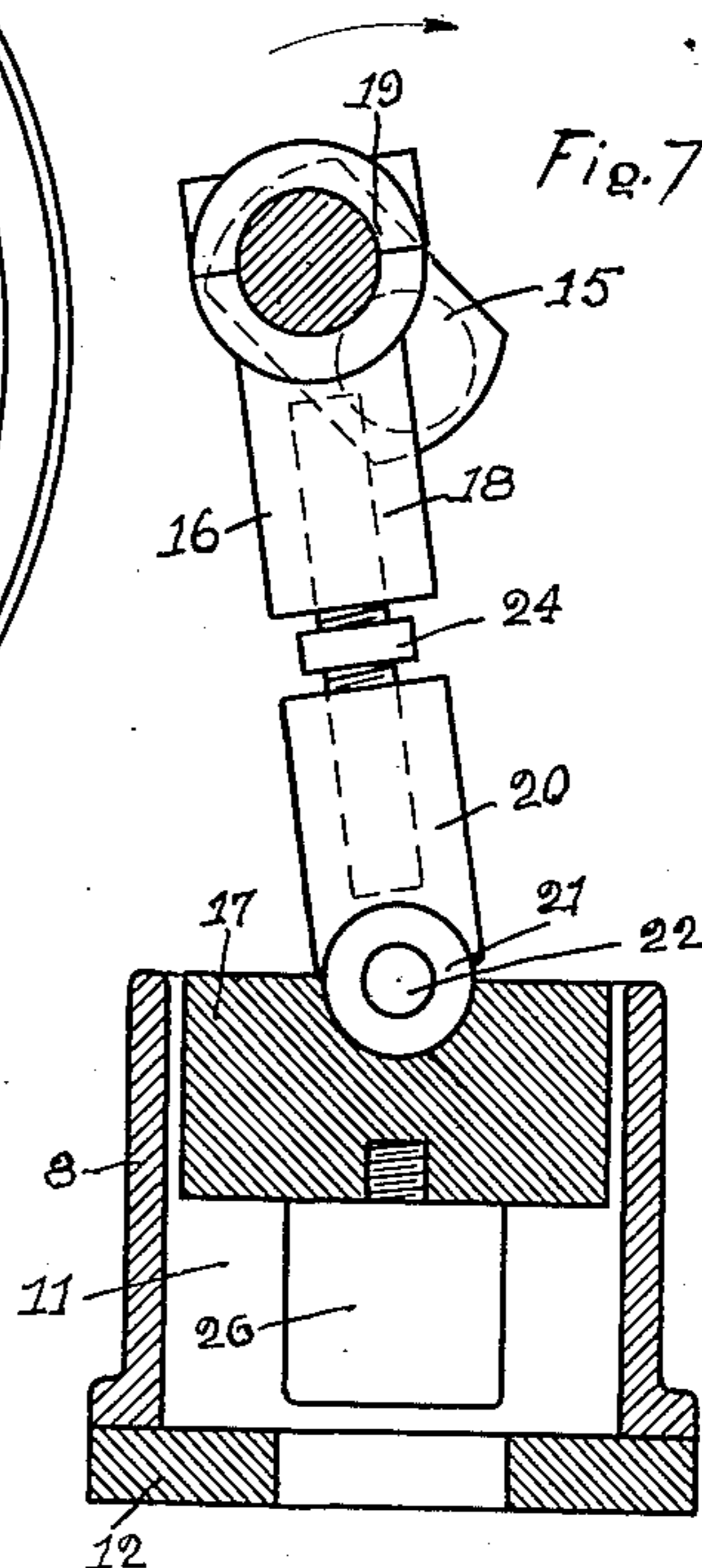


Fig. 7



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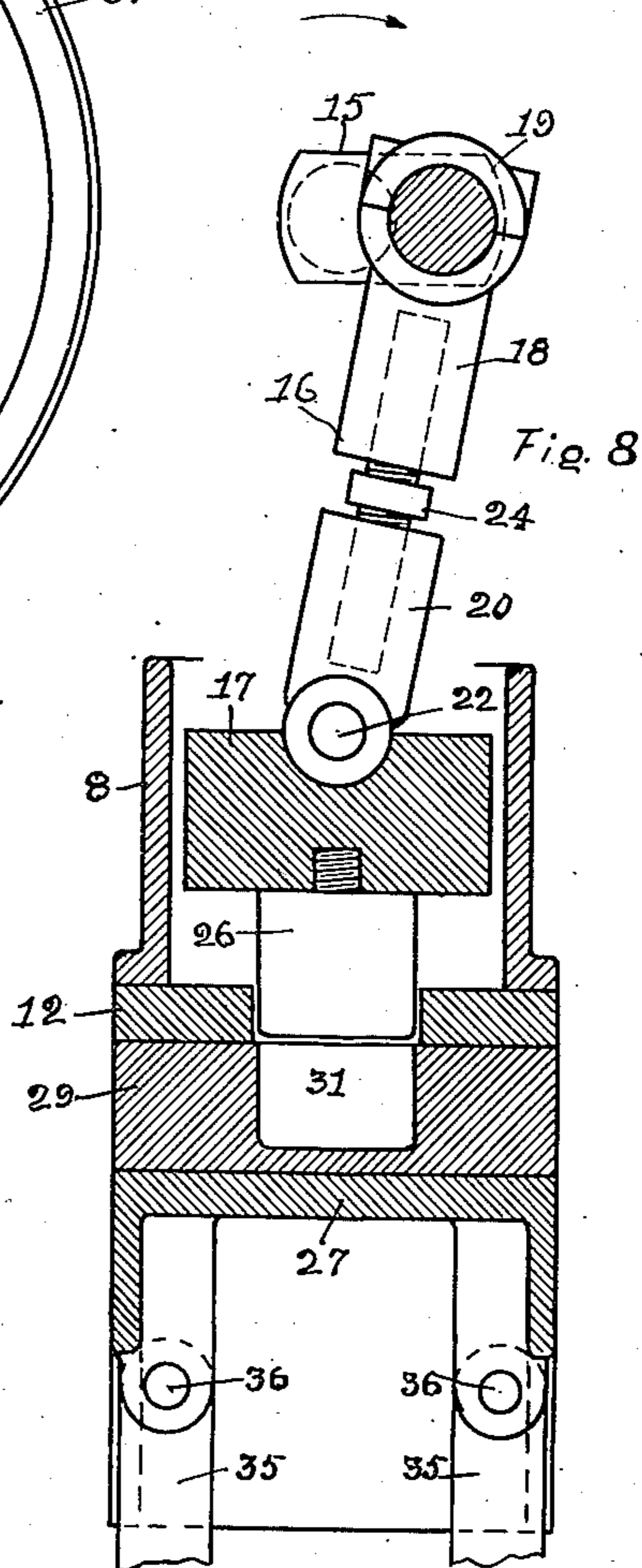
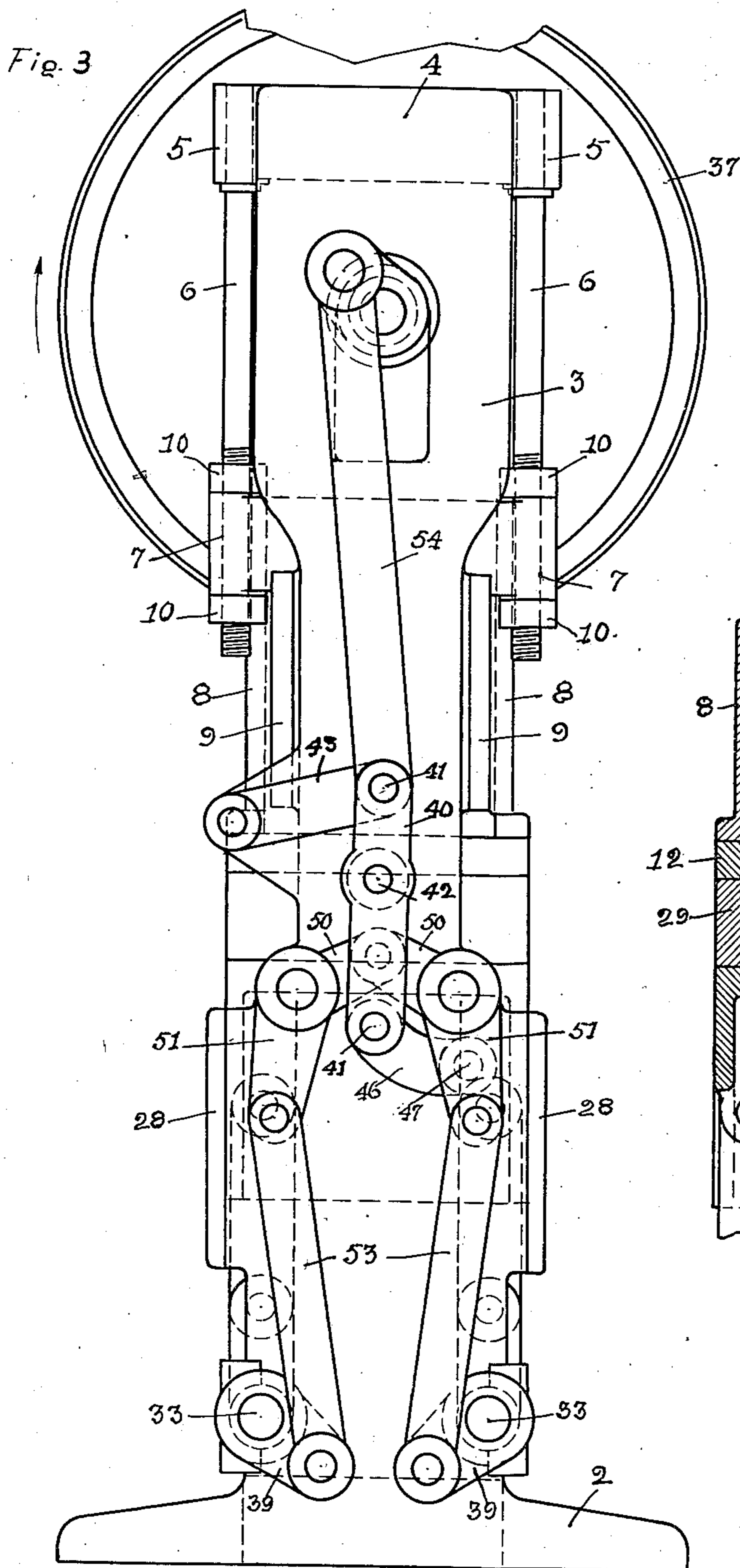
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5 SHEETS—SHEET 3.



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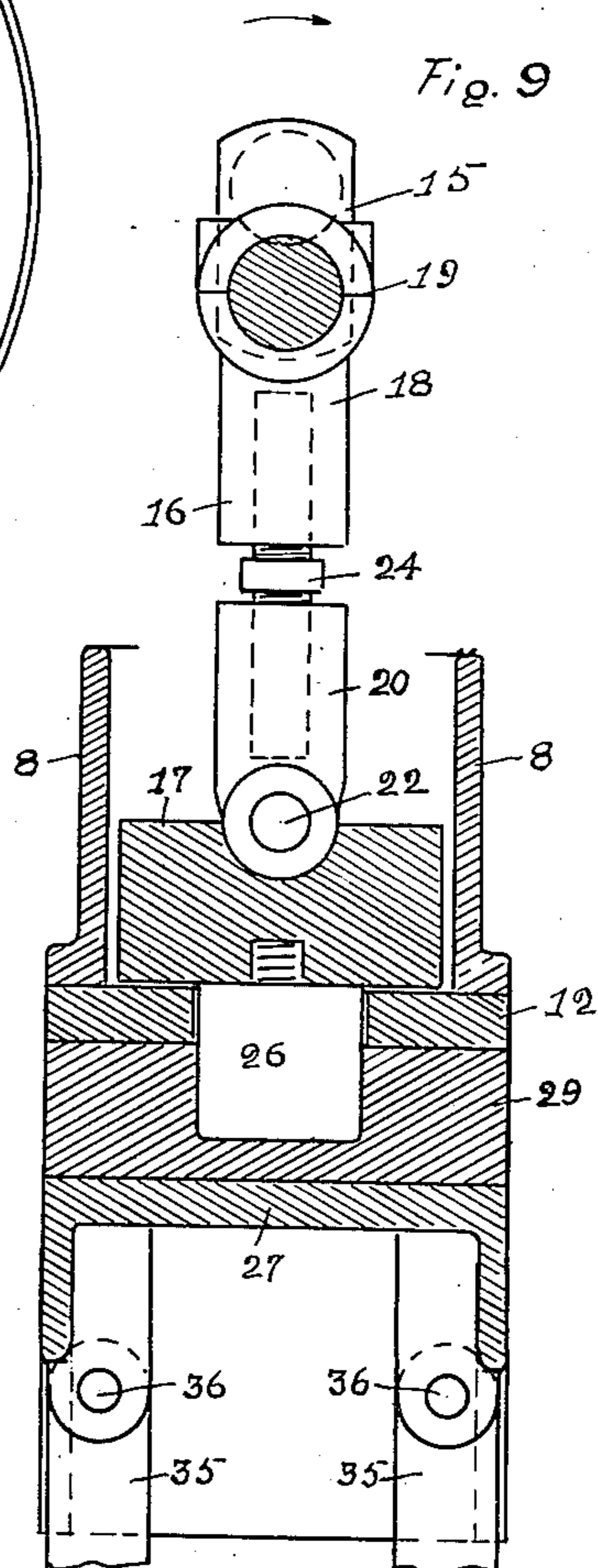
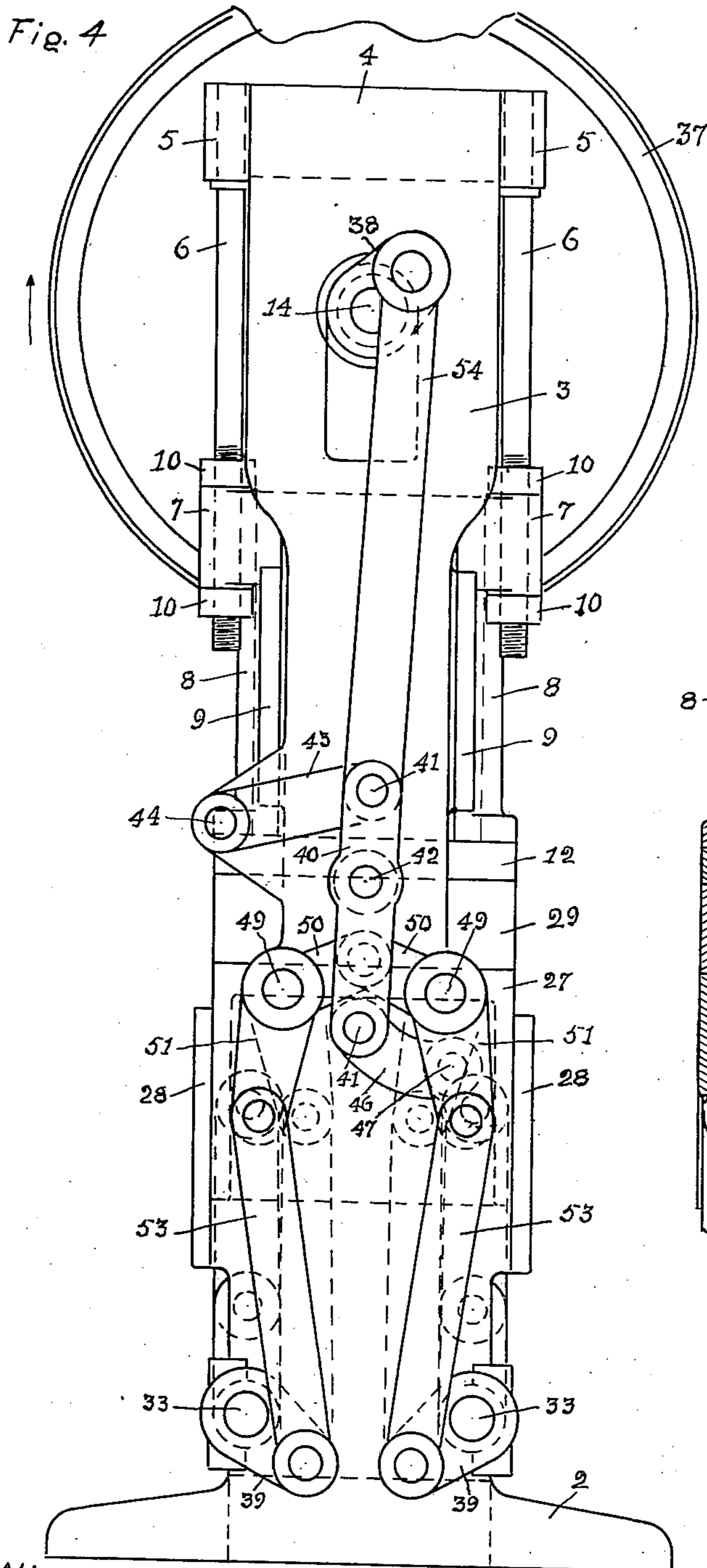
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5 SHEETS—SHEET 4.



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APPLICATION FILED DEC. 31, 1906.

5 SHEETS—SHEET 5.

Fig. 10

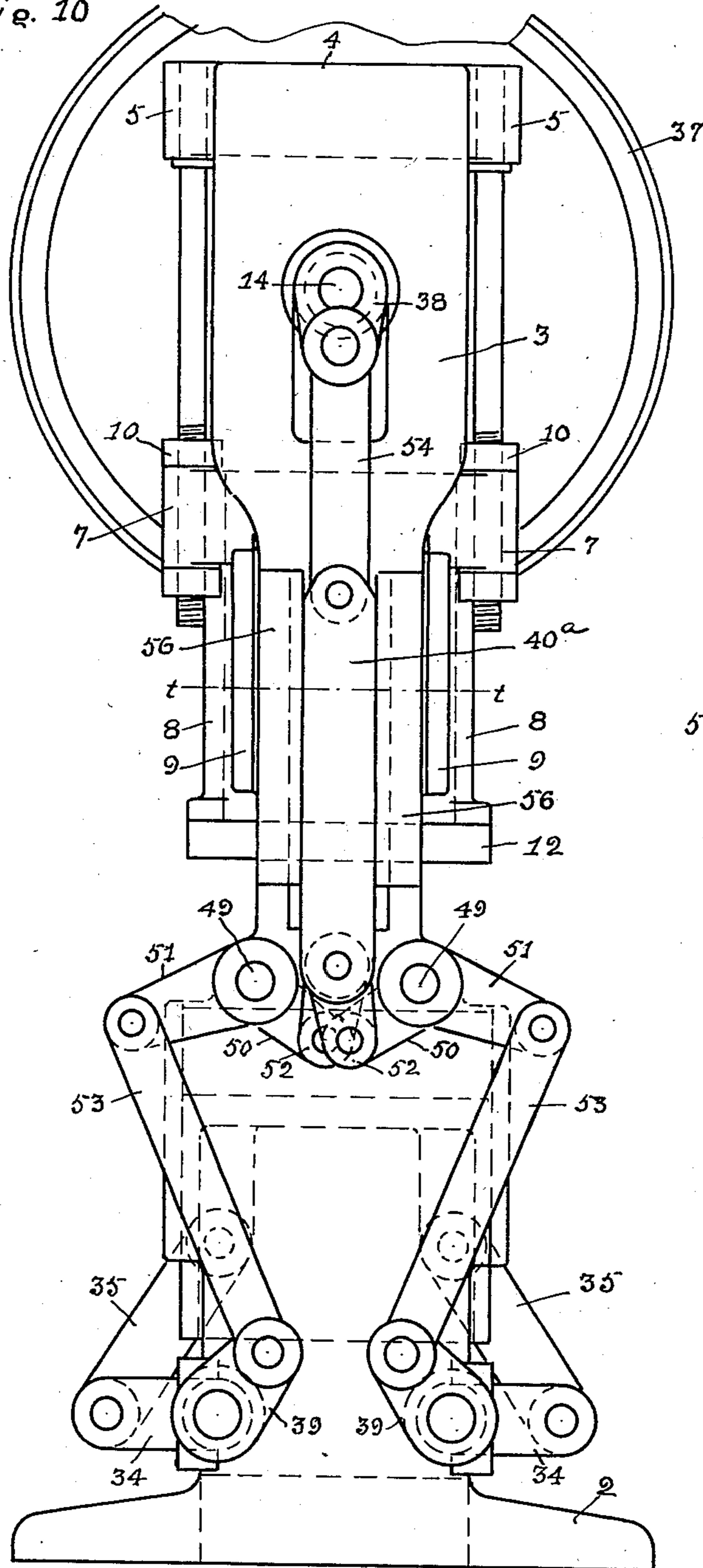
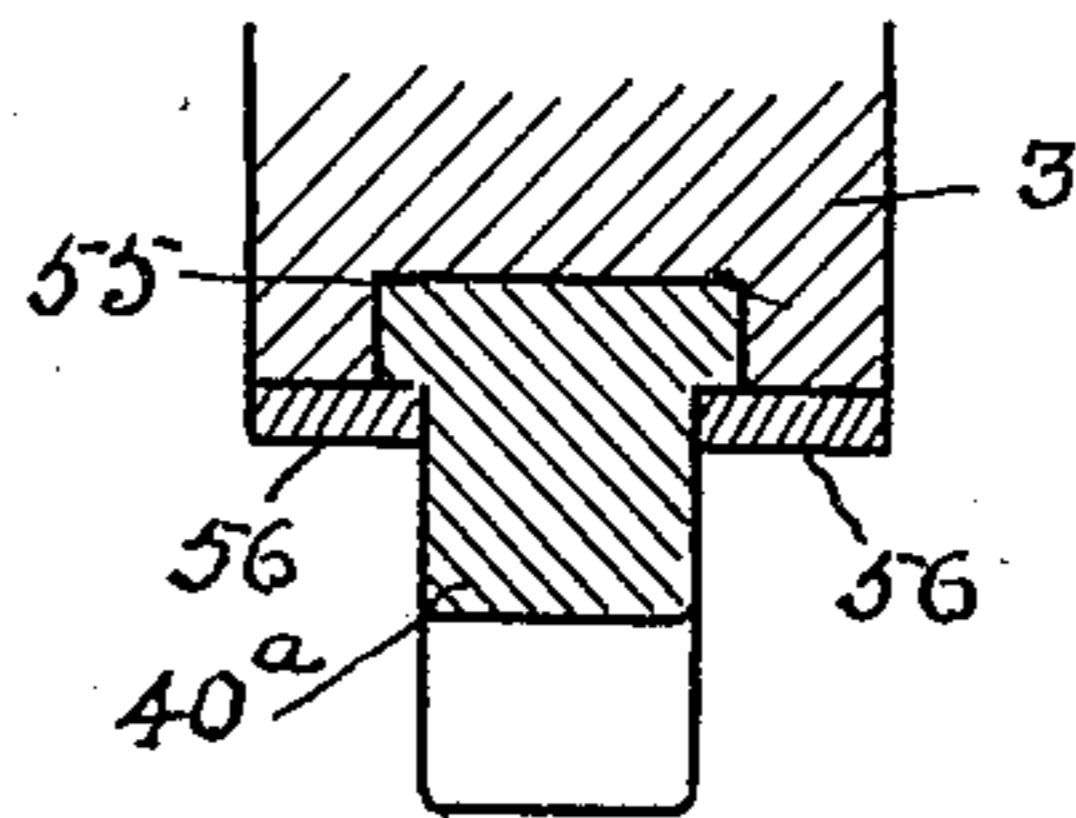


Fig. 11



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UNITED STATES PATENT OFFICE.

PAUL M. H. LANGE, OF TOLEDO, OHIO.

DRAWING-PRESS.

No. 883,813.

Specification of Letters Patent.

Patented April 7, 1908.

Application filed December 31, 1906. Serial No. 350,109.

To all whom it may concern:

Be it known that I, PAUL M. H. LANGE, a citizen of Germany, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Improvement in Drawing-Presses, of which the following is a specification.

My invention relates to a drawing press and has for its object to provide a stable press of the kind, having reduced friction and vibration, and that is effective, in a single stroke of the plunger, to complete the drawing of a suitable blank of sheet metal into a hollow body of a desired form. Furthermore that is convenient and safe in its operation for the placing of the blank, and the removal of the product. Furthermore to provide a press of the kind that is adjustable to produce from suitable blanks various forms of press drawn articles. I accomplish these objects by the novel construction, combination and operation of the parts as hereinafter described and claimed, and illustrated in the drawings, in which

Figure 1 is a side elevation of a press constructed in accordance with my invention, showing the position of the parts at the beginning of the downward stroke of the plunger and the upward stroke of the die-bed. Fig. 2 is an end elevation of the same with the parts in like position as shown in Fig. 1. Fig. 3 is an end elevation of the same showing the parts in position nearing the completion of the downward stroke of the plunger and at the completion of the up stroke of the die-bed. Fig. 4 is an end elevation of the same at the beginning of the up stroke of the plunger and of the down stroke of the die-bed. Fig. 5 is a cross section on line $x-x$ of Fig. 1, showing top view of blank holder and plunger. Fig. 6 is a cross section on line $y-y$ of Fig. 1, showing top view of die-bed. Fig. 7 is a vertical section through the plunger, the blank holder and the die bed, and showing the relative positions of the plunger crank, the plunger, the blank holder and the die bed, near the completion of the upward stroke of the plunger, and the die bed in its lowest position. Fig. 8 is a similar view illustrating the position of the same parts when the plunger has made one half the downward stroke. Fig. 9 is a similar view showing the position of the same parts at the completion of the down stroke of the plunger. Fig. 10 is an end elevation of a press constructed in accordance with my invention,

showing a modified form of reciprocating member for transmitting motion from the driving shaft to the rock shafts, and Fig. 11 is a cross section of the reciprocating member on line $t-t$ of Fig. 10.

In the drawings, 1 is the frame or support of the press mechanism, comprising the base 2; the end standards 3, and top 4, the whole preferably formed, in small presses, of one casting. The top 4 is provided with the side bosses 5, which are provided with vertical bores in which are pendently mounted the supporting rods 6, the lower end portions of which are threaded and upon which is pendently mounted, by the vertically bored bosses 7, the hollow blank holder body 8, which extends between the standards 3, and is provided with the side extensions 9, which overlap the standards and give lateral support to the blank holder. The threaded portions of the rods 6 above and below the bosses 7 of the blank holder, are provided with the adjusting nuts 10 by which the position of the blank holder is adjusted as required for different articles produced by the press. The blank holder body is provided with the enlarged central opening 11, and to the lower end of the body is attached a blank holder plate 12, having a reduced central opening suited to the work of the press.

In suitable bearings 13 in the standards, above the blank holder, is mounted the horizontal driving shaft 14, which, central between the standards, is provided with a double crank 15 to which is connected at one end a connecting rod 16, the opposite end of which is pivoted to a plunger body 17 adapted to move as a piston in the opening 11 of the blank holder body 8. The connecting rod 16 is formed of the upper end section 18 having the wrist bearing 19 journaling the crank 15; the lower end section 20, having its lower end portion pivoted to the plunger head 21 by a pivot bolt 22 extending through suitable raised portions 23 of the plunger body; and an adjusting screw section 24 comprising a central squared portion and reduced end portions reversely threaded and run into suitable threaded orifices in the upper and lower sections, whereby the connecting rod is made adjustable in length.

The plunger body 17 is provided with end guides 22' which project into vertical slots 25 in the inner wall of the blank holder body, and form guides for the plunger body, which is of a form complementary to the opening 11

of the blank holder body and adapted to move freely therein. The lower end of the plunger body is centrally provided with means by which there is attached thereto a drawing punch 26, suitable to draw and shape the article to be formed of the blank, and complementary to the opening in the blank holder plate. Below the blank holder is provided a movable die bed 27, which extends between the standards 3, and is provided with the guide slides 28, which engage the standards on opposite side edges, and direct the upward and downward movement of the die-bed. The die bed is box shaped and open at the bottom, and to the top of the die bed is suitably secured a die block 29, provided with a suitable matrix 31 complementary to the drawing punch secured to the plunger.

In suitable bearings 32 provided on opposite sides of each standard above the base 2 there is horizontally mounted a pair of rock shafts 33, each of which is provided with a pair of rock arms 34, the arms of one rock shaft being arranged opposite the arms of the other. The free ends of the rock arms are pivoted to the lower ends of the toggle arms 35, the upper ends of which are pivotally mounted on the stud pins 36 which project inward from downward extensions of the ends of the die bed, the studs for the link bars of the rock arms of each shaft being located at equal distances from the central vertical plane of the die bed, whereby when the rock arms are simultaneously moved upward through arcs of about 90° from a horizontal position, the die bed is moved upward with diminishing speed, coming to a gradual stop as the rock arms come into alinement with the toggle bars, and with gradually increasing speed as the rock arms are moved downward through the same arcs to a horizontal position.

The blank holder is adjusted by the nuts 10 at such a height above the die-bed that when the die-bed with a suitable die-block mounted thereon, and with a suitable blank of sheet metal on the die-block, is raised by the rock arms until the rock arms are nearly in alinement with the toggle bars, the blank will engage the bottom of the blank holder and be clamped between the die-block and the blank holder during the completion of the upward movement of the rock arms from a horizontal to a vertical position.

The blank holder body being provided with a blank holder plate provided with an opening complementary to the matrix, the connecting rod 16 is accurately adjusted to the required length by the screw section 24 for terminating the down stroke of the drawing punch with only the thickness of the drawn metal of the blank between the lowermost portion of the drawing punch and the bottom of the matrix of the die-block.

The crank shaft 14 is provided with an extension at one end upon which is mounted a driving pulley 37 or other suitable means of connecting the crank shaft with suitable power. At the opposite end the crank shaft is provided with an extension upon which is mounted at about 135° from the crank 15 operating the plunger, a crank 38 of suitable radius. The rock shafts 33 are also provided with end extensions upon which are mounted rock arms 39 set at about 45° angles above a diametric plane of the shaft that coincides with a line extending through the pivotal centers of the rock arms 34, the rock arms 39 being of suitable radius relative to the arms 34 and extending inward.

To transmit reciprocal motion to the die-bed opposite and differential to that of the plunger, there is provided between the crank 38 of the crank shaft, and the rock arms 39 of the rock shafts, the central link 40 having the upper and lower pivot rods 41 and the middle pivot rod 42; the upper link arm 43, the inner end of which is pivoted to the upper pivot rod 41 of the link 40 and the outer end portion to a stud pivot 44 projecting from a side projection 45 of the adjacent standard; the lower link arm 46, the inner end portion of which is pivoted to the lower pivot rod 41 of the link 40, and the outer end portion to a stud pivot 47 located, relative to the upper stud pivot 44, on the opposite side of the adjacent standard; a pair of bell crank levers 48, pivotally mounted at their angles to stud pivots 49 projecting from the adjacent standards, one on each side of the lower end portion of the central link 40, the bell cranks having the short arms 50 projecting inward and the long arms 51 projecting outward; the toggle arms 52 linking the short arms 50 of the bell cranks to the middle pivot rod of the central link 40; the toggle arms 53 linking the long arms 51 of the bell cranks to the rock arms 39 of the rock shafts; and the connecting rod 54 connecting the crank 38 of the crank shaft with the upper pivot rod 41 of the central link 40.

The relative lengths of the arms of the bell cranks, the rock arms of the rock shafts, and the crank 38 of the driving shaft are such that a half revolution of the crank 38 from its lower center as shown in Fig. 2 will bring the toggle arms 53 into the position relative to the long arms 51 of the bell cranks shown by dotted lines in Fig. 4, thereby depressing the rock arms 39 and raising the rock arms 34 of the rock shafts 33 into substantial alinement with the toggle arms 35, thereby raising the die-bed to its upper position and bringing the die-block into contact with the blank holder as shown in Figs. 3 and 4, the effect of the relation of the parts being to produce such opposite and differential reciprocation of the die-bed and the plunger, that the die block with a blank deposited thereon contacts with

the blank holder in advance of the drawing punch of the plunger engaging the blank in its descent, the upward movement of the die-bed being substantially completed during the first 135° of the movement of the crank 38 from its lower center to its upper center. The movement of the die-bed during the next 90° of the revolution of the crank 38 producing only sufficient movement of the die-bed to clamp and unclamp the blank by reason of all the toggle joints passing to and from their centers during such period of its revolution.

In Fig. 10 of the drawings is shown a modified form of reciprocating member 40^a, which may be substituted for the link 40, and the upper and lower link arms 43 and 46, by providing the adjacent standard with a suitable guide groove 55, and with the retaining plates 56, the reciprocating member 40^a being a bar fitted to slide in the groove 55 and adapted to be retained therein by the plates 56. The connecting bar 54 is pivotally connected to the upper end of the reciprocating bar 40^a, and the toggle arms 52 of the short arms 50 of the bell cranks 48 are pivoted to its lower end. Thus connected the reciprocation of the bar 40^a by the crank 38 operates the rock shafts to reciprocate the die-bed in like manner as before described. This opposite reciprocation of the plunger and die-bed gives ample time during the upward movement of the die-bed to place a blank in position thereon and during its downward movement for removing the drawn article.

By the construction shown and described, I secure (1) greater stability of the machine by reason of the working parts being located mainly at the base of the machine; (2) reduced vibration by reason of the counteracting opposite movements of the plunger and die-bed; (3) greater convenience and safety in the operation of the machine by reason of the increased time and opportunity afforded by the opposite movements of the die-head and plunger for the introduction of the blank and removal of the product; and (4) greatly reduced friction and wear by reason of the avoidance of all use of cams and gear in producing the opposite and differential reciprocation of the plunger and die-bed. I have also produced a drawing press that is conveniently adjustable to produce articles of various sizes and forms from sheet metal blanks.

What I claim to be new is—

1. In a drawing press, the combination with a stationary blank holder, of a die-bed below the blank holder, a plunger above the blank holder, and means to oppositely and

differentially reciprocate the die-bed and plunger as set forth, comprising a driving shaft above the plunger, a single and a double crank on the driving shaft, a connection between the double crank and the plunger, a pair of rock shafts below the die-bed, a pair of rock arms on each rock shaft below the die-bed, toggle arms connecting the rock arms of each rock shaft with the die-bed, an outer rock arm for each rock shaft, and means connecting the single crank of the driving shaft with the outer rock arms of the rock shaft, comprising a reciprocating member, a pair of bell crank levers, a pair of links connecting corresponding arms of the bell crank levers with the reciprocating member, a pair of toggle arms connecting the other arms of the bell crank levers with the outer rock arms of the rock shafts, and a connecting rod directly connecting the reciprocating member to the single crank of the driving shaft.

2. In a drawing press, the combination with a frame, a stationary blank holder adjustably supported in the frame, a plunger adapted to reciprocate in and through the blank holder, a driving shaft journaled in the frame above the plunger, and provided with a double and a single crank, a connecting rod adjustable in length, connecting the double crank with the plunger, and a die-bed reciprocable in the frame below the blank holder, to and from engagement with the blank holder, of means to reciprocate the die-bed oppositely and differentially from the reciprocation of the plunger, as set forth, comprising a pair of rock shafts journaled in the frame below the die-bed, a pair of rock arms on each rock shaft below the die-bed, toggle arms connecting each pair of rock arms to the die-bed, a rock arm at one end of each rock shaft adapted to rock the shaft, guides secured to the frame, a reciprocating member movable between the guides, a pair of bell crank levers reversely pivoted at their angles to the frame, link arms connecting corresponding arms of the bell crank levers with the reciprocating member, toggle arms connecting the other arms of the bell cranks with corresponding end rock arms of the rock shafts, and a connecting rod directly connecting the reciprocating member with the single crank of the driving shaft.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses, this 22nd day of December, 1906.

PAUL M. H. LANGE.

In presence of:—

J. H. AINSWORTH,
WM. F. MONGHLER.