2 Sheets--Sheet 1.

J. H. TEAL.
Rotary-Engines.

No. 157,429. Patented Dec. 1, 1874.

FIG I

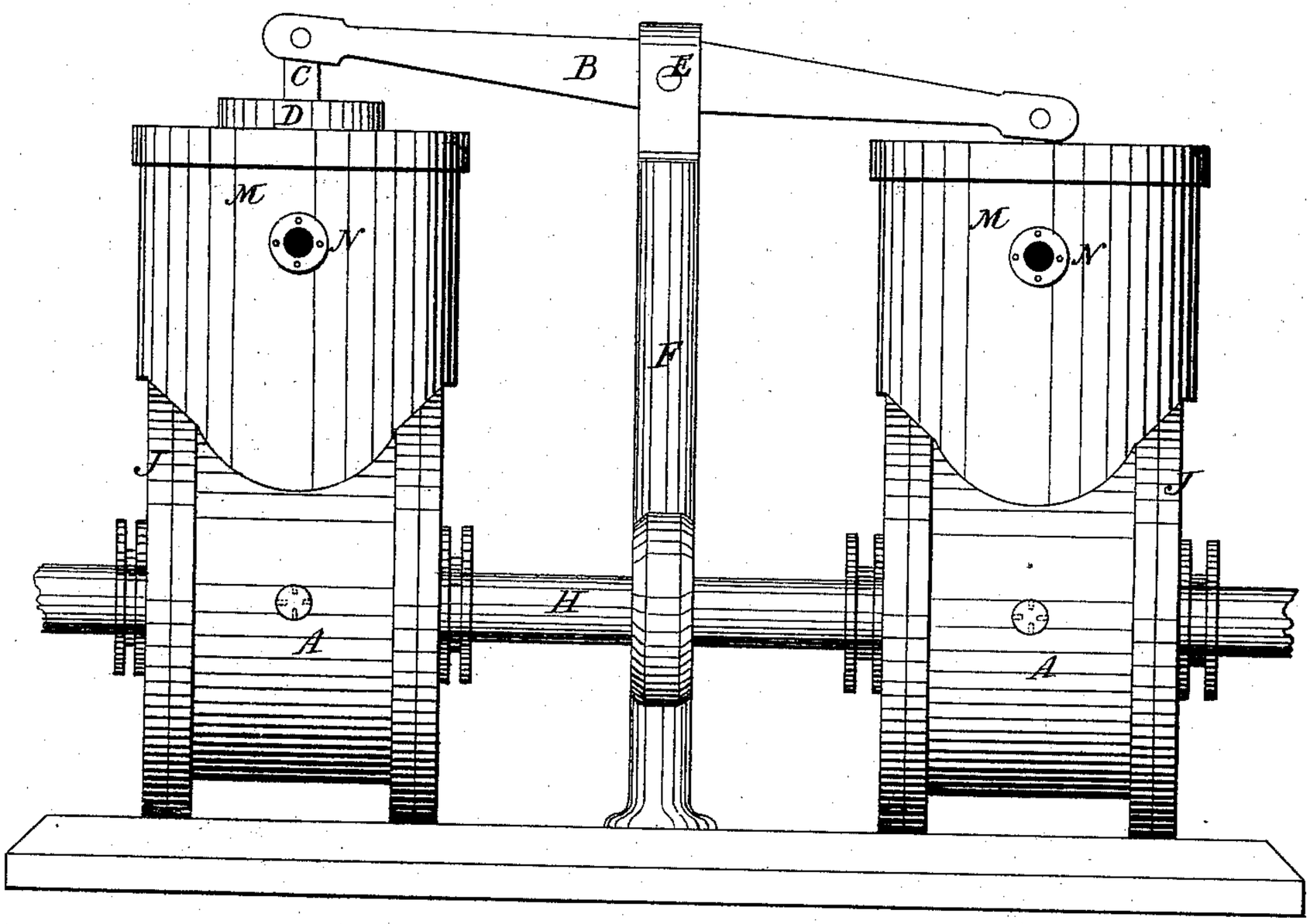
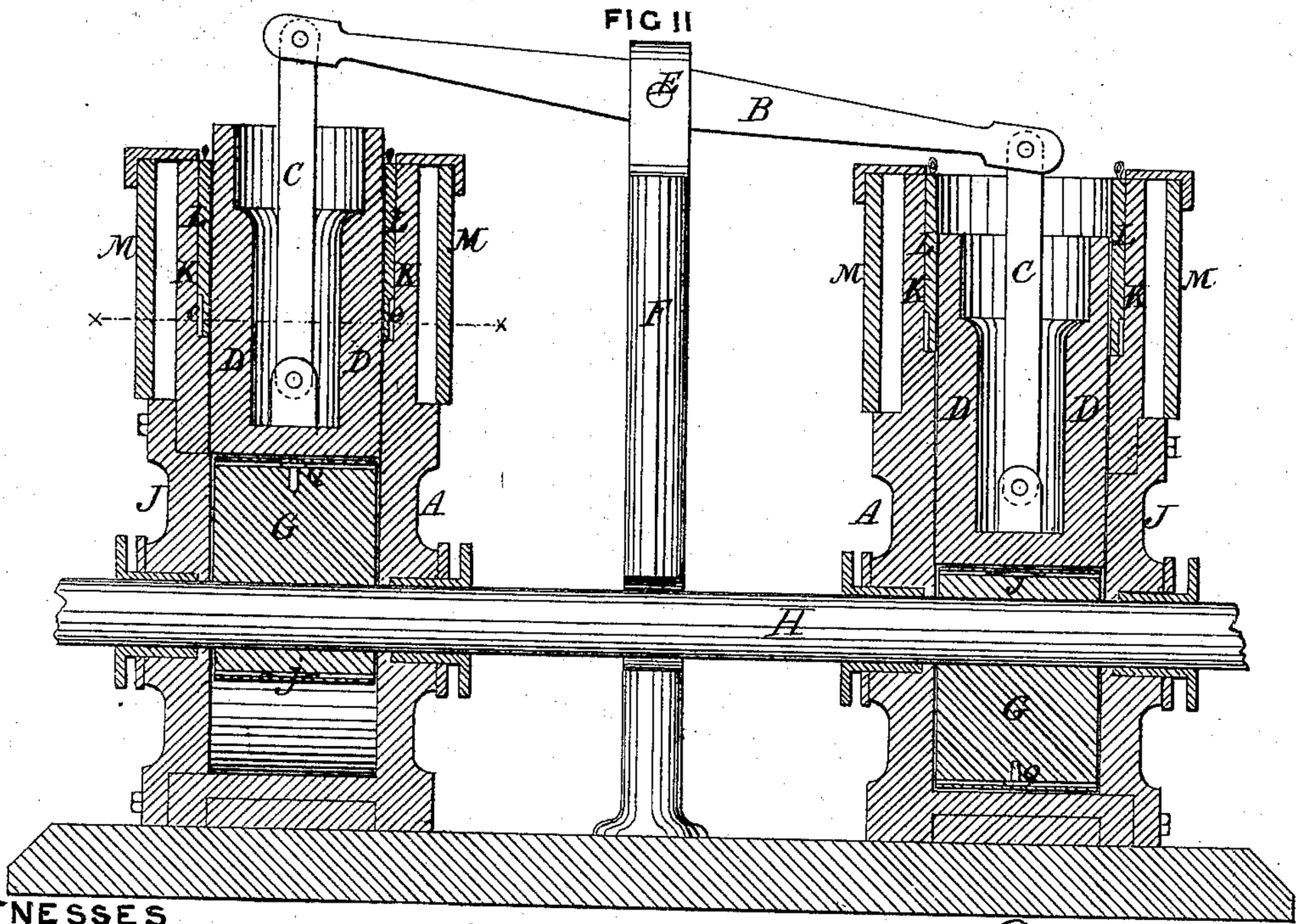


FIG II



WITNESSES
John E. Laing.
J. H. Rutherford

INVENTOR
Jesse Head Teal
by Johnson and Johnson
his Attys.

2 Sheets--Sheet 2.

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FIG III

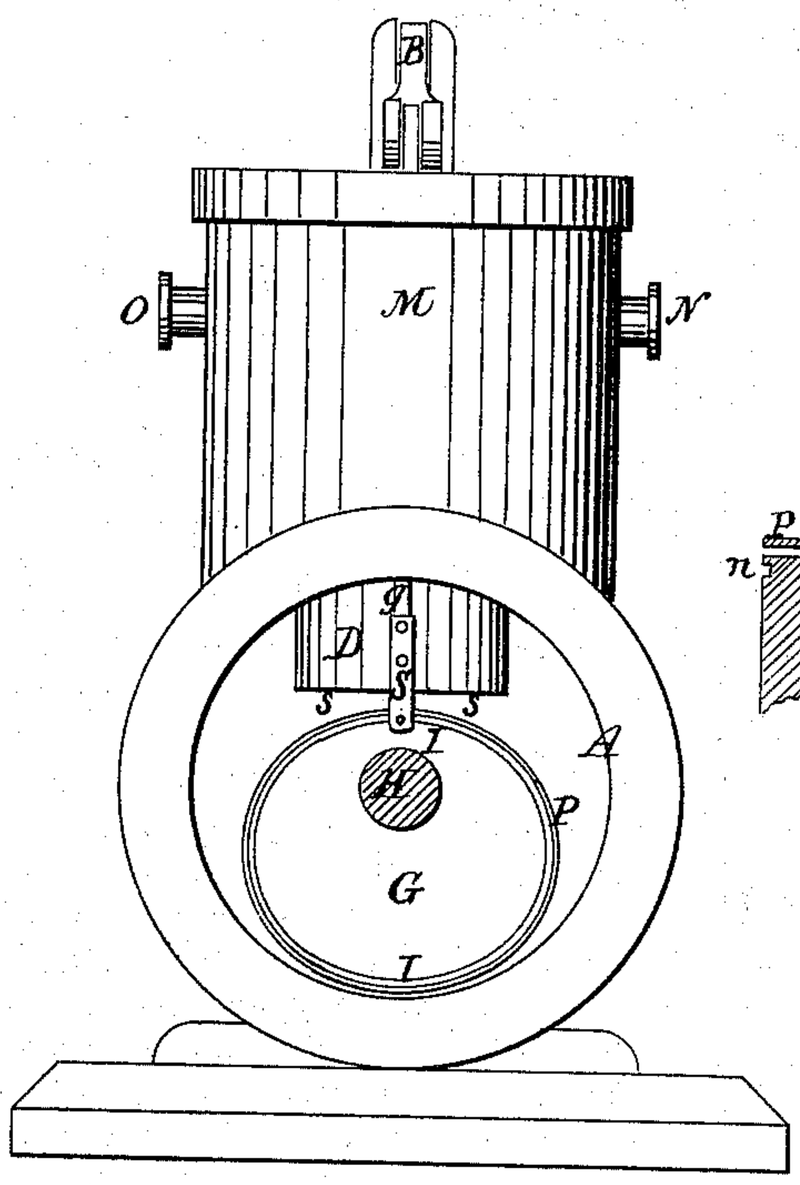


FIG X

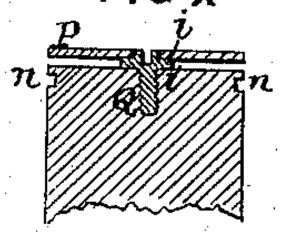


FIG IV

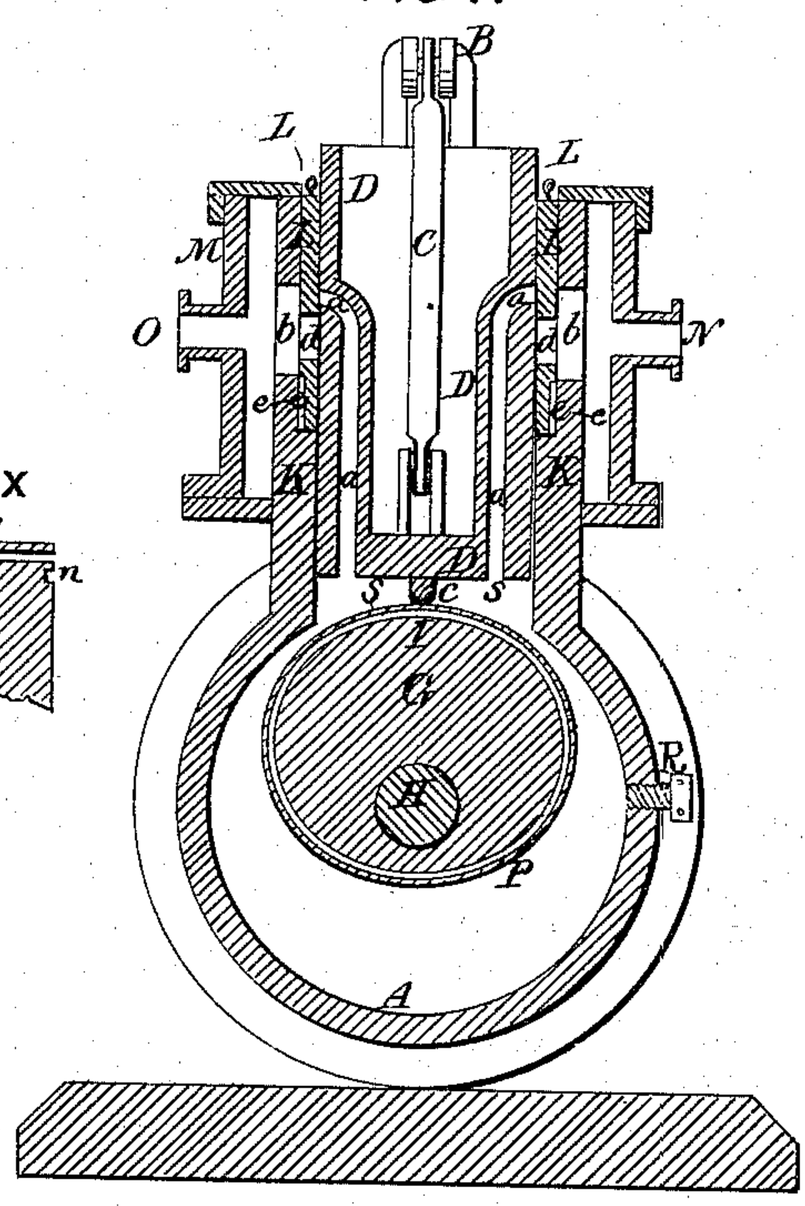


FIG V

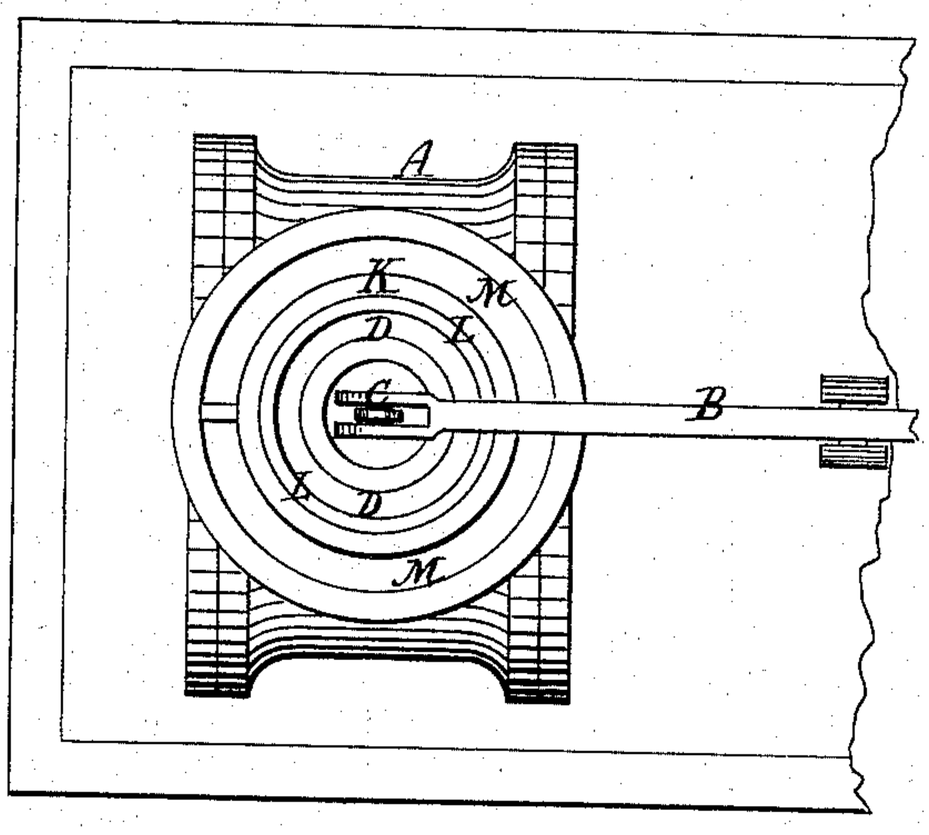


FIG VI

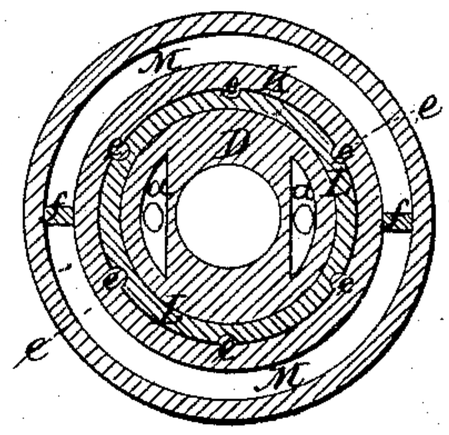


FIG VII

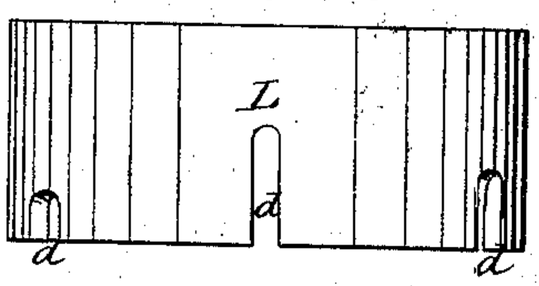


FIG VIII

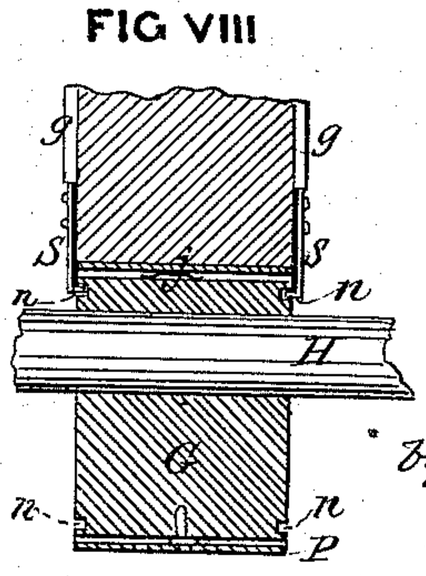
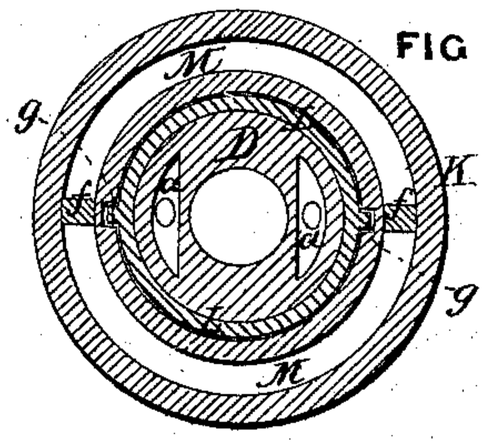


FIG IX



WITNESSES

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UNITED STATES PATENT OFFICE.

JESSE HEAD TEAL, OF NASHVILLE, TENNESSEE.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **157,429**, dated December 1, 1874; application filed November 6, 1874.

To all whom it may concern:

Be it known that I, JESSE HEAD TEAL, of Nashville, in the county of Davidson and State of Tennessee, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to that class of rotary engines in which revolving drivers are mounted eccentrically upon the same shaft in separate and distinct steam-chambers.

My invention consists in the combination of the cylindrical piston-valves, working in corresponding chambers, with elliptical drivers of the steam-cylinders, whereby a steam-joint is obtained between the drivers and the piston-valves of both cylinders. In combination with the cylindrical piston-valves I employ cylindrical regulators, interposed between the cylindrical pistons and their chamber-casing, the said regulators having a suitable number of circumferential openings of varying vertical depth, and equidistant from each other, in order that any two of such openings will, when the regulator is turned, coincide with the inlet and exhaust openings of the piston-valve, whereby a greater or less quantity of steam may be used to increase or diminish the power of the engine by adjusting the regulator upon its seat, its inner periphery and the corresponding wall of the cylindrical piston being provided with grooves and corresponding beads on the casing by which to make such adjustment, and hold the regulator in proper position when so adjusted. Also, in the combination, with the cylindrical pistons, of guide-arms on the piston-valves, working in grooves in the piston-cylinders, whereby the cylindrical piston-valves are prevented from having any rotary movement, and their inlet and outlet openings are kept in coincidence with the corresponding openings of the cylindrical regulator.

I also employ, with the drivers, loose compensating-rings, encircling their acting surfaces, in combination with an adjusting-screw and spring, and a removable screw-plug in the side of the cylinder, whereby the ring may be tightened, as may be required from time to time, by simply removing the side screw-plug, and turning the adjusting-screw by a square wrench.

In the accompanying drawings, Figure 1 represents an elevation of a rotary engine embracing my invention; Fig. 2, a vertical section of the same; Fig. 3, an end elevation of the cylinder with the head removed to show the elliptic driver; Fig. 4, a vertical cross-section of the same; Fig. 5, a top view of one of the cylinders and its cylindrical piston-valve, and Fig. 6 a horizontal section of the same at the line *x x* of Fig. 2.

I employ two independently-working cylinders, A, separated a sufficient distance to allow of the arrangement above them, in the line of their axis, of a uniting-beam, B, for the rods C, which connect the vertical piston-valve D of each cylinder, the said beam having its pivotal connection E in the center upon a column, F. Each cylinder is provided with a driver, G, of elliptical form, fixed upon a shaft, H, extending through the cylinders, and having its bearings therein. This shaft transmits the power of the engine, and can be connected, by any suitable means, to whatever machinery is to be driven. The elliptical drivers G are secured eccentrically to the shaft, and their greatest point, I, of projection comes close enough to the walls of the cylinder to be steam-tight without friction. They are arranged so as to balance each other, and produce an easy motion as they revolve. Each cylinder has only one removable head, J, which materially lessens the expense of construction. In connection with the elliptical drivers G I employ cylindrical piston-valves D, which work vertically through the top of each cylinder, and have a reciprocal movement given them, by their uniting-beam B, in a manner to be hereinafter described. These cylindrical piston-valves D are fitted and work within cylindrical chambers formed within cases K cast upon the cylinders, and which I make about double the length of the travel of the piston-valves. The piston-valves are provided with diameter side openings *a*, which extend down to the bottom

of said valves, and correspond in vertical range with openings *b* in the cases K, for the admission of the steam into the cylinder and its exhaust therefrom; and these openings *a b* are brought in coincidence for that purpose by the reciprocal vertical movements of the piston-valves, their descent making such communication, and their ascent cutting it off, as shown in Fig. 4, and this action is made alternate by the reciprocal movement of the piston-valves. These piston-valves D are provided on their lower ends with diameter tongues *c*, which form the bearing-points upon the drivers. It is by the elliptical form of these drivers that their revolution is in perfect unison with the travel of the valves, so that at no point in their combined movement will there be the least undue friction. The cylindrical pistons, while acting as slide-valves for the inlet and outlet of the steam, serve also, by their bearing-tongues *c*, as partitions to divide the steam-space in the cylinders, and while one driver is at full stroke under the action of the steam, and its piston at its lowest descent, the valve of the other driver is in position to cut off the steam, and the moment the driver at full stroke passes its bottom center, the opposite driver will take steam at the top, and thus avoid all dead-points in the revolutions of the drivers.

In connection with these piston-valves, I employ cylindrical regulators L, arranged between the walls of the piston-valves and the valve-chambers. It is supported upon a seat in the valve-casing, or it may be seated upon the valve-surface and move therewith, if desired. It is free to be raised and turned horizontally for a purpose to be presently described. It is provided with any suitable number of circumferential openings, *d*, (shown in Fig. 7, which is an enlarged view of the regulator,) for the passage of the steam. These openings are arranged in pairs, and the center of every one is on a horizontal line drawn round the regulator. Each diametrical pair of these openings *d* are of equal vertical depth, but each pair are of different vertical depths, so that, by raising the regulator and turning it round in either direction, openings of different depths will be brought opposite to those *a b* in the valve D and casing K, and the vertical depth of each pair of openings of the regulator so brought into position will determine the quantity of steam let into the cylinder, as all the openings are of equal cross-section. To hold the regulator in position when so adjusted, its inner surface is provided with short vertical grooves, which fit into corresponding beads or ribs *e* upon the adjacent walls of the valve-casing, and, in making such adjustment of the regulators, they are raised a short distance to take them from the locking-ribs *e*, and then turned to the desired openings, and again interlocked with the fixed part. A steam-chamber, M, surrounds the valve-casing K, with a diameter partition, *f*, to divide it into receiving and exhaust chambers, with which the inlet and exhaust steam-pipes N and O communicate. The covers of these steam-chests fit over the top edges of the valve-chambers K, and are secured thereto. To prevent the cylindrical valves from having any oscillating movement while working up and down, they are provided with ribs *g*, as shown in Fig. 9, on their outer walls, which fit into corresponding grooves in the adjacent walls of the valve-casing, but these ribs *g* are formed upon the lower end of the valve, and are of such length as to be always below the lower end of the cylindrical regulator, so as not to interfere with its adjustment. The inner edge of the steam-chest may be provided with suitable gage-marks, by which to indicate the size of the openings in the regulator, and the latter is provided with suitable handles on its upper edge, by which to adjust it when desired.

Each driver is provided with a ring, P, of equal width therewith, and loosely fitted on, so as to leave a small space between it and the surface of the driver, as a means for forming an adjustable steam-tight joint with the cylinder. For this purpose I combine an adjusting-screw, Q, with said ring. This adjusting-screw screws into the driver, and has a collar, *i*, (shown in Fig. 10,) on its head, which fits between the ring and said driver, with the head projecting through the ring just flush with its outer surface, and has a square socket in its head, by which to introduce the square end of a wrench to adjust the ring outward against the walls of the cylinder, so as to be sufficiently steam-tight. To allow the ring to yield, a spring, *j*, is arranged between it and the driver at a point opposite to the adjusting-screw.

To give access to said adjusting-screw I form an aperture in the side of the cylinder, which is fitted with a screw-plug, R, which is removed to introduce the wrench. The piston-valves are connected, as shown in Figs. 3 and 8, to the heads of the drivers, by means of arms S, extending from the lower ends of said valves in the line of their guide-ribs *g*, the connection being made by anti-friction rollers on the ends of said arms S, fitting into grooves *n*, formed in the heads of the drivers, the purpose of which connection being to drive the piston-valves independent of the outside connection, in which case the reciprocal action of the piston-valves is produced by the drivers, aided by the pressure of the steam upon the inner heads of the piston-valves, such connecting-arms insuring the descent of the disconnected piston-valves. These connecting-arms may, however, be used with the outside valve connections. It will be observed that the inner ends of the piston-valves are solid, except the openings which lead from the openings above, and that this flat surface *s* is divided by the cross-bearing tongue, as shown in Figs. 3 and 4. This flat surface *s*, therefore, is exposed to the full pressure of the steam in the cylinder, whether entering or leaving said cylinder, and that by reason of such pressure upon the pistons they are equally balanced,

and not only balanced but their reciprocal action is mainly produced and maintained by such pressure. I compensate for wear at the ends of the elliptic drivers by means of metal disks between the drivers and the cylinder-covers. These disks can be set up by set-screws, as required.

I have described my invention as a rotary motor, but it is obvious that I can employ it as a pump, and also use water as the motive power instead of steam. I may also arrange the cylindrical regulators outside of the piston-valve cases, and adjust them by suitable outside devices. I have also described the locking-beads for holding the regulators as being on the walls of the casing, but it is obvious the same object may be obtained by having stud-pins on the lower edge of the regulator, fitting into corresponding recesses in the casing-seat for the regulator.

The engine is reversible at will.

I claim—

1. The combination of the vertically-working cylindrical piston-valves D, having diameter bearing-tongues *c*, with the elliptical drivers G of the steam-cylinders, substantially as and for the purpose herein set forth.

2. The combination, with the vertically-working cylindrical piston-valves D, and the elliptical drivers, of cylindrical regulators L, interposed between the piston-valves D and their casing K, substantially as and for the purpose herein set forth.

3. The cylindrical regulators L, provided with circumferential openings *d*, of varying vertical depth, in combination with openings *a* in the piston-valves, and the openings *b* in the valve-casing K, substantially as and for the purpose herein set forth.

4. The cylindrical regulators L, combined with the piston-valves D, and their casing K, to allow them to have both a vertical and horizontal movement to effect the adjustment of their circumferential openings with those in the valve and casing, substantially as and for the purpose herein set forth.

5. The cylindrical regulators L, provided with grooves or notches, in combination with corresponding ribs or pins *e* in the valve-casing K, substantially as and for the purpose herein set forth.

6. The vertically-working piston-valves D, provided with ribs *g* on their circumference, in combination with corresponding grooves in the valve-casing K, substantially as and for the purpose herein set forth.

7. The vertically-working cylindrical piston-valves D, in combination with their diameter bearing-tongues *c*, and the flat heads *s s*, for the pressure of the steam thereon on opposite sides of said bearing-tongues, substantially as and for the purpose herein set forth.

8. The combination, with the cylindrical case for the piston-valves D, having inlet and exhaust-ports *a*, as described, of the inclosing divided steam-chest M for said valve-case K, substantially as and for the purpose herein set forth.

9. The combination, with the elliptical drivers G, of the loose rings P, the adjusting-screw Q *i*, the spring *j*, and the screw-plug R in the cylinder, substantially as and for the purpose herein set forth.

In testimony that I claim the foregoing I have affixed my signature in the presence of two witnesses.

JESSE HEAD TEAL.

Witnesses:

A. E. H. JOHNSON,

J. W. HAMILTON JOHNSON.