No. 659,675. Patented Oct. 16, 1900.

F. W. JAEGER.

ROTARY PISTON MOTOR.

(Application filed Nov. 18, 1897.)

(No Model.) 3 Sheets—Sheet 1.

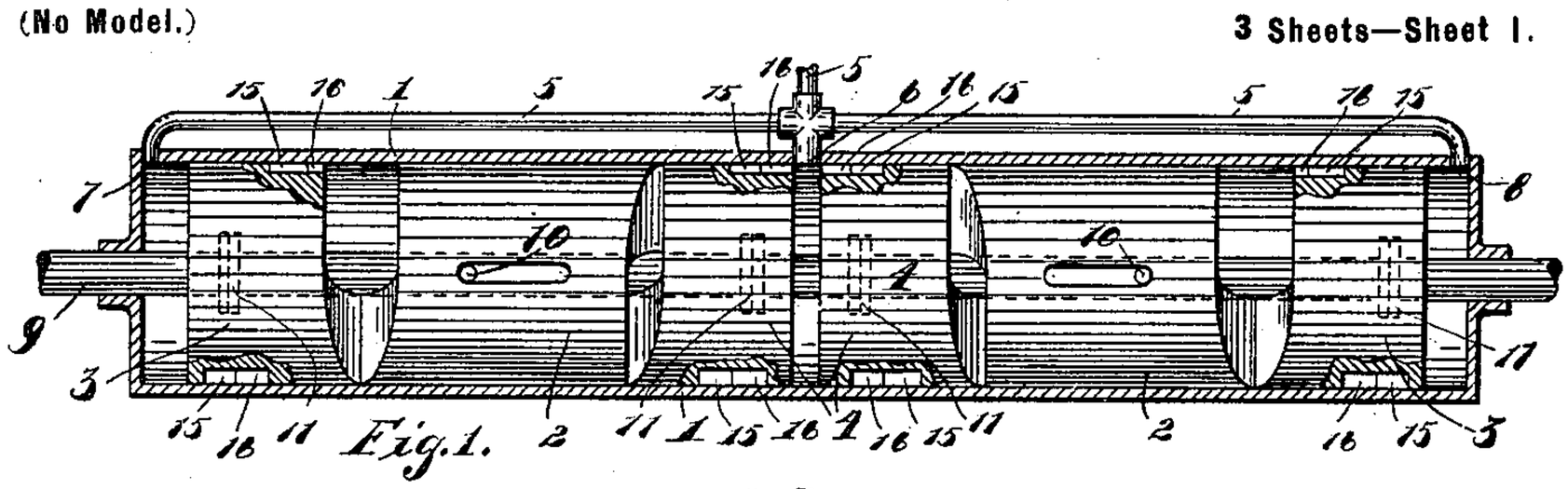

Fig. 1.

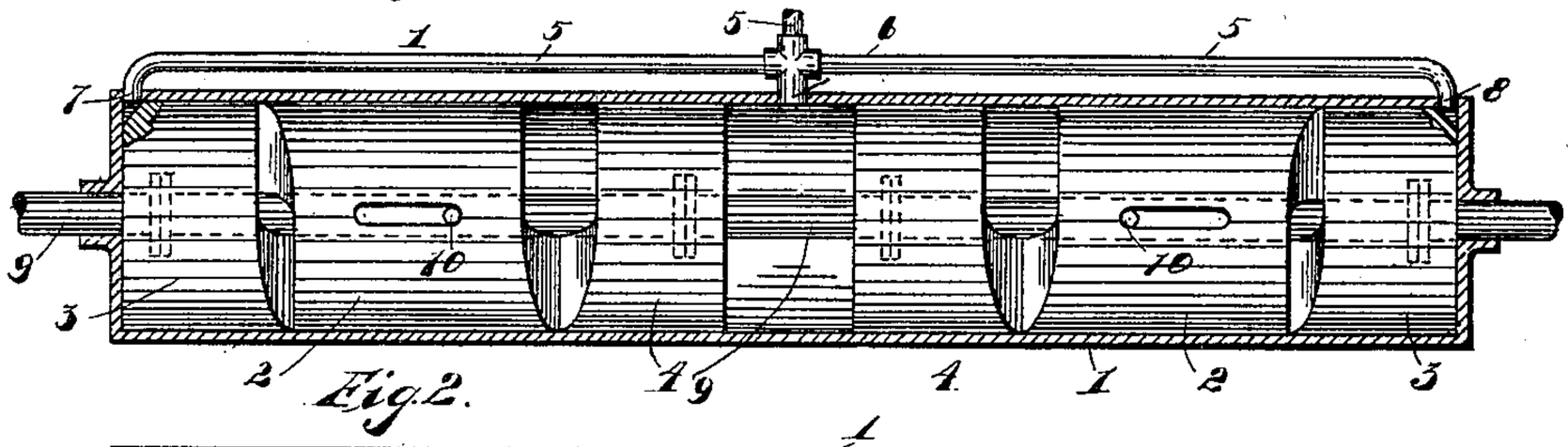

Fig. 2.

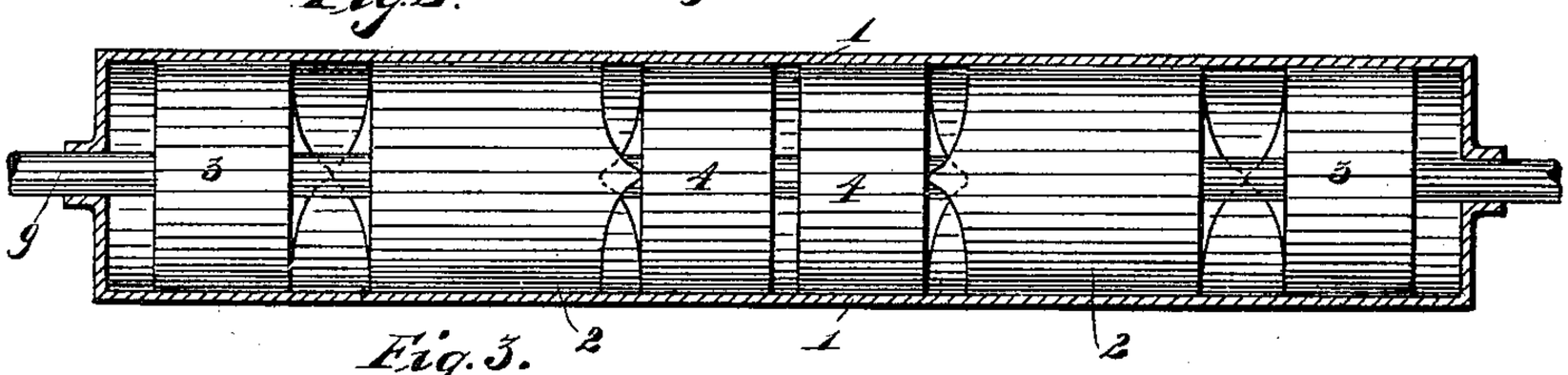

Fig. 3.

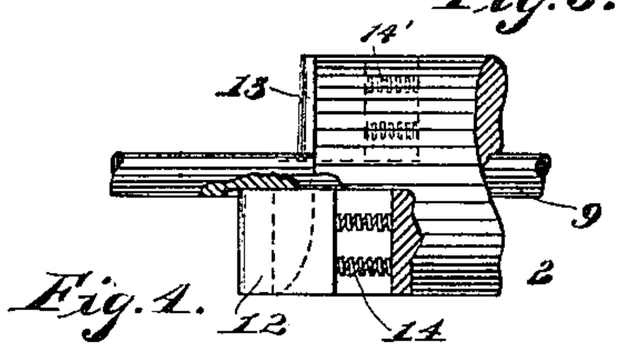

Fig. 4.

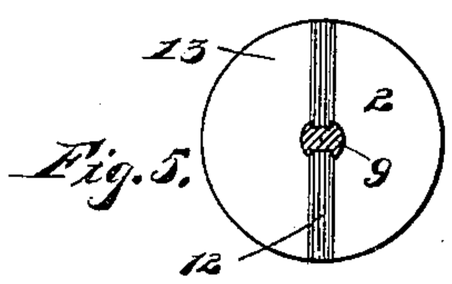

Fig. 5.

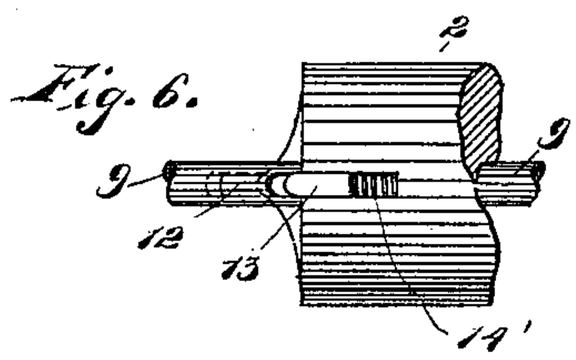

Fig. 6.

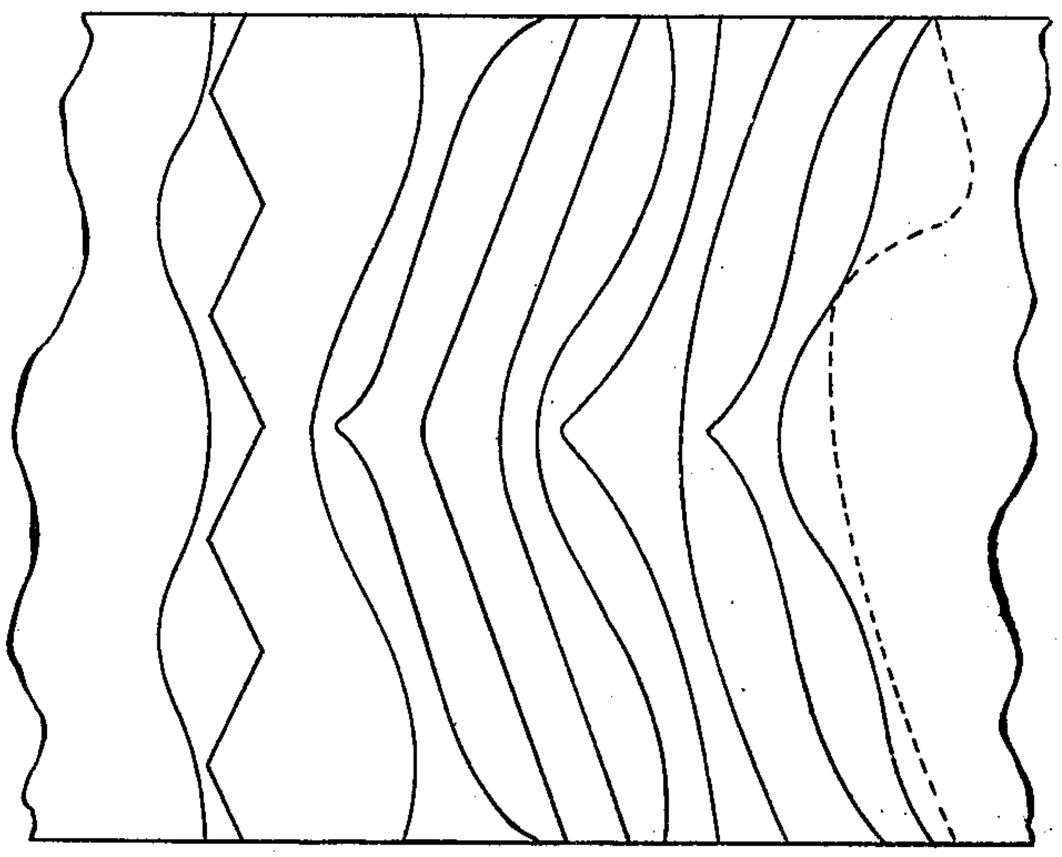

Fig. 7.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 8.

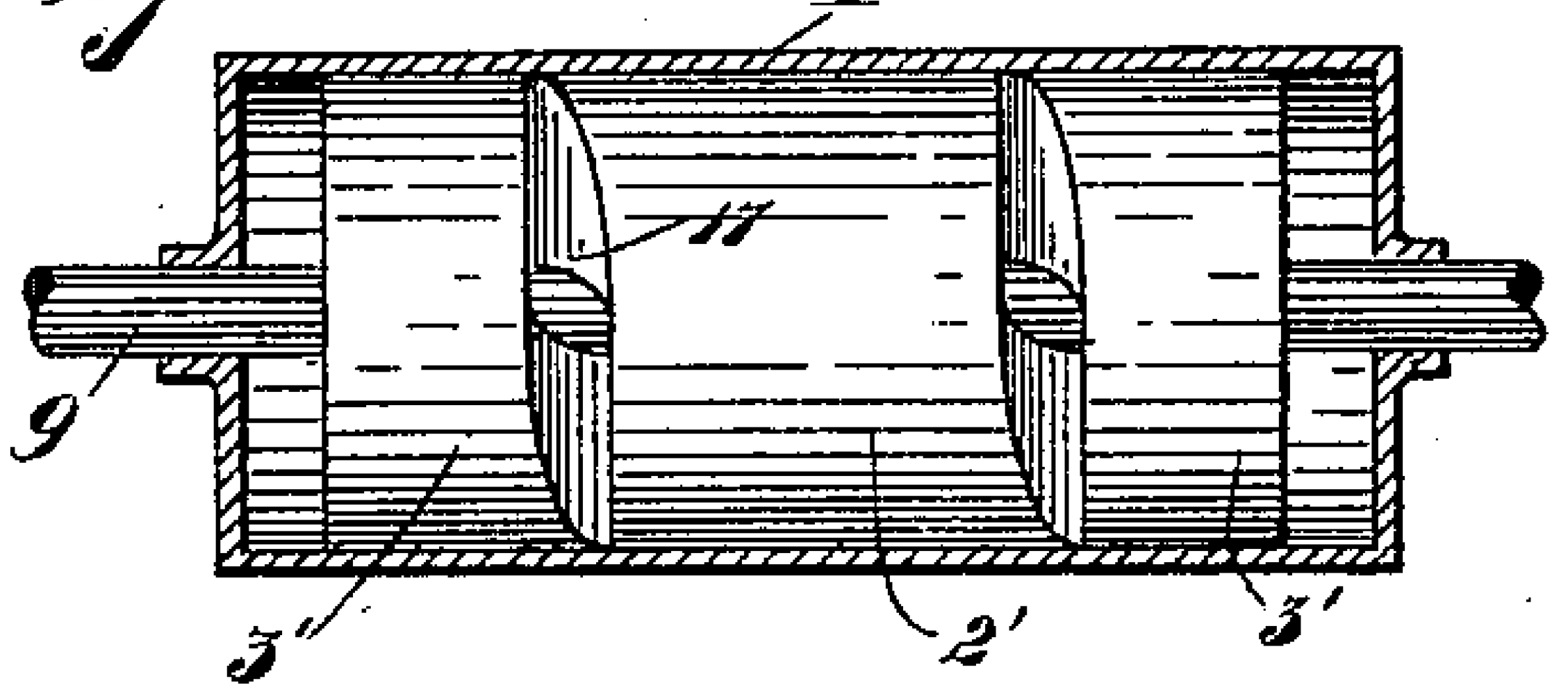


Fig. 10.

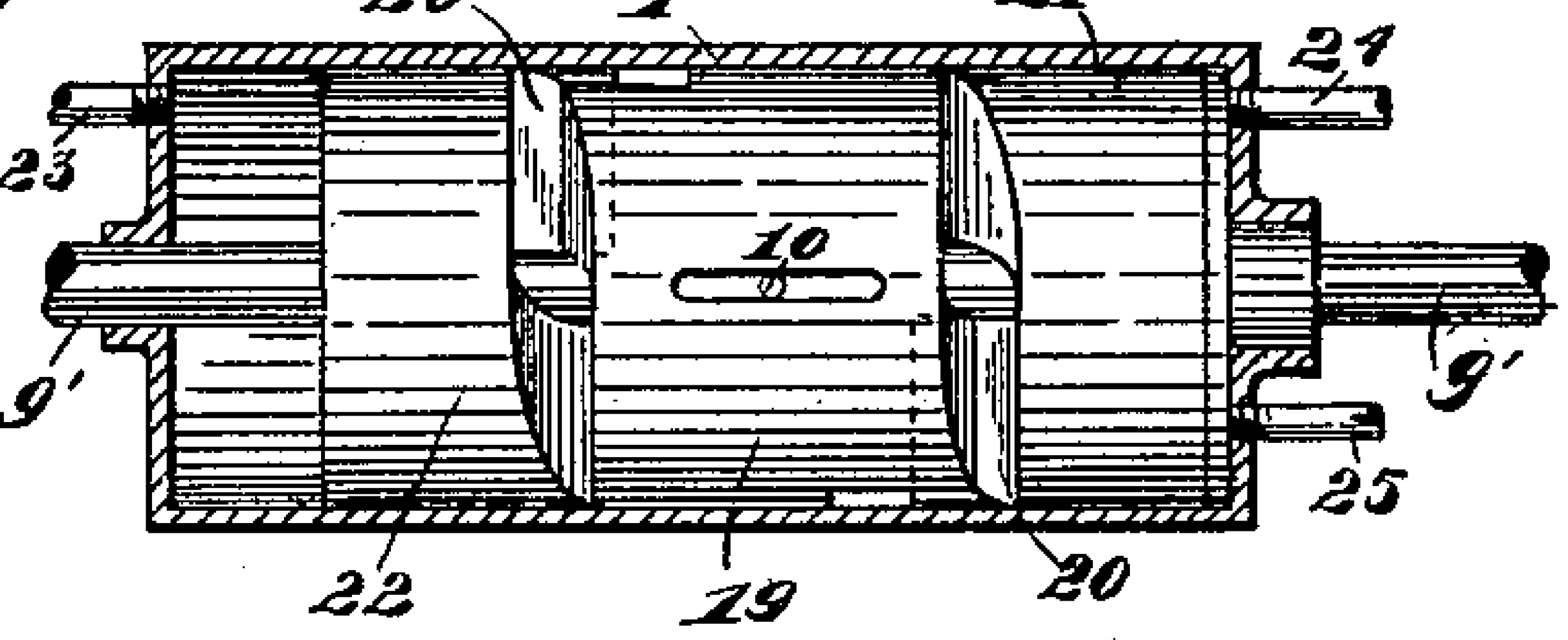


Fig. 9.

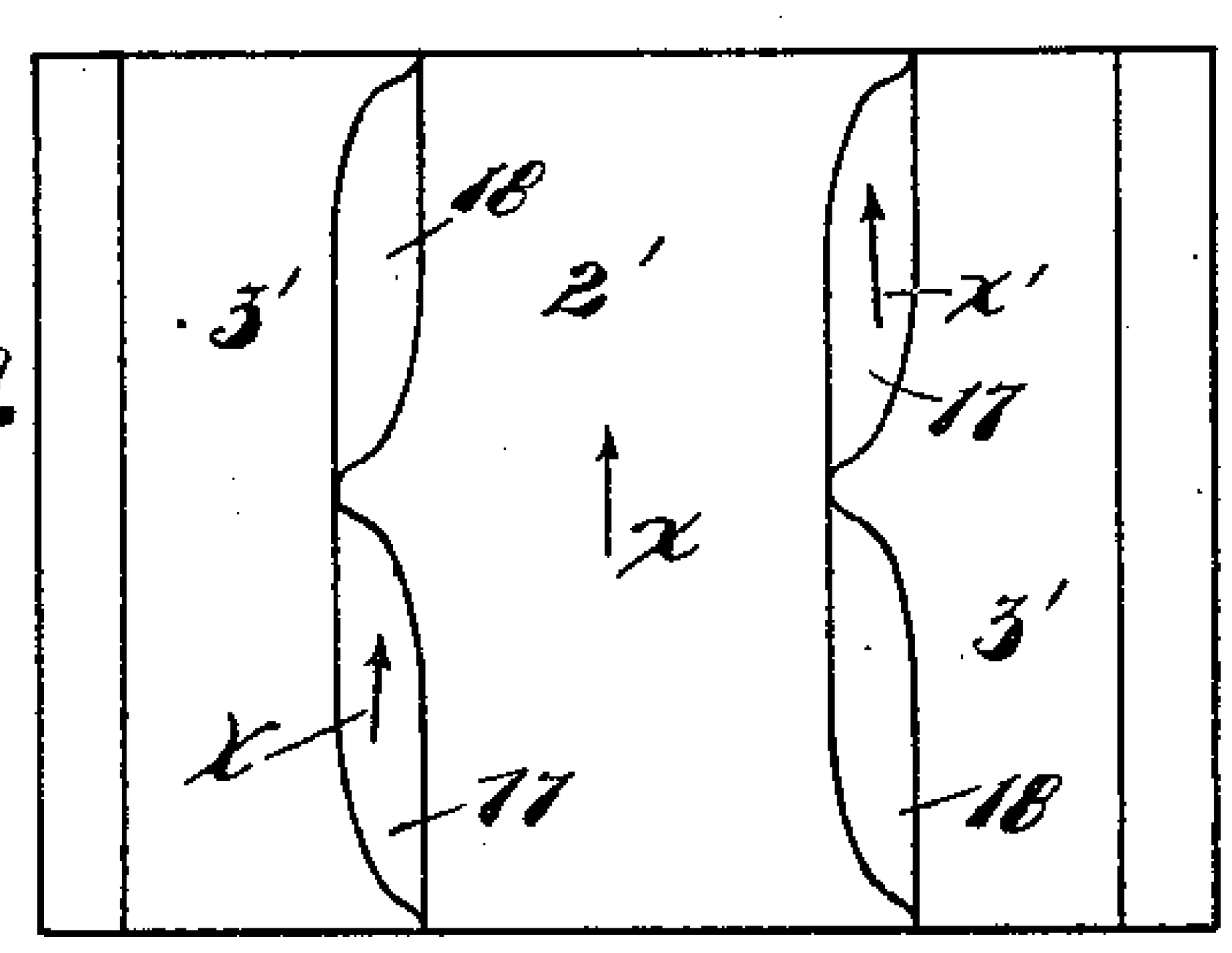


Fig. 11.

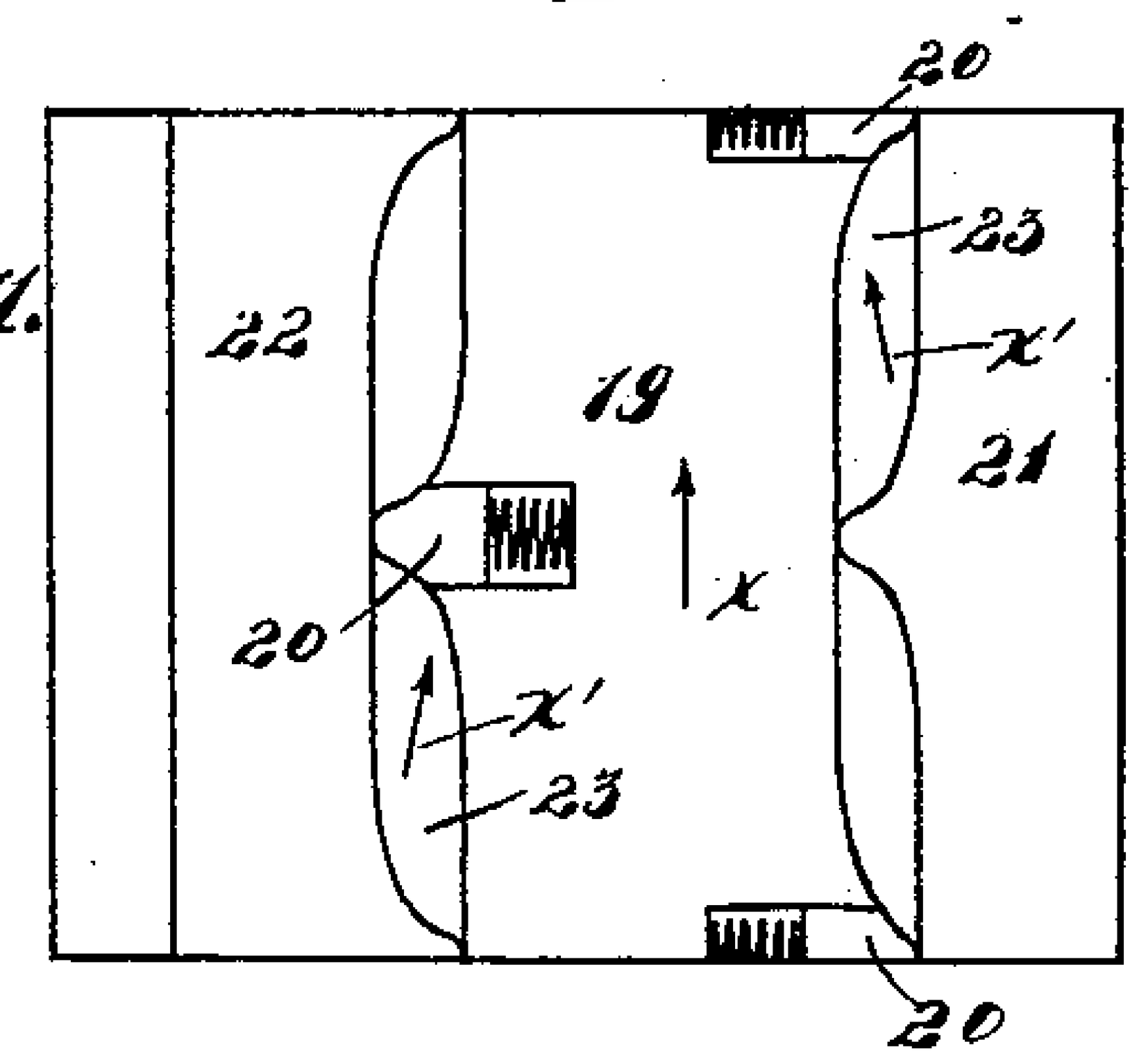


Fig. 12.

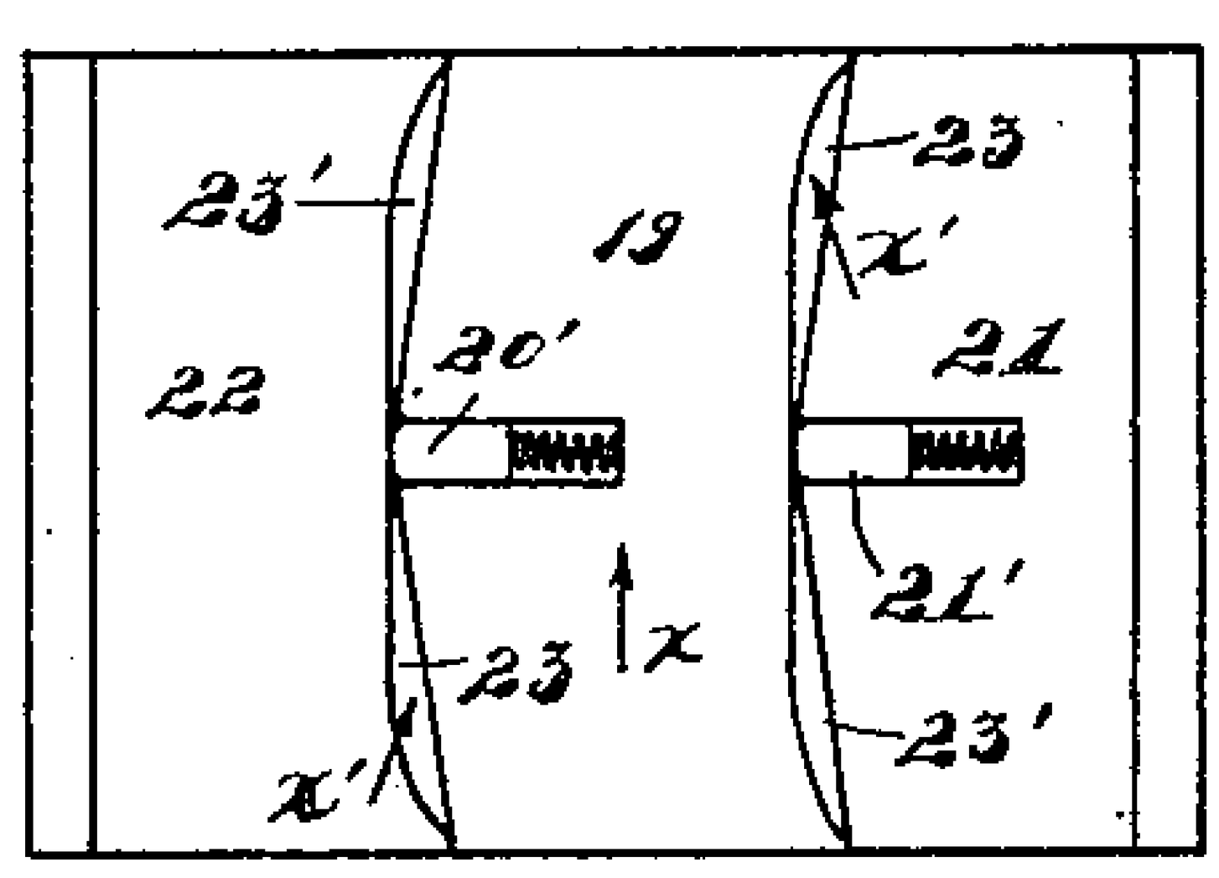


Fig. 13.

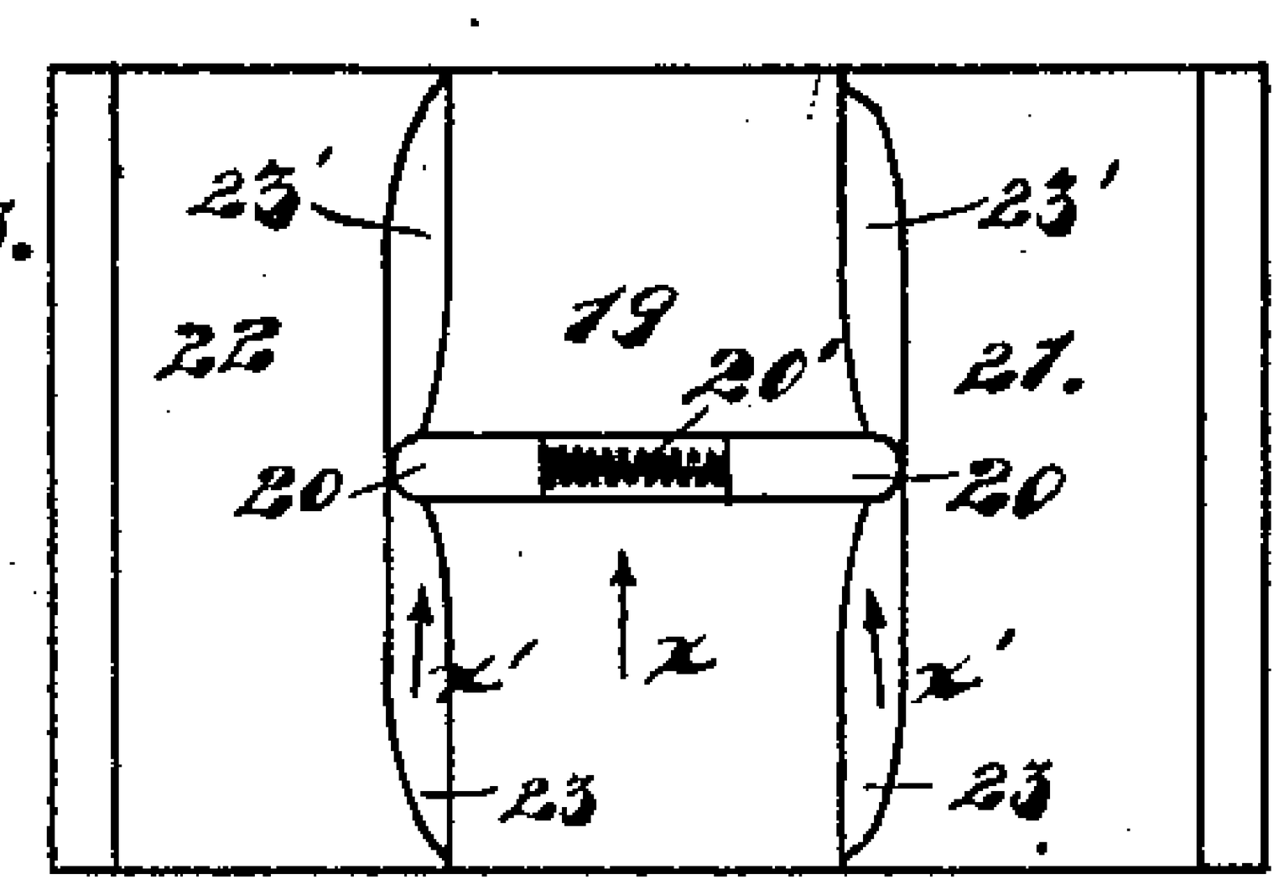


Fig. 14.

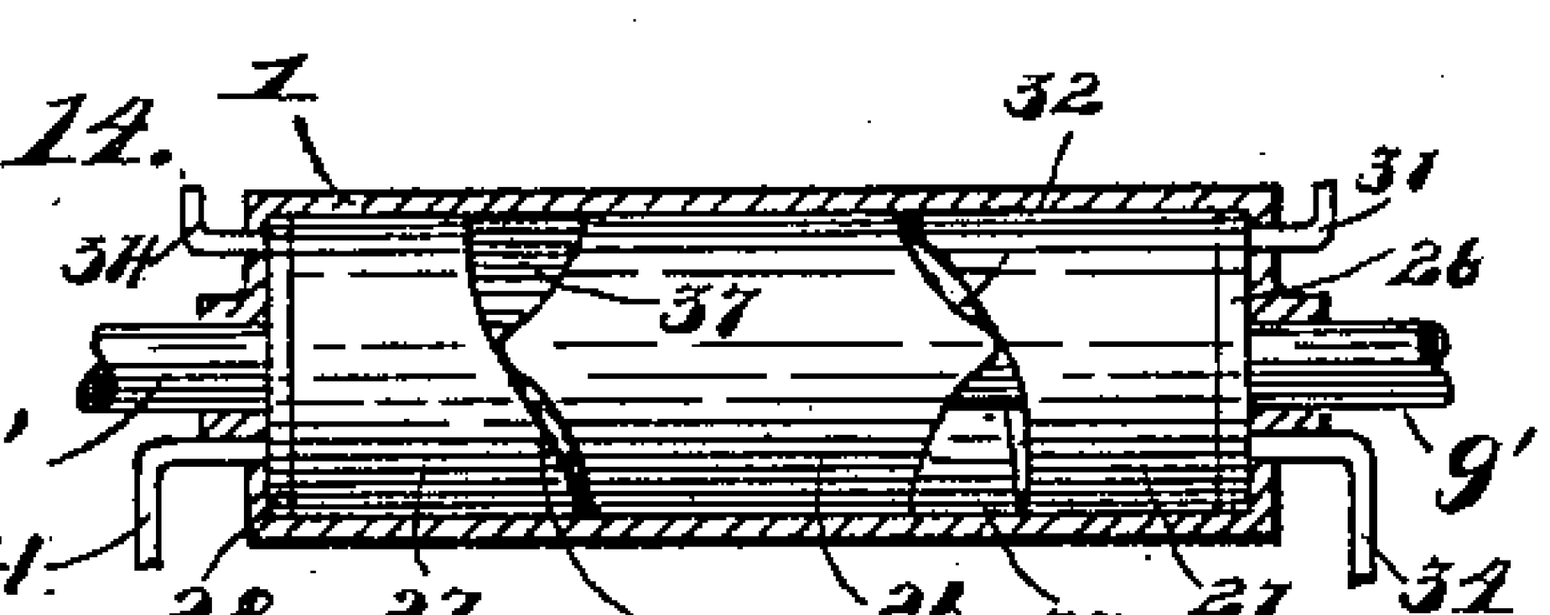


Fig. 16.

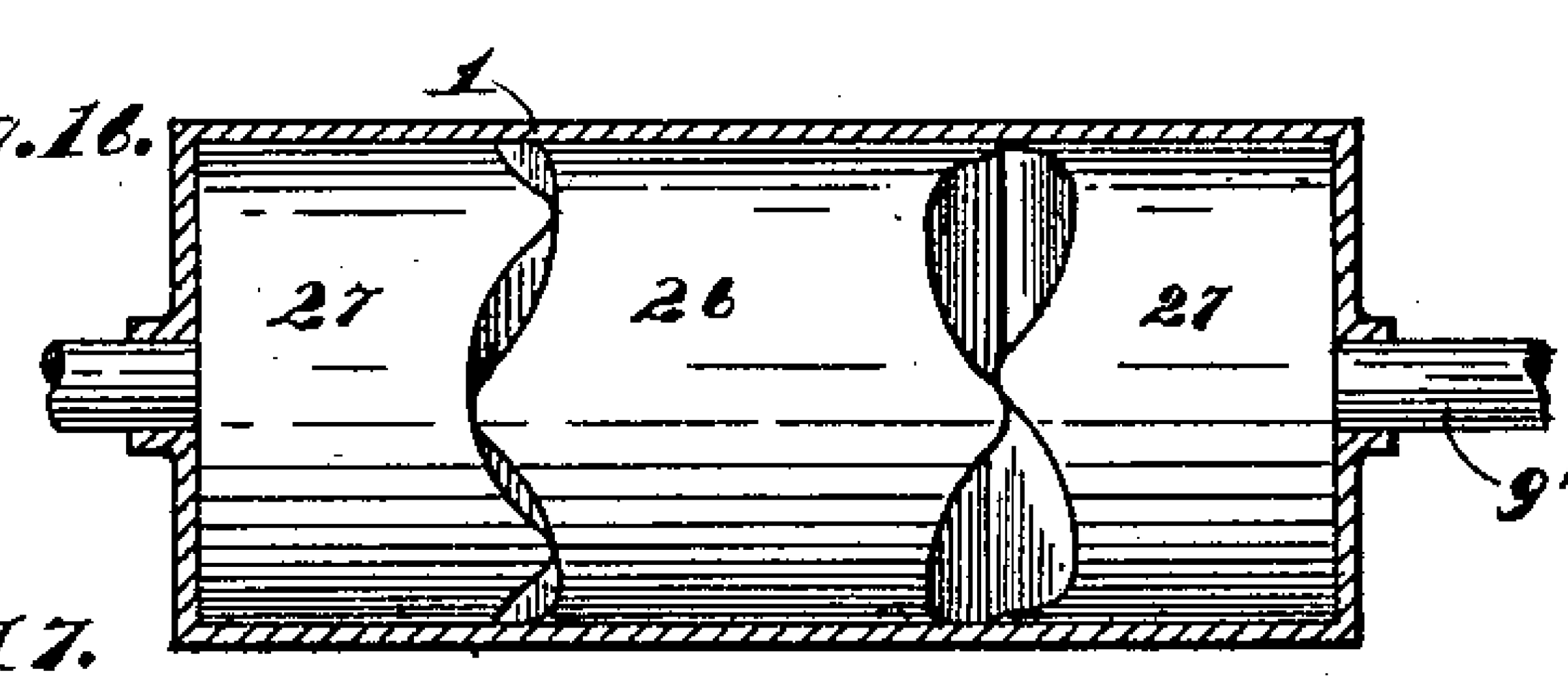


Fig. 15.

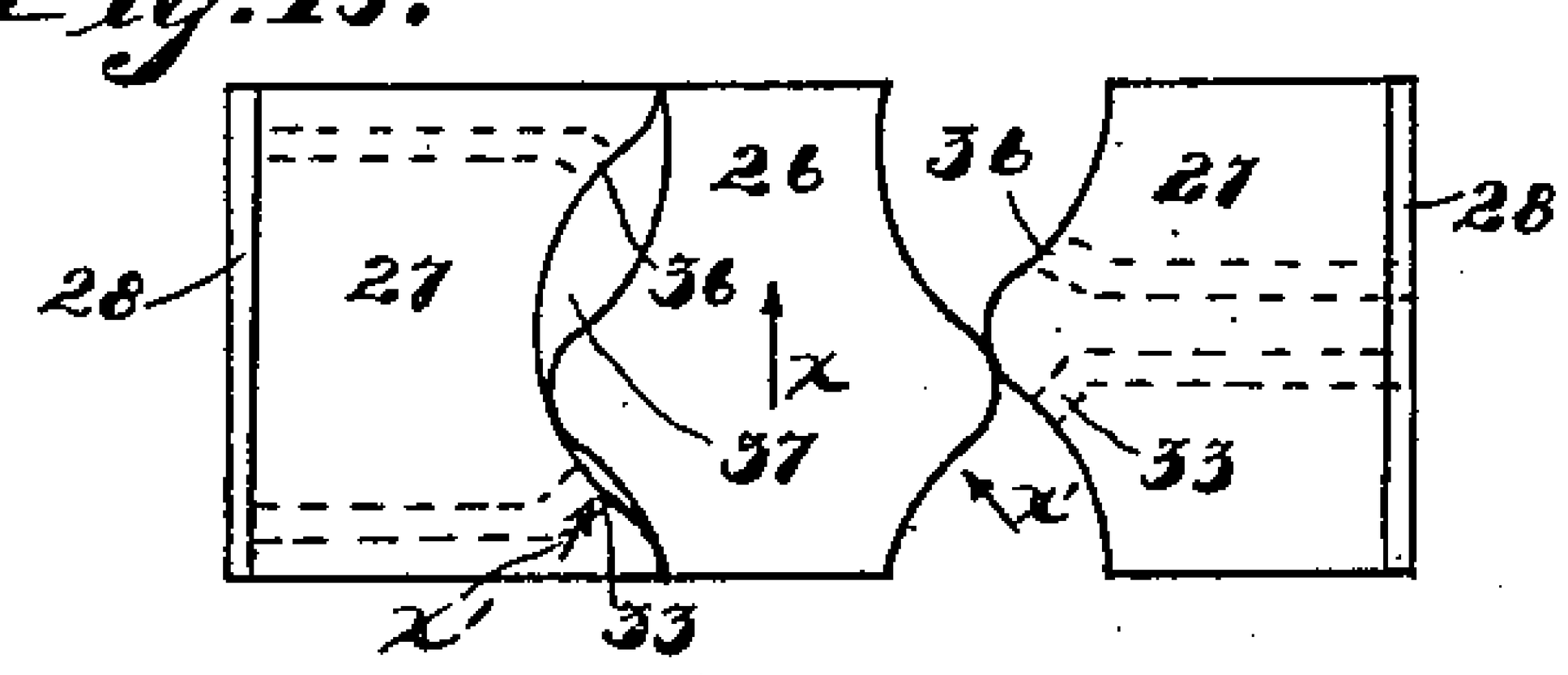


Fig. 17.

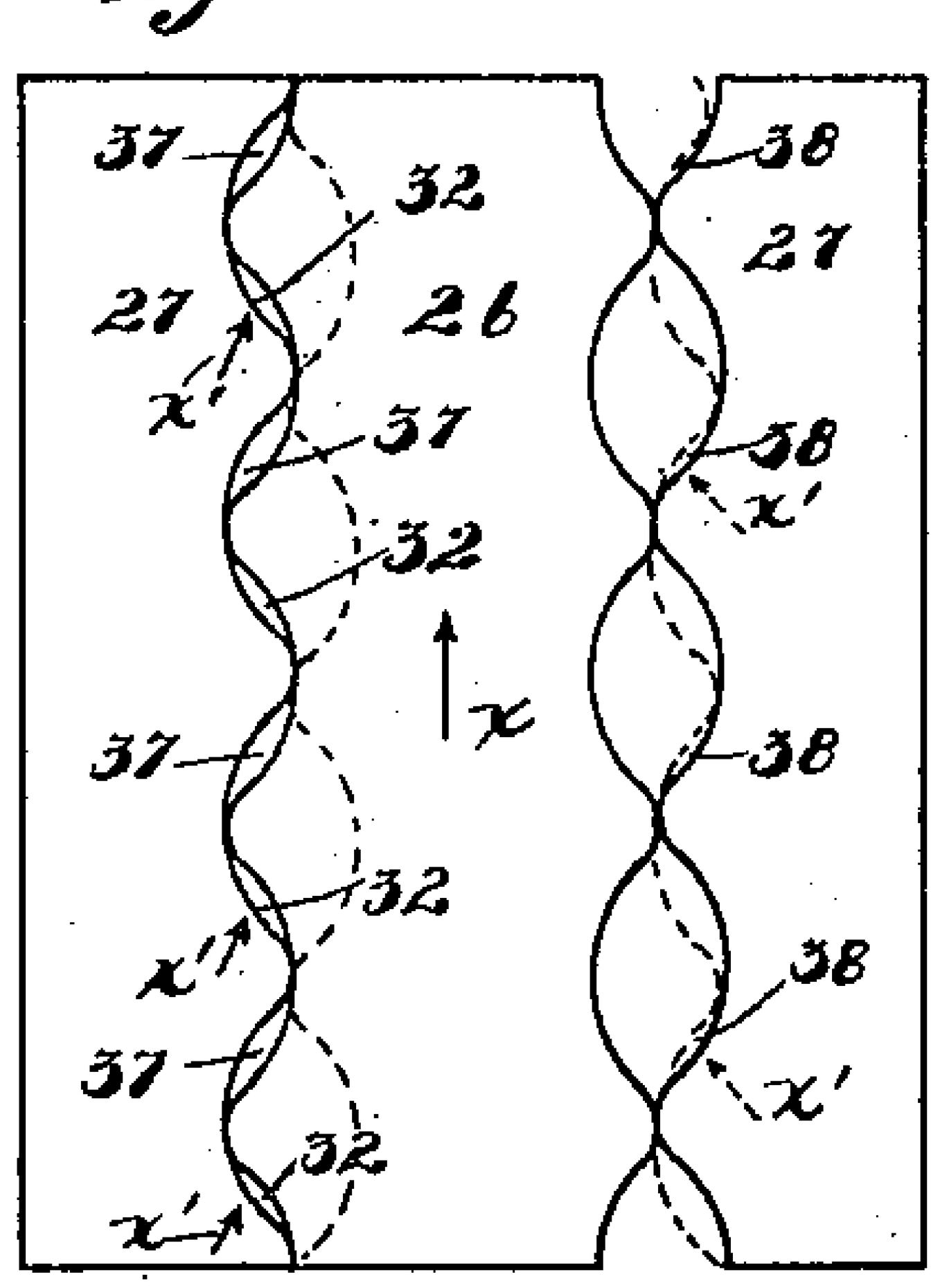


Fig. 18.

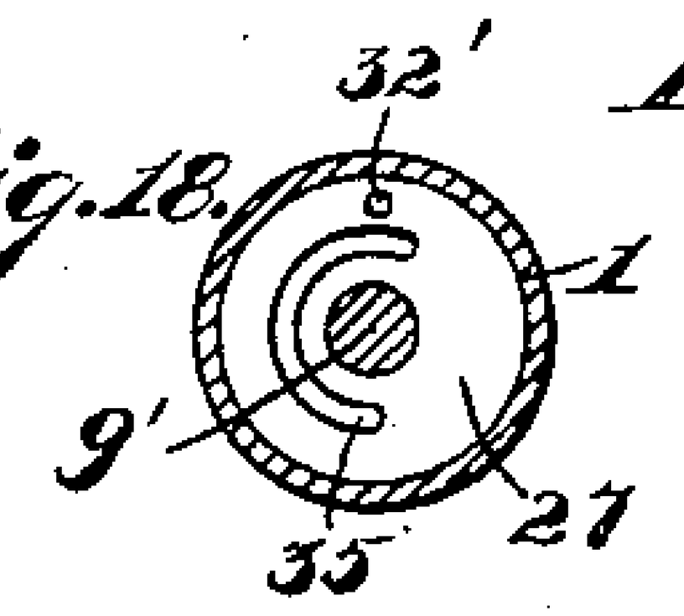


Fig. 19.

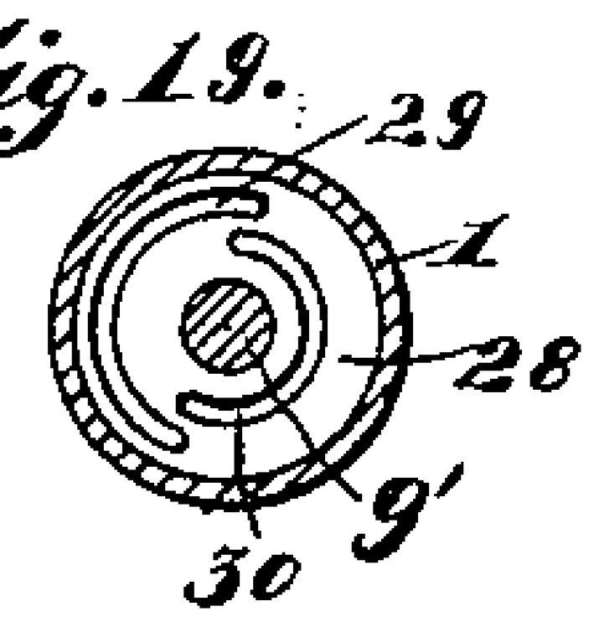
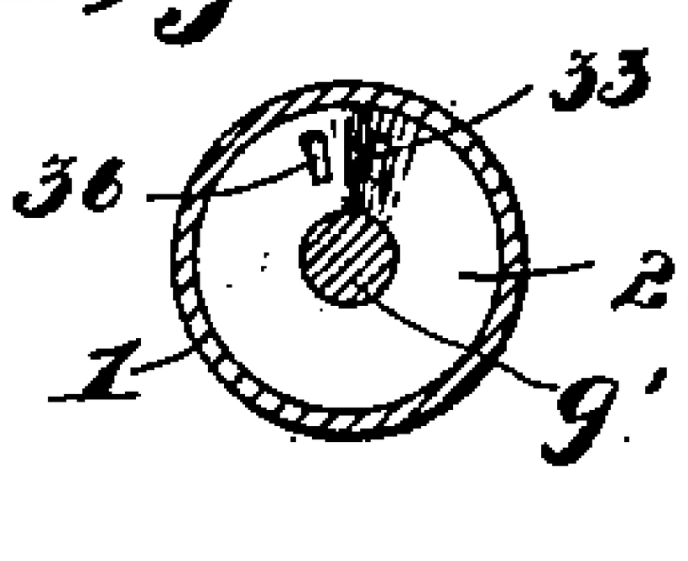


Fig. 20.



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No. 659,675. Patented Oct. 16, 1900.

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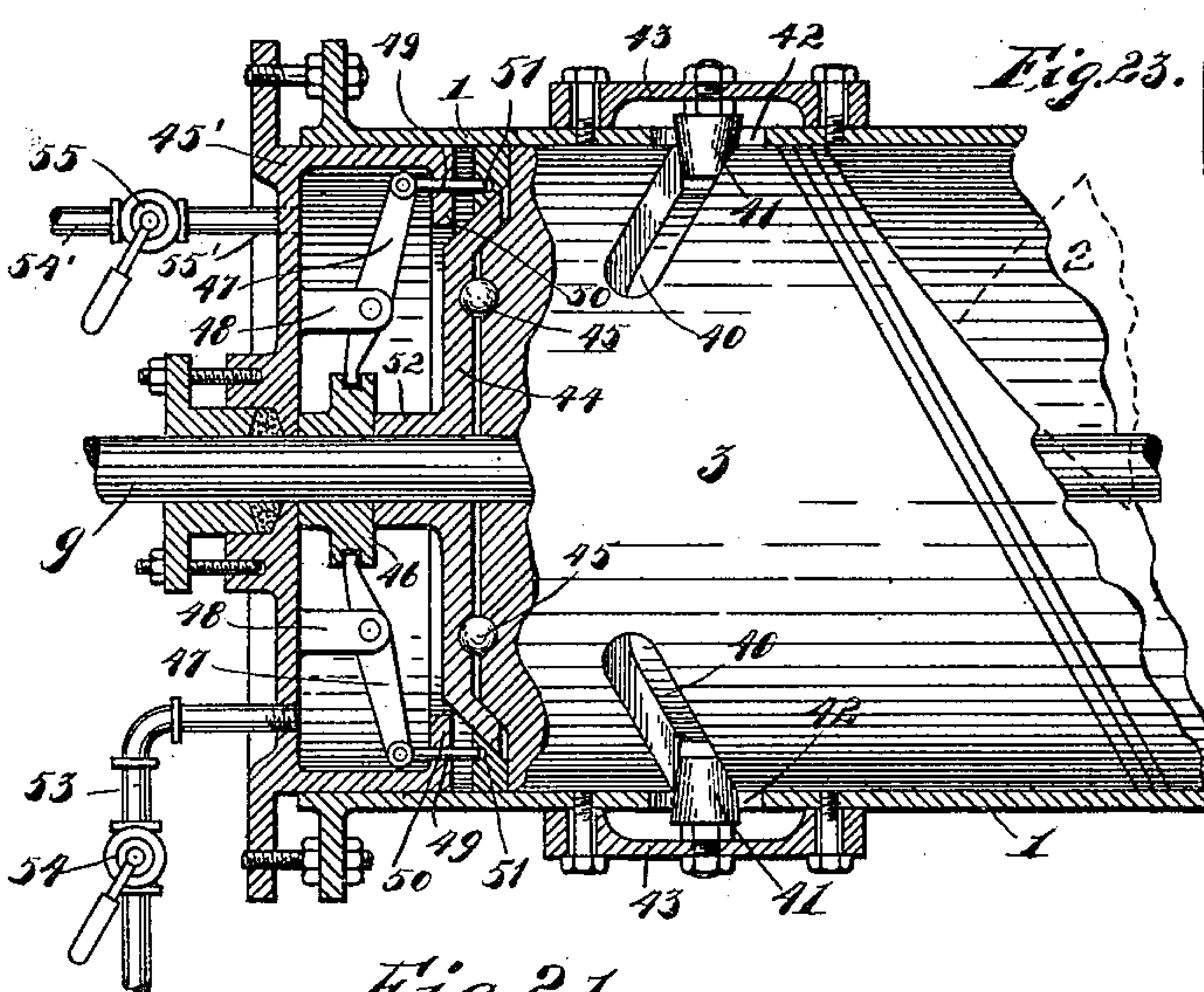
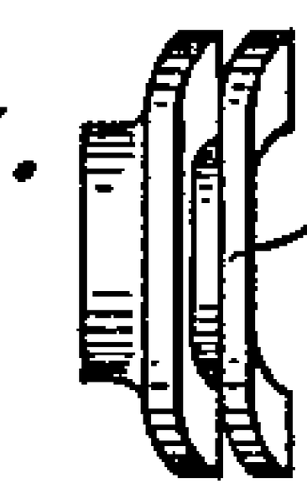


Fig. 21.

Fig. 23.



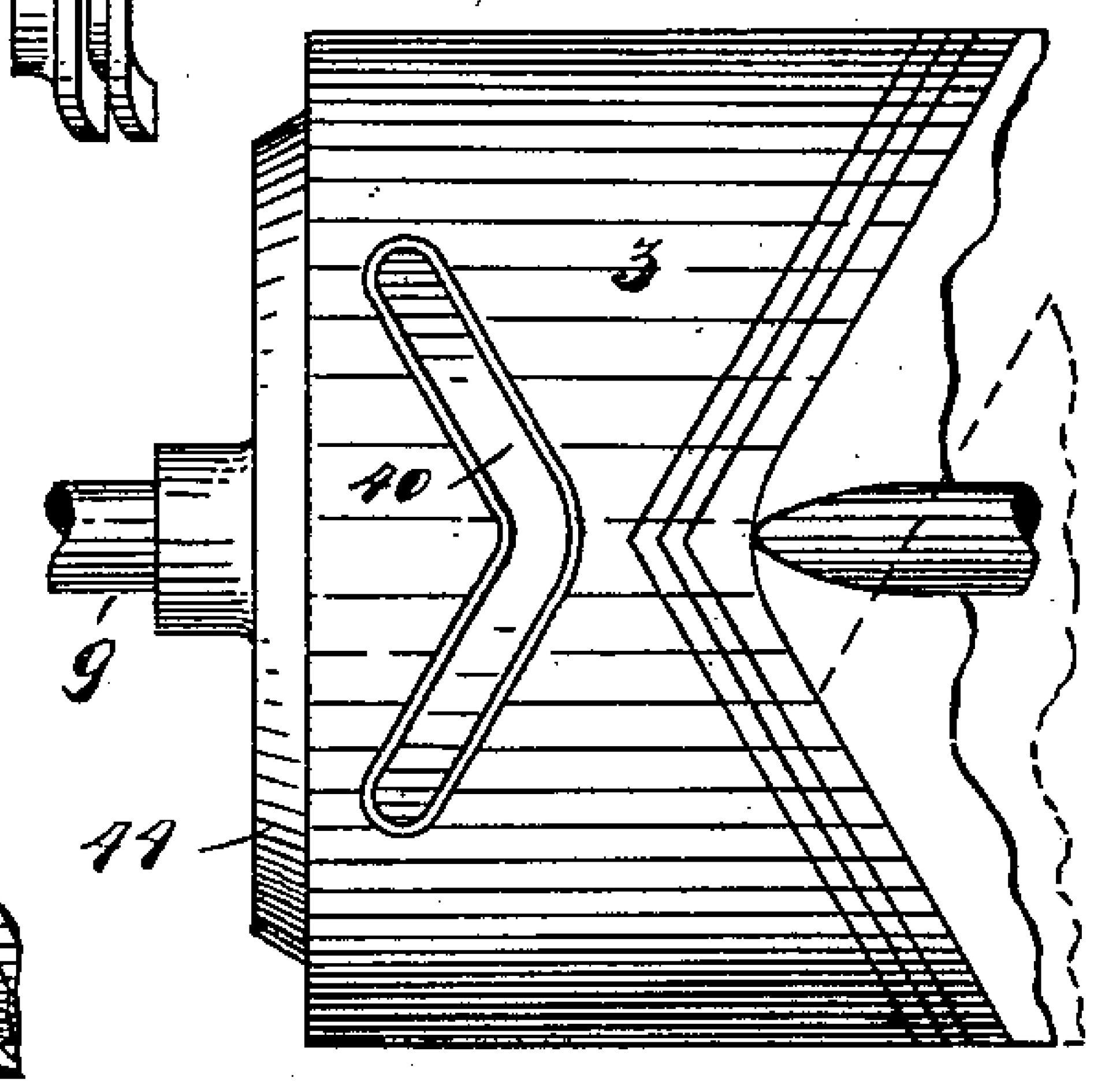


Fig. 22.

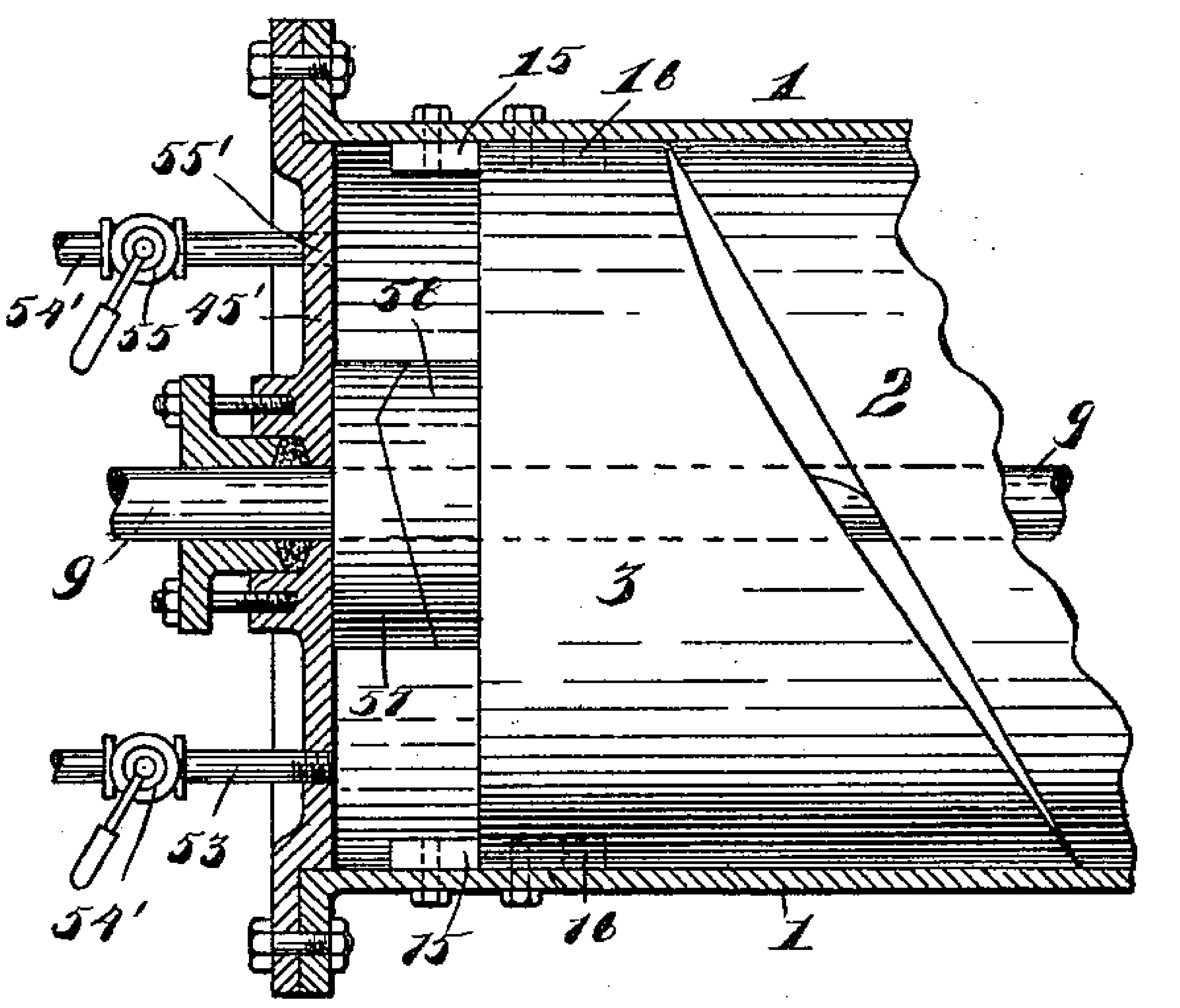


Fig. 24.

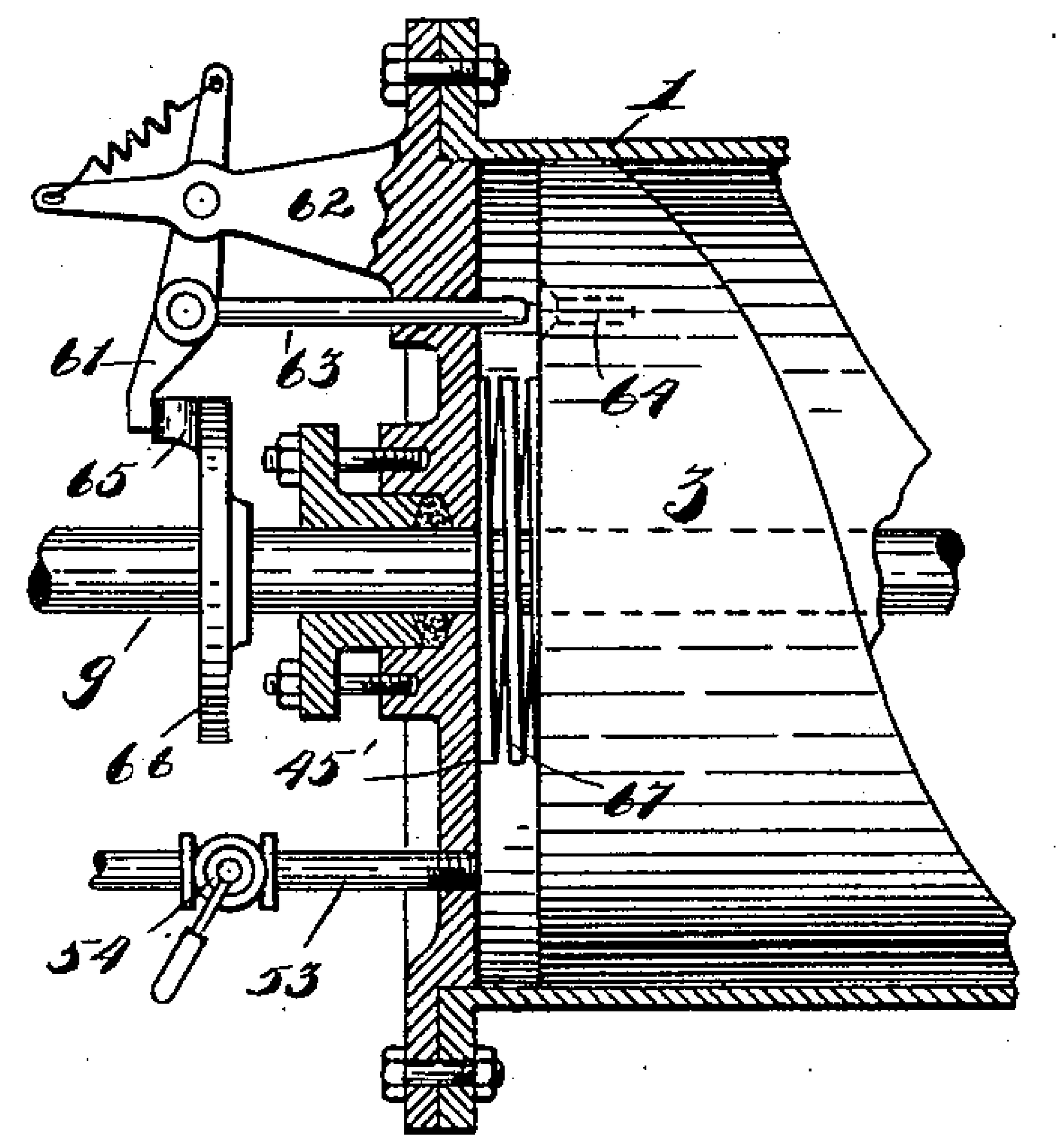


Fig. 25.

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UNITED STATES PATENT OFFICE.

FREDERICK W. JAEGER, OF NEW YORK, N. Y.

ROTARY-PISTON MOTOR.

SPECIFICATION forming part of Letters Patent No. 659,675, dated October 16, 1900.

Application filed November 18, 1897. Serial No. 658,945. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. JAEGER, a citizen of the United States of America, and a resident of New York, in the county and State of New York, have invented a certain new and useful Improvement in Rotary-Piston Motors, of which the following is a specification.

My invention relates to a rotary reciprocating engine in which I suspend the piston during the greater part of its revolution by the action of the expansive fluid exerting a pressure against the two sides of the said piston, thereby tending to balance the same. I accomplish this result by inclosing in an outer casing or shell a piston mounted upon a shaft and having projecting noses formed as a part of the piston or by mounting sliding vanes upon the sides of the said piston, the said noses engaging against the sides of adjacent abutting heads. Heretofore engines of this class have been made in which pockets were formed upon each side of the rotating piston, the pockets on one side of the piston being adapted to contain live fluid, while the pockets on the other side of the piston contain exhaustive fluid. In my invention I form two series of pockets on each side of the piston, one series on each side being adapted to contain live fluid, while the other series contain exhaustive fluid. By this arrangement I provide pockets containing live fluid on both sides of the piston, exhausting-pockets at the same time, thereby balancing the piston and assuring an easier rotation than was possible in devices heretofore invented.

In the drawings, I have shown various forms of pistons and abutting heads, any of which may be adapted without diverging from my principle of suspending the piston by the two or more pocket formations on each side of the piston adapted to contain live fluid on one side of the projecting noses or vanes of the piston and exhaustive fluid on the other side of the projecting noses or vanes of the piston.

The nature of my invention will be best understood when described in connection with the accompanying drawings, in which—

Figure 1 is a longitudinal section of an engine embodying my principle and shows duplicate positions and heads. Fig. 2 is a similar section showing the position of the parts when the pistons are in the opposite positions to those shown in Fig. 1. Fig. 3 is a longitudinal section showing a top view of Fig. 1. Fig. 4 is a detail view of a piston-head having sliding vanes. Fig. 5 is an end view, and Fig. 6 is a top view, of the same. Fig. 7 is a chart showing the peripheral edges of different forms of operating-faces for the pistons and heads in their developed state. Fig. 8 is a longitudinal section showing a single piston and two abutting heads. Fig. 9 is a diagram showing the developed peripheral lines of the piston and heads of Fig. 8. Fig. 10 is a longitudinal section showing a piston provided with sliding vanes and a rotary disk valve. Fig. 11 is a diagram showing the developed peripheral lines of the same. Figs. 12 and 13 are diagrams showing slight modifications. Fig. 14 is a longitudinal section and shows an engine having stationary heads and reciprocating and rotating pistons. Fig. 15 is a diagram showing the developed peripheral lines of the same. Fig. 16 is a view which shows a reciprocating and rotating piston and abutting heads having four abutting noses and cams on their adjacent ends. Fig. 17 is a diagram showing the developed peripheral lines of the same. Fig. 18 is an end view of the head in Fig. 14. Fig. 19 is a view of the rotary disk valve of the same. Fig. 20 is an end view of the head in Fig. 14, showing the nose and cam-surface. Fig. 21 is an enlarged partial longitudinal section of one end of a cylinder and head, showing means for giving a positive course to the movement of the head and mechanism for holding and releasing the head. Fig. 22 is a top view of the head with shaft, as illustrated in Fig. 21. Fig. 23 is a detail view of the cam for operating the holding and releasing mechanism of the head shown in Fig. 21. Fig. 24 is a similar view to Fig. 21, but showing mechanism for giving a positive forward and backward movement to the head and showing a portion of the piston. Fig. 25 is a similar view to Fig. 19, but showing mechanism for giving a positive backward movement to the piston-head and different mechanism for holding and releasing the head.

Similar numerals of reference designate corresponding parts throughout the several views of the drawings.

Referring to the drawings, numeral 1 designates an outer shell or casing inclosing the pistons 2 2 and heads 3 3 and 4 4.

5 is an inlet-pipe for steam or other expansible fluid and may be provided with any suitable means for regulating the passage of said fluid through the same. The pipe 5 is provided with the three outlets 6, 7, and 8, leading into the chambers formed at the center between the heads 4 4 and behind the heads 3 3. This inlet-pipe, with its outlets, provides means whereby the cylinder-heads are always kept in contact with their respective pistons, as there will be an even pressure against the outside of the heads in the direction of their pistons while the engine is in operation. Steam is admitted by suitable means to ports on the side of the nose on end of the piston and is contained in the pocket formed between the nose on the piston and adjacent head, as will be hereinafter more fully described.

The construction shown in Figs. 1 to 3, inclusive, provides a cushion behind each head to receive the first impact of the head in its outward movement, the fluid that is forced back into the pipe 5 at the cylinder end of such outwardly-moving head, as at the inlets 7 and 8, being driven through the outlet beyond the opposite head through the inlet 6 and between the heads 4 4. The pistons 2 2 are secured to the shaft 9 by means of the pins 10 and are allowed to reciprocate upon the shaft. The said shaft 9 may be provided with two hollow passages or channels which run through the shaft to the external parts 11, which connect by passages to ports on each side of the noses upon the said piston. One of the said channels or passages in the shaft 9 is adapted to admit steam or other live fluid into the pocket formed between the noses on the pistons and noses on adjacent abutting heads. The other channel or passage is adapted to take away the exhaust steam or fluid from the pocket formed on the opposite side of said noses. Feathers or short strips 15, attached to the outer casing 1 and on opposite sides of the same, engage corresponding slits or grooves 16 in the periphery of the heads to allow of longitudinal but not rotary movement of the same.

In Figs. 4, 5, and 6 I have shown a piston or head having two sliding vanes 12 and 13, one located at the nose of the cam-surface and the other located radially opposite, and are provided with springs 14 and 14′, which are adapted to allow the vanes to butt and engage against the cam-shaped surface on the adjacent head.

In Fig. 7 I show various forms of peripheral lines for pistons and abutting heads, any of which may be adapted to my principle.

In Fig. 8 I show a simple form of engine embodying my principle, in which the piston 2 is securely fastened to the shaft and rotates, but does not reciprocate, the reciprocating motion being taken up by the heads 3′, which are suitably fastened to the casing 1, so as to prevent the rotation of the same. Steam or other live fluid is admitted by means of suitable valves and ports into the chamber 17, and tends to drive the piston in the direction indicated by arrow X in Fig. 9. The arrow X′ shows the direction of the expansion of the fluid. The chamber becomes an exhaust-chamber and exhausts the fluid out through a port on the side of the nose of the piston and through suitable passages and connections to exhaust-pipe.

In Fig. 10 I show an engine having a single piston, provided with sliding vanes 20 and fastened to the shaft 9′ by means of the pin 10 and adapted to reciprocate upon and rotate the shaft. 21 is a stationary head fastened in casing, and 22 is a reciprocating head. The sliding vanes 20 are mounted upon the noses of the piston and butt against and engage with the cam-shaped surface on adjacent heads. Steam or other expansive fluid is allowed to enter the chambers 23, and expanding tends to drive the piston 19 in the direction indicated by the arrow X, the expansion of the steam or fluid being in the direction indicated by the arrows X′. 23 is an inlet and allows steam or live fluid to enter the chamber behind the head 22 and acts to keep the adjacent abutting noses and surfaces of the piston and heads in contact. 24 is an inlet for live fluid, and 25 is an outlet-pipe for exhaustive fluid.

Fig. 12 is a diagram and shows a piston 19, with a sliding vane 20′ forming a nose upon the piston and a sliding vane 21′ forming a nose upon the adjacent head 21, and provides the pockets for the admission of live fluid and the pockets for containing exhaustive fluid.

In Fig. 12 I show a slight modification in diagrammatic form to the form shown in Fig. 11, the sliding vanes 20 being plane on a line and having one spring 20′ to keep them normally in contact with the cam-surfaces on adjacent heads. Chambers 23 contain the live fluid and chambers 23′ contain the exhaustive fluid.

Fig. 14 shows a complete engine having a single reciprocating and rotating piston 26 and two stationary adjacent heads 27. 28 is a rotary-disk valve fastened to the shaft 9′ and is provided with the segmental grooves or slots 29 and 30. The slot 29 engages with the inlet-pipe 31 and the passage 32′ in the head 27 and admits steam to the pockets 32 through the ports 33 during one-half the revolution of the piston 26. The slot 30 engages with the exhaust-pipe 34 and with the slot 35 in the head 27, which connects with the port 36 and is adapted to exhaust the fluid from the chamber 37.

Fig. 16 shows a modification of Fig. 14, in which I form four noses upon each adjacent cam-surface, thereby forming two series of

four pockets each upon each side of the piston, one series on each side of the piston being adapted to contain live fluid and the other series on each side of the piston being adapted to contain exhaustive fluid.

In Fig. 17 I show a diagram giving the developed peripheral lines of the piston and heads of Fig. 16. The pockets 32 contain live fluid, while the pockets 37 contain exhaustive fluid. The noses here shown on one side of the piston are just passing the noses on the adjacent head, and the action of the live fluid in the pockets 32 drives the piston 26 in the direction indicated by the arrow X until the said noses take the position shown by the dotted lines, forming the pockets 38 for the admission of live fluid. The noses on the opposite side of the piston are now passing the noses on the adjacent head. In this form as well as in that shown in Figs. 14 and 15 the rotary piston reciprocates, while the heads remain stationary.

In order that the heads may be guided positively and with as little friction as possible in their movement in the casing 1, the said head 3 may be provided with angular slots 40 on opposite sides of the head, and conical rollers 41 may be inserted in said slots. The said conical rollers pass through holes 42 in the casing 1 and are loosely journaled on steam-tight adjustable caps 43, covering said holes. Additional antifrictional bearing for the head in its rotary movements is provided by the use of a cup 44, fitting over the outer end of the head 3 and inclosing between said head and cup in concentric circular grooves in the same roller-balls 45, which receive the first impact of the head in its outward movement. 46 is a grooved cam (shown in detail in Fig. 23) secured to the shaft 9 next to the cylinder-head 45′. Levers 47 are pivoted to brackets 48 on the inside of cylinder-head 45′, with one end of said levers entering the groove of the cam 46 and the other end of the levers provided with pins 49, which pass through guides in an inner flange 50 of the cylinder-head 45′ and enter holes 51 in the head 3 at the time when it is necessary to lock said head 3. The cup 44 is provided with an outwardly-extending hub 52, through which the shaft 9 passes, so that the said hub resting against the cam 46 will take the thrust.

The above-described mechanism (shown in Fig. 21) should be duplicated on the opposite end of casing 1 when the opposite head has a reciprocating motion.

Any antifriction-guide for the reciprocating heads may be used to permit the needed movement of said heads, no matter what the form of the heads or pistons may be.

In Figs. 21, 24, and 25 I have shown an inlet-pipe 53, governed by a valve or cock 54, for the admission of live fluid to the chamber behind the head 3 to form a cushion of expansive fluid to assist in driving the head. Instead of the disk valve for regulating the passage of the exhaust through the port 55′ to the pipe 54′ I may use a valve 55 in the pipe 54′, and both valves 54 and 55 may be operated by suitable connections with the shaft 9.

In Fig. 24 I have shown a very simple means for guiding the reciprocating head 3. 57 is a cam mounted upon and secured to the shaft 9 and adjacent to the inner side of the cylinder-head 45′. 58 is a cam engaging the cam 57 and formed as a port of the head 3. Feathers or short strips 15 are secured to the shell or casing 1 and engage in grooves 16 in the head and are adapted to allow the said head to reciprocate, but not to rotate. The cams 57 and 58 are adapted to give the proper reciprocating motion to the reciprocating head 3, thereby taking up the reciprocating motion of the reciprocating ports.

In Fig. 25 I show a modified form of locking device, the spring-lever 61 being pivoted to a bracket 62 on the head 45′ and the locking-pin 63 adapted to fit into a socket 64 in the outer end of the head 3 and to enter the said socket at a certain position of the head, and thus lock the same until the cam 65 of the cam disk 66 on the shaft 9 has raised the pin 63 out of the socket 64. A tension-spring 67 between the cylinder-head 45′ and the head 3 provides means for pressing said head forward when relieved of pressure from the opposite direction.

It is obvious that any of the constructions described may be modified to suit various purposes without departing from the spirit of my invention.

Various forms of valves may be employed to admit live fluid into the pockets. In Figs. 14, 18, and 19 I have shown a form of rotary disk valve; but it is obvious that slide or rotary valves could be used formed upon the exterior of the casing and having proper connecting-channels leading into the pockets for containing live and exhaustive fluid.

It is also obvious that with slight modifications my principle may be adapted to be used as an oil or explosive-gas engine.

In the drawings I have shown engines in which the piston rotates the shaft, while the casing remains stationary; but the casing may be allowed to revolve by holding the shaft stationary. I have also shown in the drawings a reciprocating piston; but if the piston be securely held upon the shaft the shaft may be made to reciprocate with the piston, or if the shaft be held stationary the casing will reciprocate, as well as revolve. It is obvious then that an engine embodying my principle may be made to make any of three distinct motions—viz., rotary, reciprocating, or rotary and reciprocating combined.

All the oblique faces for the heads and pistons have been shown in the drawings as cut radially; but they could be cut at an angle, or, if desired, be cut with arched faces.

It is obvious that an engine embodying my principle could be made to act as a pump if

the pistons were driven by another engine, or the reciprocating motion could be used to actuate a cylinder-pump.

In some forms of the engine where there is a movable head the chamber formed behind the head could be made to act as a pump, the reciprocating head acting as the plunger in its backward and forward movement.

The engines described are particularly adapted for application to horseless carriages, where the engine could be placed directly on the driving-shaft between the two wheels of the vehicle, or for the propulsion of bicycles, where the engine could be placed on the side of the driving-wheel between the crank-hanger and the hub. This form of engine is also adapted for cartridge-hoists on board warships, for moving turrets, the propulsion of small boats, and can be placed within a hoisting-drum or in any place where compactness and efficiency are desired.

What I claim as new is—

1. In combination with the casing of an engine, pump, or similar apparatus, a piston and heads having cam-shaped contacting surfaces and noses, the piston and heads being concentric with each other, and the adjacent cam-shaped surfaces and noses being adapted to contact and ride rotatably over each other, forming two or more pockets on each side of said piston adapted to receive live and exhausted fluid, substantially as described.

2. In combination with the casing of an engine, pump, or similar apparatus, a piston or pistons, reciprocating head or heads having adjacent cam-shaped contacting surfaces and noses adapted to rotatably ride over each other and form two series of pockets upon each side of said piston, one series being adapted to contain live fluid and the other being adapted to contain exhaustive fluid, and means for admitting and exhausting said fluid, substantially as described.

3. In combination with the casing of an engine, pump, or similar apparatus, a rotary reciprocating piston, and stationary heads provided with cam-shaped adjacent contacting surfaces and noses, the noses of cam-surface upon said piston being adapted to ride over adjacent surfaces and noses upon said stationary heads and form two series of one or more pockets upon each side of said piston, one series being adapted to contain live fluid and the other series being adapted to contain exhaustive fluid, and means for admitting and exhausting said fluid, substantially as described.

4. In combination with the casing of an engine, pump, or similar apparatus, a piston or pistons and reciprocating head or heads, having cam-shaped abutting surfaces, sliding vanes mounted in the abutting surfaces and adapted to engage and butt against the adjacent cam-surfaces, pockets formed upon each side of said piston and adapted to contain live and exhaustive fluid, and suitable means for admitting and exhausting fluid to and from said pockets, substantially as described.

5. An engine comprising a piston having projecting abutting surfaces upon both sides and mounted upon a shaft, and heads having adjacent abutting cam-shaped surfaces and mounted within a casing, the said piston being adapted to rotate and form pockets or chambers on both sides of the piston for the admission of live fluid and also forming pockets upon each side of the said piston which are adapted to contain exhaustive fluid, the pressure of the fluid in said pockets acting to balance the said piston, substantially as described.

6. An engine comprising a piston having projecting abutting surfaces upon both sides and mounted upon a shaft, and heads having adjacent abutting yielding cam-shaped surfaces and mounted within a casing, the said piston being adapted to rotate and form pockets or chambers on both sides of the piston for the admission of live fluid and also forming pockets upon each side of the said piston which are adapted to contain exhaustive fluid, the pressure of the fluid in said pockets acting to balance the said piston, substantially as described.

7. In an engine comprising a piston and heads with abutting surfaces inclosed within a casing, said piston being adapted to rotate and form pockets on each side of said piston for admission of live and exhaustive fluid, the pressure of the fluid acting in opposite directions simultaneously on each side of said piston; thereby causing the suspension of the piston, substantially as described.

8. An engine comprising a piston mounted upon a shaft within a casing, said piston having projecting noses upon each side of said piston and rotatably riding over projecting abutments; thereby forming a set of two or more pockets or chambers upon each side of said piston, one or more pockets of each set being used for live fluid and the other of each set adapted to be used for exhaustive fluid; thereby tending to balance the piston by the action of the pressure of the fluid, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 16th day of November, 1897.

FRED. W. JAEGER.

Witnesses:

EUGENIE P. HENDRICKSON,

A. FABER DU FAUR, Jr.