No. 834,478. PATENTED OCT. 30, 1906.

P. J. DE B. KOPS.

ROTARY ENGINE.

APPLICATION FILED MAR. 13, 1906.

3 SHEETS—SHEET 1.

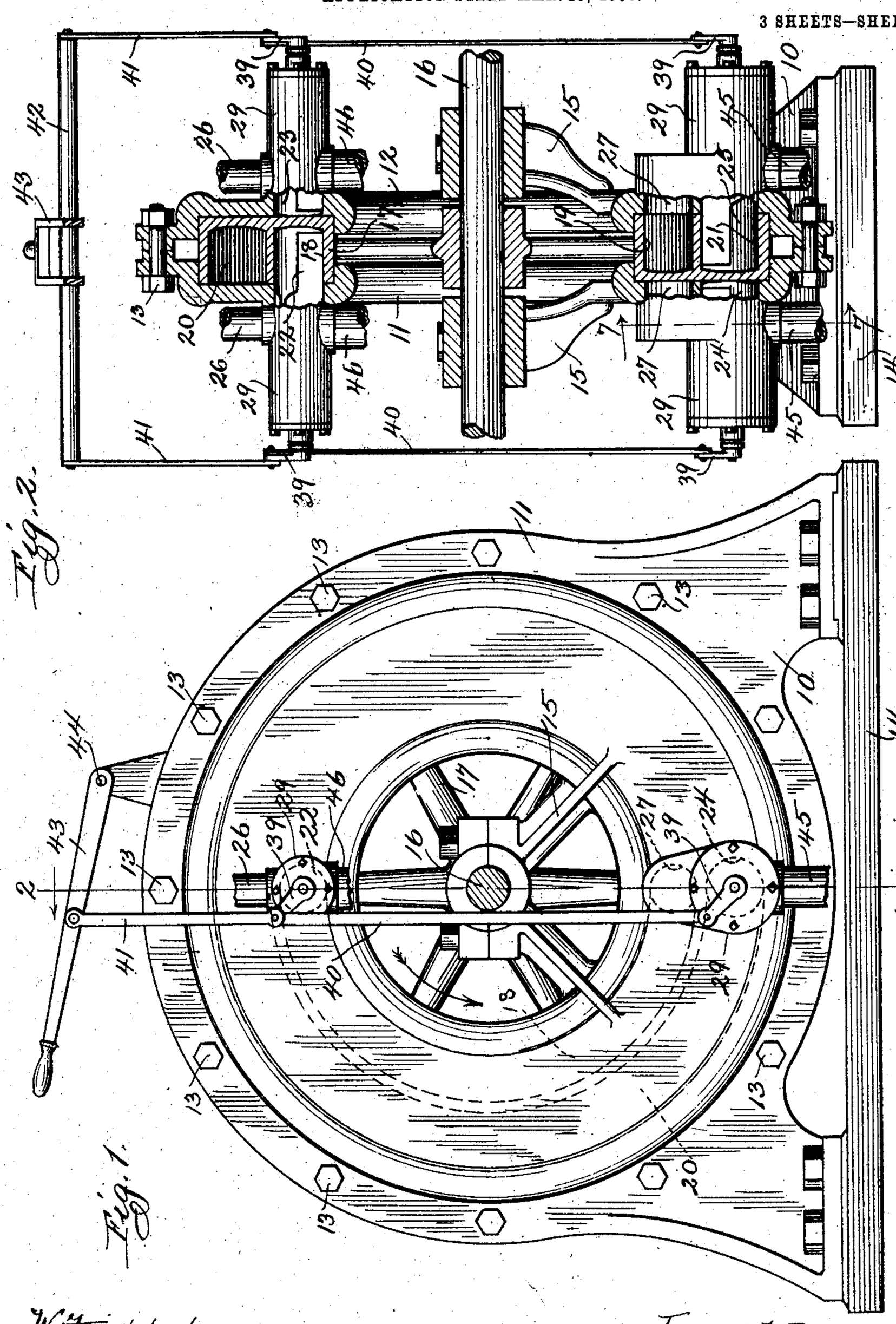

Fig. 2.

Fig. 1.

Witnesses:

N. L. Williamson

M. C. Coburn.

Inventor:

Paul. J. de Bruyn Kops

By R. J. Jacker

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3 SHEETS—SHEET 3.

Fig. 7.

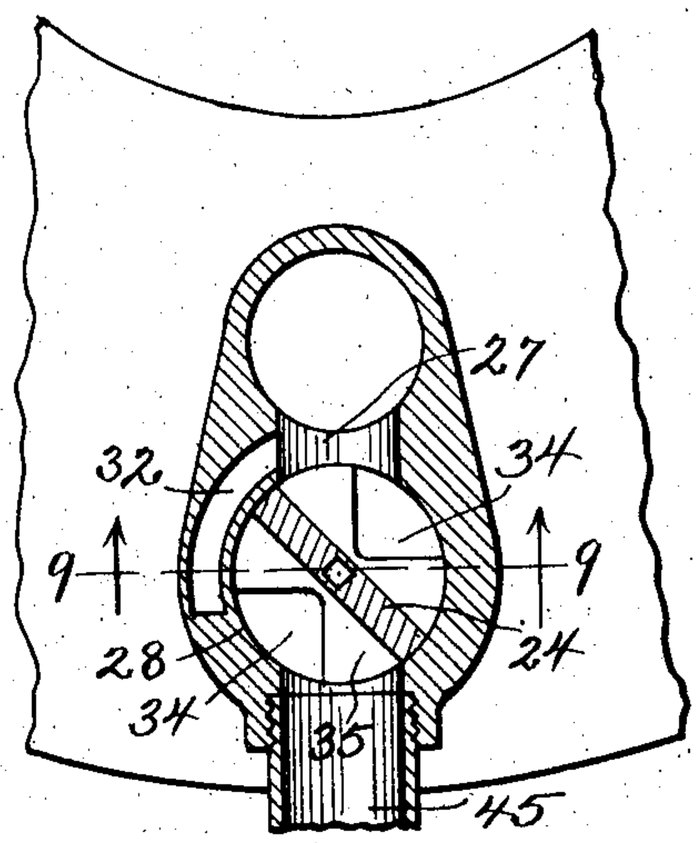


Fig. 8.

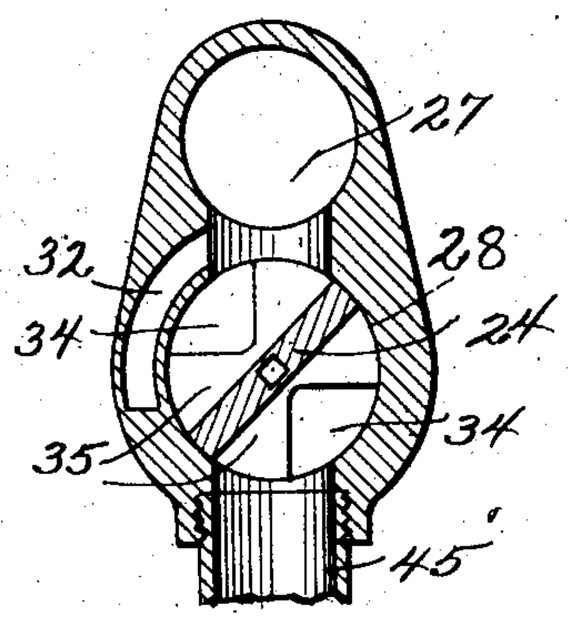
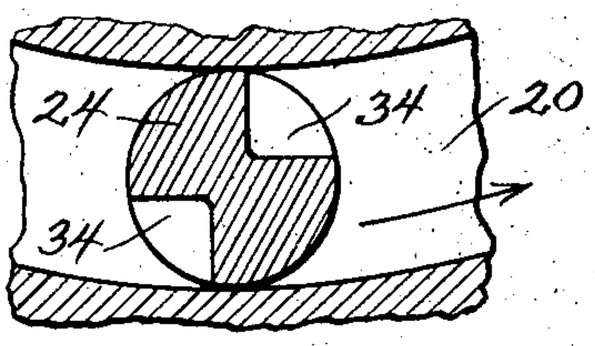


Fig. 9.

Fig. 10.



Witnesses:

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3 SHEETS—SHEET 2.

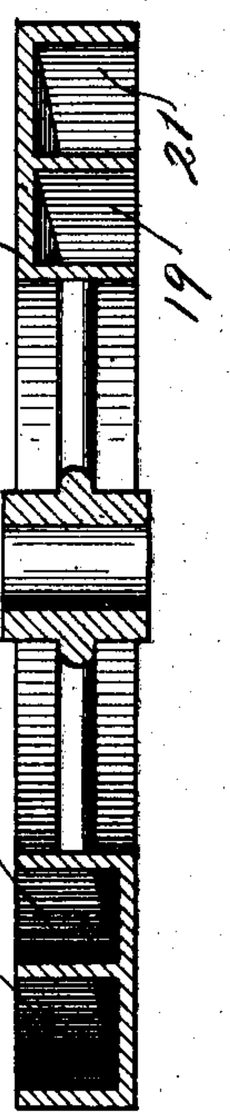

Fig. 4.

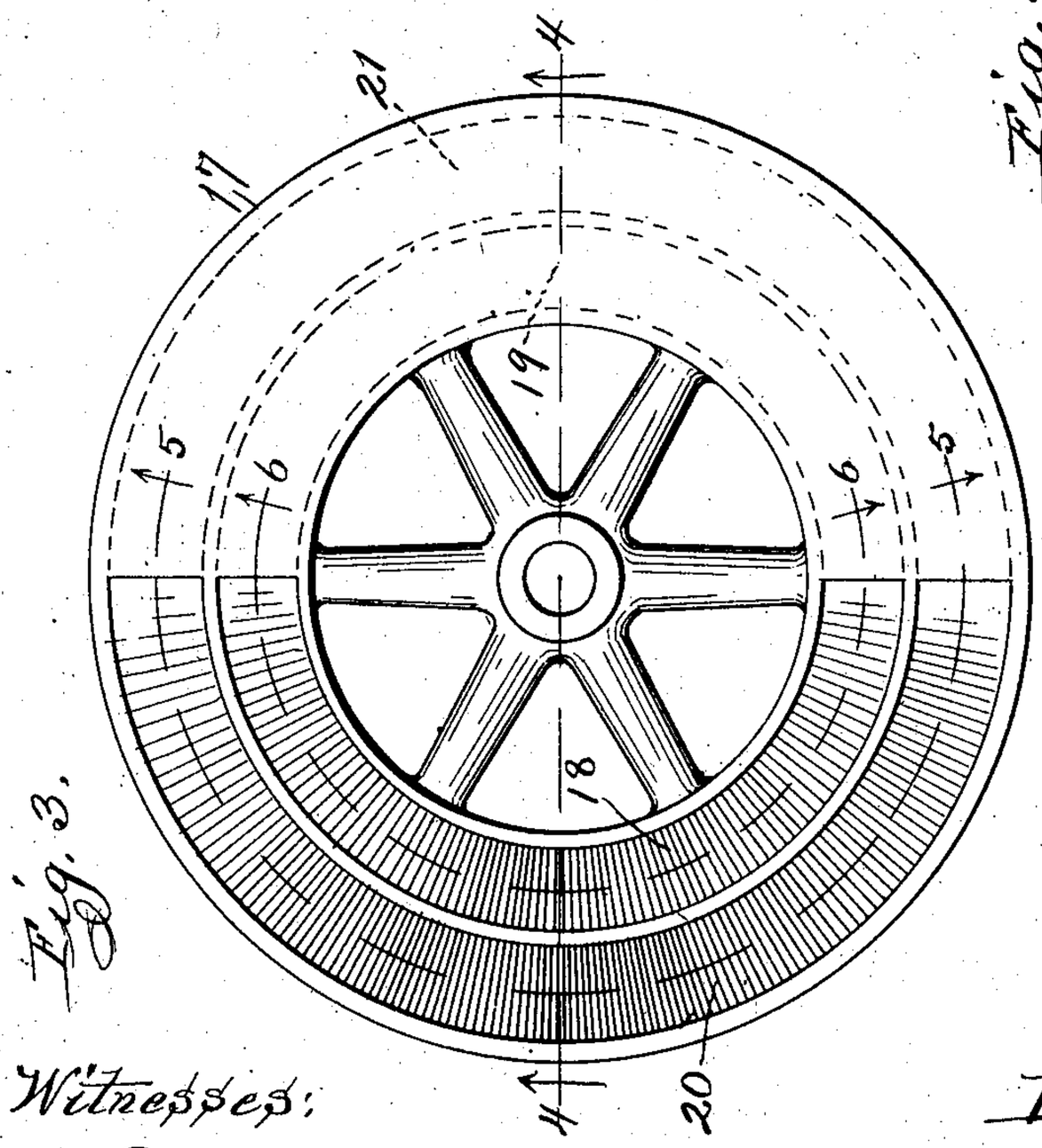

Fig. 3.

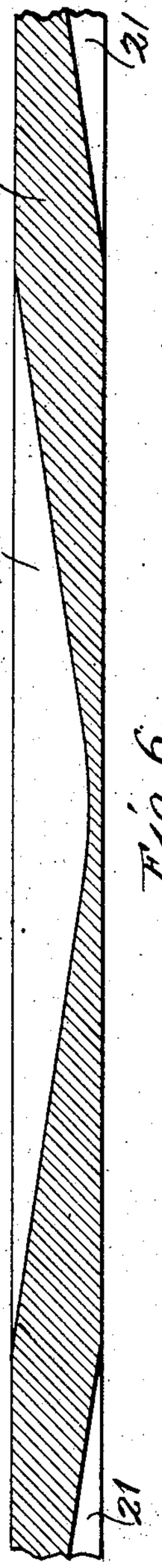

Fig. 5.

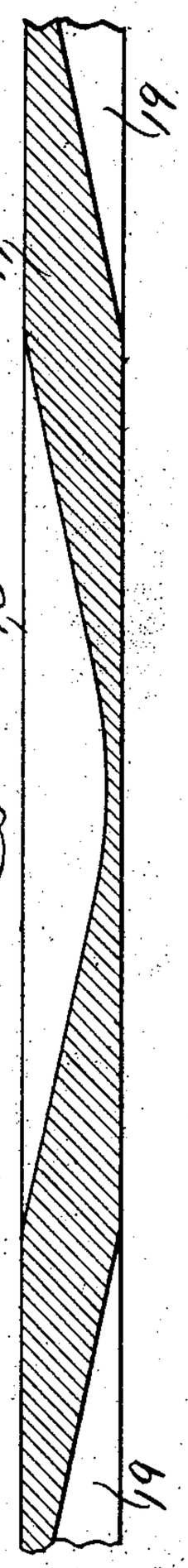

Fig. 6.

Witnesses:

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UNITED STATES PATENT OFFICE.

PAUL J. DE BRUYN KOPS, OF WAKE, VIRGINIA.

ROTARY ENGINE.

No. 834,478. Specification of Letters Patent. Patented Oct. 30, 1906.

Application filed March 13, 1906. Serial No. 306,472.

To all whom it may concern:

Be it known that I, PAUL J. DE BRUYN KOPS, a citizen of the United States, residing at Wake, in the county of Middlesex and State of Virginia, have invented a new and useful Rotary Engine, of which the following is a specification.

My invention relates to rotary engines in which a pressure fluid, as steam, is used to drive or rotate the piston; and the objects of my improvements are, first, to provide a compact and durable construction; second, to make the operating parts of simple construction; third, to have the fluid-pressure-supply valves operate automatically without any lever or rod connections; fourth, to facilitate the compounding of the pressure fluid; fifth, to enable the reversing of the engine, and other objects to become apparent from the description to follow.

By the use of my invention I aim to overcome many of the objectionable features common to rotary engines. All lever, cam, or rod connections with relation to the supply-valves are dispensed with, which obviates the possibility of these parts getting out of order or refusing to properly work during high speed. A very simple and inexpensive means is provided for compounding the pressure fluid, and the valves for admitting the pressure fluid into the piston-chamber serve also as the abutments in the piston-chamber, thus reducing the number of parts to a minimum.

The engine, generally speaking, consists of three parts—the revolving piston and the two-piece frame inclosing the same. The valves or controlling parts for the pressure fluid are arranged to move in the frame and in and out of arcuate grooves provided on the sides of the wheel-like piston. These controlling parts I term the "valves," which also serve as the abutments for the fluid-pressure when forcing the piston around and are of a novel construction. They are so made that by giving them a one-quarter rotation in either direction it will cause the piston to rotate in an opposite direction.

I have illustrated an engine embodying my invention on the accompanying three sheets of drawings, forming a part of this specification, in which—

Figure 1 is a side elevation. Fig. 2 is a section on line 2 2 of Fig. 1, partly in elevation. Fig. 3 is a side elevation of the piston detached. Fig. 4 is a section on line 4 4 of Fig. 3. Fig. 5 is a section on line 5 5 of Fig. 3. Fig. 6 is a section on line 6 6 of Fig. 3. Fig. 7 is a section on line 7 7 of Fig. 2. Fig. 8 is a similar view showing the valve in another position. Fig. 9 is a section on line 9 9 of Fig. 7, and Fig. 10 is a section on line 10 10 of Fig. 9.

Similar reference characters refer to similar parts throughout the several views.

The frame 10 may be of any desired form, but I prefer to make it of two counterparts 11 and 12, secured together by bolts 13 and mounted on a base 14. The frame is provided with brackets 15, surmounted by bearings for the shaft 16, on which is secured the wheel-like piston 17, the rim of which is slidingly fitted between the frame parts 11 and 12.

Both sides of the rim of the piston 17 are provided with similarly-formed arcuate grooves, those on one side being on one half of the piston and those on the other side being on the other half of the piston, so as to keep the piston in perfect balance. The grooves 18 and 19 (see Figs. 3 and 4) are smaller in area and closer to the shaft 16 than the grooves 20 and 21. This is to provide for the expansion of the pressure fluid, which is first admitted to the grooves 18 and 19, and after exhausting from these is admitted into the larger grooves 20 and 21. To accomplish this, I provide the sliding valves 22 and 23 for the grooves 18 and 19, respectively, and the similar valves 24 and 25 for the grooves 20 and 21, respectively. The high-pressure-fluid pipes 26 lead to the valves 22 and 23, while the exhaust-ports 27 lead from the grooves 18 and 19 to the valves 24 and 25. In this one respect only is there any difference in the valves 22, 23, 24, and 25 as to their construction, operation, and connection, and I will therefore describe only one of said valves in detail, which will suffice for a description of all four.

Referring to Figs. 7 to 10, valve 24 is made to fit snugly in a round bore 28 in the extension 29 provided on the frame 10 and extending out laterally therefrom directly over the groove 20 in the piston 17. To constantly hold the one end of the valve 24 against the piston 17 so that it will rest snugly against the bottom of the groove 20 at the proper time, an enlargement 30 is provided on the other end of the valve which fits in the enlarged bore 31 and pressure fluid is admitted through the passage 32 from the inlet 27 to constantly press against the end of the valve, there being a vent 33 in the extension 29 be-

low the enlargement 30 leading to the outside atmosphere.

The end of the valve 24 adjacent to the piston 17 is provided with two diametrically oppositely arranged longitudinal grooves 34, extending from near the extreme end of the valve back a distance equal to the greatest depth of the groove 20, where they merge into the broader grooves 35. Each groove 34 extends slightly less than one-quarter way around the valve 24, so that a perfect abutment will be formed by the valve 24 in the groove 20, no matter which of its two positions the valve may be in. (See Fig. 10.) Each groove 35 extends circumferentially slightly less than one-half way around the valve, longitudinally just beyond the inlet-port 27, and necessarily one is diametrically opposite the other. The reason for making two grooves 34 and two grooves 35 is to enable the reversing of the engine, which is done by rotating all the valves one-quarter way.

It will be seen that when the valve is in the position shown in Fig. 7 the pressure fluid will enter groove 35 from port 27, pass through groove 34 and enter the groove 20 in the piston 17, so as to rotate the piston in the direction indicated by the arrow in Fig. 10, and if the valve is placed in the reverse position, as seen in Fig. 8, the pressure fluid will enter the groove 20 in piston 17, so as to rotate the piston in a direction reverse to that indicated by the arrow in Fig. 10.

Any convenient means may be provided to simultaneously rotate all four valves a one-quarter revolution. I have shown one, which consists of providing each valve with a concentric square hole 36, into which is slidingly fitted the square end of a shaft 37, which extends out through a stuffing-box 38 and has secured to its outer end a crank-arm 39. As seen in Figs. 1 and 2, the crank-arms 39 on either side of the engine are connected by links 40, and the upper ends of these links are connected by other links 41 to a cross-bar 42 of a hand-lever 43, which is pivoted to the frame 10 at 44. To rotate the valves, the hand-lever 43 is moved down or up, as the case may be.

The grooves 18, 19, 20, and 21 extend circumferentially one-half way around on the piston and each of them has its bottom inclined in either direction to form the approaches shown in Figs. 5 and 6.

In operation, referring to the side shown in Fig. 1, the pressure fluid enters at 26, passes through valve 22 and into the groove 18, forcing the piston 17 around in the direction indicated by the arrow in Fig. 1. When the rear end of the groove 18 reaches the valve 22, the front end of the groove 20 is at valve 24, (in which position it is shown by dotted lines at Fig. 1,) the flow of pressure fluid at valve 22 is shut off, and the expanding pressure of the fluid in groove 18 is starting to pass through port 27 and valve 24 into groove 20, the front end of which is now at valve 24, thus assisting in the rotation of the piston 17. As the piston continues to revolve the valve 24 enters the groove 20 and the pressure fluid in the groove 20 back of valve 24 is allowed to exhaust to the atmosphere through port 45 during the time that the pressure fluid from groove 18 is passing through port 27 and valve 24 into groove 20 in front of valve 24. As the piston 17 revolves still further and the front end of groove 18 reaches valve 22 again, said valve enters said groove and the fluid remaining in groove 18 after passing port 27 is allowed to exhaust into the atmosphere through valve 22 and port 46.

The grooves and their respective valves on either side of the piston are so arranged with relation to each other that when the pressure fluid at valve 22 is about to be shut off the pressure fluid at valve 23 is turned on, so that the engine has no dead-center

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

1. In a rotary engine, a rotatable disk provided with an arcuate groove having circumferentially-inclined approaches secured to a shaft, a suitable frame inclosing said arcuate groove and a pin capable of partial rotation guided by said frame serving as an inlet-valve for the steam arranged to move in and out of said arcuate groove.

2. In a rotary engine, a rotatable disk provided with a depressed surface on either side, each having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable pins guided by said frame serving as inlet-valves for the steam arranged to be moved in and out of said depressed surfaces.

3. In a rotary engine, a rotatable disk provided on one side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surface, a rotatable pin guided by said frame arranged to move in and out of said depressed surface laterally and a portion of said pin cut away to serve as a passage for steam

4. In a rotary engine, a rotatable disk provided on one side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surface and a rotatable pin guided by said frame arranged to move in and out of said depressed portion laterally serving as an abutment for the steam and an inlet-valve for the steam.

5. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said

groove, a rotatable pin guided by said frame arranged to move in and out of said groove laterally and a portion of said pin cut away to serve as a passage for steam.

6. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove and a rotatable pin guided by said frame arranged to move in and out of said groove laterally serving as an abutment for the steam and an inlet-valve for the steam.

7. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves and rotatable pins serving as inlet-valves for the steam guided by said frame and arranged to move in and out of said grooves laterally.

8. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally and a portion of each cut away to serve as a passage for steam.

9. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves and rotatable pins guided by said frame arranged to move in and out of said grooves laterally serving as abutments for the steam and as inlet-valves for the steam.

10. In a rotary engine, a rotatable disk provided on either side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable pins guided by said frame arranged to move in and out of said depressed portion laterally and a portion of each pin cut away to serve as a passage for steam.

11. In a rotary engine, a rotatable disk provided on one side with two arcuate grooves of different areas having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally and a portion of each pin cut away to form a passage-way for steam.

12. In a rotary engine, a rotatable disk provided on one side with two arcuate grooves of different areas having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally serving as abutments for the steam and as inlet-valves for steam.

13. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentally-inclined approaches, a suitable frame inclosing said groove, and a rotatable pin serving as an inlet-valve for steam guided by said frame arranged to move in and out of said groove laterally.

14. In a rotary engine, a rotatable disk provided with an arcuate groove having circumferentially-inclined approaches secured to a shaft, a suitable frame inclosing said arcuate groove and a pin capable of partial rotation guided by said frame serving as an inlet and outlet valve for the steam arranged to move in and out of said arcuate groove.

15. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove, a rotatable pin guided by said frame arranged to move in and out of said groove laterally and a portion of said pin cut away to serve as an inlet and outlet for steam.

16. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove and a rotatable pin guided by said frame arranged to move in and out of said groove laterally serving as an abutment for the steam and an inlet and outlet valve for the steam.

17. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves and rotatable pins serving as inlet and outlet valves for the steam guided by said frame and arranged to move in and out of said grooves laterally.

18. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally and a portion of each cut away to serve as an inlet and outlet for steam.

19. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves and rotatable pins guided by said frame arranged to move in and out of said grooves laterally serving as abutments for the steam and as inlet and outlet valves for the steam.

20. In a rotary engine, a rotatable disk provided on one side with two arcuate grooves of different areas having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable pins guided by said frame arranged to move in and out of said depressed portion laterally and a portion of each pin cut away to serve as an inlet and outlet for steam.

21. In a rotary engine, a rotatable disk provided on one side with two arcuate

grooves of different areas having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally serving as abutments for the steam and as inlet and outlet valves for steam.

22. In a rotary engine, a rotatable disk provided on either side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces and rotatable abutments guided by said frame arranged to move in and out of said depressed portion laterally and a portion of each abutment cut away to serve as an inlet and outlet for steam.

23. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove, and a rotatable pin serving as an inlet and outlet valve for steam guided by said frame arranged to move in and out of said groove laterally.

24. In a rotary engine, a rotatable disk provided with an arcuate groove having circumferentially-inclined approaches secured to a shaft, a suitable frame inclosing said arcuate groove and a pin capable of partial rotation guided by said frame serving as an inlet and outlet valve for the steam arranged to move in and out of said arcuate groove and means for rotating said pin.

25. In a rotary engine, a rotatable disk provided with a depressed surface on either side, each having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable pins guided by said frame serving as inlet and outlet valves for the steam arranged to be moved in and out of said depressed surfaces and means for rotating said pins simultaneously.

26. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove, a rotatable pin guided by said frame arranged to move in and out of said groove laterally and a portion of said pin cut away to serve as an inlet and outlet for steam.

27. In a rotary engine, a rotatable disk provided on one side with a arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove, a rotatable pin guided by said frame arranged to move in and out of said groove laterally serving as an abutment for the steam and an inlet and outlet valve for the steam and means for rotating said pin.

28. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove rotatable pins serving as inlet and outlet valves for the steam guided by said frame and arranged to move in and out of said groove laterally and means for rotating said pins simultaneously.

29. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally, a portion of each cut away to serve as an inlet and outlet for steam and means for rotating said pins simultaneously.

30. In a rotary engine, a rotatable disk provided on either side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said grooves rotatable pins guided by said frame arranged to move in and out of said grooves laterally serving as abutments for the steam and as inlet and outlet valves for the steam and means for rotating said pins simultaneously.

31. In a rotary engine, a rotatable disk provided on one side with two arcuate grooves of different areas having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable pins guided by said frame arranged to move in and out of said depressed portion laterally and a portion of each pin cut away to serve as an inlet and outlet for steam, and means for rotating said pins simultaneously.

32. In a rotary engine, a rotatable disk provided on one side with two arcuate grooves of different areas having circumferentially-inclined approaches, a suitable frame inclosing said grooves, rotatable pins guided by said frame arranged to move in and out of said grooves laterally serving as abutments for the steam and as inlet and outlet valves for steam and means for rotating said pins simultaneously.

33. In a rotary engine, a rotatable disk provided on either side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable pins guided by said frame arranged to move in and out of said depressed portions laterally serving as abutments for the steam and as inlet and outlet valves for the steam and means for rotating said pins simultaneously.

34. In a rotary engine, a rotatable disk provided on one side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surface, a rotatable abutment guided by said frame arranged to move in and out of said depressed surface laterally, a portion of said abutment cut away to serve as a passage for steam and means of rotating said abutment.

35. In a rotary engine, a rotatable disk provided on one side with a depressed surface having circumferentially-inclined ap-

proaches, a suitable frame inclosing said depressed surface, a rotatable abutment guided by said frame arranged to move in and out of said depressed portion laterally serving as an abutment for the steam and an inlet and outlet valve for the steam and means for rotating said abutment.

36. In a rotary engine, a rotatable disk provided on either side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable abutments guided by said frame arranged to move in and out of said depressed portion laterally and a portion of each abutment cut away to serve as an inlet and outlet for steam and means for rotating said abutment.

37. In a rotary engine, a rotatable disk provided on either side with a depressed surface having circumferentially-inclined approaches, a suitable frame inclosing said depressed surfaces, rotatable abutments guided by said frame arranged to move in and out of said depressed portions laterally serving as abutments for the steam and as inlet and outlet valves for the steam and means for rotating said abutments simultaneously.

38. In a rotary engine, a rotatable disk provided on one side with an arcuate groove having circumferentially-inclined approaches, a suitable frame inclosing said groove, a rotatable pin serving as an inlet and outlet valve for steam guided by said frame arranged to move in and out of said groove laterally and means for rotating said pin.

39. In an engine, a piston, and a valve capable of longitudinal and rotating movements, said valve held normally against said piston by a fluid-pressure.

In testimony whereof I have signed my name to this specification, in presence of two subscribing witnesses, this 3d day of March, 1906, at West Hope, North Dakota.

PAUL J. DE BRUYN KOPS.

Witnesses:

A. J. McKee,

James M. Baker.