No. 714,582. Patented Nov. 25, 1902.

S. J. JOHNSON.

ROTARY ENGINE.

(Application filed Mar. 22, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

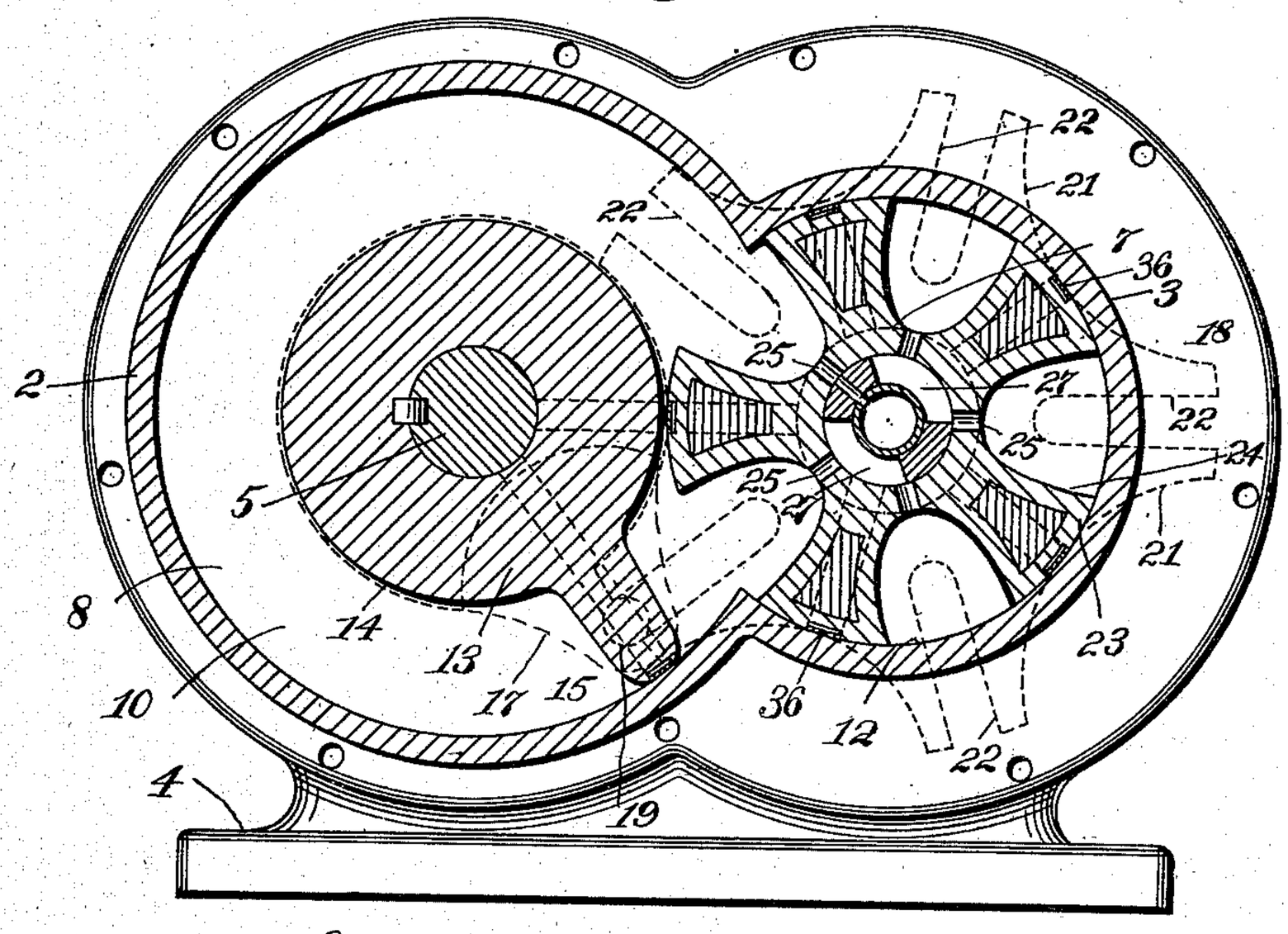

Fig. 2.

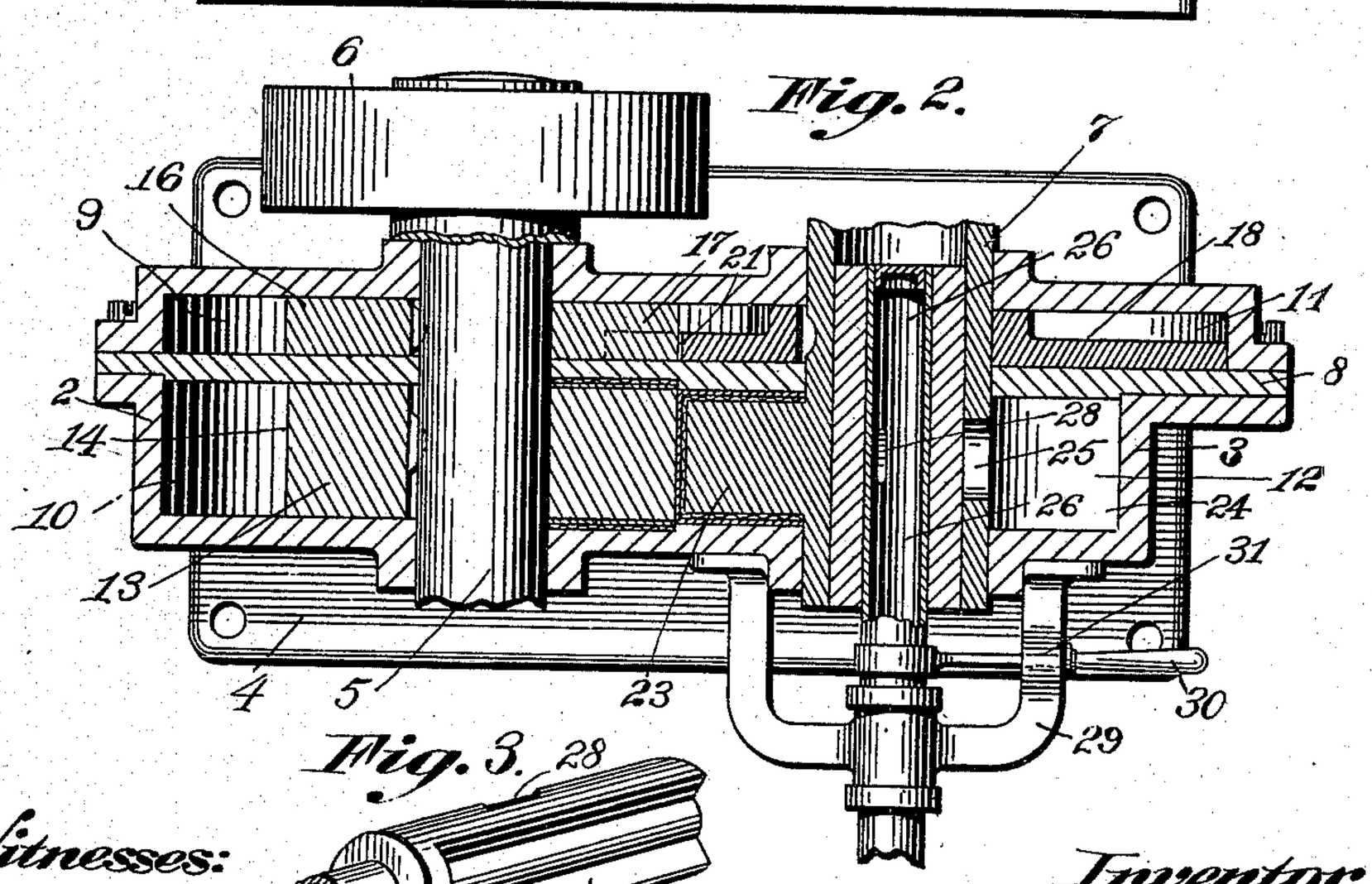

Fig. 3.

Witnesses:
A. C. Abbott
R. W. Pittman

Inventor;
Sinclair J. Johnson,
By his Attorney,
F. A. Richards.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 4.

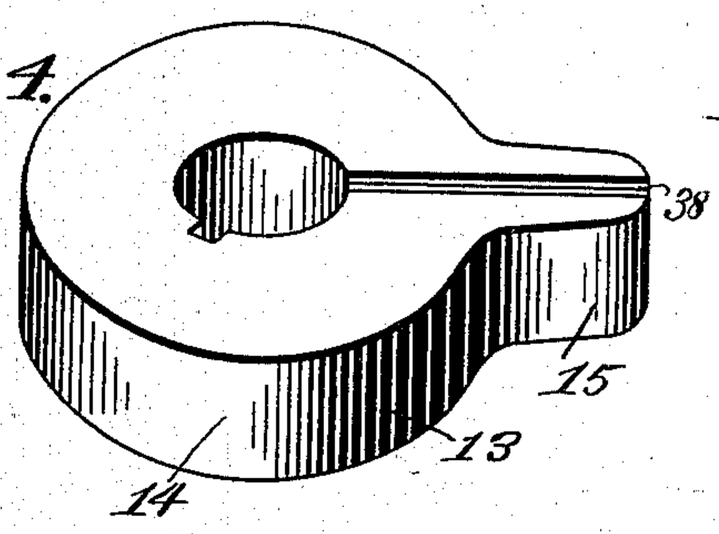


Fig. 6.

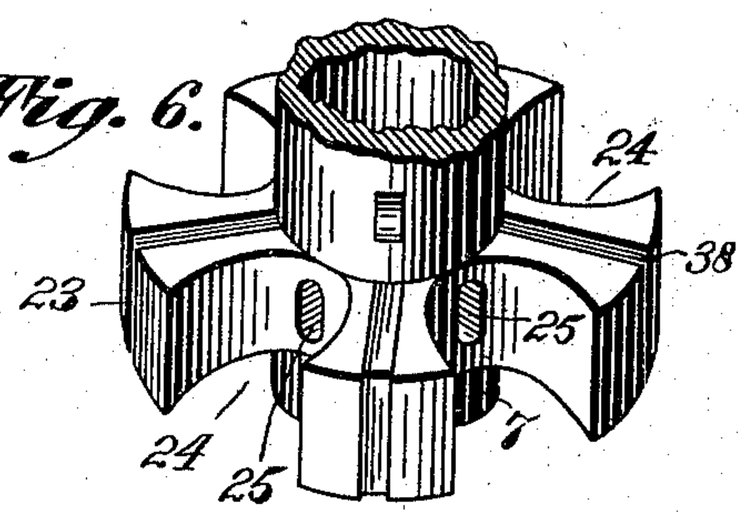


Fig. 5.

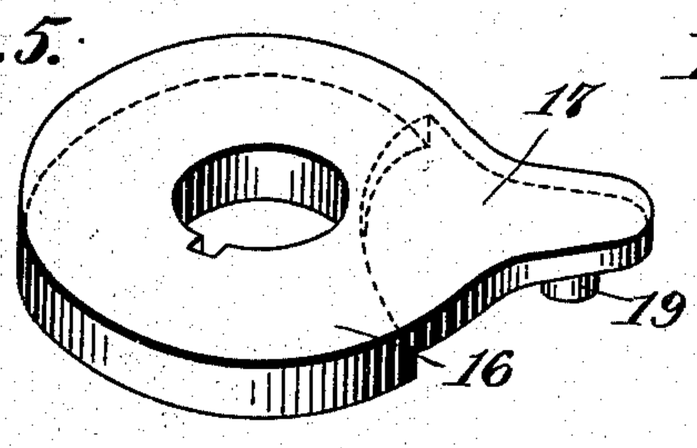


Fig. 7.

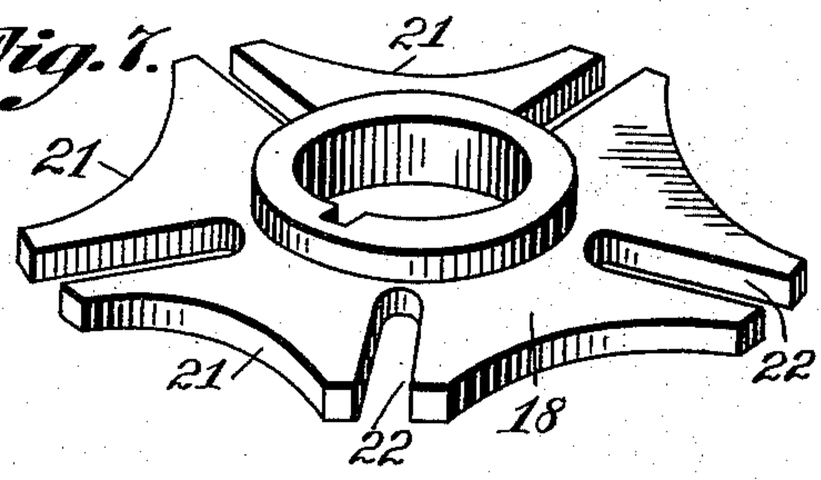


Fig. 8.

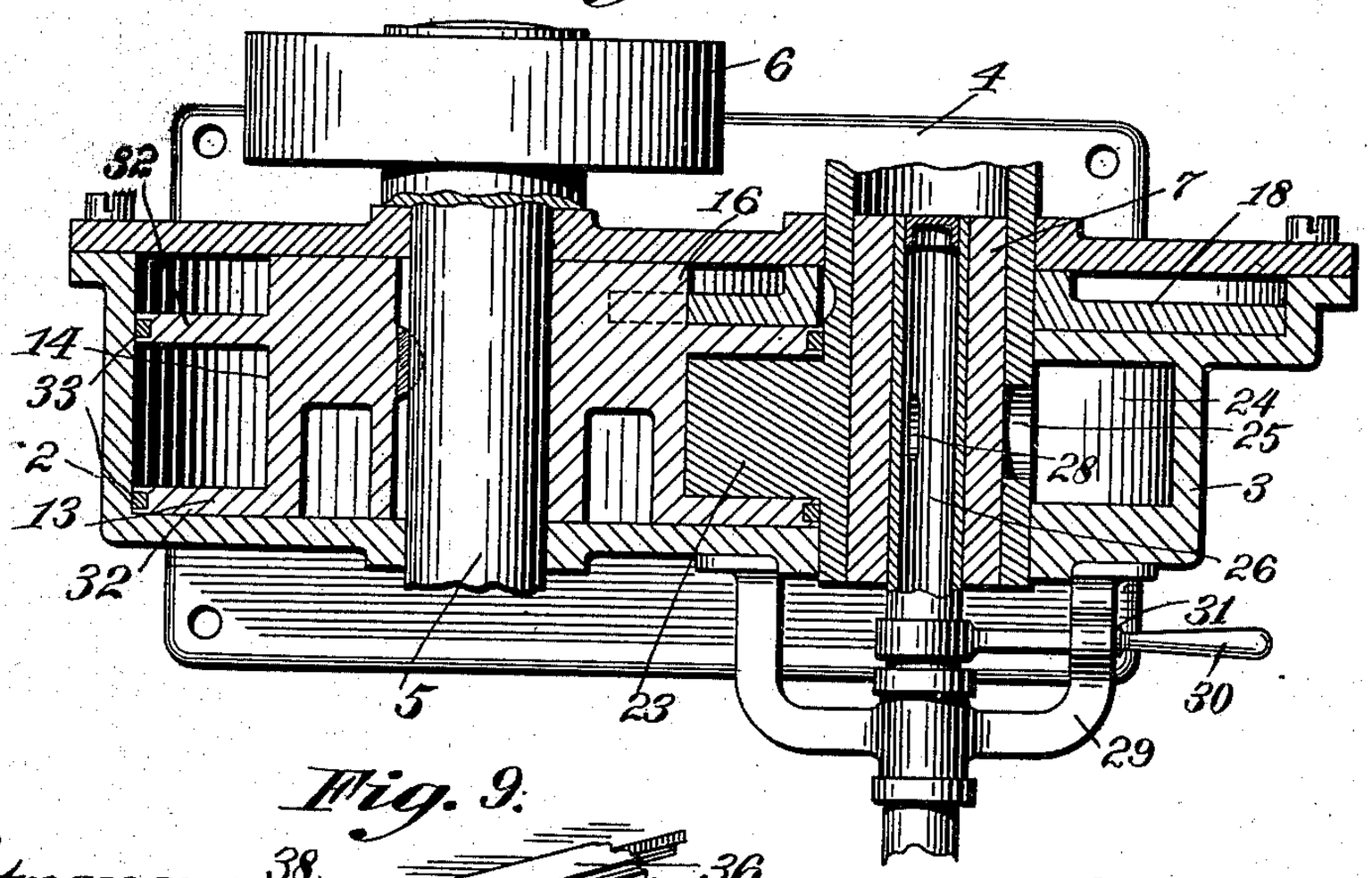
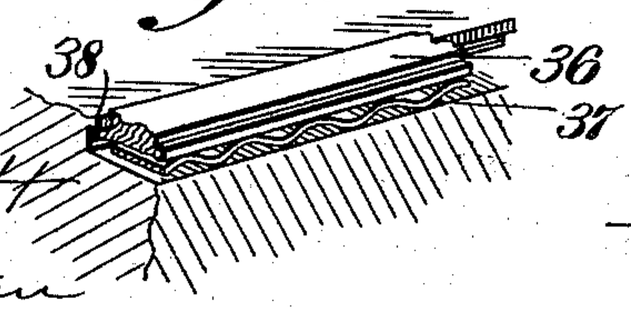


Fig. 9.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 10.

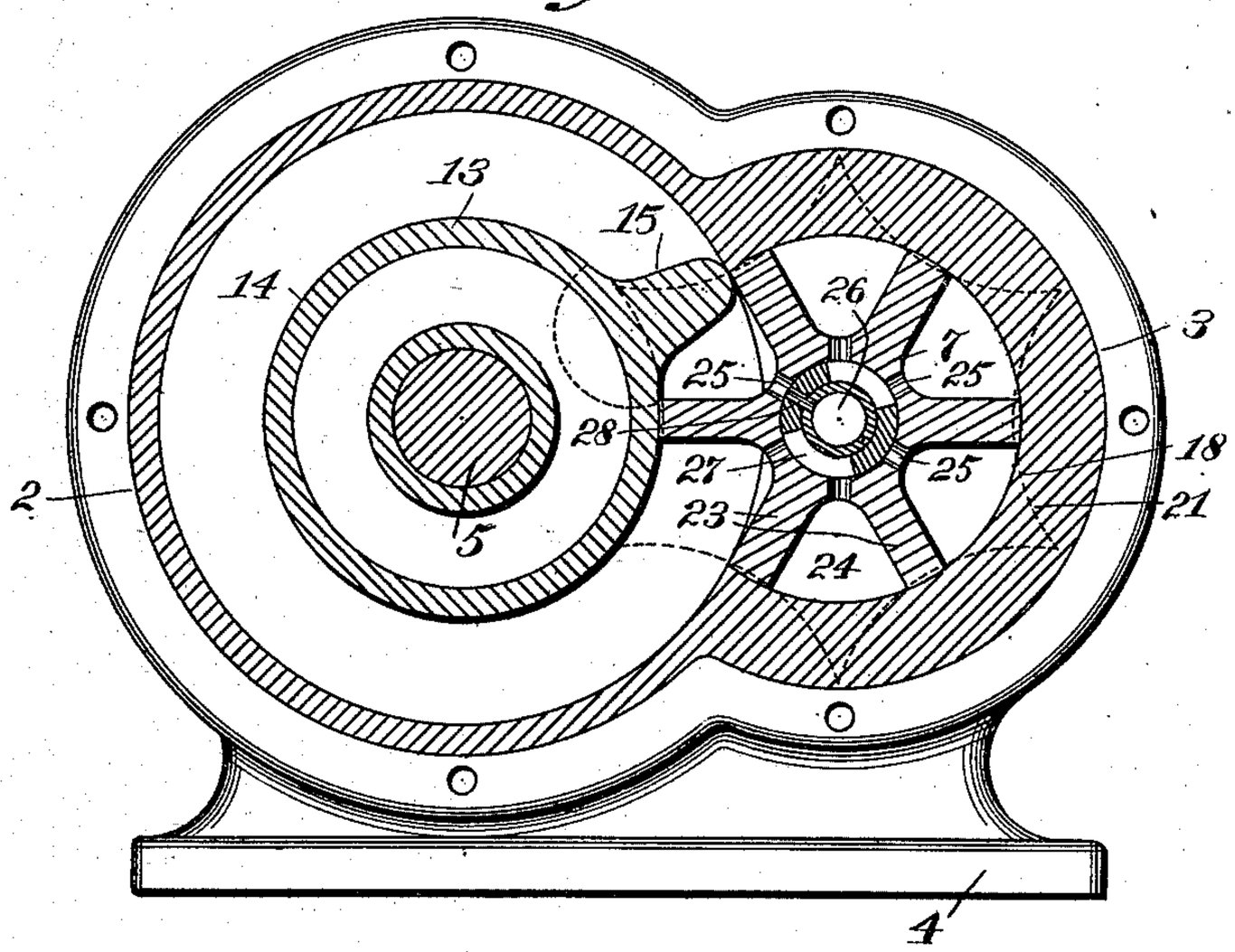
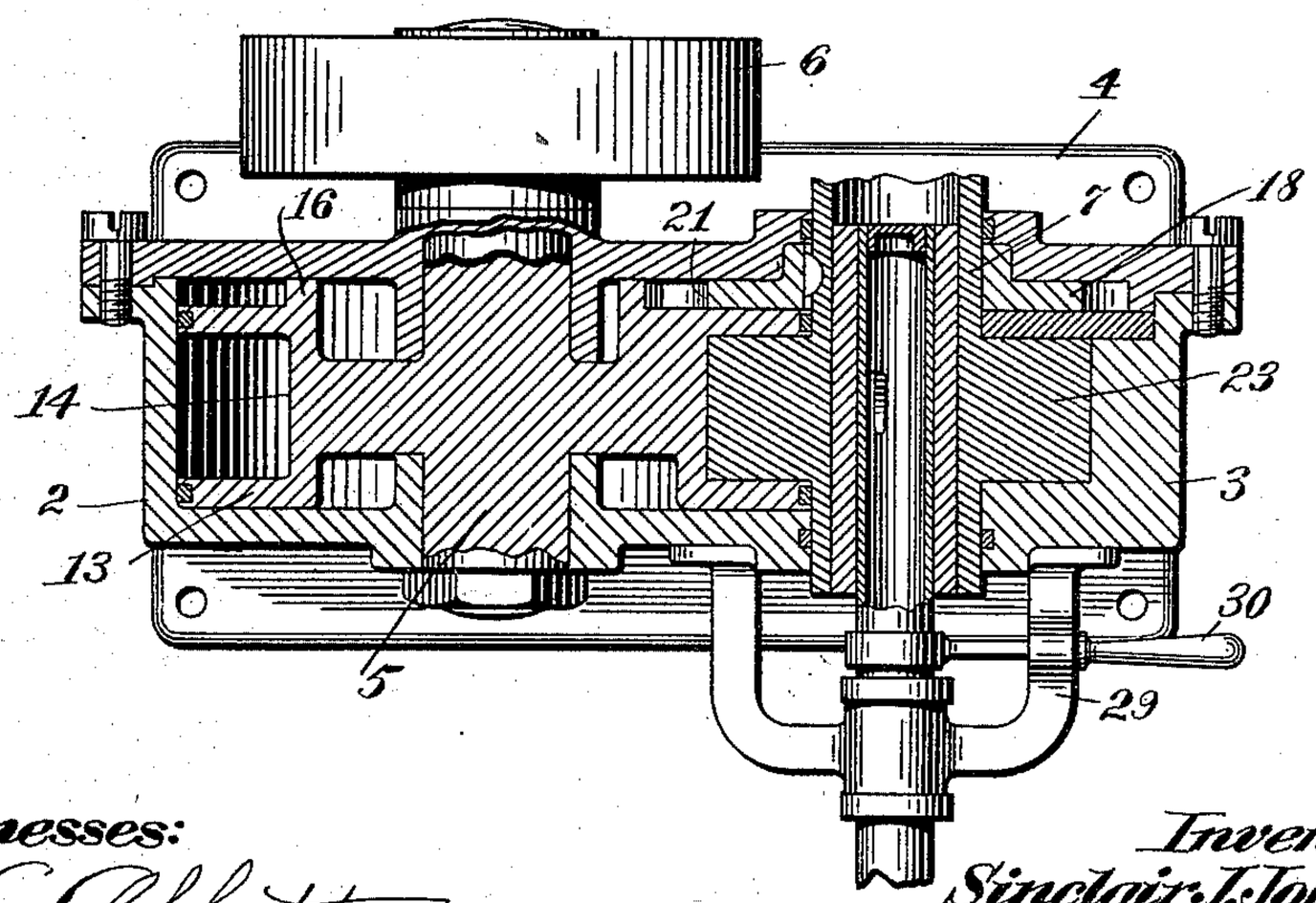


Fig. 11.



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(No Model.) 4 Sheets—Sheet 4.

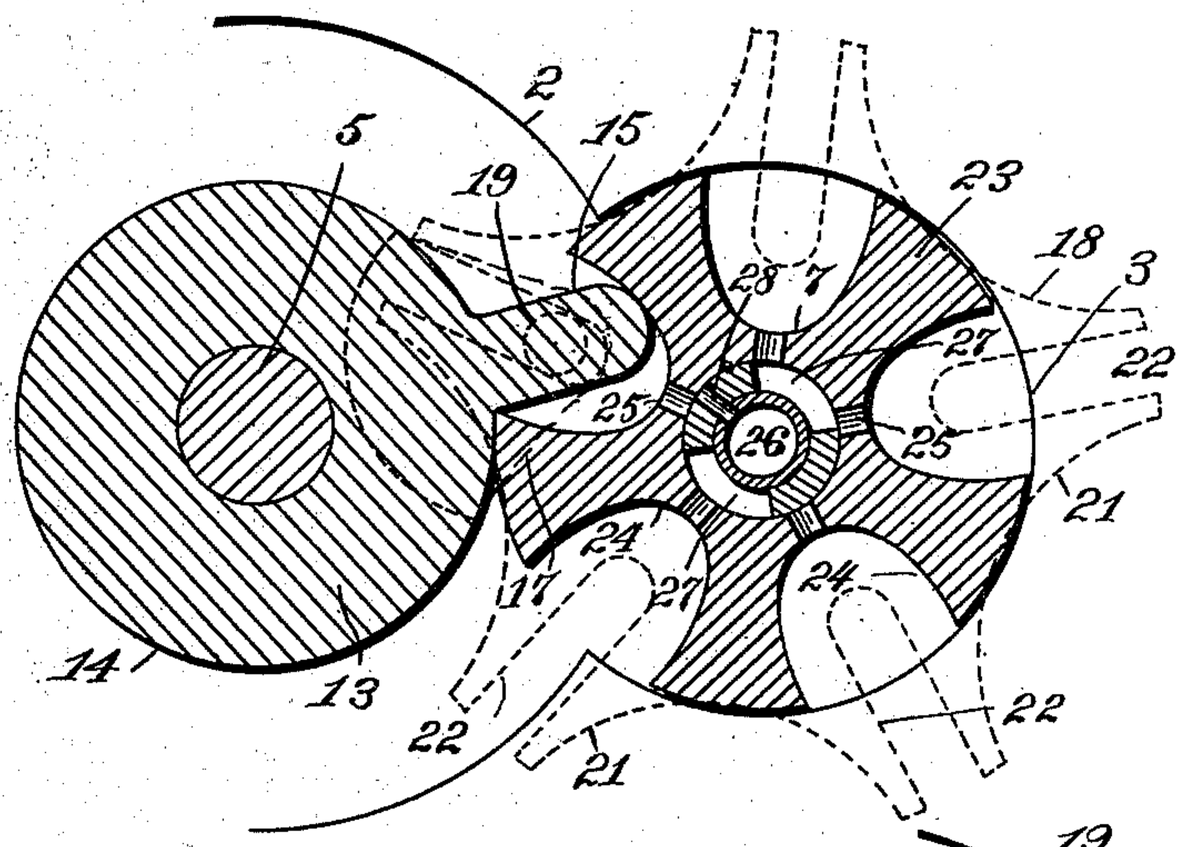

Fig. 12.

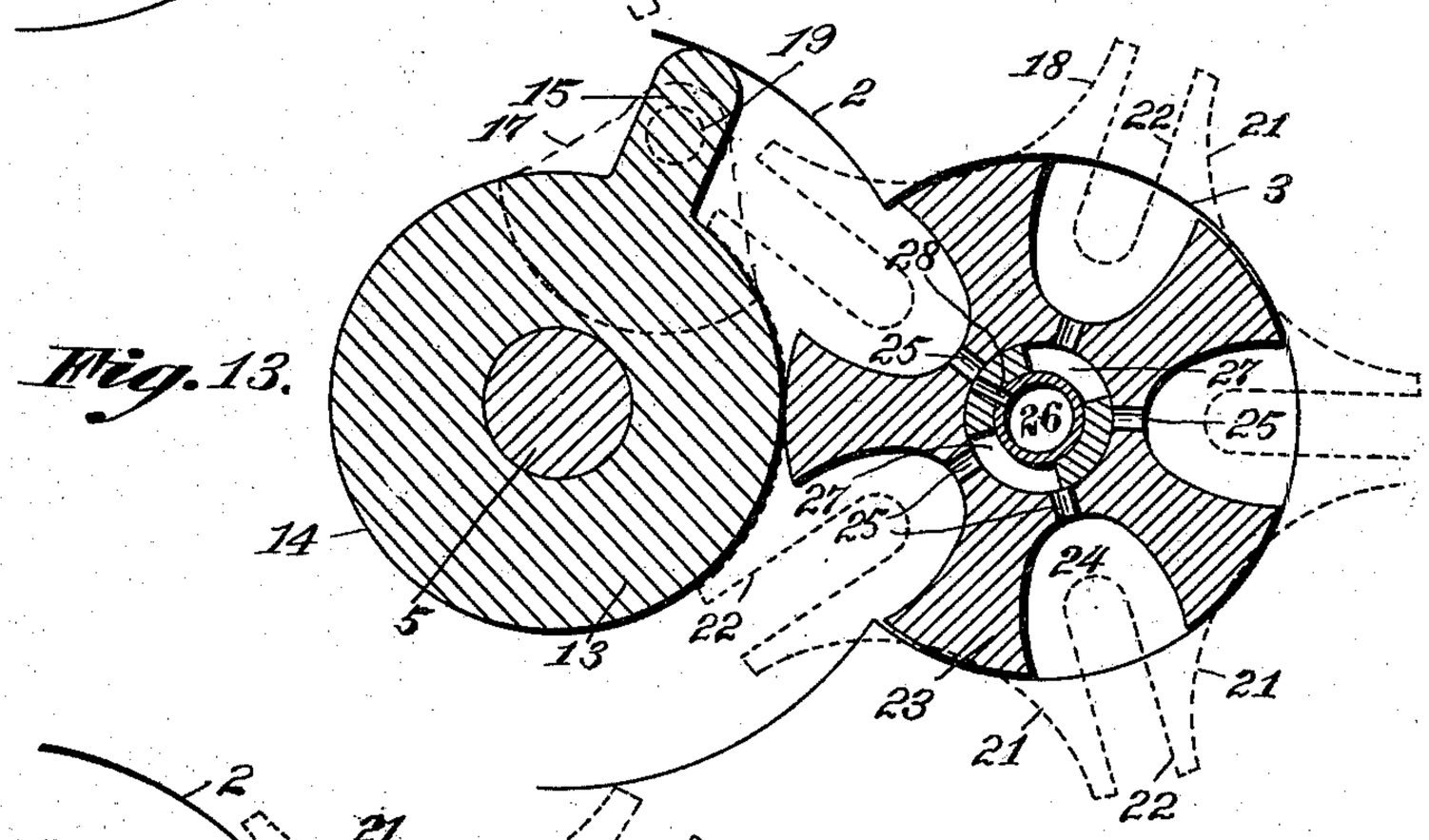

Fig. 13.

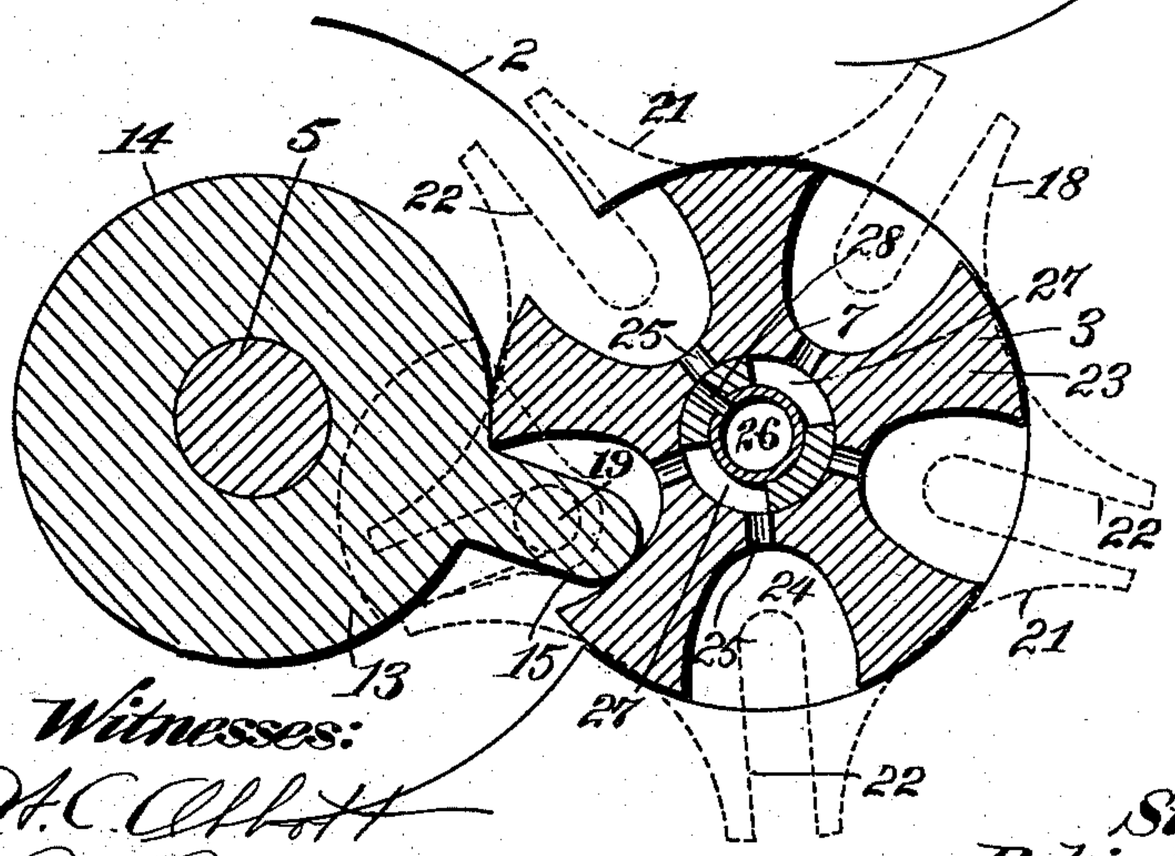

Fig. 14.

Witnesses:
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F. H. Richards.

UNITED STATES PATENT OFFICE.

SINCLAIR J. JOHNSON, OF NUTLEY, NEW JERSEY.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 714,582, dated November 25, 1902.

Application filed March 22, 1901. Serial No. 52,297. (No model.)

To all whom it may concern:

Be it known that I, SINCLAIR JOSEPH JOHNSON, a citizen of the United States, residing in Nutley, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines, the object of the invention being to provide an improved rotary engine simple and durable in construction and economical to manufacture and use, the organization being such that the engine will work substantially noiselessly and with little friction and substantially without vibration, particularly when running at a high speed.

A further object of the invention is to provide an engine so organized that it will convert the maximum amount of the actuating medium into available energy and be adapted to have the supply of such actuating medium regulated at different times, so as to use the expansive force of such medium.

This improved rotary engine comprises in a general way two rotary members, one adapted to form appearing and disappearing abutments—that is, to make a partial rotation to every complete rotation of the other member and at each partial rotation to remove an abutment and close the inlet-port and the outlet-port and again open the inlet-port and the outlet-port, replacing the abutment—and is herein shown as means adapted to be partially turned by the piston at each rotation, such partial turning cutting off the supply of motive medium during the first part of the movement closing the outlet-port and removing the abutment and during the latter part of such movement opening the inlet-port and the outlet-port and replacing the abutment. It in practice may comprise a cylinder, a chamber opening into said cylinder, a piston mounted in such cylinder and provided with an arm fitting properly against the walls of such cylinder, and an intermittent rotary member mounted in the said chamber, said rotary member fitting properly against the walls of said chamber adjacent to the opening between the cylinder and said chamber and having recesses in its periphery positioned in such a manner that when said rotary member is at rest one of the unrecessed portions of the periphery adjoins one side of the opening between the cylinder and the chamber and a similar portion adjoins the edge of the other side of said opening and an intermediate similar portion forms the abutment and rests against the piston while the arm of the piston bears against the boundary of such recesses, such boundary supplementing the walls of the cylinder, the organization of the mechanism being such that the arm passing across the opening between the cylinder and said chamber will cause such member to make a partial rotation. Such member is provided in each recess with a port, one of which when said rotary member is at rest serves as an inlet-port and another as an outlet-port. Means to prevent the rotation of this rotary member at predetermined periods are provided.

This improvement is susceptible of various changes in form, proportion, and the details of construction without departing from the principle or sacrificing any of the advantages thereof, and a full disclosure of one of the adaptations of the invention is shown in the drawings accompanying and forming part of this specification, in which—

Figure 1 is a vertical transverse sectional view of the improvement. Fig. 2 is a plan view of the same, partly in section and with parts broken away. Fig. 3 is a detail view in perspective of the conduit. Fig. 4 is a detail view in perspective of the piston and piston-arm. Fig. 5 is a detail view in perspective of a part of the improvement. Fig. 6 is a detail view in perspective of the hub and wheel. Fig. 7 is a detail view in perspective of another part of this improvement. Fig. 8 is a plan view, partly in section and with parts broken away, of the improvement in a modified form. Fig. 9 is a detail view in perspective of a piece of the packing. Fig. 10 is a vertical transverse sectional view of another modification of the improvement. Fig. 11 is a top plan view, partly in section and with parts broken away, of the modification of the improvement shown in Fig. 10; and Figs. 12, 13, and 14 are diagrammatic views of the piston and hub and rotary member, showing their relative positions at different periods in the rotation of the piston.

Similar characters of reference designate

corresponding parts in the different figures of the drawings.

In the construction shown two intersecting cylinders 2 and 3 are mounted on a suitable bed-plate 4. A rotatable shaft 5 is concentrically mounted in cylinder 2 and in practice may be provided with suitable stuffing-boxes (not shown) between such shaft 5 and the walls of the openings in the cylinder-head through which it passes and with suitable bearings. If desired, such shaft 5 may be provided at one end with a driving-pulley 6 or other suitable means for the transmission of power. In the cylinder 3 is a rotary member, shown here as comprising a rotatable tubular hub 7, which is shown concentrically mounted in said cylinder and in practice may be provided with suitable stuffing-boxes (not shown) between such hub 7 and the walls of the openings in the ends of the cylinder 3 through which such hub 7 passes, and with suitable bearings. The cylinders 2 and 3 may have a transverse partition 8, dividing their interiors into two compartments each 9 and 10 and 11 and 12, respectively. The compartment 11 may be of greater diameter than the rest of such cylinder 3. In practice packing (not shown) may be provided between the shaft 5 and the hub 7 and the walls of the openings in the partition 8 through which they pass.

In the compartment 10 of the cylinder 2 a piston 13 is keyed or otherwise suitably secured to the shaft 5 or made integral therewith. Such piston 13 may comprise a cylindrical portion 14, which is smaller in diameter than the cylinder 2, in which it rotates, and an arm 15, shown having substantially straight sides, which projects from such cylindrical portion 14 and extends to the inner periphery of such cylinder 2, such arm 15 fitting properly against the walls of said cylinder 2 and shown in cross-section with its outer end curved. In the compartment 9 of the cylinder 2 a disk 16, having an arm 17, is keyed or otherwise suitably secured to said shaft 5 or made integral therewith, substantially approximately in the same radial position relative to such shaft 5 as the piston 13. One side of said arm 17 and the adjoining portion of the disk 16 may be cut away to permit the passage of the disk 18, hereinafter described, and said arm 17 may be provided near its outer end on such cut-away portion with a stud 19, here shown cylindrical.

In the compartment 11 of the cylinder 3 a disk 18, substantially of the same diameter as the interior of said compartment 11, is keyed or otherwise suitably secured to the hub 7 or made integral therewith. The periphery of the disk 18 is cut away at intervals to form curved recesses 21, which engage the periphery of the disk 16 for an appreciable time during the rotation of the piston 13 and during such engagement prevent the hub 7 from turning. Between each pair of such recesses 21 a slot 22, with relatively long sides tangential respectively to the circle described by the inner and outer sides of the stud 19 as the piston 13 rotates and the width of which is substantially equal to the width or diameter of the stud 19, is cut in the disk 18, the stud 19 being adapted to move in such slots 22 and rotate the hub 7 as the arm 15 crosses the opening between the cylinders 2 and 3. These slots 22 in the form of engine shown are radial to the hub.

In the compartment 12 of the cylinder 3 a rotary member 23, shown here as of such diameter that its periphery rolls on the cylindrical portion 14 of the piston 13 and fits properly against the walls of its cylinder adjacent to the opening between the cylinders 2 and 3, is keyed or otherwise suitably secured to or made integral with the hub 7. Such member 23 has recesses 24 in its periphery, each of curved formation from end to end and of suitable depth and shape to engage and fit properly against the curved end of the piston-arm 15 during its passage across the opening between the cylinders 2 and 3, preventing the escape of any of the motive medium around the arm 15 during that part of its rotation. In each recess 24 is a port 25, one of which serves as an inlet-port and another as an outlet-port when the rotary member is at rest.

The recesses 24 are equal in number and placed substantially in the same relative radial position with the hub 7 as the slots 22. The parts of the member 23 between the recesses 24 may be termed "abutments," and when said member 23 is at rest one of these abutments will be in the path of the arm 15 on the center line of the cylinders 2 and 3, and the two adjoining abutments will then be adjacent to the edges of the opening between the cylinders 2 and 3.

In the construction shown a conduit 26, having one end closed, projects into the hub 7 and is provided on its exterior surface on opposite sides with longitudinal recesses 27 and with a port 28 on one side intermediate such recesses 27. The recesses 27 communicate with suitable exhaust connections. (Not shown.) The conduit 26 communicates with the source of supply (not shown) and may be in practice supported in any suitable way and is here shown mounted on a U-shaped bracket 29, secured to the end of the cylinder 3. This conduit 26 may be turned by a handle 30, working in a slot 31 in one arm of the bracket 29, to bring the port 28 opposite one of the ports 25 when such port 25 is then the inlet-port, which will present one of the longitudinal recesses 27 to another of the ports 25, which is then the outlet-port.

The operation of this engine, it will be observed, is as follows: The parts being in the operative position, (shown in Fig. 1,) the conduit 26 is turned so as to make the port 28 register with one of the ports 25, which is then the inlet-port. This permits the medium to enter the cylinder 2 and pass around

the piston 13 until it reaches the working face of the arm 15, when it forces the arm 15 from right to left, the stud 19 entering one of the slots 22 in the disk 18, causing the hub 7, with the member 23, to rotate. It will be observed that the sides of the slot 22 being tangential to the circles described by the outer and inner sides of the stud 19, the disk 18, member 23, and hub 7 will begin to rotate substantially infinitesimally slowly as the stud 19 enters the recess 22, increasing in rapidity until the stud 19 is in a line with the center of the cylinders 2 and 3, when such rotation will be at its maximum, and will again decrease until as the stud 19 leaves the slot 22 it will be again infinitesimally slow. This fact will substantially prevent any jar as stud 19 enters slot 22 and as the periphery of the disk 16 and the curved recess 21 of the disk 18 come into engagement. As the stud 19 moves in the slot 22 the unrecessed portion of the disk 18 rotates in the cut-away portion of the disk 16, such unrecessed portion of the disk 18 passing out of the cut-away portion of the disk 16 as the stud 19 leaves recess 22. The engagement of the disk 16 and the recess 21 prevents the rotation of the member 23 during the rotation of the piston 13 until the stud 19 again enters another slot 22. As the piston-arm 15 comes to the opening between the cylinders 2 and 3 the means to revolve the member 23 has brought one of the recesses 24 to the side of the opening, so that the piston-arm 15 fits properly in such recess 24, and the boundary of the said recess 24 is so constructed and the means of rotating the member 23 is such that the piston-arm 15 fits properly against such boundary as it passes across the opening between cylinders 2 and 3, the recess 24 substantially acting as the wall of the cylinder 2. As the piston-arm 15 passes across the opening between the cylinders 2 and 3 that part of the member 23 which previously formed the abutment recedes, and its place is taken by an adjoining similar part of member 23, one of the ports 25, which formerly constituted the outlet-port, becoming the inlet-port, having passed across the unrecessed part of the conduit 26 to the port 28. This change of abutments and also from the time the medium is cut off until it is turned on again the interval is very short, as this occurs at the time of the maximum rotation of the member 23. The medium is cut off by the time the edge of the abutment leaves the piston 13 and is again turned on as the edge of the adjoining abutment engages said piston 13, when it is in position to allow it to exercise its full force on the piston-arm 15. When the engine is running under certain conditions and there is not enough force to carry the piston-arm 15 across this interval, a fly-wheel may be used or two or more such engines properly put on a single shaft. Although the abutment sustains the reaction of the medium used, there is no tendency of the member 23 to rotate, such pressure being equalized by the pressure on the opposite side of the same recess 24, the reaction acting substantially radially against the hub 7 and there being no force tending to hinder the rotation of the member 23 other than friction. The ports 25 and 28 are shown registering full in Fig. 1 when the member 23 is at rest; but in Fig. 13 the port 28 is turned so that it registers only partly with one of the ports 25, in which case the expansion of the medium can be used if desired.

When it is desired to stop the engine, the conduit or member 26 is turned so that its port 28 will lie substantially in the plane of the axes of the two rotary members, whereupon during the further rotation of the piston under the expansive energy of the steam such port 28 will register with one of the ports 25 only when such port 25 and the piston-arm are in the same plane as the port 28, so that the passage of steam through the port 25 will be cut off by the end of the piston-arm. Upon turning the conduit 26 so that the port 28 will register with the port 25, which in the previous cycle of operation constituted the exhaust-port, the engine will be reversed.

One form of this invention is here shown and described; but it may be modified in many ways, some of which modifications will now be pointed out.

In Fig. 8 a modification is shown in which the piston 13 has terminal heads 32, provided with suitable packing-rings 33, the partition 8 in cylinder 2 being dispensed with. In this case the member 23 revolves between the heads 32, and the disk 16 is made integral with the cylindrical portion 14 of the piston 13 on the outside of one of the terminal heads 32.

In Figs. 10 and 11 the stud 19 and the slots 22 may be dispensed with and the disk 18 simply provided with the curved recess 21. In this case the periphery of the piston-arm 15 is the actuating cause of the partial rotation of the member 23. The disks 16 and 18 may be placed, if desired, on the shaft 5 and hub 7 at a distance away from the cylinders 2 and 3 and may be provided with a suitable casing.

Any suitable form of packing or packing-rings may be used and may be placed as required by the particular construction of the improvement adopted; but the form of packing shown, Fig. 9, which may be the preferred form, if desired, comprises a T-shaped strip 36, provided along its broad portion with a spring 37, which may be a corrugated leaf-spring, and inverted-T-shaped grooves 38 may be provided to receive such strips, the springs 37 tending to force such packing against the walls of the cylinder outwardly.

I have described and shown my invention more particularly as an improved rotary engine; but it may be used also for many other purposes—such, for instance, as a pump for liquids or a meter.

Having described my invention, I claim—

1. In a rotary motor, the combination of a cylinder; a chamber opening into said cylinder; an intermittently-rotary member in said chamber having recesses in its periphery; a rotary piston in said cylinder having an arm provided with substantially straight sides and a curved end, said arm projecting successively into said recesses substantially its entire length during one part of its rotation and having its curved end engaging successive parts of the walls of each of said recesses during each partial rotation of said rotary member.

2. In a rotary motor, the combination of a cylinder; a chamber opening into said cylinder; an intermittently-rotary member in said chamber having curved recesses in its periphery each provided with a port communicating with the interior of said member; a rotary piston in said cylinder having an arm provided with substantially straight sides and a curved end, said arm projecting successively into said recesses substantially its entire length during one part of its rotation and having its curved end engaging successive parts of the wall of each of said recesses during each partial rotation of said rotary member, the organization being such that the walls of the recess into which the arm projects form a continuation of the walls of the cylinder and those portions of the periphery of said member intermediate said recesses form successive abutments between the rotations of said member.

3. In a rotary motor, the combination of a cylinder; a chamber opening into said cylinder; an intermittently-rotary member in said chamber having substantially parabolically-curved recesses in its periphery each provided with a port communicating with the interior of said member; a rotary piston in said cylinder having an arm provided with substantially straight sides and a curved end, said arm projecting successively into said recesses substantially its entire length during one part of its rotation and having its curved end engaging successive parts of the wall of each of said recesses during each partial rotation of said rotary member, the organization being such that the walls of the recess into which the arm projects form a continuation of the walls of the cylinder and those portions of the periphery of said member intermediate said recesses form successive abutments between the rotations of said member.

4. In a rotary motor, the combination of a cylinder; a rotary piston therein having an arm; a chamber opening into said cylinder; an intermittently-rotary member in said chamber having recesses in its periphery, each having its wall continuously curved from end to end and adapted during the rotation of said member to receive the piston and form continuations of the walls of said cylinder, those portions of the periphery of said member intermediate said recesses forming successive abutments between the rotations of said rotary member, the end of said piston-arm engaging successively the curved portions of a recess at each rotation of the piston.

5. In a rotary motor, the combination of a cylinder; a rotary piston therein; a chamber opening into said cylinder; an intermittently-rotary, hollow member in said chamber, the said member having recesses in its periphery adapted during the rotation of said member to receive the piston and form a continuation of the walls of said cylinder, and the portions of the periphery of said member intermediate said recesses forming successive abutments between the rotations of said member, said recesses and the interior of said member being connected by ports; and a conduit projecting into said hollow member and having on its exterior longitudinal recesses on opposite sides and a port on one side intermediate such recesses, said port and one of said recesses adapted, when said conduit is in working position, to register with two of said member's ports.

6. In a rotary motor, the combination of a cylinder; a rotary piston therein; a chamber opening into said cylinder; an intermittently-rotary, hollow member in said chamber, the said member having recesses in its periphery adapted during the rotation of said member to receive the piston and form a continuation of the walls of said cylinder, and the portions of the periphery of said member intermediate said recesses forming successive abutments between the rotations of said member, said recesses and the interior of said member being connected by ports; and a tubular conduit projecting into said hollow member and having on its exterior longitudinal recesses on opposite sides and a port on one side intermediate such recesses, said port and one of said recesses adapted, when said conduit is in working position, to register with two of said member's ports.

7. In a rotary motor, the combination of a cylinder; a shaft mounted therein; a rotary piston carried by said shaft and having an arm; a chamber opening into said cylinder; a rotary member in said chamber having recesses in its periphery each having its wall continuously curved from end to end and adapted during the rotation of said member to receive the piston and form continuations of the walls of said cylinder, those portions of the periphery of said member intermediate said recesses forming successive abutments between the rotations of said member, the end of said piston-arm engaging successively the curved portions of a recess at each rotation of the piston; and means carried by said shaft and operatively connected with said rotary member for causing said member to make a partial rotation for each complete rotation of said piston.

8. In a rotary motor, the combination of a cylinder; a shaft mounted therein; a rotary piston carried by said shaft; a chamber opening into said cylinder; a rotary member in said chamber and having a hub, said member having recesses in its periphery adapted dur-

ing the rotation of said member to receive the piston and form a continuation of the walls of said cylinder, and the portions of the periphery of said member intermediate said recesses forming successive abutments between the rotations of said member, said recesses and the interior of said hub being connected by ports; means carried by said shaft and said hub for causing said member to make a partial rotation for each complete rotation of said piston; and a conduit having on its exterior longitudinal recesses on opposite sides and a port on one side intermediate such recesses, said port and one of said recesses adapted, when said conduit is in working position, to register with two of said member's ports.

9. The combination of a pair of intersecting cylinders; and a rotary member located in each of said cylinders, such members organized one to make a partial rotation for each complete rotation of the other member, and one of such members provided with a piston and the other provided with recesses in its periphery each having its wall continuously curved from end to end and adapted to form continuations of the walls of the piston-cylinder and a steam-tight joint with the end of said piston during the rotation of said recessed member, said recessed member having ports communicating with said recesses, the partial rotation of such recessed member controlling such ports.

10. The combination of a pair of intersecting cylinders; a rotary member located in each of said cylinders, such members organized one to make a partial rotation for each complete rotation of the other member, and one of such members provided with a piston and the other provided with recesses in its periphery, each having its wall continuously curved from end to end and adapted to form continuations of the walls of the piston-cylinder and a steam-tight joint with the end of said piston during the rotation of said recessed member, said recessed member having ports communicating with said recesses, the partial rotation of such recessed member controlling such ports; a slotted disk operatively connected with said recessed member; and a member operatively connected with the piston and provided with a device adapted to enter said slots, said disk and member having coöperating parts adapted to lock the recessed member against rotation at predetermined periods.

11. In a rotary motor, the combination of a cylinder; a rotary piston therein; a rotatable abutment having a tubular hub and a plurality of recesses for the reception of said piston and for the replacement of the walls of said cylinder during the rotation of said abutment, and with ports connecting said recesses with the interior of said hub; and a conduit having on opposite sides of its exterior longitudinal recesses and on one side intermediate such recesses a port, said port and one of said recesses adapted to register with two of said hub's ports at each rotation.

12. In a rotary motor, the combination of a cylinder; a rotary piston therein; a rotatable abutment having a tubular hub and a plurality of recesses for the reception of said piston and for the replacement of the walls of said cylinder during the rotation of said abutment, and with ports connecting said recesses with the interior of said hub; and a tubular conduit having on opposite sides of its exterior longitudinal recesses and on one side intermediate such recesses a port, said port and one of said recesses adapted to register with two of said hub's ports at each rotation.

13. The combination, with two intersecting cylinders and a rotary member located in each of said cylinders, one of said rotary members having a tubular hub provided with ports and adapted to rotate a predetermined distance for each complete rotation of the other rotary member, of a tubular conduit projecting into said hub and having on its exterior surface longitudinal recesses on opposite sides and a port on one side intermediate such recesses, said port and one of said recesses adapted when the conduit is in working position to register with two of the ports in the rotary member, and means for operating said conduit.

14. The combination, with two intersecting cylinders and a rotary member located in each of said cylinders, one of said rotary members having a tubular hub provided with ports and adapted to rotate a predetermined distance for each complete rotation of the other rotary member, of a member located in said hub and having on its exterior surface longitudinal recesses on opposite sides and a port on one side intermediate such recesses, said port and one of said recesses adapted, when said member is in working position, to register with two of the ports in the rotary member, and means for operating said member.

15. In a rotary motor, the combination of a cylinder; a rotary piston therein having an arm; a chamber opening into said cylinder; a rotatable abutment in said chamber having a hub provided with ports, said abutment having recesses adapted to receive said piston-arm as said abutment rotates; a member located in said hub and having a port and a pair of recesses one at each side of said port, the former communicating with the interior of said member, said port and a recess adapted to register with two of the ports in said hub; a slotted disk operatively connected with said abutment; and a member operatively connected with the piston and provided with a device adapted to enter said slots, said disk and member having coöperating parts adapted to lock the abutment against rotation at predetermined periods.

16. In a rotary motor, the combination of a cylinder; a rotary piston therein provided across its ends and along its sides with inverted-T-shaped packing-grooves; a rotatable abutment provided with similar inverted-T-shaped packing-grooves and having a tubular hub and provided with a plurality of recesses adapted to receive said piston as said abutment rotates and forming a plurality of abutments successively replacing each other during the rotation of said abutment and with ports connecting said recesses and hub; a conduit projecting into said hub and having on opposite sides of its exterior longitudinal recesses and on one side intermediate said recesses a port, said port and one of said recesses adapted to register with two of said hub's ports; a radially-slotted disk mounted on one end of said hub, said disk having portions of its periphery intermediate said slots reëntrant; a member carried by the piston and provided with a stud adapted to enter said slots and with a portion adapted to engage the reëntrant portions of said disk; and spring-controlled T-shaped packing adapted to fit in said packing-grooves.

17. The combination of a pair of intersecting cylinders; a rotary piston located in one of said cylinders and an intermittently-rotary member in the other of said cylinders; a member operatively connected with said intermittently-rotary member, each of said members having recesses, the recesses of one member having a different formation from the recesses of the other member, and said intermittently-rotary member having its recesses communicating with ports and forming abutments effective to successively replace each other during the rotation of said member; means operatively connected with the piston and coöperating with the recesses of the other member for imparting intermittent rotary movement to said intermittently-rotary member, said parts also having coöperating portions effective to lock the intermittently-rotary member against movement at predetermined periods; and a member located interiorly of said intermittently-rotary member and provided with a port communicating with the ports of said member, and with a pair of longitudinally-extending recesses one at each side of said port.

18. The combination of a pair of intersecting cylinders; a rotary piston located in one of said cylinders and an intermittently-rotary member in the other of said cylinders; a member operatively connected with said intermittently-rotary member, each of said members having recesses, the recesses of one member having a different formation from the recesses of the other member, and said intermittently-rotary member having its recesses communicating with ports and forming abutments effective to successively replace each other during the rotation of said member; means operatively connected with the piston and coöperating with the recesses of the other member for imparting intermittent rotary movement to said intermittently-rotary member, said parts also having coöperating portions effective to lock the intermittently-rotary member against movement at predetermined periods; a member located interiorly of said intermittently-rotary member and provided with a port communicating with the ports of said member and with a pair of longitudinally-extending recesses one at each side of said port; and means for rotating said member to reverse or stop the engine.

19. In a rotary motor, the combination of a cylinder; a rotary piston therein having an arm; a chamber opening into said cylinder; and an intermittently-rotary member in said chamber having recesses in its periphery forming abutments adapted successively to replace each other during the rotation of said member, the organization being such that the wall of each recess will be at a predetermined period in position to constitute a continuation of the wall of the cylinder so that the end of said piston-arm will, as it passes from the cylinder-wall, engage the wall of one of said recesses and such end continue to engage successive portions of such wall until it passes from such recess into engagement with the cylinder-wall proper, whereby the end of the piston-arm will be in engagement with some part of the cylinder-wall during its entire rotation.

20. In a rotary motor, the combination of a cylinder; a rotary piston therein having an arm; a chamber opening into said cylinder; an intermittently-rotary member in said chamber having recesses in its periphery forming abutments adapted successively to replace each other during the rotation of said member, the organization being such that the wall of each recess will be at a predetermined period in position to constitute a continuation of the wall of the cylinder so that the end of said piston-arm will, as it passes from the cylinder-wall, engage the wall of one of said recesses and such end continue to engage successive portions of such wall until it passes from such recess into engagement with the cylinder-wall proper, whereby the end of the piston-arm will be in engagement with some part of the cylinder-wall during its entire rotation; and means in operative connection with such piston and rotary member for imparting intermittent rotary movement to said member and having coöperating parts effective to lock said member against movement at predetermined periods.

21. The combination with two intersecting cylinders, of a rotary member located in each of said cylinders, one of said members having a piston and the other of said members having recesses with which said piston coöperates and having its hub provided with ports communicating with said recesses, and adapted to be rotated a predetermined distance for

each complete rotation of the other rotary member; a tubular member located in said hub and having a port communicating with the interior of said member, and also having a longitudinally-extending recess cut off from communication with the interior of said member by a wall of said member and opening at the end of said hub, said port and said recess adapted when said member is in working position to register with ports in said hub.

SINCLAIR J. JOHNSON.

Witnesses:

FRED. J. DOLE,

C. E. VOSS.