(No Model.) 7 Sheets—Sheet 1.

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BORING MACHINE.

No. 408,259. Patented Aug. 6, 1889.

Fig. 1.

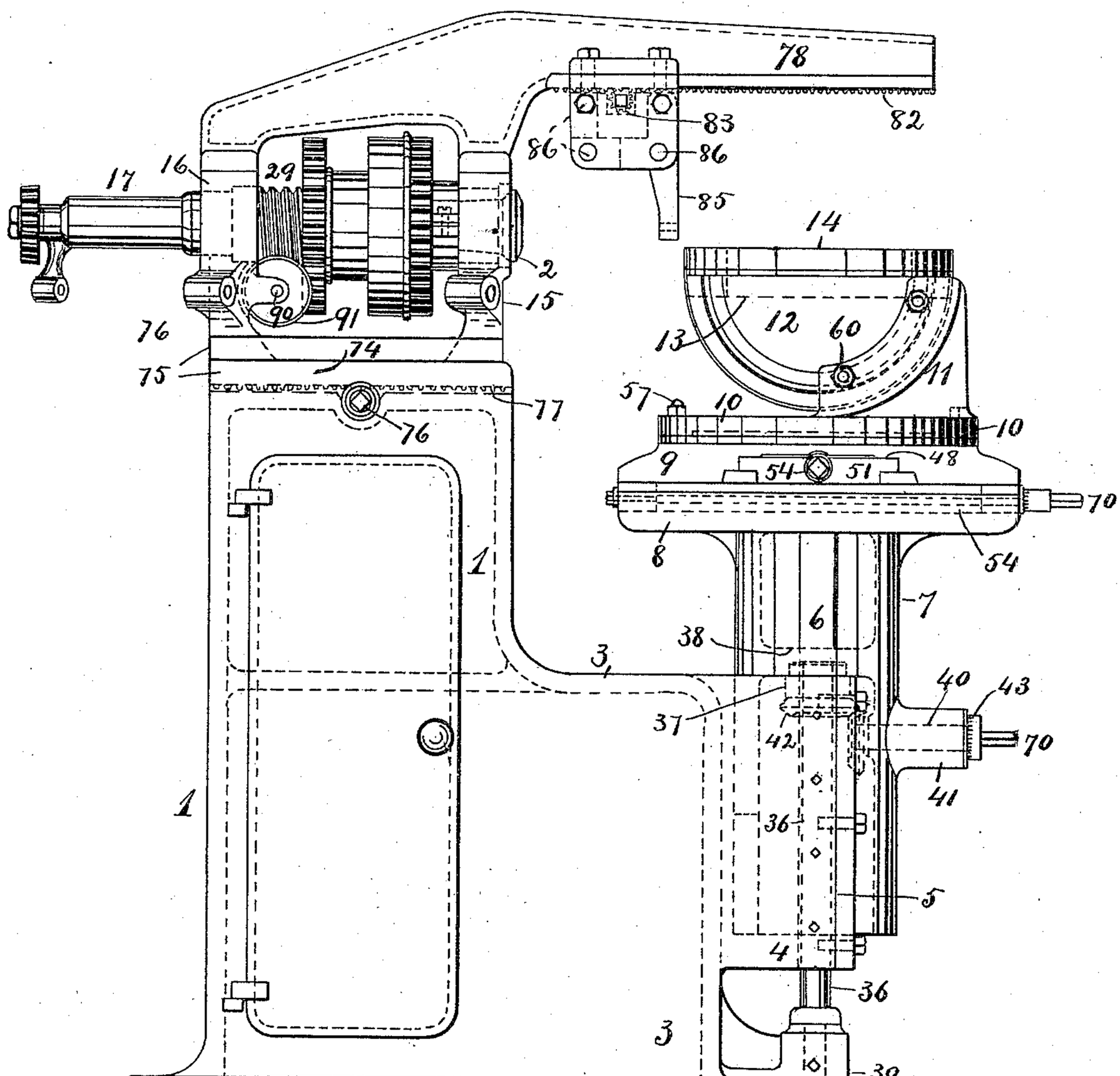

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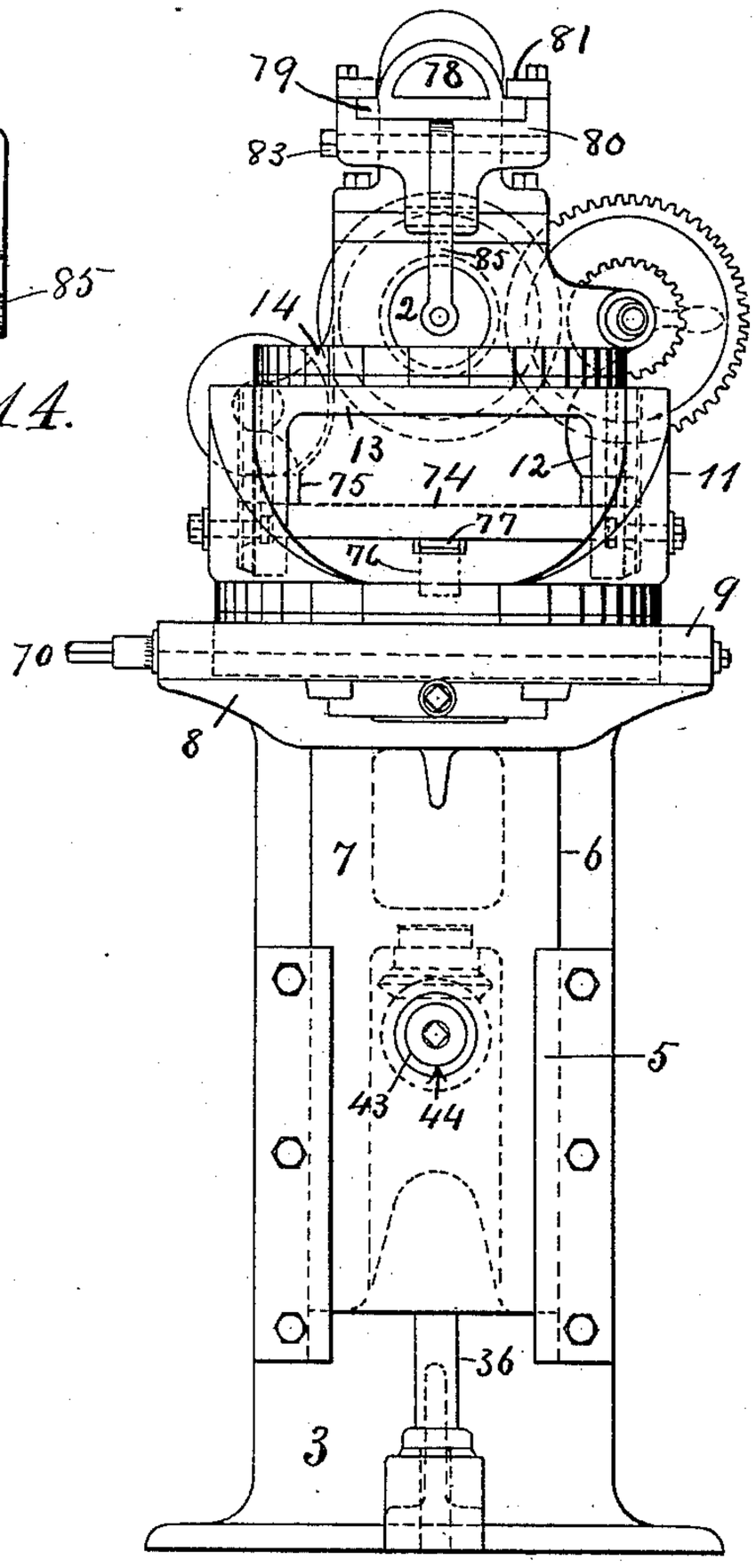
Fig. 2.



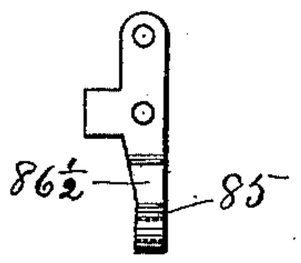


Fig. 14.

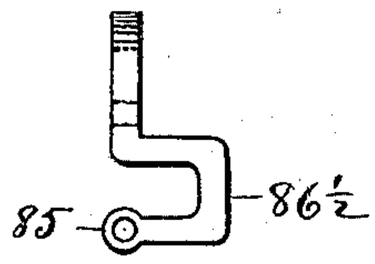


Fig. 15.

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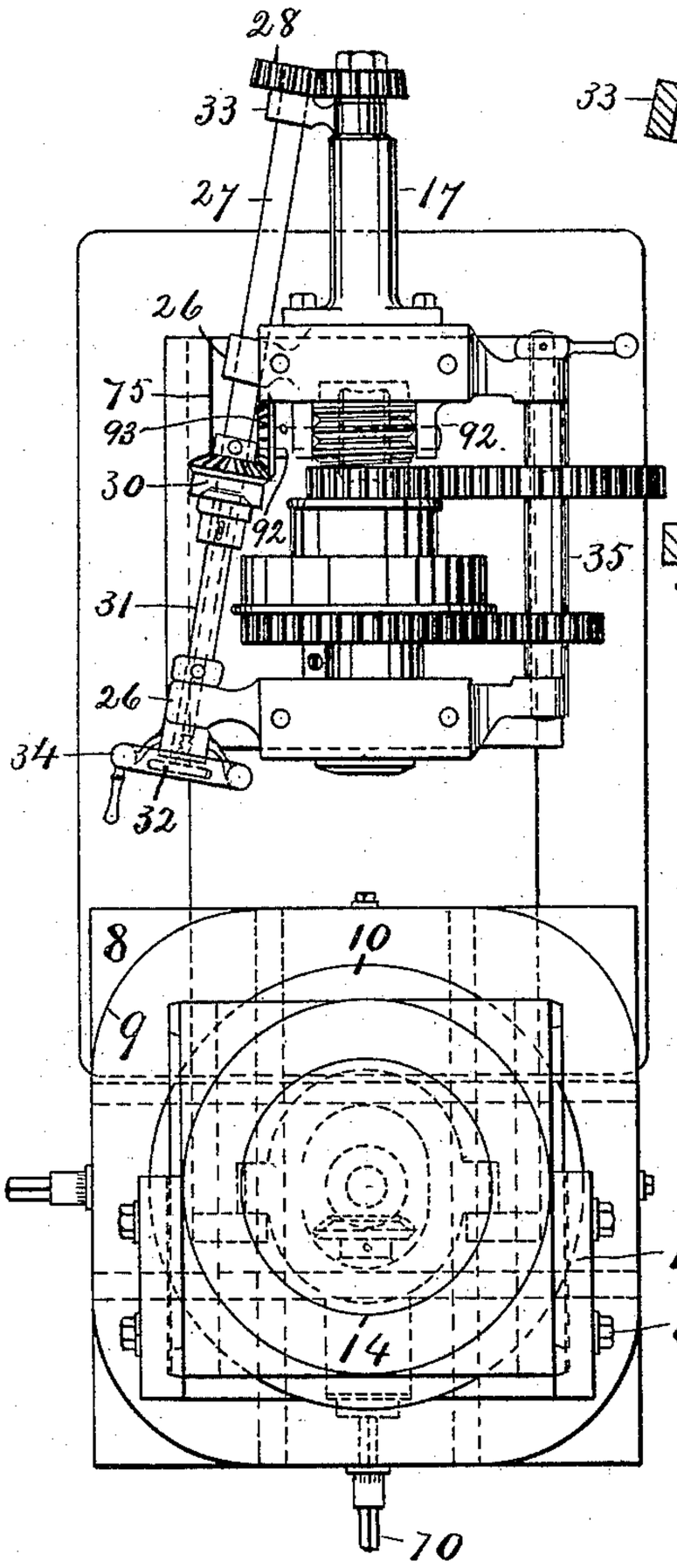
Fig 3.



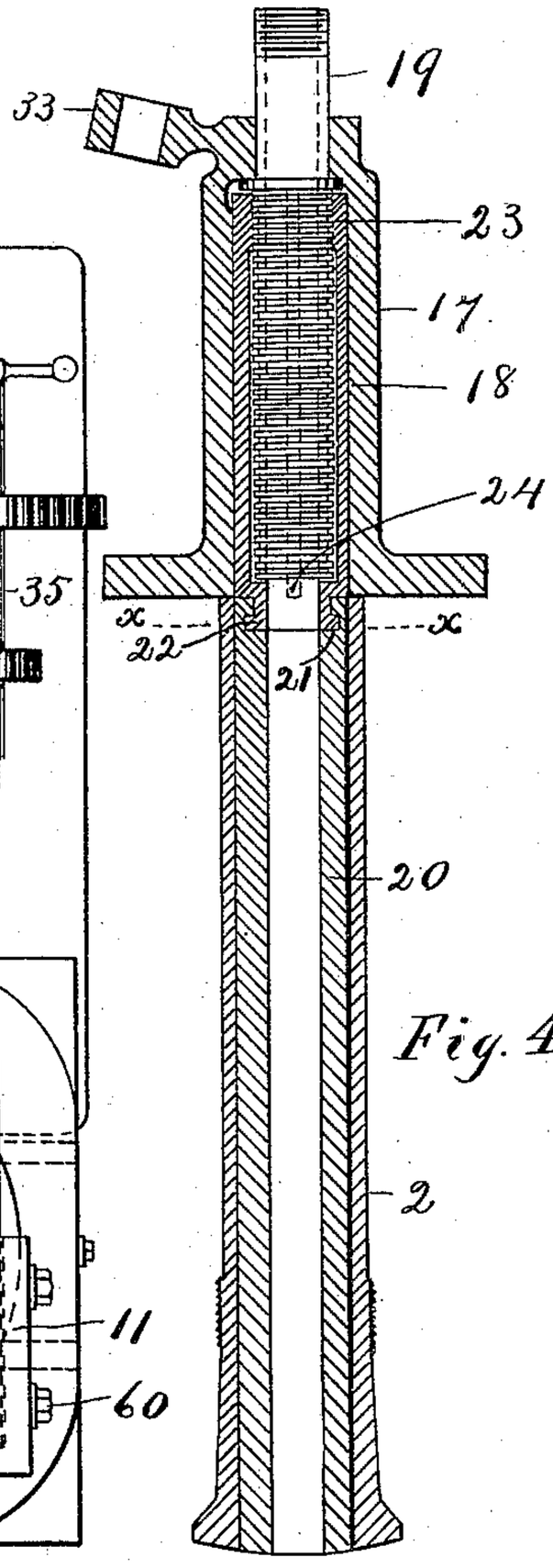


Fig. 4.

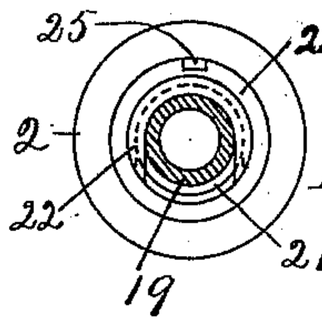


Fig 4a.

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Fig. 6.

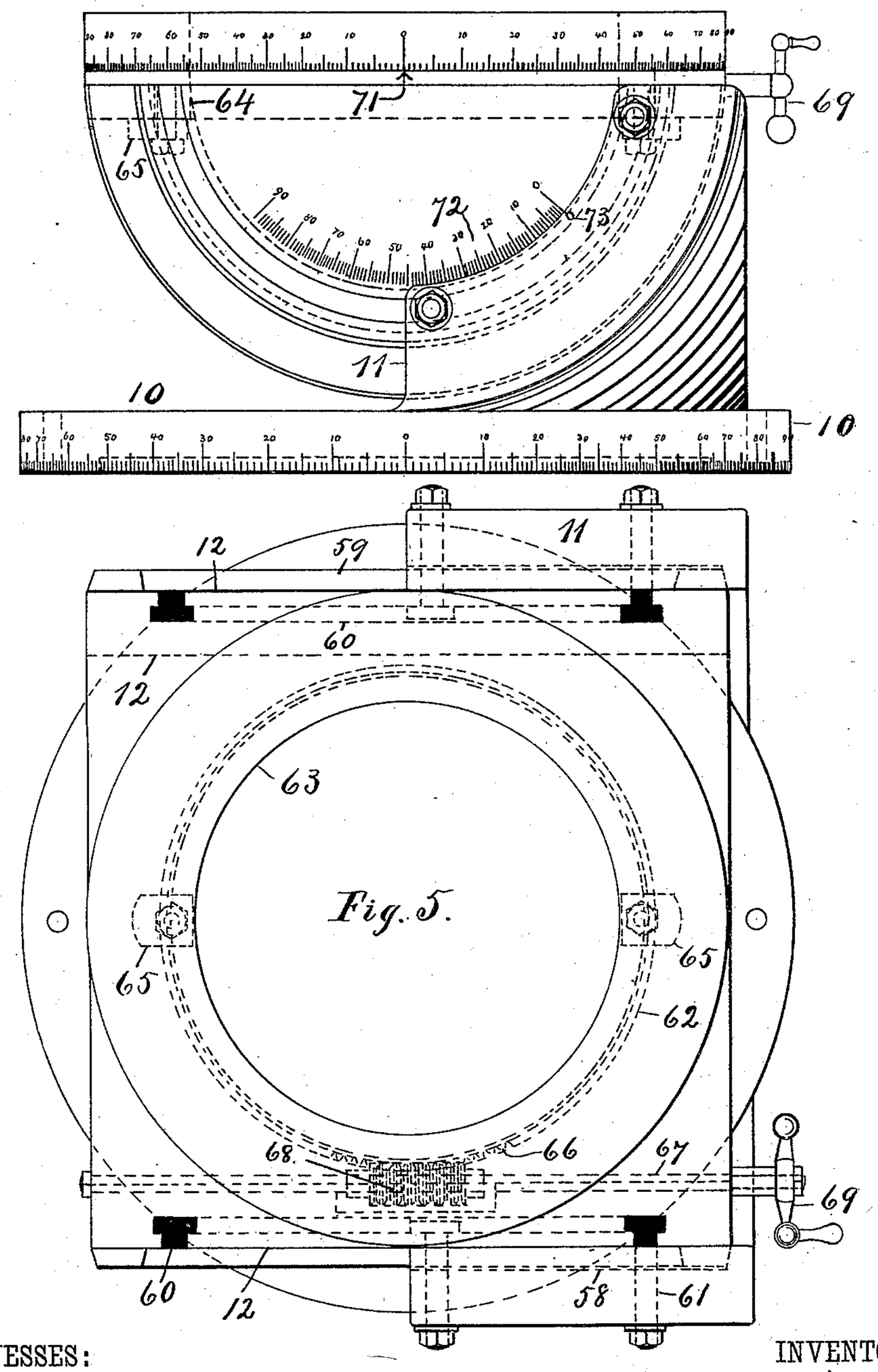

Fig. 5.

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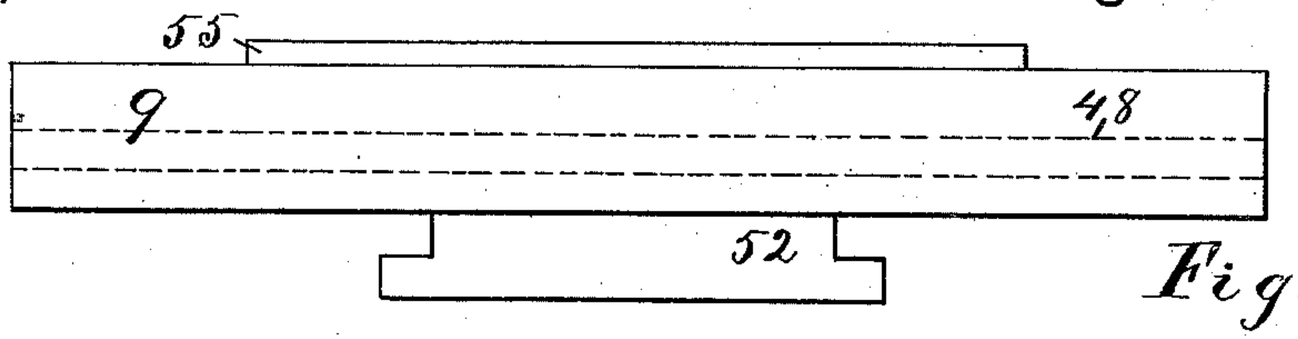

Fig. 9.

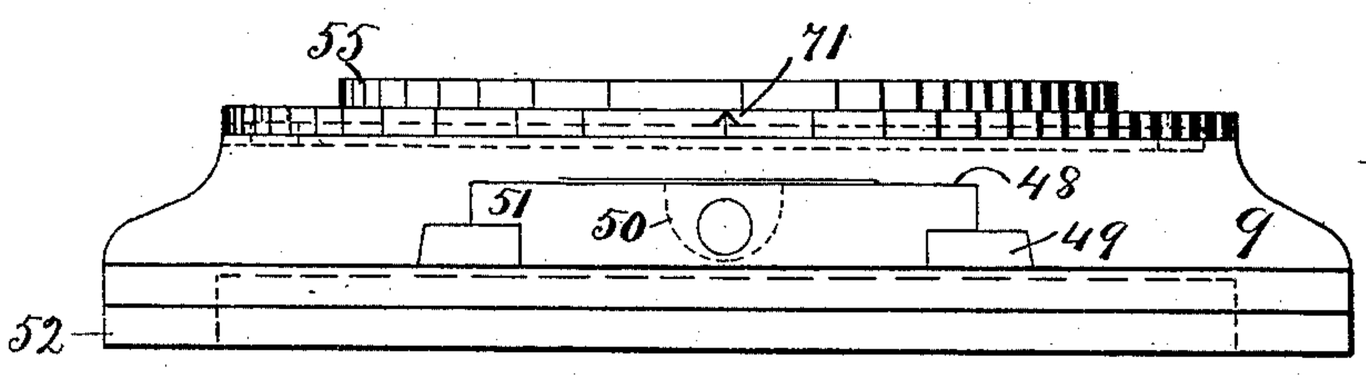

Fig. 8.

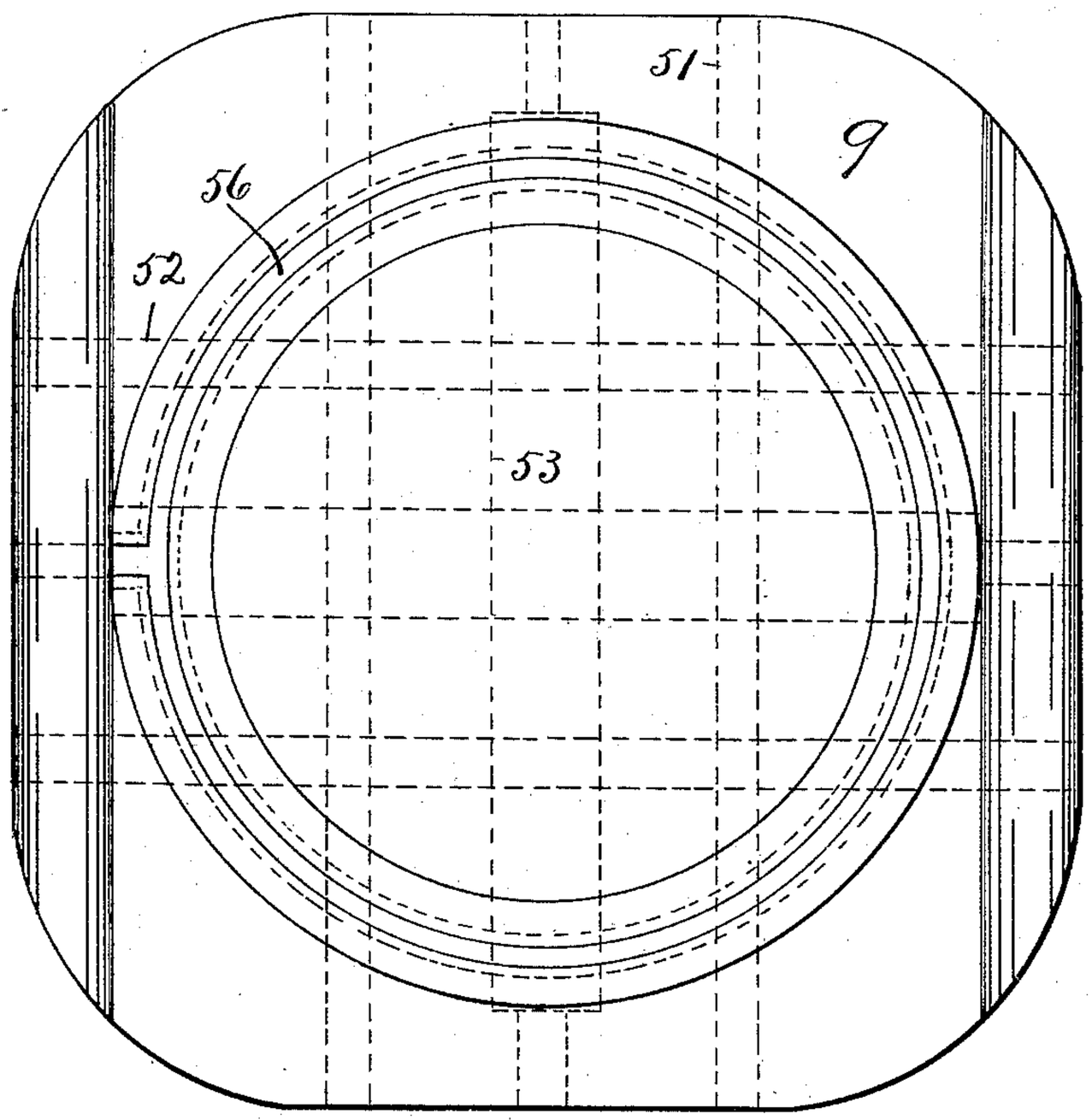

Fig. 7.

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Fig. 11.

Fig. 10.

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Fig. 13.

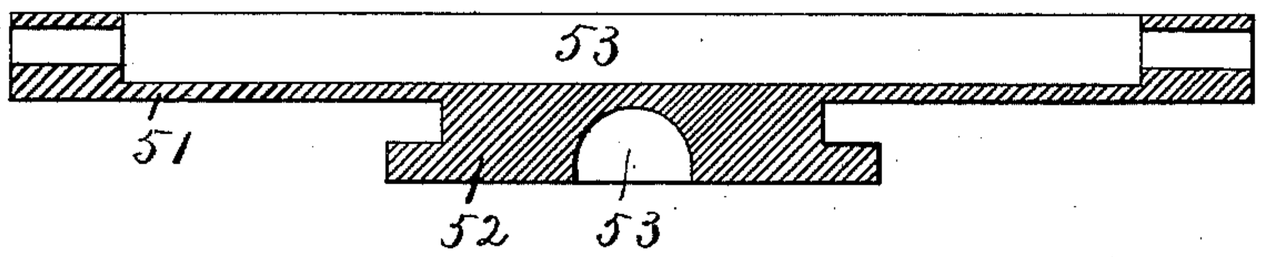
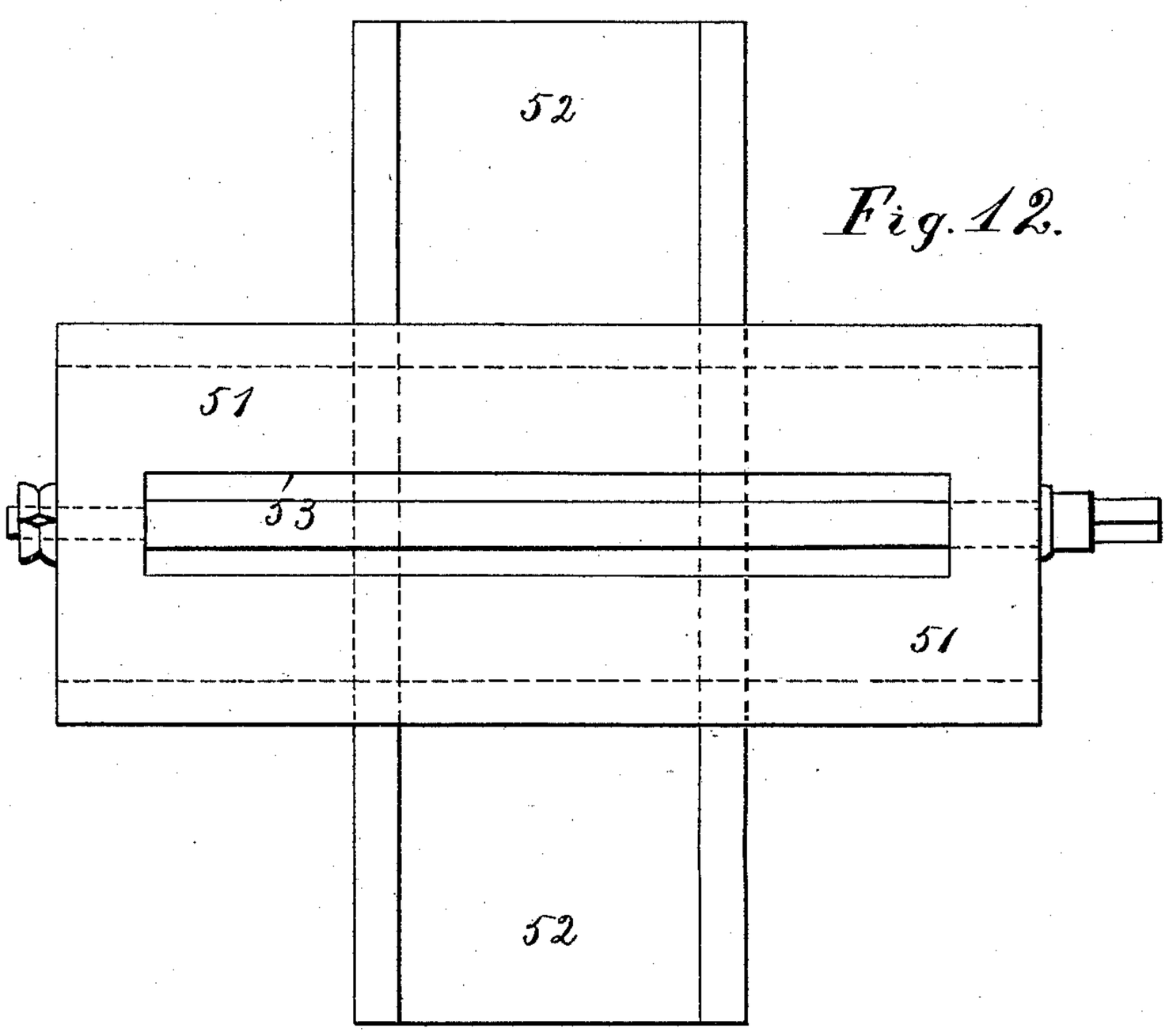


Fig. 12.



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UNITED STATES PATENT OFFICE.

ALBERT D. PENTZ, OF ELIZABETH, NEW JERSEY, ASSIGNOR OF ONE-HALF TO ABRAHAM VANDERBEEK, OF NEW YORK, N. Y.

BORING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 408,259, dated August 6, 1889.

Application filed June 20, 1888. Serial No. 277,621. (No model.)

To all whom it may concern:

Be it known that I, ALBERT D. PENTZ, a citizen of the United States, residing at Elizabeth, Union county, New Jersey, have invented certain new and useful Improvements in Boring-Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to provide a boring engine or mill with a variety of attachments to adapt it for more perfectly and conveniently boring holes and cavities in intricate constructions; and the invention consists in a particular construction for a boring-bar guide, for the bar-feeding devices, for the fitting of the spindle-head upon the frame, and for the work-table and its means of support, all of which will be fully understood by reference to the annexed drawings, in which—

Figure 1 is a side elevation of a boring engine or mill provided with my attachments. Fig. 2 is a front elevation of the same, and Fig. 3 is a plan of the same. Fig. 4 is a longitudinal section of the spindle and the socket for sustaining the feeding-screw and nut. Fig. 4ª is a section on line *x x* in Fig. 4. Fig. 5 is a plan of the work-table and its supporting carrier and rotary plate. Fig. 6 is a side elevation of the same. Fig. 7 is a plan of the block for supporting such rotary plate with a cruciform slide attached. Fig. 8 is an edge view of the same viewed from the lower side of Fig. 7, and Fig. 9 is an edge view of the same viewed from the right side of Fig. 7. Fig. 10 is a plan of the bed for supporting the block with the attached column by which the bed is carried, the rear edge of the bed being broken off for want of room on the drawing, and Fig. 11 is a front elevation of the same with a portion broken from the column for the same reason. Fig. 12 is a plan, and Fig. 13 a section, of the cruciform slide. Figs. 14 and 15 are a side and end view of the boring-bar guide.

The frame is shown formed as a hollow box provided with a post 1, upon which the head of the spindle 2 is mounted, and with an extension 3, having lugs 4, provided with vertical grooves 5 to receive tongues 6 upon a column 7, which sustains the work-table. The top of the column is provided with a horizontal bed 8, upon which is fitted a block 9, adapted to move longitudinally and transversely. A rotary plate 10 is mounted upon the block and provided with segmental guides 11. To these guides is fitted by means of vertical cheeks 12 a carrier 13, upon which a rotary work-table 14 is secured.

The spindle-head is provided with a front bearing 15 and with a rear bearing 16, from the rear side of which a socket 17 is projected to sustain a sliding nut 18 and a feed-screw 19. (See Fig. 4.) The spindle is shown of hollow form in Fig. 4 and provided with an internal sleeve 20, which is rotated within the spindle and movable longitudinally therein upon a spline 25. At the rear end of the sleeve is formed an annular groove 21, open at one side, as shown in Fig. 4ª.

The nut 18 is provided at one end with a collar 22, fitted to such groove, and at the other end with a nut 23, fitted to the thread of the screw 19. The nut is fitted to the socket with a spline 24, which permits it to move longitudinally into the hollow spindle without rotating, and the nut is held in line with the sleeve (when the collar 22 is inserted laterally in the groove 21) by the socket 17 and operates to move the sleeve longitudinally when the screw is rotated. The nut and the screw are made hollow to admit a boring-bar, and the latter would be clamped within the sleeve 20 by any suitable means, and would thus be fed longitudinally and rotated with the sleeve.

Bearings 26 are fixed upon the spindle-head to carry an inclined shaft 27, the forward end of which is provided with a hand-wheel 34, and the latter end connected with the shank of the screw 19 by gear-wheels 28.

A bearing 33 is formed upon the socket 17 to support the rear end of the shaft and hold the gear-wheels in mesh with one another, and the inclined position of the shaft makes the construction more compact and avoids the necessity for a bracket and intermediate wheels or the use of large gear-wheels to connect the shaft and screw, while it brings the hand-wheel 34, adjacent to the front bearing 15, in

a very convenient position for the use of the operator. The shaft 27 is also connected with the spindle by a worm 29 and suitable mechanism for driving a bevel-wheel 30, which may be clamped upon the shaft when desired by a sleeve 31 and a hand-nut 32, as is common in many feeding devices.

In Figs. 1 and 3 a shaft 90 is shown sustained in bearings 92 and provided with a worm-wheel 91, meshing with the worm 29. The outer end of the shaft is provided with a bevel-wheel 93, with teeth formed at a suitable angle to fit the wheel 30 upon the inclined shaft 27.

The parts for driving the shaft 27 are not shown more in detail, as they form no part of my present invention.

A back gear-shaft carrying cog-wheels to drive the spindle at slow speeds is also shown upon the spindle-head, but forms no part of my present invention.

The column which supports the bed 8, Fig. 1, is adjustable vertically in the grooves 5 by means of a rotary nut 37, supported by a bearing 38 within the column and fitted to the thread of a stationary screw 36, the lower end of which is secured in a lug 39, projected from the base of the extension 3 between the lower ends of the lugs 4.

A hand-shaft 40, Figs. 1 and 10, is fitted to a bearing 41 upon the front of the column and connected with the nut by bevel-gears 42, and the head of the shaft is provided with an annular micrometer-scale 43, adapted to fit an index 44, formed upon the bearing 41.

The bed 8, as shown in Figs. 10 and 11, is recessed upon the top to form a longitudinal seat 45, the edges of which are provided with gibs 46 and the center with a nut 47. The block 9, which rests upon the bed, is provided with a transverse seat 48, having gibs 49 at its edges, and provided also with a nut 50 at its middle. The block is held adjustably upon the table by a cruciform slide having two arms or plates attached rigidly together at right angles to one another. The two plates of the cruciform slide (marked 51 and 52) are fitted, respectively, to the block 9 and the bed 8, and are held therein by the gibs 49 and 46, which are fitted to rabbets formed in the edges of the plates.

Grooves 53 are formed longitudinally along the middle of each plate, as shown in Figs. 12 and 13, to admit the nuts 47 and 50, and screws 54 (shown in Figs. 1 and 12) are fitted through the middle of each of the plates to actuate the parts, as desired. As shown in Fig. 11, the nut 47 is fixed to the bed and the lower plate of the slide is moved (by rotating the screw 54) to or from the post 1, and operates to move the work-table longitudinally or parallel with the spindle 2.

The nut 50 is fixed in the block 9, and the manipulation of the screw in the plate 51 operates to move the block transversely upon such plate and to adjust the work-table transverse to the spindle 2. The block is shown in Figs. 7 and 8 provided with a collar 55 and a T-shaped groove 56, and the rotary plate 10 is fitted to such collar and clamped to the block by nuts 57, applied to bolts which would be fitted to the groove 56. The segmental guides 11 are shown in detail in Figs. 5 and 6, and are provided with grooves 58, concentric with a horizontal axis arranged transverse to the vertical axis of the plate 10.

The cheeks 12 are attached to the opposite edges of a square plate 13, which serves as the carrier for the work-table 14, and are formed with tongues 59 and T-shaped slots 60, concentric with the axis of the grooves 58, and bolts 61 are inserted through the guides and fitted to the slots 60 to clamp the carrier in position between the guides when properly adjusted. The carrier is shown in Figs. 5 and 6 formed with a central aperture 62, and the table is formed with a central aperture 63 and with a collar 64, fitted to the aperture in the carrier to guide it in a rotary movement.

Gibs 65 are attached to the under side of the collar 64 to clamp the table to the carrier. The collar is provided upon its outer rim with worm-teeth, a few of which are shown at 66 near the lower side of Fig. 5, and a worm-shaft 67 is inserted through the carrier longitudinally and provided at its middle with a worm 68, fitted in a suitable bearing in the carrier to rotate the collar, and thus turn the table upon the carrier. A hand-crank 69 is shown fitted upon the end of the shaft 67, and would, as in other such machines, be made removable and fitted also to the ends of the screws 54 and the elevating-shaft 40, which are shown provided with squared ends 70 for such purpose.

In Fig. 6 the table and the plate 10 are each provided with scales of degrees, which, with a suitable index, as the arrow-head 71, (shown in Figs. 6 and 8,) would enable the operator to set the table and plate independently. The plate is not provided with any means for rotating it, but is meant to be turned by hand and secured in the desired position, while the gibs 65, which secure the work-table to its carrier, are intended to be so fitted that the table, if desired, may be rotated by the worm 68. The cheeks 12 are also provided with a quadrantal scale 72, and are intended to hold the table at any angle between the horizontal and vertical positions, the guides 11 being furnished with an index 73 to indicate the setting of the table.

The combined operation of these various attachments to the work-table is as follows: The cruciform slide permits the adjustment of the work-table longitudinally and transversely. The guides 11 and cheeks 12 permit the inclination of the table at any angle. The fitting of the table to its carrier by a circular joint and the provision of the worm 68 enable the operator to rotate the table throughout the entire circle in any inclined position, and the annular adjustment of the plate 10,

which sustains the carrier, enables the inclined rotary table to be pointed in any direction around the entire horizon or presented at any angle whatsoever to the boring-bar. The horizontal axis of the cheeks 12 is shown in Figs. 1 and 6 even with the under side of the rotary table; but the top of the table may be made coincident with such axis, and in such case a hemisphere could be secured centrally upon the table and its spherical surface presented in any conceivable position to a drill carried by the spindle 2. In other words, the combination of a rotary table with means for tipping it upon a second rotary plate permits the adjustment of the work that may be carried by the table in every desired position in relation to the spindle.

The bearings of the spindle are united by a foot 74 to form a movable head, which is adjustable upon the top of the post 1, so that the front end of the spindle may be moved to and from the column 7 and the work-table sustained thereon.

Guides 75 are formed upon the top of the post and a pinion and shaft 76 are inserted therein, and rack-teeth 77 are formed upon the under side of the foot 74, so that the head may be readily adjusted longitudinally.

Upon the top of the bearings 15 and 16 is bolted an arm 78, which is preferably formed, as shown in Fig. 2, as a hollow beam with longitudinal flanges 79 at its opposite edges to sustain a carriage 80, held thereon by gibs 81.

The arm is furnished with rack-teeth 82 and the carriage with a pinion 83 for shifting the carrier at pleasure, the gibs being bolted rigidly to the arm, if desired, when the carriage is adjusted, so as to clamp the carriage firmly in place.

The object of the carriage is to sustain a boring-bar guide 85 in line with the axis of the spindle, as shown in Figs. 1 and 2, the guide being detachably held to the carriage by bolts 86, two of which are shown in Fig. 1 at the right side of the carriage and two at the left side.

The guide is constructed to reverse, so that it may be clamped at pleasure by the right or left hand pair of bolts, and may thus be set nearer to or farther from the end of the spindle, as may be required.

Fig. 14 shows the guide detached from the carriage and exposes the portion that is clamped by the bolts 86, and two different forms for the portion of the guide which projects below the carriage, as shown in Figs. 2 and 15, the neck of the guide projecting straight downward in Fig. 2, while it is bent three times at right angles in Fig. 15 to form an offset neck, by which the end of the boring-bar may be sustained inside a mortise or cavity in the "work" upon the work-table.

The offset in the neck may be extended in any direction that is desired to suit the construction of the work and sustain the end of the boring-bar within the same.

It will be understood that the block 9 rests directly upon the four corners of the bed 8 outside of the seats in which the cruciform slide is fitted, and therefore has a firm bearing independent of the slide, and the function of the latter is not, therefore, to support the load imposed upon the block, but only to guide the same in its movements. The cruciform slide operates, therefore, differently from any compound rest or other fitting which furnishes two guides at right angles to one another, and does not impair the solidity of the structure, as is commonly the case with other compound rests.

Having thus set forth my invention, what I claim herein is—

1. In a boring-engine, the combination, with a hollow spindle and a hollow sleeve movable longitudinally through the same, of an arm projected from the upper side of the spindle-bearing and a boring-bar guide adjustable thereon, as and for the purpose set forth.

2. In a boring-engine, the combination, with a hollow spindle and a hollow sleeve movable longitudinally through the same, of an arm projected from the upper side of the spindle-bearing, a carriage movable on such arm, and a boring-bar guide detachably held on such carriage, as and for the purpose set forth.

3. In a boring-engine, the combination, with a hollow spindle and a hollow sleeve movable longitudinally through the same, of a head to sustain such hollow spindle and a hollow arm bolted upon such head and projected above the line of the boring-bar, a carriage movable on such arm, and a boring-bar guide detachably held on such carriage, as and for the purpose set forth.

4. In a boring-engine, the combination, with a hollow spindle and a hollow sleeve movable longitudinally through the same, of an arm projected from the upper side of the spindle-bearing, a carriage movable on such arm, and a boring-bar guide held reversibly on such carriage, as and for the purpose set forth.

5. In a boring-engine, the combination, with a hollow spindle and a sleeve movable longitudinally in the hollow spindle and provided with an annular groove open at one side, of a socket projected from the spindle-bearing, a nut movable longitudinally in such socket and provided with a collar fitted to such annular groove, and a screw rotated to feed the nut and sleeve through the spindle, substantially as herein set forth.

6. In a boring-engine, the combination, with a hollow spindle and a sleeve movable longitudinally in the hollow spindle and provided with an annular groove open at one side, of a socket projected from the spindle-bearing, a nut movable longitudinally in such socket and provided with a collar fitted to such annular groove, a screw journaled in such socket, and an inclined shaft extended from the bearing of the screw-journal to the

front of the head and connected by suitable gearing with the screw and with the spindle, as and for the purpose set forth.

7. In a boring-engine, the combination, with the rotary work-table, of the carrier provided with vertical cheeks fitted to segmental guides, the carrier being adjustable in the guides about a horizontal axis, and the table rotary in various inclined planes, as and for the purpose set forth.

8. In a boring-engine, the combination, with the rotary work-table, of a carrier adjustable about a horizontal axis and the carrier-clamps mounted upon a rotary plate to turn the inclined plane of the work-table in every direction, as and for the purpose set forth.

9. In a boring-engine, the combination, with the rotary work-table, of a carrier adjustable about a horizontal axis, carrier-clamps mounted upon a rotary plate to turn the inclined plane of the work-table in every direction, the block 9 and bed 8, provided with the seats 48 and 45 at right angles, as described, and the cruciform slide 51 and 52, fitted to such seats and held adjustably therein, as and for the purpose set forth.

10. In a boring-engine, the combination, with the rotary work-table, of a carrier adjustable about a horizontal axis, carrier-clamps mounted upon a rotary plate to turn the inclined plane of the work-table in every direction, the block 9 and bed 8, provided with the seats 48 and 45 at right angles, as described, the cruciform slide 51 and 52, fitted to such seats and held adjustably therein, the frame 1, carrying the spindle-head and spindle 2, the vertical grooves 5 in the frame, and the column 7, having tongues 6, fitted to such grooves, and having the bed 8 affixed to its upper end, as and for the purpose set forth.

11. In a boring-engine, the combination, with the rotary work-table, of a carrier adjustable about a horizontal axis, carrier-clamps mounted upon a rotary plate to turn the inclined plane of the work-table in every direction, the block 9 and bed 8, provided with the seats 48 and 45 at right angles, as described, the cruciform slide 51 and 52, fitted to such seats and held adjustably therein, the frame 1, carrying the spindle-head and spindle 2, the vertical grooves 5 in the frame, the column 7, having tongues 6 fitted to such grooves and having the bed 8 affixed to its upper end, screws 54, for adjusting the cruciform slide in the block and bed, a stationary screw 36, supported in the column, a rotary nut 37, fitted to the screw and to a bearing 38 upon the column, a hand-shaft 40 and gears 42, retaining such nut, and annular micrometer-scales fitted to the said shaft and to the screws of the cruciform slide, as and for the purpose set forth.

12. In a boring-engine, the combination, with a hollow spindle and a hollow sleeve movable longitudinally through the same, of an arm projected from the upper side of the spindle-bearing, a carriage and boring-bar guide movable upon such arm, a rotary work-table, and a carrier for the same adjustable about a horizontal axis, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALBERT D. PENTZ.

Witnesses:
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THOS. S. CRANE.