F. J. SPROEHNLE.

ROTARY ENGINE.

APPLICATION FILED MAY 19, 1909.

959,812. Patented May 31, 1910.

4 SHEETS—SHEET 1.

FIG. 1.

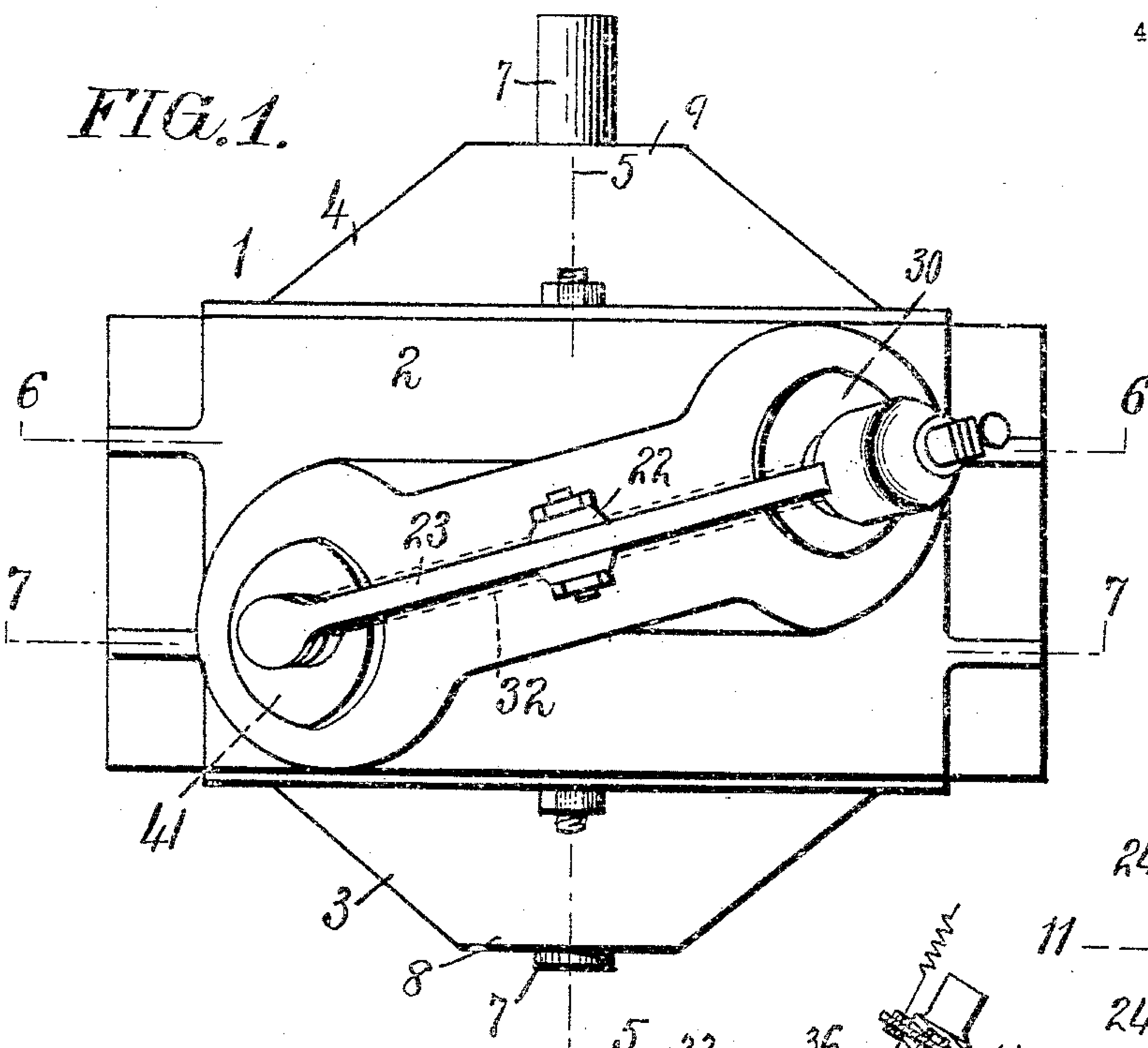


FIG. 10.

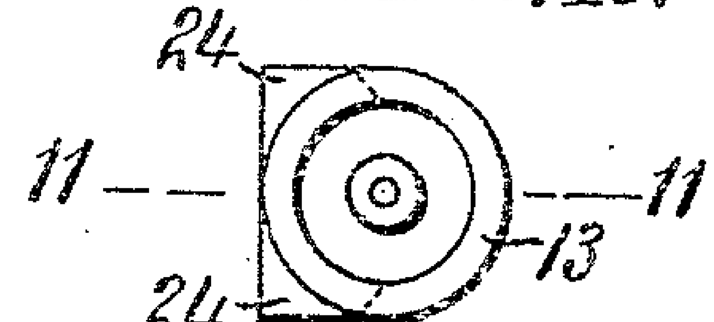


FIG. 11.

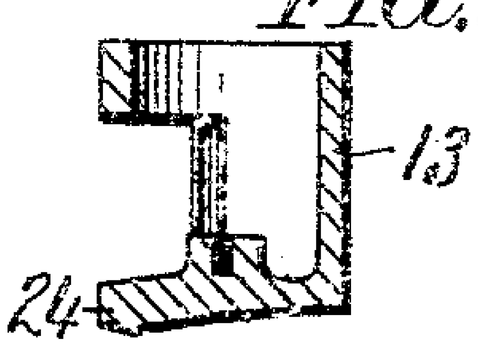


FIG. 6.

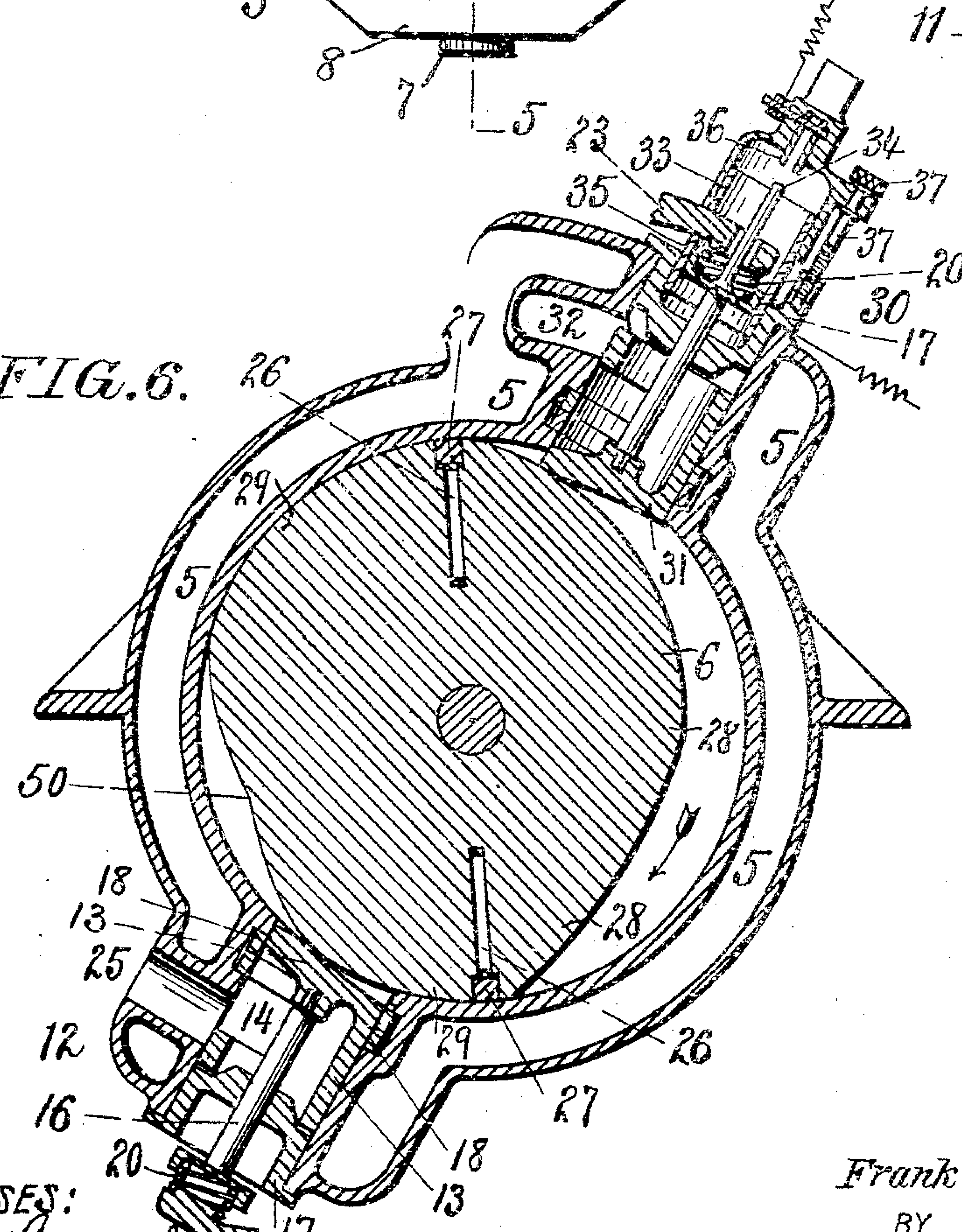
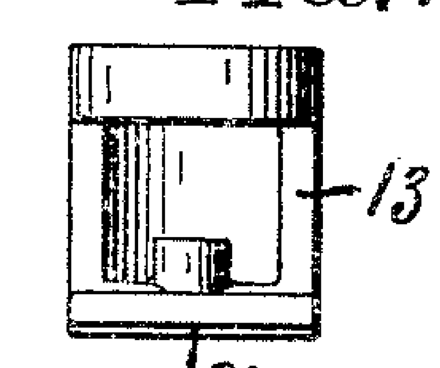


FIG. 12.



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4 SHEETS—SHEET 2.

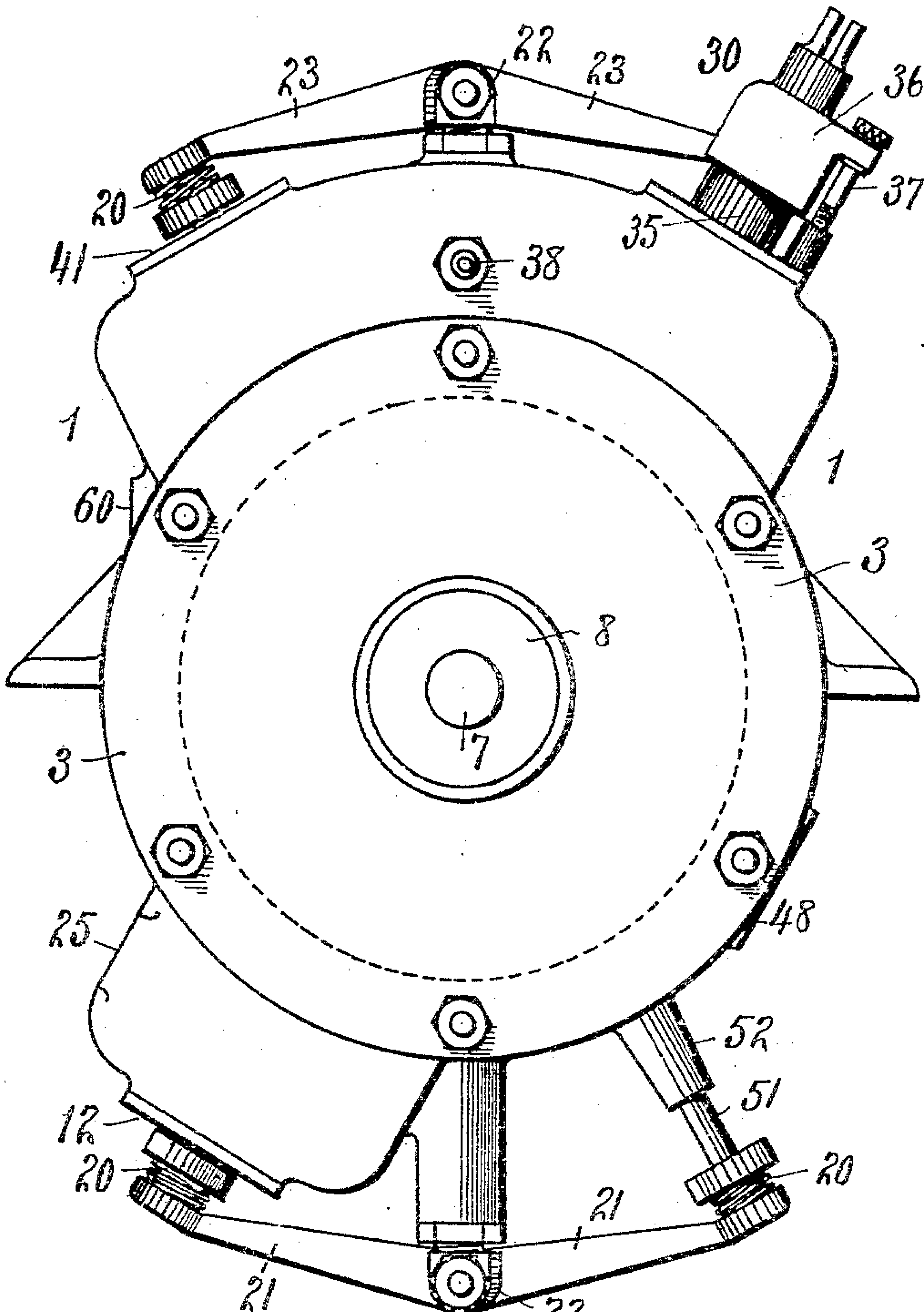

FIG. 2.

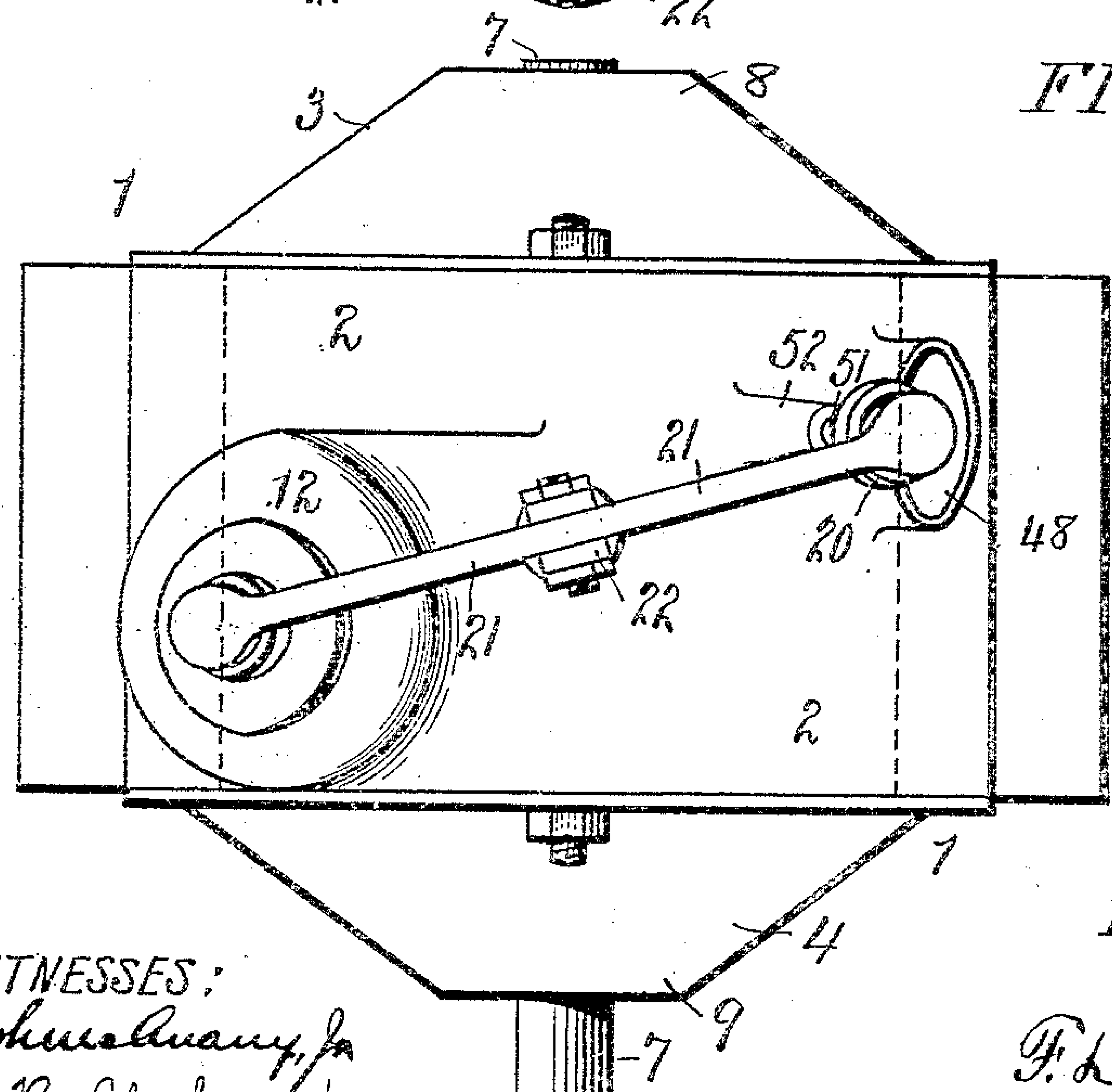

FIG. 3.

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4 SHEETS—SHEET 3.

FIG. 4.

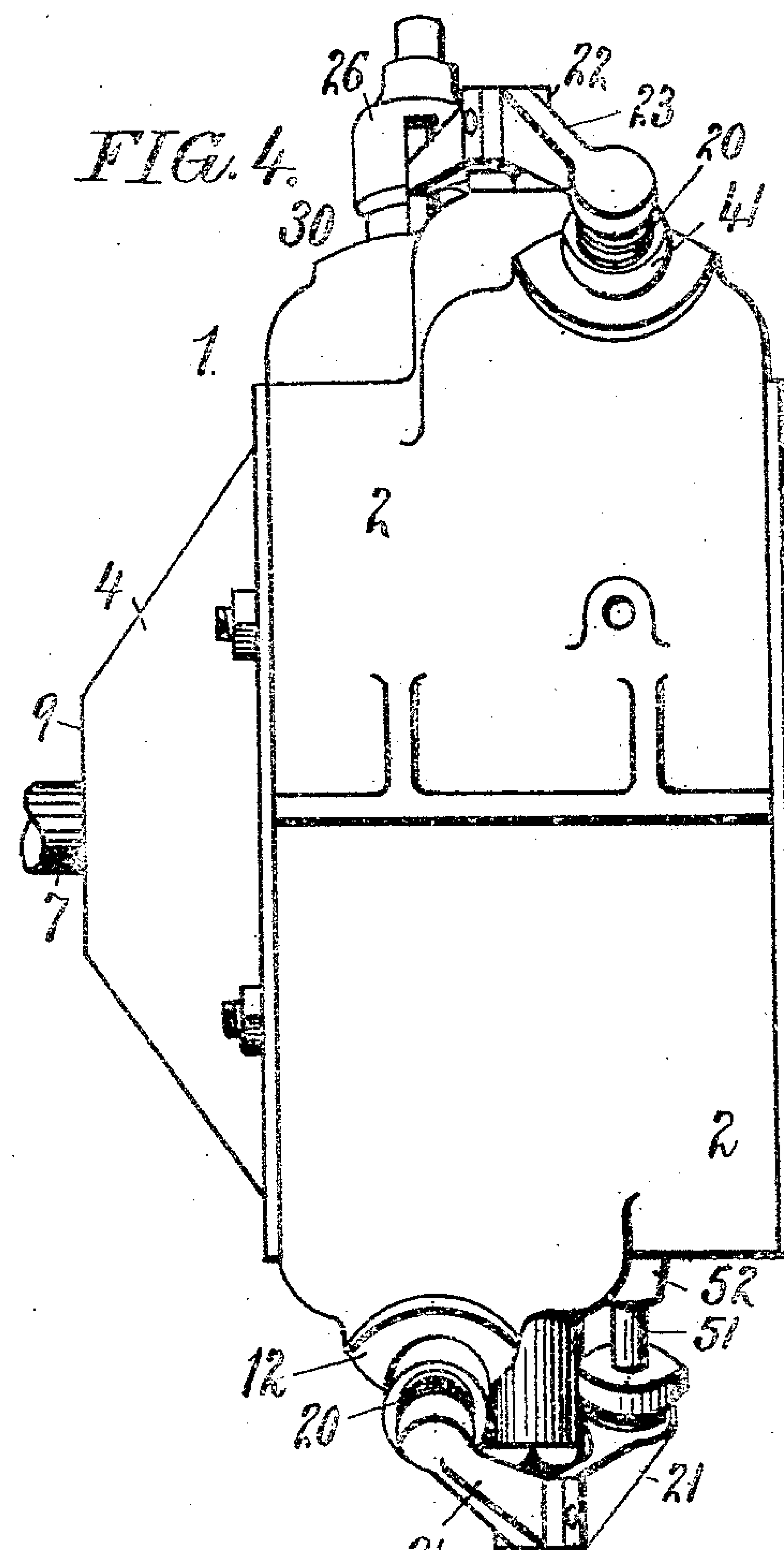


FIG. 13.

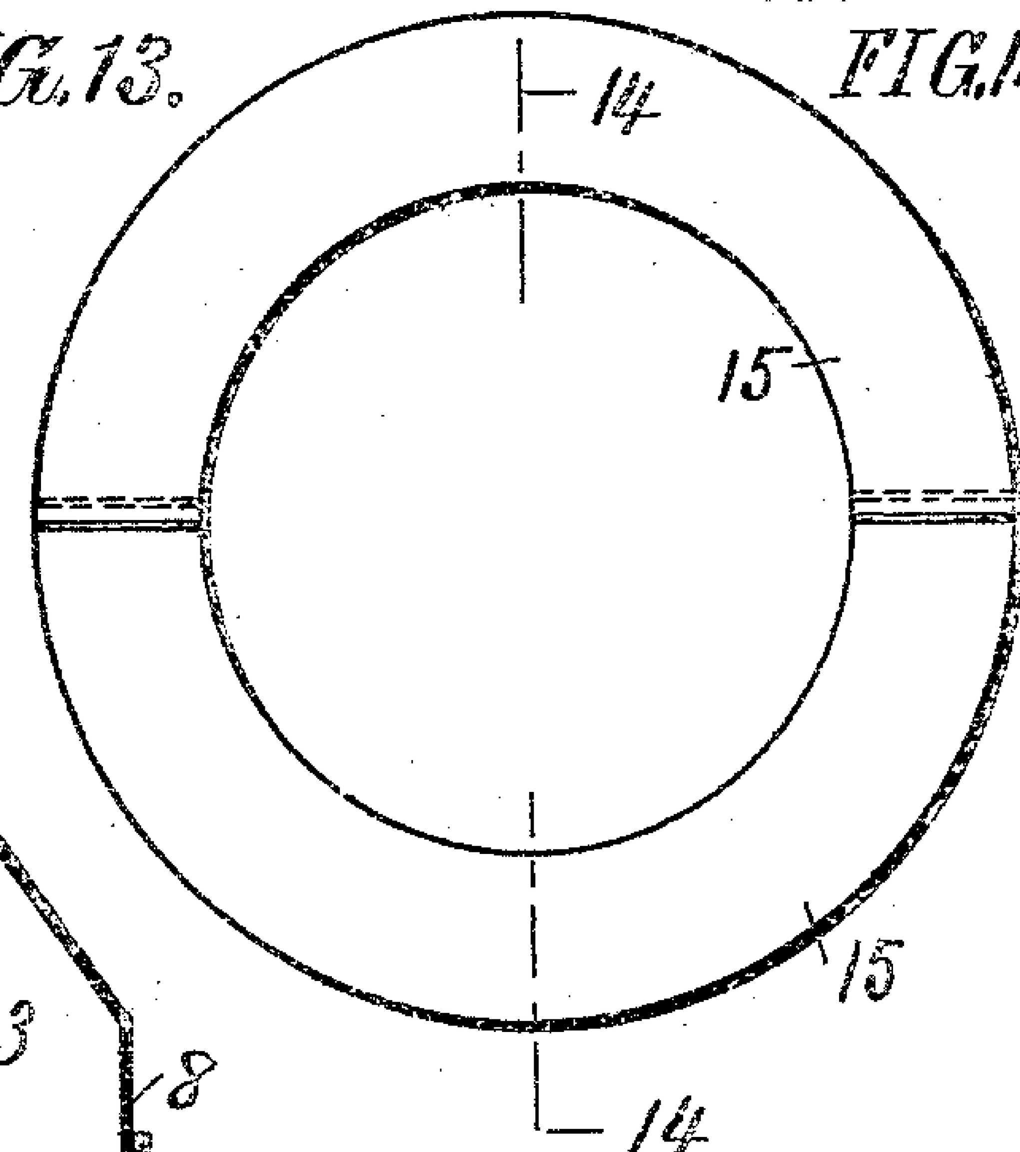


FIG. 14.

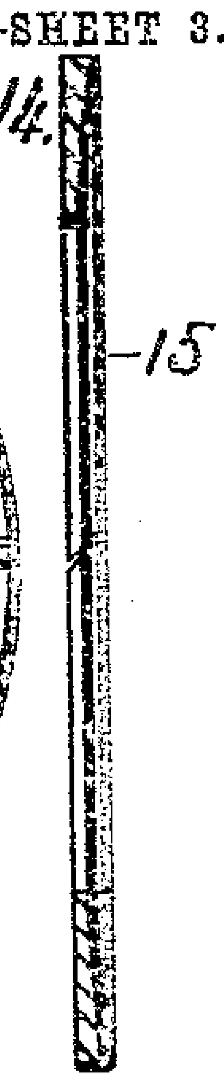


FIG. 5.

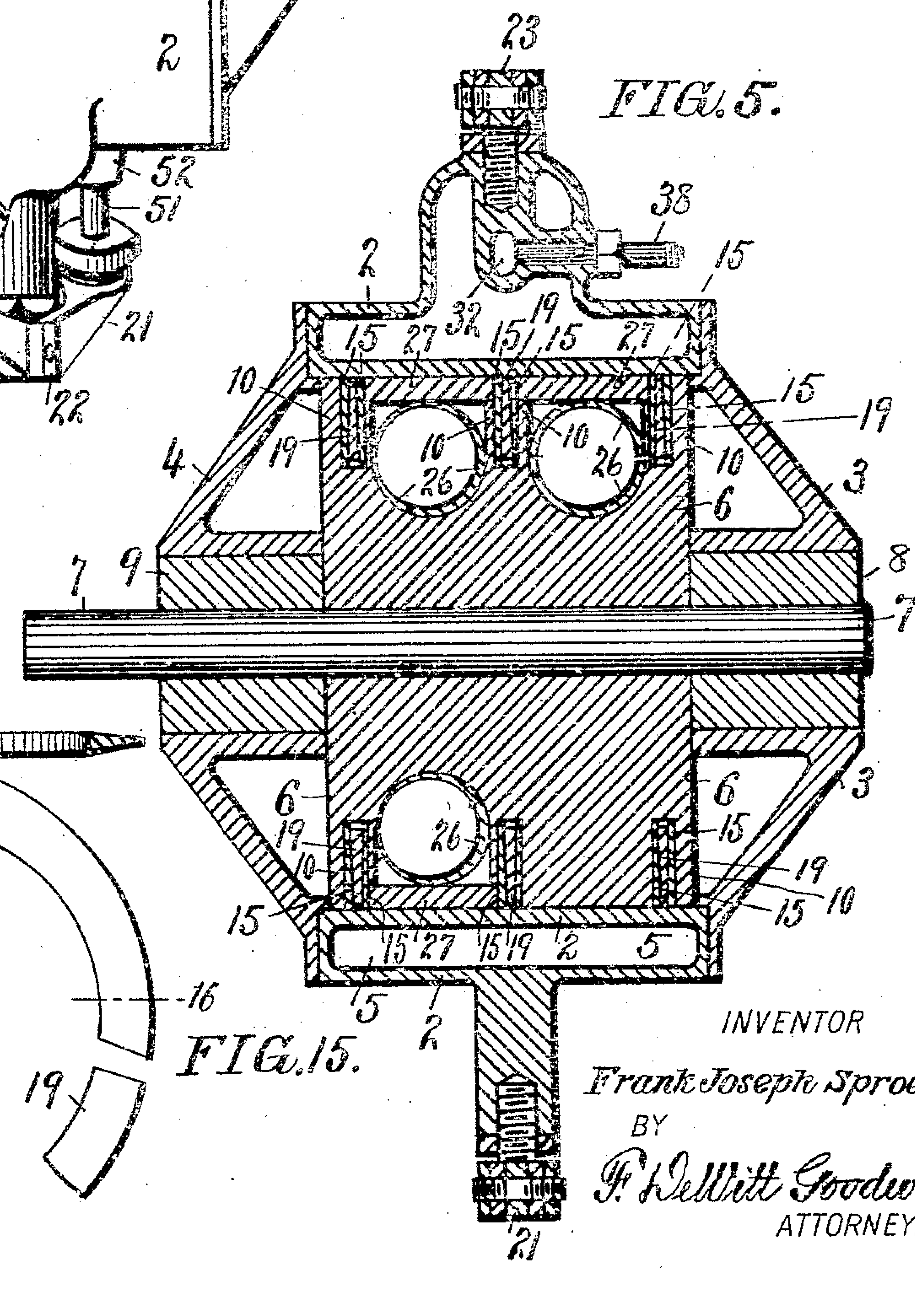
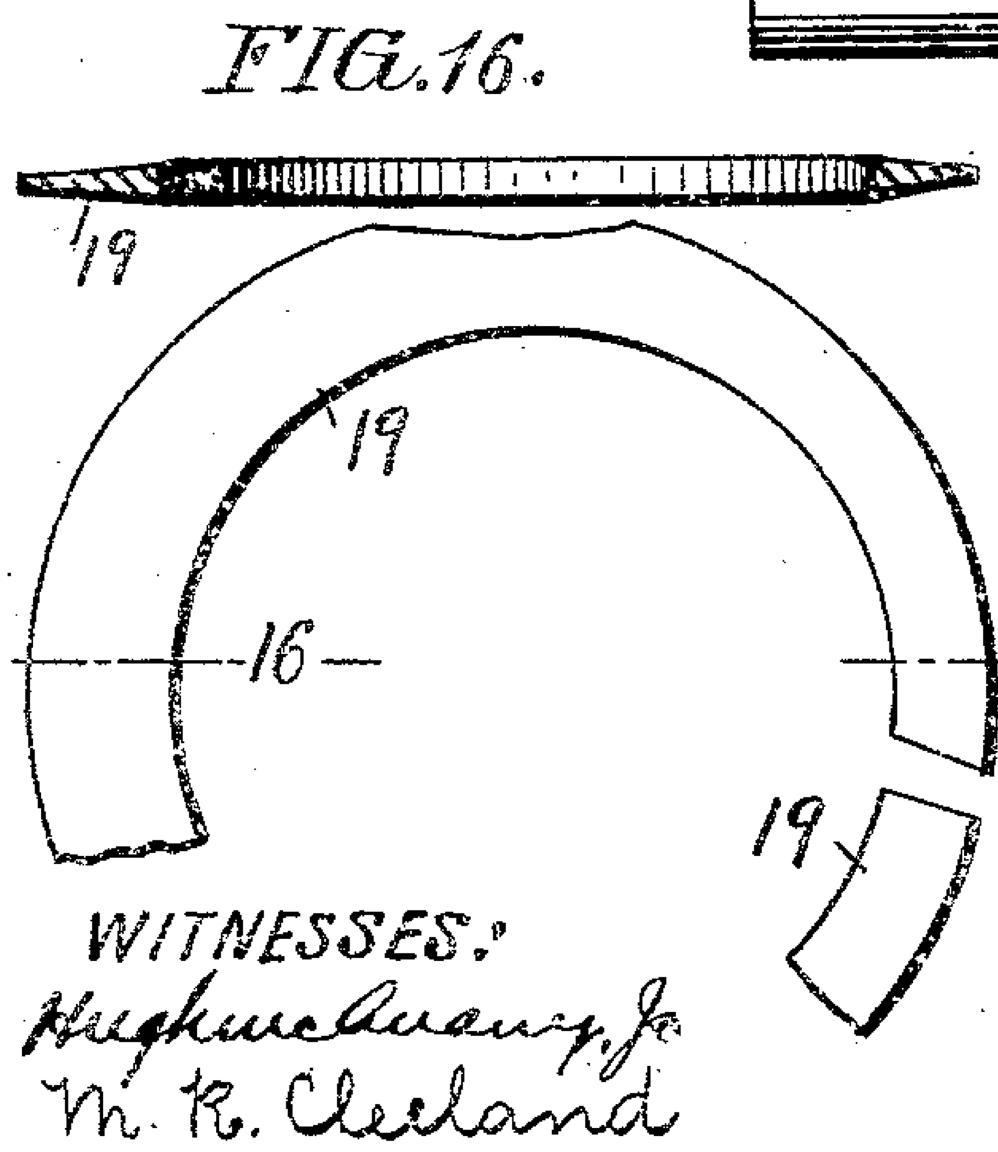


FIG. 16.

FIG. 15.



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4 SHEETS—SHEET 4.

FIG. 7.

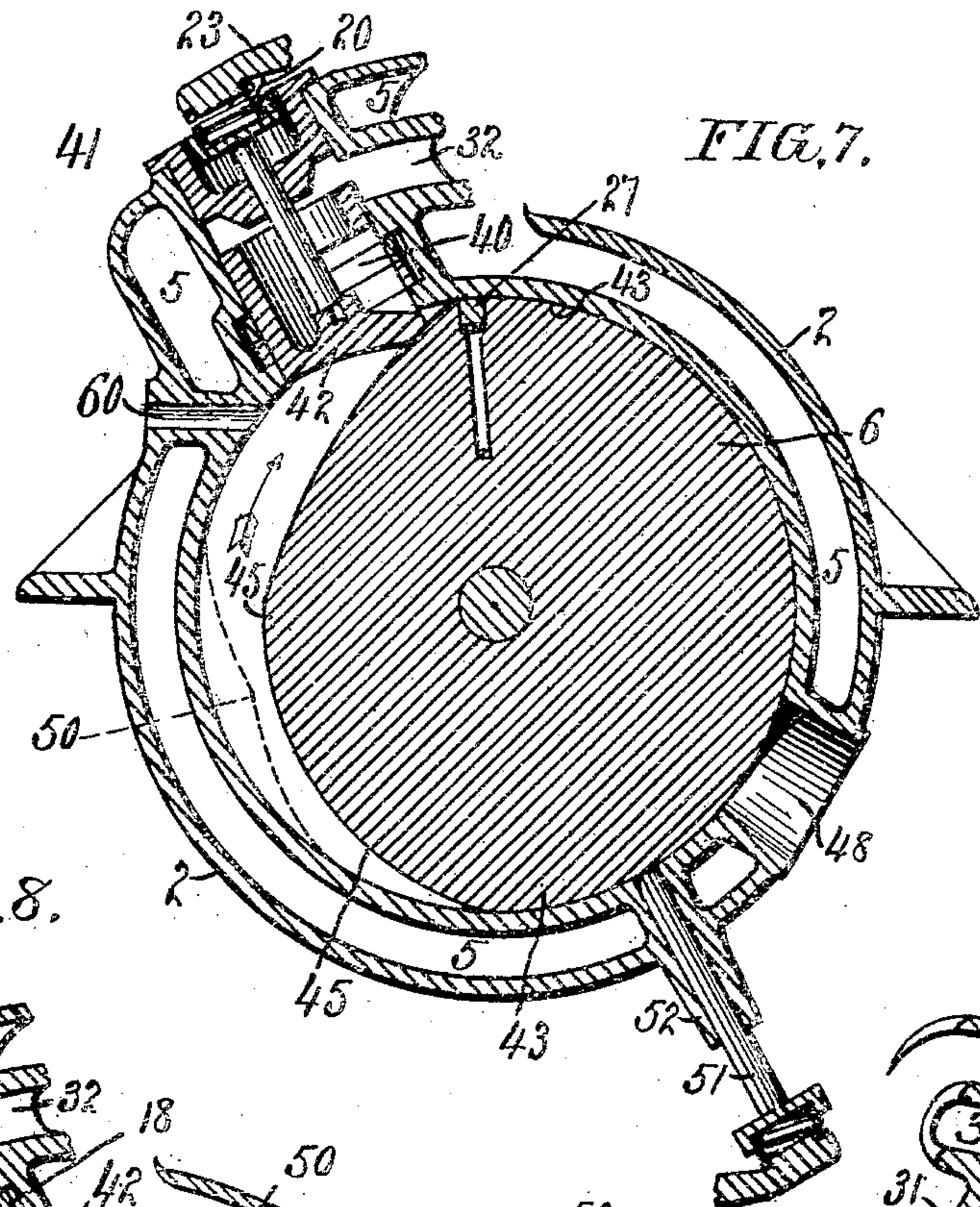


FIG. 8.

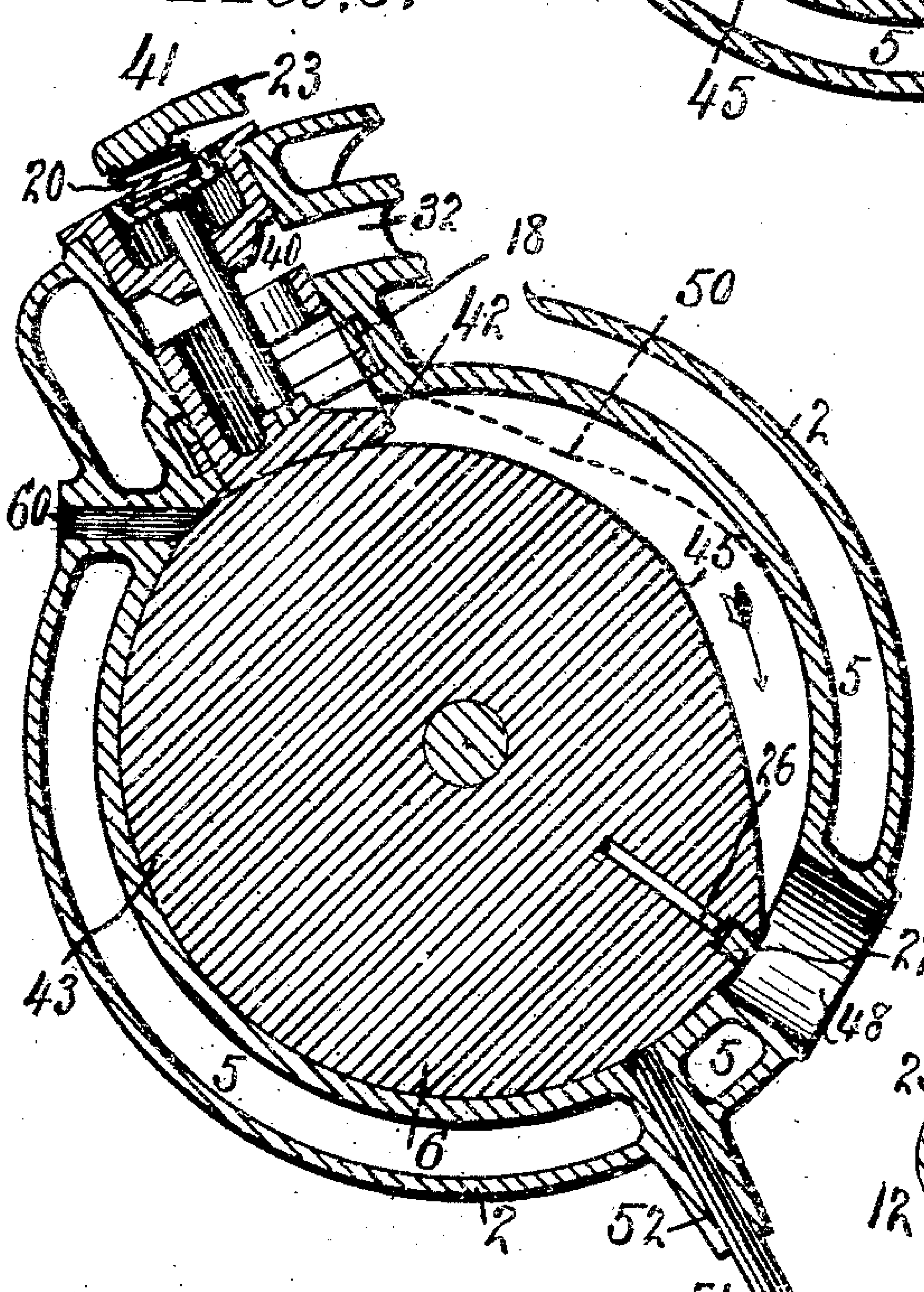
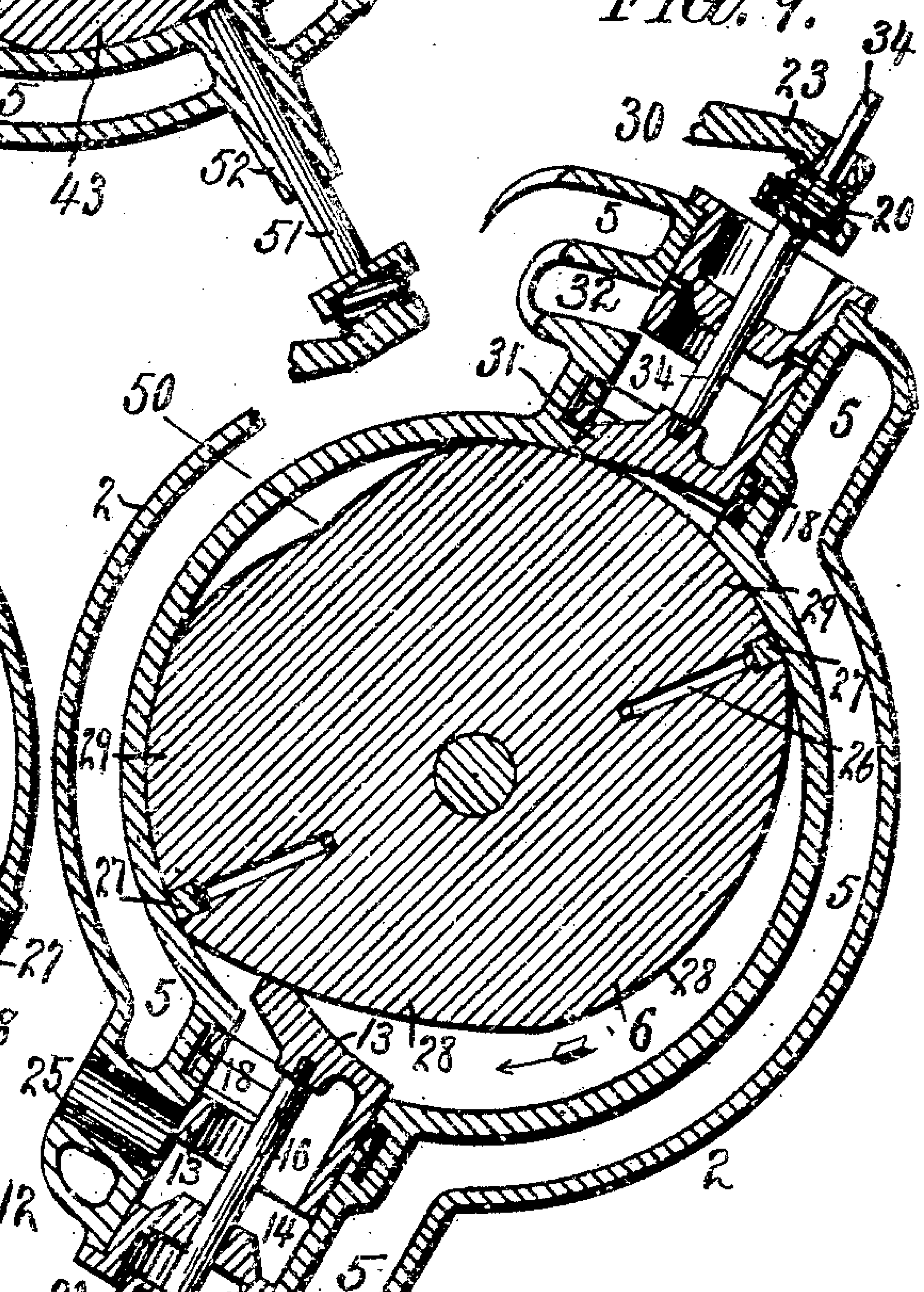


FIG. 9.



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ROTARY ENGINE.

959,812. Specification of Letters Patent. **Patented May 31, 1910.**

Application filed May 19, 1909. Serial No. 497,124.

To all whom it may concern:

Be it known that I, FRANK JOSEPH SPROEHNLE, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to improvements in that type of engines known as rotary engines.

The object of my invention is to provide a rotary engine embodying in its construction a cylinder or casing in which is rotatably mounted a piston, which latter is provided upon its periphery with concentric portions and depressed portions for admitting, compressing and exploding the gas for the purpose of rotating the piston; a further object of my invention is to simplify the construction of the engine by arranging the cams upon the periphery of the piston in different vertical planes; and a still further object of my invention is to provide valves in said casing for controlling the gas and directing it through a diagonal passage from the chamber formed in one vertical plane of the piston to the chambers formed in a different vertical plane of said piston. This together with various other novel features and forms of construction of the several parts constitute my invention.

Referring to the drawings in which like references refer to like parts:—Figure 1. is a plan view of my improved rotary engine; Fig. 2. is a front elevation of Fig. 1; Fig. 3. is an inverted plan view of the rotary engine; Fig. 4. is a side elevation of Fig. 1; Fig. 5. is a vertical section on line 5—5 Fig. 1; Fig. 6. is a vertical transverse section on line 6—6 Fig. 1; Fig. 7. is a vertical transverse section on line 7—7 Fig. 1; Fig. 8. is a view similar to Fig. 7, showing the parts in a different position; Fig. 9. is a view similar to Fig. 6, showing the parts in a different position; Fig. 10 is a plan view of the valve, detached; Fig. 11 is a vertical section on line 11—11 Fig. 10; Fig. 12 is a front elevation of Fig. 10; Fig. 13 is a side elevation of the outside packing rings shown in section in Fig. 5; Fig. 14 is a transverse section on line 14—14 Fig. 13; Fig. 15 is a side elevation of the center packing ring, shown in Fig. 5; and, Fig. 16 is a transverse section on line 16—16 Fig. 15.

In the drawings 1 represents a casing consisting of the central portion 2, forming the cylinder, and the front and rear heads 3 and 4 respectively. The central portion of said casing is provided with the usual form of water jacket 5. The said heads 3 and 4 are bolted to the central portion or cylinder 2, which latter is provided with a cylindrical chamber or cylinder proper, in which is placed the rotary piston 6, secured upon the shaft 7, loosely mounted in the bearings 8 and 9 in the heads 3 and 4. The rotary piston 6 is made in the form of a disk and is co-extensive in size with the bore of the cylinder. The rotary piston 6 is provided upon its periphery with depressions to form pockets or chambers. Said depressions are arranged in separate vertical planes and valves are arranged upon the cylinder casing in alinement with the above mentioned depressions formed in said rotary piston.

The inlet valve 12, shown in Figs. 2, 3, 4, 6 and 9 consists of the plunger 13, shown detached in Figs. 10, 11 and 12. Said plunger is cylindrical in form and is adapted to slide in the cylindrical valve chamber 14 formed in the enlargement upon the cylinder casing 2. Said plunger is provided with an opening in the side of its cylindrical surface and near the end of said plunger, through which opening air and gas passes when the plunger is depressed below the line of the valve chamber. The end of the plunger is closed below the line of said opening and said plunger 24 has a straight surface along its front edge, which tightly impinges the surface of the rotary piston. The said projection has right-angle corners which impinge the vertical surfaces of said piston. The said rectangular projection 24 on said plunger fits into a similarly shaped recess formed in the casing, into which recess said projection 24 is forced by the superior cam upon the piston to close the valve. The said rectangular projection 24 on said plunger also prevents the plunger from turning.

A valve stem 16 is secured to the plunger 13 and a collar 17 fits into the valve chamber 14, which collar is provided with a central aperture through which said valve stem 16 passes to form a bearing to guide said valve stem. Packing rings 18 are provided in the valve chamber 14 to bear against said plunger 13 and a spring 20 acts between the valve stem and a lever 21, pivoted in a bearing 22, upon the outside of the cylinder casing and said spring 20 tends to hold the plunger 13 tightly in contact with the periphery of the rotary piston 6. Air and gas is admitted to the valve chamber 14, of the inlet valve, through an aperture 25 formed in the casing.

The rotary piston 6 forms cams hereafter designated as superior and inferior cams. The concentric portion of the piston being the superior cam which closes the valves and the depressed portion of the piston forms the inferior cam which regulates the opening of the valves and also forms pockets or chambers for the gas, the pressure of the gas is adapted to act against one of said cams and rotate said piston, as hereinafter described. The rotary piston 6 has three concentric portions co-extensive in size with the inside of the cylinder and said concentric portions form annular ribs 10, shown in sections in Fig. 5. In said ribs 10 are formed annular grooves to receive packing rings. There are two rings 15, shown detached in Figs. 13 and 14 which are thicker on the outside edge than on the inside edge and these rings 15 are placed at either side of the wedge shaped ring 19, shown detached in Figs. 15 and 16. The said packing rings are split rings and made of spring metal so that the periphery of the rings bears against the inner surface of the cylinders and the central wedge shaped ring 19 tends to force the two rings 15 apart and tightly fill the groove formed in the ribs 10 of the piston.

The superior cams upon the rotary piston are provided with packing bars 27 which are forced outwardly by spring rings 26. Said bars 27 and said springs are set in longitudinal grooves cut in the piston and said springs cause said packing bars 27 to impinge the inner surface of the cylinder and also the plungers of the valves.

When the rotary piston is turned in the direction of the arrow the plunger 13 of the inlet valve 12 will be opened as shown in Fig. 9, and the gas will be drawn through the inlet valve 12 into the pocket formed between the inner surface of the cylinder and the inferior cam surface 28. As the piston rotates the plunger 13 of the inlet valve 12 will be closed by the superior cam 29 and when said inlet valve 12 is closed the compression valve 30, which is similar in construction to the valve 12, will be opened by the plunger 31 of said valve 30 following the line of the inferior cam 28 and the gas will be forced from the pocket formed by said inferior cam 28, through the compression valve 30 into the explosion chamber 32 formed in the enlargement upon the cylinder casing. The gas is compressed in the explosion chamber 32 by the movement of the rotary piston forcing the gas through the compression valve 30 which is then closed by the superior cam 29. The plunger rod or valve stem 34 of the compression valve 30 makes electrical contact with the terminal 36 which causes a spark at the spark plug 38, shown in Fig. 5, which explodes the gas in the explosion chamber 32. The contact point 36, as shown in Fig. 6, is carried by a cap 33 which is slidably mounted upon a cylinder 35 secured in the collar 17 of the valve 30. An adjusting screw 37 is provided to regulate the distance between the plunger rod 34 and the contact point 36. The said explosion chamber 32 leads obliquely across the cylinder casing, as shown in dotted lines, Fig. 1, and communicates with the chamber 40 of the pressure valve 41, which is located in a different vertical plane from the inlet valve 12 and the compression valve 30, above described. The sections shown in Figs. 7 and 8 are taken on the plane in which is located the pressure valve 41.

The plunger 42 of the pressure valve 41 is controlled by the rotary piston 6, which is provided with a superior cam 43 in the same plane with the said pressure valve 41, which cam 43 holds said valve closed. A depressed portion or inferior cam 45, also in the same plane with said pressure valve 41, permits said latter valve to open and allows the pressure to escape from the explosion chamber 32 and act against the surface of the inferior cam 45. In Fig. 7, the piston is shown in the position in which the pressure valve 41 is beginning to open and in Fig. 8, the piston is shown in the position which it assumes after the pressure has acted upon said piston and rotated the same into a position in which the exhaust port 48 is opened. The said exhaust port is formed in the cylinder casing in the same plane with the pressure valve 41.

A depression 50 is formed in the periphery of the piston and said depression 50 is located in the same plane in which the supply valve 12 and the compression valve are located. The said depression 50 is arranged in advance of the pocket formed in the piston by the inferior cam 28 and opens the supply valve 12 to allow the piston to draw air into the space formed by said depression 50 in the piston. The said depression 50 formed in the piston opens the compression valve 30 at the time the pressure valve 41 and the exhaust port 48 are open and the rotation of the piston forces the air from said depression 50 in the piston, through the compression valve, the explosion chamber, the pressure valve, the pocket formed in the cylinder by the inferior cam 45 of the piston and out through the exhaust port 48, thereby cleansing all the chambers and valves after the explosion has taken place.

The valve plungers are held against the surface of the piston by the action of the springs 20 acting upon the plunger rods.

To insure a uniform pressure upon the said springs, levers 21 and 23 are provided, which are pivotally mounted in bearings 22 on the casing. The ends of said levers press upon the springs 20 of the valves. Throughout the greater part of the movement of the piston the compression valve 30 is open when the pressure valve 41 is closed or vice versa, so that as one valve plunger is forced up by the piston the action of the spring on that valve will be relieved by the movement of the lever 23, as the opposite end of the lever 23 is relieved from the increased spring pressure by the fact that the other valve is opened or depressed.

The lever 21 acting upon the supply valve 12, upon the under side of the casing, is pivoted in the bearing 22 and extends obliquely from the plane in which the supply valve 12 is located to the plane in which the exhaust port 48 is located. A pin 51 slidably mounted in the bearing 52 in the casing, extends through said casing and rests upon the piston, which latter will force said pin 51 outwardly when the supply valve 12 is open or allow said pin 51 to move inwardly when the inferior cam is in contact with said pin 51. By this arrangement the spring pressure upon the valve 12 is equalized when the valve is in the opened and closed positions.

It will be seen that if there are two valves located adjacent to each other the lever arranged between the valves will compensate the spring pressure in each of said valves. Where there is a single valve it is necessary to provide the pin 51 to take the place of the second valve.

The operation of my invention is as follows:—The piston is rotated by hand or other means sufficiently to cause the piston to open the inlet valve 12 and allow the piston to draw the gas into the pocket formed by the inferior cam 28. The piston then rotates still farther until the compression valve 30 opens, due to the action of the inferior cam 28 and the rotation of the piston will force the gas through the valve 30 into the explosion chamber 32. The said explosion chamber leads obliquely across the cylinder casing and communicates with the explosion valve 41. When the compression valve 30 is closed by the superior cam 29, electrical contact is made which causes a spark at the spark plug in the explosion chamber, which explodes the charge of gas in said chamber. A further rotation of the piston allows the pressure valve 41 to open and the gas to act upon the inferior cam surface 45, of the piston, which pressure causes said piston to rotate. As the pressure rotates the piston, the gas will be exhausted from the cylinder when the piston is in a position to force the expanded gas out through the exhaust port 48. Any residue of gas remaining in the cylinder, which has not been exhausted through the exhaust port 48, will be exhausted through the aperture 60, formed in the casing, as the piston further rotates and the gas coming in resistance with the back or closed portion of the valve 42 will be forced out through the said aperture 60. When the pressure valve and the exhaust port are still open the depression 50 in the piston opens the compression valve 30 and the piston will force the air, which has been previously drawn into the pocket formed by said depression 50 in the piston, through the compression valve, the explosion chamber, the pressure valve and the cylinder and force all the remaining gas out through the exhaust port. The action of the explosion rotates the piston with sufficient momentum to start the piston on a second revolution in which the above described operations will be repeated and give the piston a continuous rotary motion.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a rotary engine, the combination of a casing, a rotary piston having depressions formed in its periphery and arranged in different vertical planes, an explosion chamber communicating with the said depression formed in one plane of said piston and with the said depression formed in the other plane of said piston.

2. In a rotary engine, the combination of a casing, a rotary piston having depressions formed in its periphery and arranged in different vertical planes, an inlet valve and a compression valve in said casing located in one of the vertical planes of said piston, a pressure valve in said casing located in the other one of said vertical planes of said piston, an explosion chamber formed in said casing connecting said compression valve with said pressure valve and said casing having an exhaust port formed therein.

3. In a rotary engine, the combination of a casing, an inlet valve and a compression valve located in the same vertical plane in said casing, a pressure valve located in a different plane in said casing, a chamber formed in said casing connecting said compression valve with said pressure valve, a rotary piston having superior and inferior cams formed on the periphery of the same, adapted to open said inlet valve, inhale gas, force it into said explosion chamber and close said compression valve, means for exploding gas in said explosion chamber, said cams on said piston adapted to open said pressure valve to allow the gas to rotate said piston and said cams adapted to close said pressure valve and open the exhaust port in said casing.

4. In a rotary engine, the combination of

a casing, an inlet valve, an explosion chamber and an exhaust port formed in said casing, a rotary piston having superior and inferior cams formed thereon, said piston adapted to inhale gas and force it into said explosion chamber and be rotated by the expansion of said gas, said piston having a depression formed in its periphery to receive air, and said piston adapted to force the air from said depression through said explosion chamber to cleanse said explosion chamber, said pressure valve and said exhaust port.

5. In a rotary engine, the combination of a casing, an inlet valve, an explosion chamber, and an exhaust port formed in said casing, a compression valve and a pressure valve in said explosion chamber, a rotary piston having superior and inferior cams formed thereon, said piston having a depression formed in its periphery to receive air through said inlet valve, and said piston adapted to force air through said compression valve, said explosion chamber, said explosion valve and said exhaust port.

6. In a rotary engine, the combination of a casing, a rotary piston, a circular valve chamber formed in said casing, a plunger having a circular portion adapted to slide in said chamber, said plunger having a flange formed thereon with a straight edge adapted to impinge the surface of said piston.

7. In a rotary engine, the combination of a casing, a rotary piston, a circular valve chamber formed in said casing, a plunger having a circular portion adapted to slide in said chamber, said plunger having a flange formed thereon with a straight edge, said flange having right-angle corners formed thereon adapted to impinge the vertical surfaces of said piston.

8. In a rotary engine, the combination of a casing, a rotary piston, a circular valve chamber formed in said casing, a plunger having a circular portion adapted to slide in said chamber, said plunger having a flange formed thereon with a straight edge, said plunger having an opening formed in the side of the cylindrical surface of the same and a projecting flange upon said plunger below said opening to close the lower end of the said plunger.

9. In a rotary engine, the combination of a casing, a rotary piston, a valve chamber formed in said casing, a plunger in said valve chamber, a spring to act upon said plunger, an arm pivotally mounted upon said casing and means actuated by said piston to move said arm to equalize the pressure of said arm upon said spring.

10. In a rotary engine, the combination of a casing, a rotary piston, valve chambers upon said casing arranged in different vertical planes, plungers in said valve chambers, an arm pivoted upon said casing, springs between said arm and said plungers and said rotary piston adapted to raise and lower said valve plungers alternately and thereby equalize the spring pressure upon said plunger.

11. In a rotary engine, the combination of a casing, said casing having a cylindrical chamber formed therein, a rotary piston having an annular concentric portion, said concentric portion having a groove formed therein, packing rings in the said groove, two of said packing rings being made in segments and angular in cross-section, and the third ring being split and wedge shape in cross-section, said latter ring placed between said segmental rings, said wedge shape ring being made of spring metal and adapted to expand said segmental rings radially and longitudinally.

12. In a rotary engine, the combination of a casing, said casing having a cylindrical chamber formed therein, a rotary piston having an annular concentric portion, said concentric portion having a longitudinal groove formed in the surface thereof, a packing bar in said groove, and a spring in the form of split ring to hold said packing bar against the surface of said cylinder.

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

FRANK JOSEPH SPROEHNLE.

Witnesses:
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M. R. Cleeland.