

No. 771,176.

PATENTED SEPT. 27, 1904.

O. F. RODEHAVER.
STEAM ENGINE.

APPLICATION FILED FEB. 23, 1904.

NO MODEL.

3 SHEETS—SHEET 1.

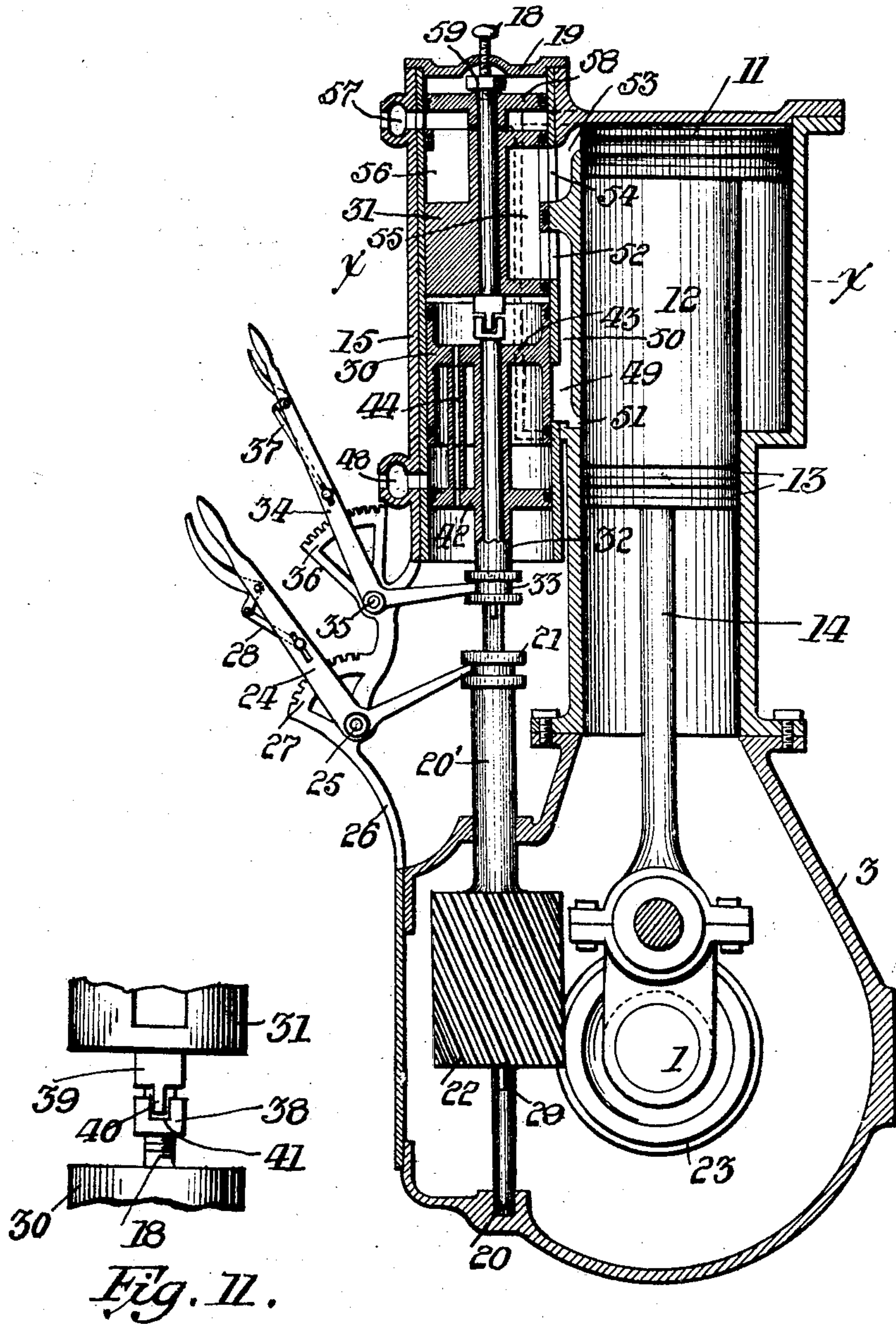


Fig. 1.

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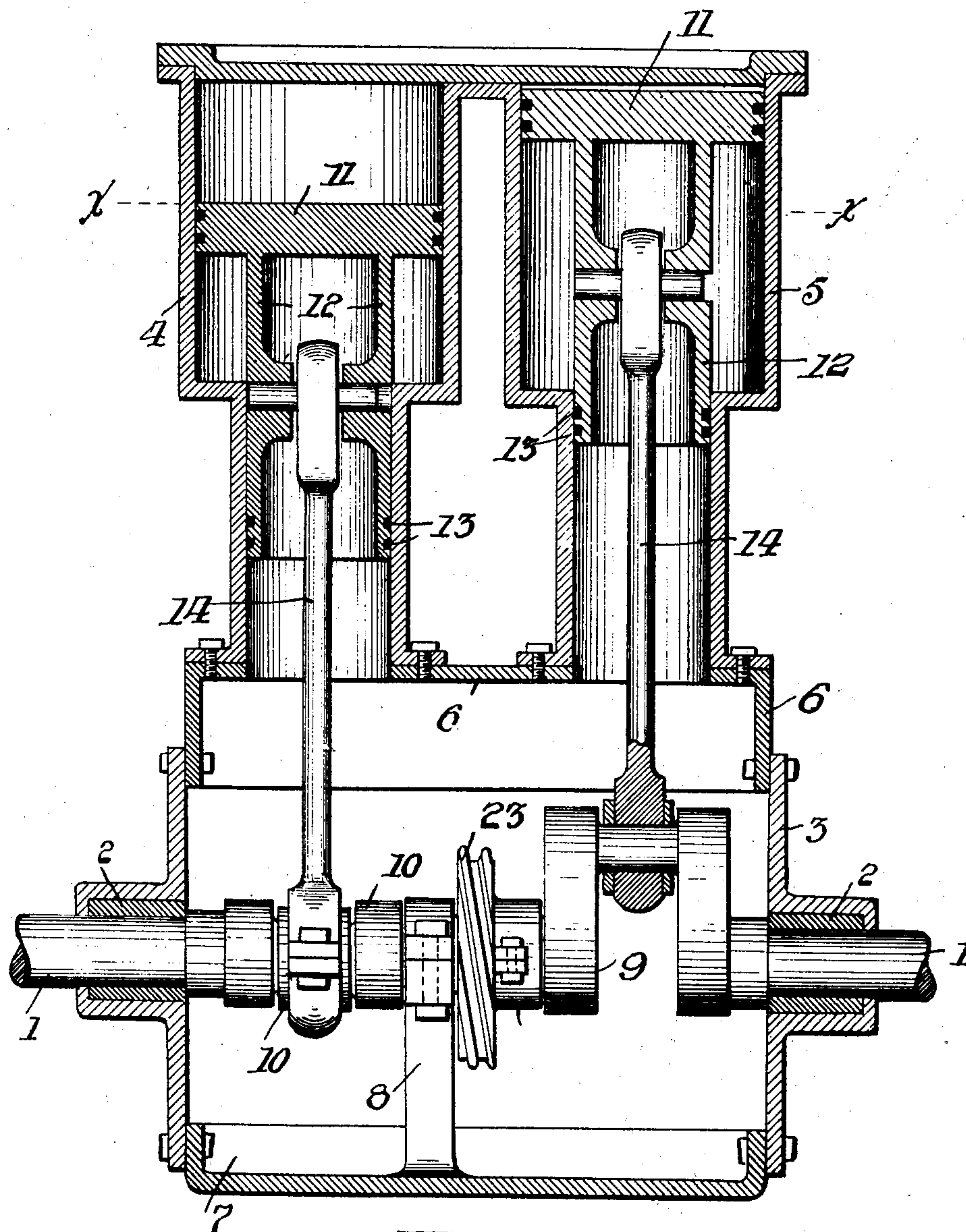


Fig. 2.

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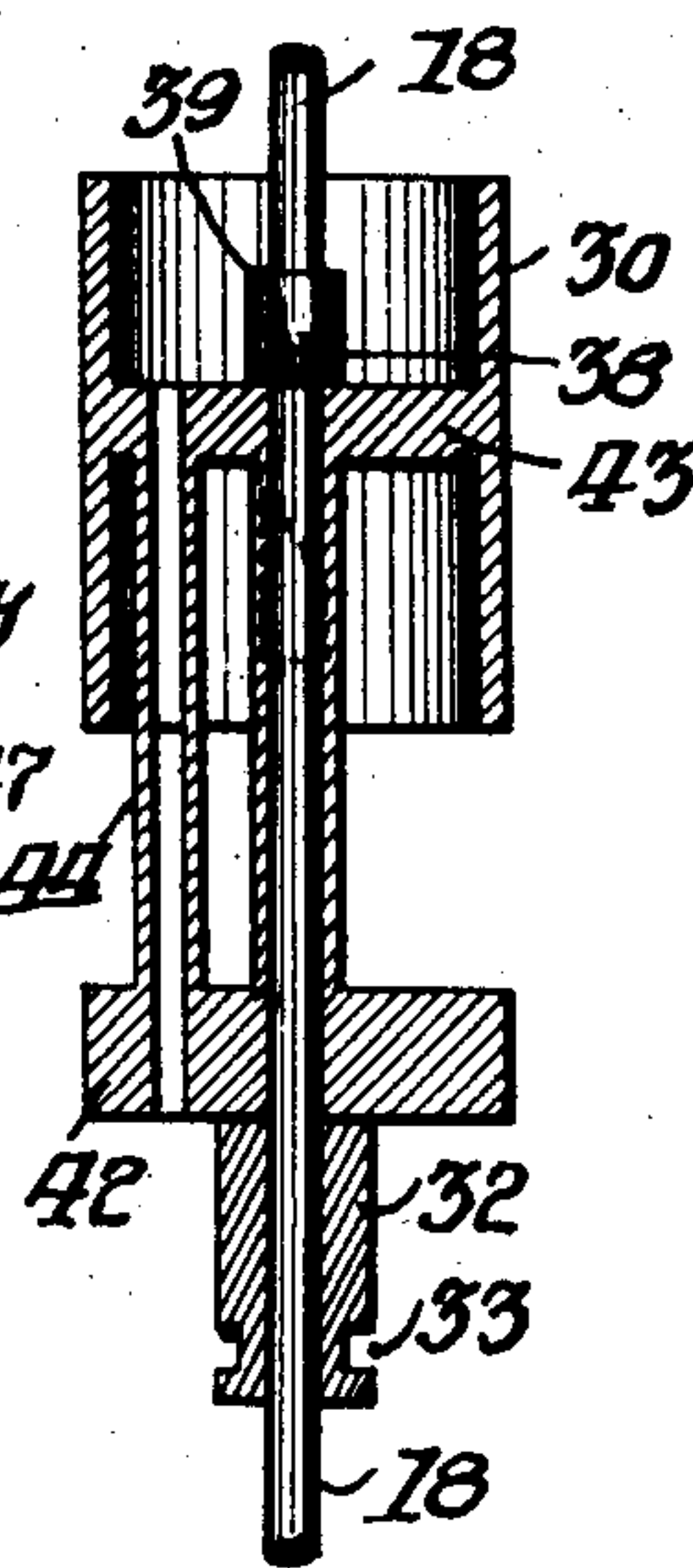
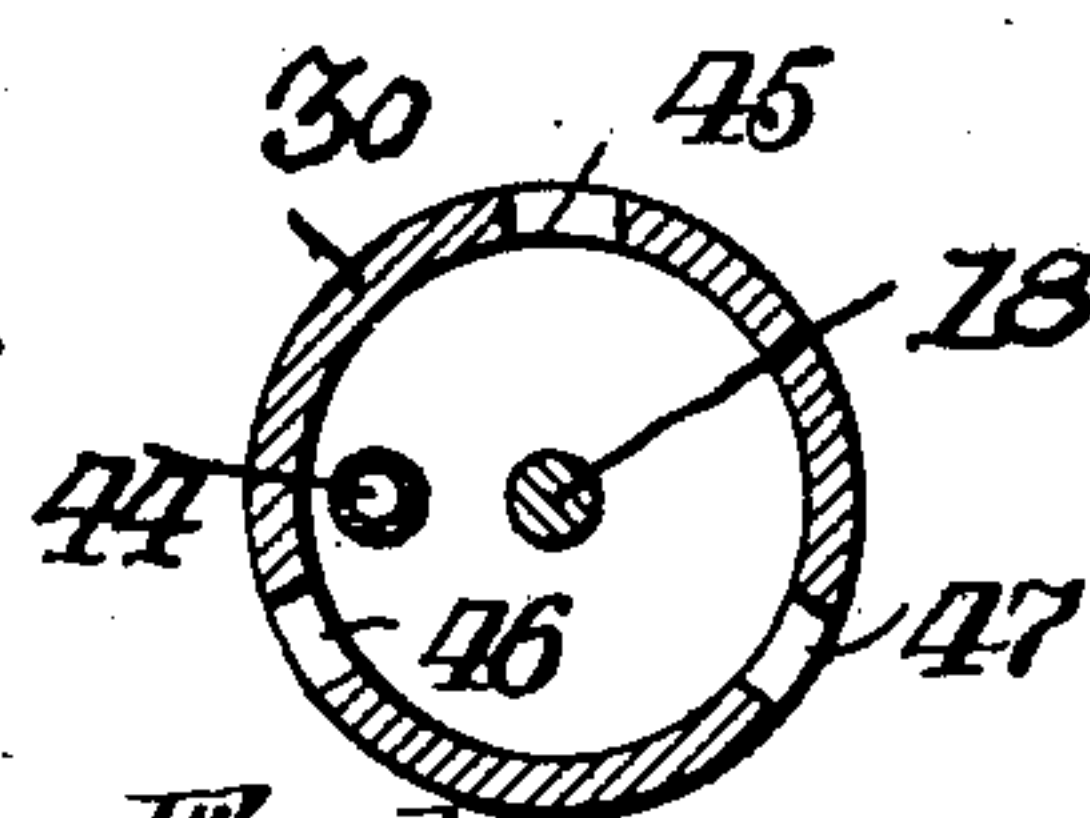
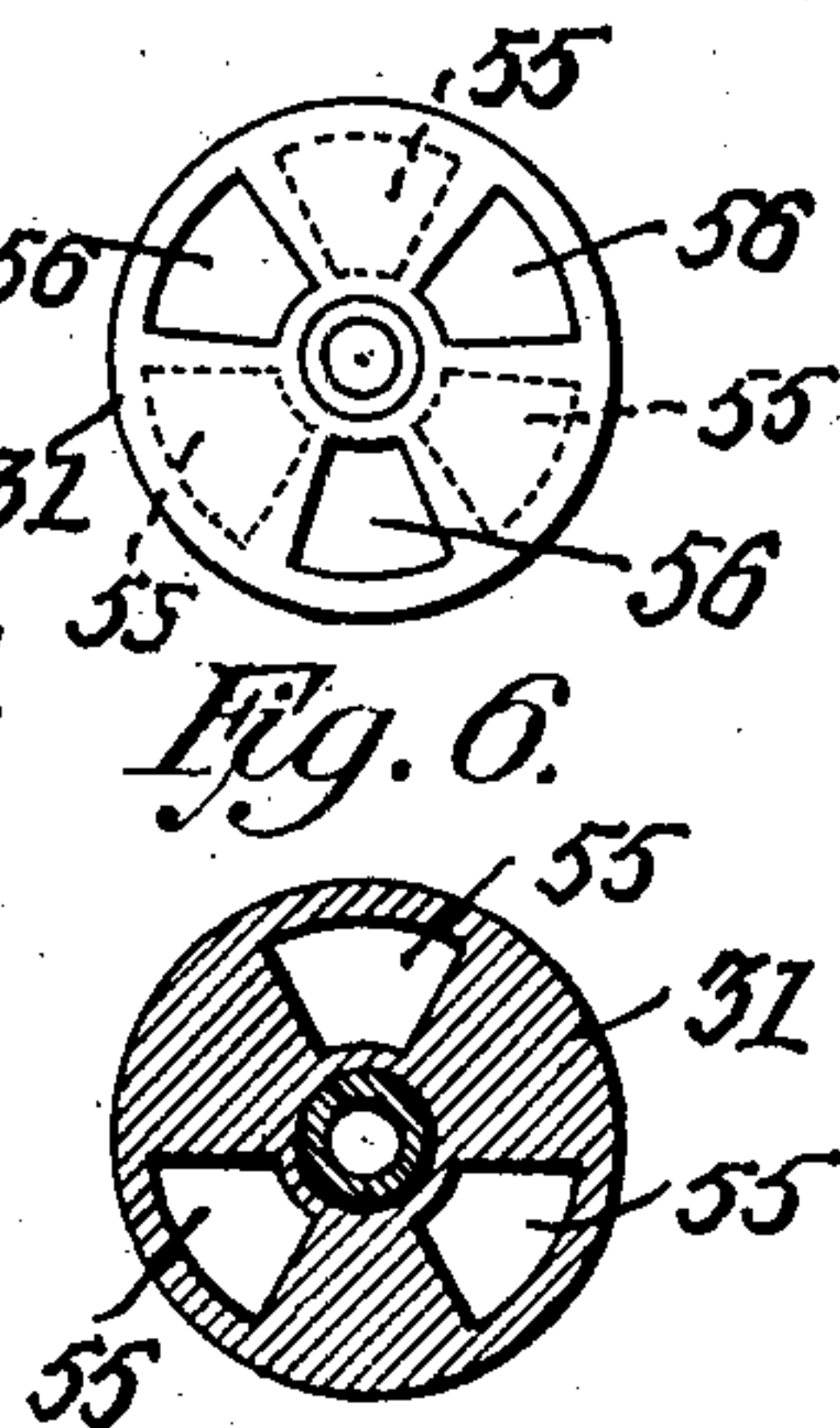
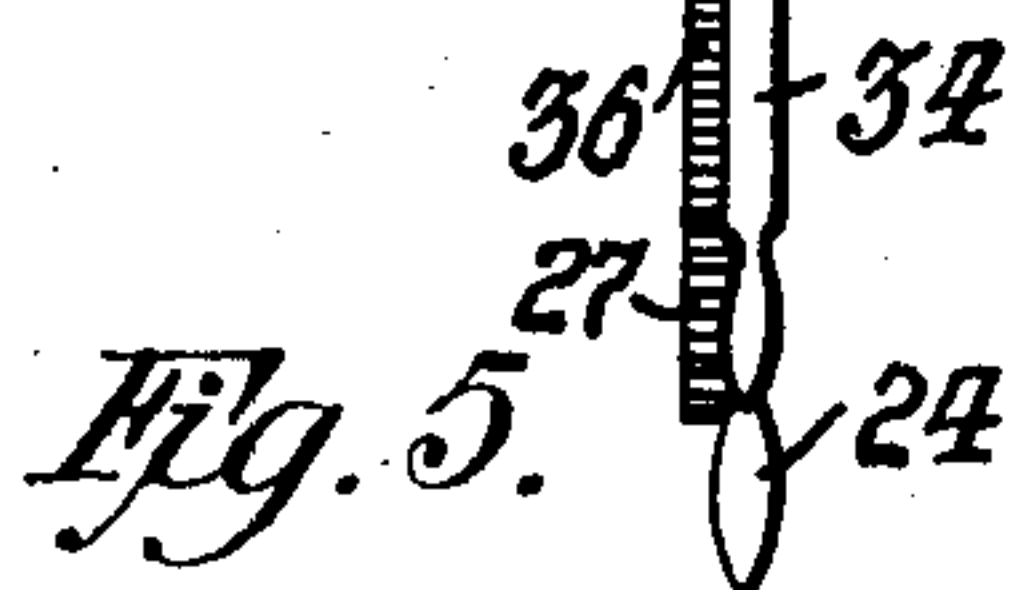
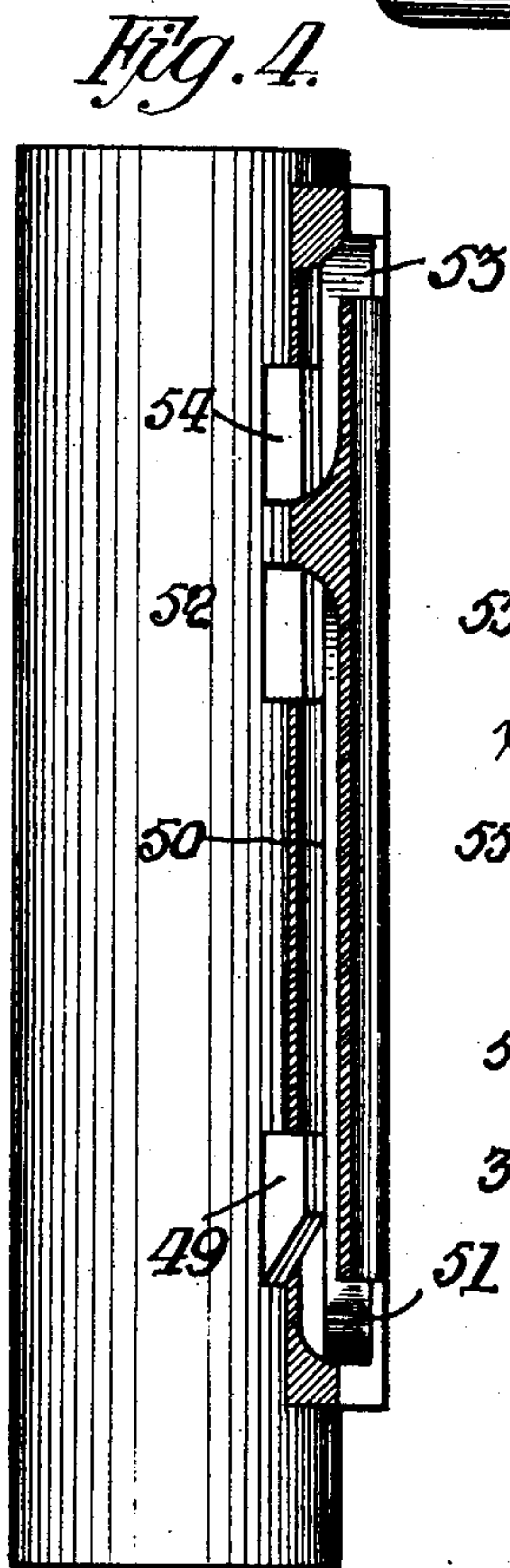
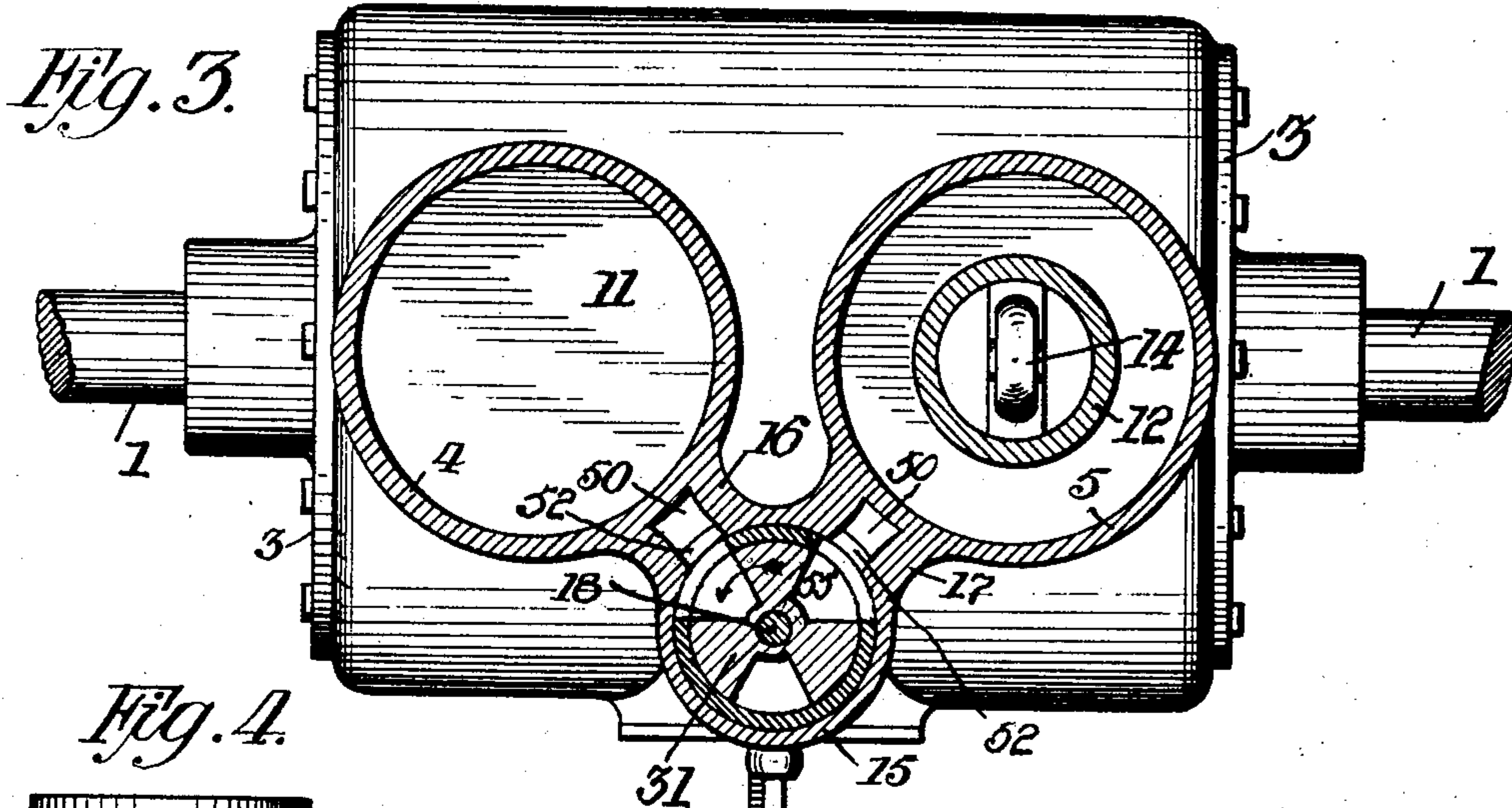
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3 SHEETS—SHEET 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

OSCAR F. RODEHAVER, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR OF
ONE-HALF TO D. C. WHITE, OF WILKINSBURG, PENNSYLVANIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 771,176, dated September 27, 1904.

Application filed February 23, 1904. Serial No. 194,737. (No model.)

To all whom it may concern:

Be it known that I, OSCAR F. RODEHAVER, a citizen of the United States of America, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention has relation to steam-engines, and relates in particular to engines having twin cylinders connected to a common shaft, and has for its object the provision of an engine of novel form wherein two cylinders having pistons connected to a common shaft are supplied with steam at a high and low pressure, the high-pressure steam being admitted on one side of each piston and the low-pressure steam on the other side of each piston.

My invention has for its further object the provision of a valve of novel form adapted to deliver steam under high pressure to one side of the piston and to transfer the steam from the high-pressure to the low-pressure side of the piston.

My invention has for its still further object the provision of a rotary valve of novel form and construction for supplying steam to the two cylinders of an engine of the twin-cylinder type.

The invention has for its still further object the provision of a rotary valve of novel form and construction adapted to supply steam to the two cylinders of an engine of the twin-cylinder type and of novel means for reversing the motion of the engine.

My invention has for its still further object the provision in a rotary valve of novel cut-off mechanism for governing the supply of steam to a piston or pistons.

Having in view the above and other objects tending to produce the engine and valve mechanism of novel character, my invention consists in the novel construction, combination, and arrangement of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1 is

a vertical transverse sectional view of an engine constructed according to my invention. 50
Fig. 2 is a vertical longitudinal sectional view of the engine shown in Fig. 1, but showing a modified form of the casing which incloses the main shaft. Fig. 3 is a horizontal sectional view on the line $x x$ of Fig. 2. Fig. 4 55
is a side elevation, partly in section, of the valve-casing. Fig. 5 is a side elevation of part of the rotary valve. Fig. 6 is a top plan view of the part shown in Fig. 5. Fig. 7 is a transverse sectional view on the line $x x$ of 60
Fig. 5. Fig. 8 is a side elevation of another portion of the valve. Fig. 9 is a vertical sectional view of a portion of the valve shown in Fig. 8. Fig. 10 is a transverse sectional view on the line $y y$ of Fig. 8. Fig. 11 is a 65
detail side elevation of a portion of the rotary valve.

In the several figures of the drawings like numerals designate corresponding parts.

1 designates the main shaft of the engine, 70
suitably mounted in bearings 2 2 in a casing 3.

4 5 designate the twin cylinders, which are mounted upon the casing 3 above the shaft 1, these cylinders being shown in Fig. 1 as bolted directly to the casing 3 and in Fig. 2 75
as being bolted to a removable top 6, which is bolted upon the casing. In Fig. 2 the casing is provided with a removable bottom 7, which is formed with a vertical standard 8, which supports the main shaft between the 80
two cranks 9 10 thereof. The cylinders 4 5 each consist of two sections of different diameters, and in the larger and upper section of each cylinder is arranged a piston 11, while in the lower and smaller section of each cylinder a plunger 12 is fitted, said plungers being packed near their lower ends at 13. Each plunger 12 is formed integral with the piston 11, and the plungers are connected to the cranks 9 10 of the main shaft 1 by pitman- 90
rods 14 of the usual construction. The rotary valve, by means of which steam is supplied to the two cylinders 4 5, is located laterally of the cylinders, the casing 15 thereof being connected to cylinder 4 by a wing 16 95
and to the cylinder 5 by a wing 17, which

wings are formed with ports and passages for the admission of steam from the valve to the cylinders, as will be hereinafter described.

18 designates the valve-stem, which is journaled at one end in the head 19 of the valve-casing and at the other end in a bearing 20 in the casing 3. Upon the said valve-stem is mounted a sleeve 20', which has at its upper end a circumferentially-grooved collar 21, said sleeve passing through the casing 3 and carrying on its lower end a worm 22, which meshes with a worm-wheel 23 on the main shaft 1, and an L-shaped lever 24 is pivoted at 25 to a bracket 26, which is formed with an arc-shaped rack 27, that is engaged by a latch 28, carried on lever 24, and the shorter arm of said lever enters the circumferential groove in the collar 21, so that by swinging the outer end of said lever 24 toward or from the valve-casing the sleeve 20' may be moved up or down on the valve-stem. The worm 22 is connected to the valve-stem by a key 29, so that the worm may be moved up and down on the valve-stem, but will turn the same at whatever position the worm may be adjusted to by lever 24. When the worm is adjusted upwardly or downwardly on the valve-stem, being in mesh with the worm-gear, the worm will be turned slightly on its longitudinal axis in one direction or the other, according as it is moved up or down, and this limited rotary motion of the worm is made available for the purpose of reversing the direction of motion of the engine, as will be presently described.

The valve proper is composed of two cylindrical sections 30 31, the section 30 being keyed on the valve-stem and having a sleeve 32 on its lower end which carries a circumferentially-grooved collar 33, with which engages the shorter arm of the L-shaped lever 34, that is pivoted at 35 to the bracket 26, said bracket having an arc-shaped rack 36 and the lever 34 carrying a latch 37, which engages with said rack and holds the latter in any position to which it may be adjusted. The section 31 is also loose on the valve-stem 18 and is connected so as to turn with the stem, but having a slight movement independently of the stem by means of the connection shown in Fig. 11, referring to which figure it will be seen that a clutch member 38, which is fast on the shaft, engages with a clutch member 39, carried by the valve-section 31, the connection between the members 38 39 being somewhat loose, so as to permit of a slight amount of play or lost motion between the members, the tongue 40 of member 39 fitting loosely into the notch 41 of member 38, as shown in said Fig. 11. A head 42 is arranged below the head of the section 30 and suitably packed, so as to fit the valve-casing tightly, and a pipe 44 provides a communication to the open air from the space above the

partition 43 in the section 30 and serves for the escape of condensed steam from above said partition. The section 30 is hollow and has an open bottom, and three ports 45 46 47 are formed in its side wall at equal distances apart, these ports tapering to a point at their upper end, as shown in Fig. 8, said ports being in constant communication with the inlet-pipe 48 in the side of the casing and being brought into communication successively with the port 49 in the inner side of the casing, that communicates with the passage 50 in wing 17 and with a similar port in wing 16, the passage 50 communicating with the cylinders 4 5 below the pistons thereof by ports 51 and communicating with the valve-casing at a point above the bottom of the upper section 31 of the valve by ports 52. Passage-ways 53, which open into the cylinders 4 5, are formed in the wings 16 17, near the upper ends thereof, said passage-ways communicating with the valve-casing by ports 54, located above the ports 52. The valve-section 31 is formed with three vertical passages 55, which by the rotation of the valve-section 31 are successively brought opposite the ports 52 and 53 in each of the wings 16 17, so that when one of the passages 55 is opposite the port 52 and port 54 a passage-way is afforded for the steam from below the pistons of the cylinders to above the same, the port 49 in this position of the valve being closed. Near the upper end of section 31 and opening out through the top thereof are three recesses 56, which alternate in position with the passages 55 and which serve to conduct the exhaust-steam from above the pistons of the cylinders to the exhaust-outlet 57 in the wall of the valve-casing. One of these passage-ways 56 is shown in Fig. 1 of the drawings as being on the side of the valve farthest away from port 54; but it will be understood that as the valve rotates one of these passages 56 is brought into communication with port 54, leading to the passage 53 of each wing, following in succession the passage-ways 55. A supplementary head 58 is located within the casing 15 below the main head 19 thereof, said supplementary head being fast on the valve-stem and being sustained in position thereon by a nut 59, the purpose of this head being to act in conjunction with the head 42 at the lower end of the valve and balance the same.

The operation of my invention is as follows: Steam enters the valve-casing above head 42 through the inlet-opening 48 and passes into the cylinder 5 between the piston 11 and the bottom of the upper section of the cylinder through the port 46 in the lower section 30 of the valve and through ports 49 51. The piston ascending under pressure of the steam turns the shaft 1, and the worm-wheel turning with the shaft rotates the worm 22, and thus rotating the valve-stem 18 and causing

the two sections 30 31 to turn and bring the port 46 into communication with ports 49 51 in the wing 16. This rotation of the valve-stem will bring the passage-way 55 in the upper section 31 thereof into communication with port 54 and passage-way 53, and the piston in cylinder 5 being now on its downward stroke will force the steam from beneath it through port 51 and passage 50 to and through port 52 into passage-way 55, from whence it passes through ports 56 and passage-way 53 to the space in the cylinder above the piston and expanding drives the piston to the extremity of its downward stroke. A further rotary movement of the valve brings the passage-way 56 into communication with port 54 and passage-way 53, and the piston now starting on its upward stroke causes the steam to be forced out through the passage-way 56 to the space between the top of section 31 and the head 58, from whence it finds an exit by the exhaust-outlet 57. This action continues so long as the steam is admitted to the valve-casing, and it will be observed the cylinders 4 5 are supplied with steam successively, and the steam which is operated under high pressure beneath the pistons is transferred above the same and there operates under low pressure and finally exhausts to the air after all or practically all of its expansive force has been utilized. When it is desired to reverse the motion of the engine, the lever 24 is moved and the worm 22 moved vertically, this movement causing the rotary valve to turn slightly in one direction or the other, according to the direction of rotary movement of the valve, which is in the same direction as the valve is being moved at that time by the main shaft, causes the port leading to the high-pressure sides of the pistons to be opened while the pistons are on their downward stroke and admitting the steam at this time has the effect of causing the pistons to reverse their stroke, and thus causing the engine to be reversed. This movement of the section 30 is effected without moving section 31 by reason of the play afforded by clutch members 38 39, so that whichever cylinder has a lead the exhaust-passages will always follow the rotary movement of the inlet-ports at equal distances behind the same. A variation of the inlet-ports which provides a cut-off is effected by the movement of lever 34, which, raising or lowering the rotary valve, will cause more or less of the ports 45 46 47 to register with ports 49, the capacity of these ports 45 46 47 being diminished by the lowering of the valve and increased by the raising of the same by reason of the fact that these ports are cut off by the lower edge of port 49. The beveling of the upper edge of ports provides for a gradual decreasing of the inlet-opening for the steam to zero.

It is to be observed that there are three sets

of steam inlet ports, passages, and outlet ports in the rotary valve, and the worm by which the valve is rotated is so proportioned to the worm-wheel on the valve-stem that the valve will be given one complete revolution during three revolutions of the engine-shaft. By means of this construction and arrangement of parts I secure a comparatively slow movement of the valve, and thus save wear on the valve and the packings thereof.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination in a steam-engine of a cylinder having two portions of different internal diameters, a piston working in the larger portion and a plunger connected to the piston and working in the smaller portion, ports leading into the cylinder in front of and behind the piston, a passage-way in the cylinder communicating with the port that leads to behind the piston and leading to a port adjacent to the port which leads to the front of the piston, a rotary valve, said valve having a succession of alternating passage-ways comprising a plurality of passage-ways adapted to each establish communication between the passage-way in the cylinder and the port leading to the front of the piston, and a plurality of passage-ways adapted to establish communication between a passage-way leading from said port in front of the piston to the exhaust-opening.

2. In a steam-engine, the combination with a piston and a cylinder, of a rotary valve provided with inlet and exhaust ports, the said valve being composed of two sections, one rotatably movable with relation to the other, with means for producing a rotation of one section relatively to the other, whereby the relative position of the inlet and exhaust ports will be changed.

3. In an engine of the twin-cylinder type, the combination of twin cylinders having reciprocating pistons, a rotary valve composed of two sections one of which has a limited rotary movement relatively to and independent of the other section said valve having inlet and exhaust ports adapted to successively register with the inlet and exhaust ports of the cylinder, and means for affording a lead to the piston of either cylinder.

4. In an engine of the type described, the combination with twin cylinders, of a two-part cylindrical rotary valve having a plurality of longitudinally-disposed inlet and exhaust ports, means for moving one part of the valve longitudinally independently of the other part, each inlet and each exhaust port being adapted to be brought successively into communication with the inlet and exhaust ports of each cylinder.

5. In an engine of the type described, the combination with the cylinders and their pistons, of a sectional rotary valve adapted to

supply steam successively to each of said cylinders, composed of two sections one containing inlet-ports and the other containing exhaust-ports and means for longitudinally moving that section of the valve containing the inlet-ports independently of that section of the valve containing the exhaust-ports.

In testimony whereof I affix my signature in presence of two witnesses.

OSCAR F. RODEHAVER.

Witnesses:

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