(No Model.) 3 Sheets—Sheet 1.

R. TEMPLE.

ROTARY ENGINE.

No. 511,311. Patented Dec. 19, 1893.

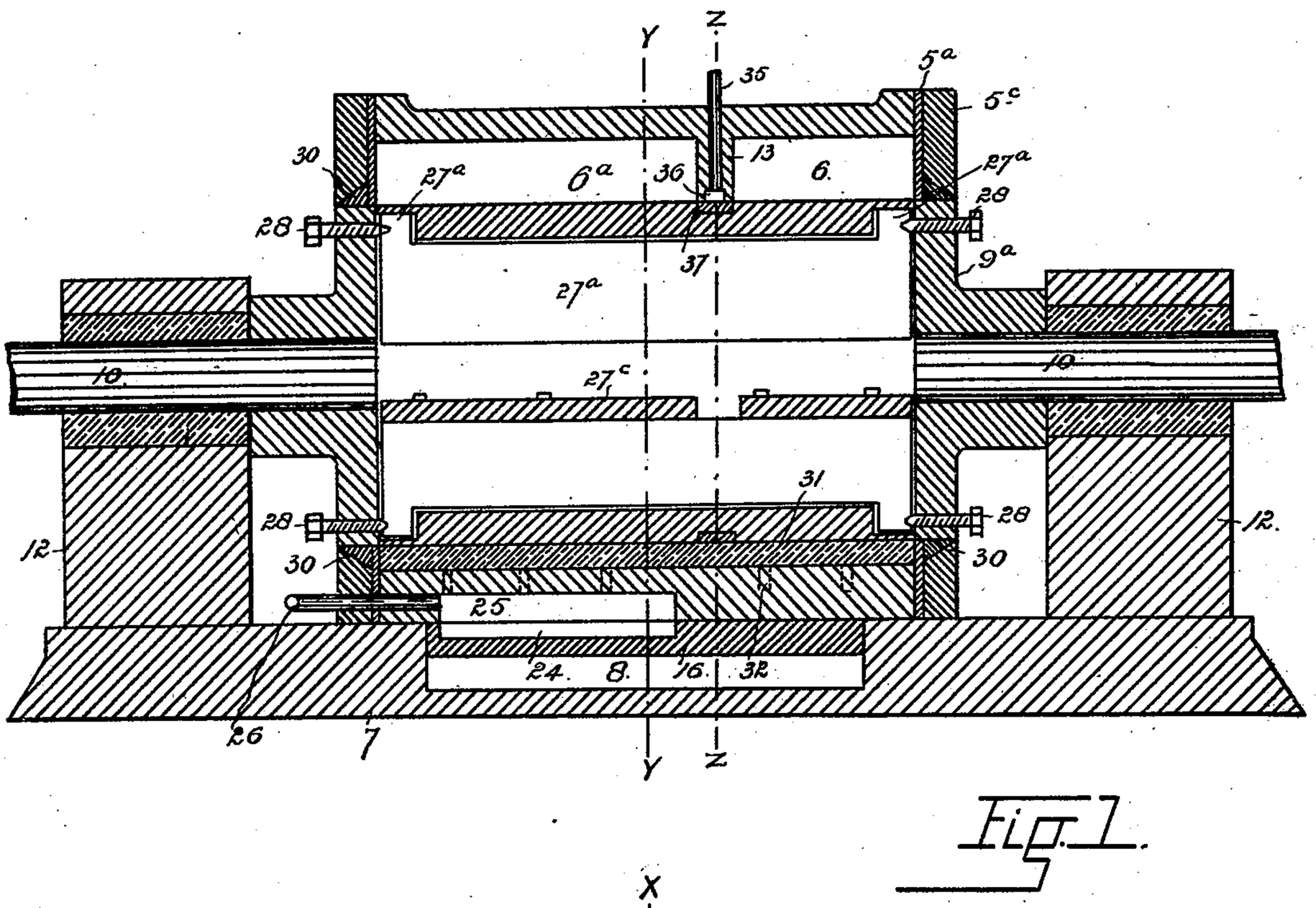

Fig. 1.

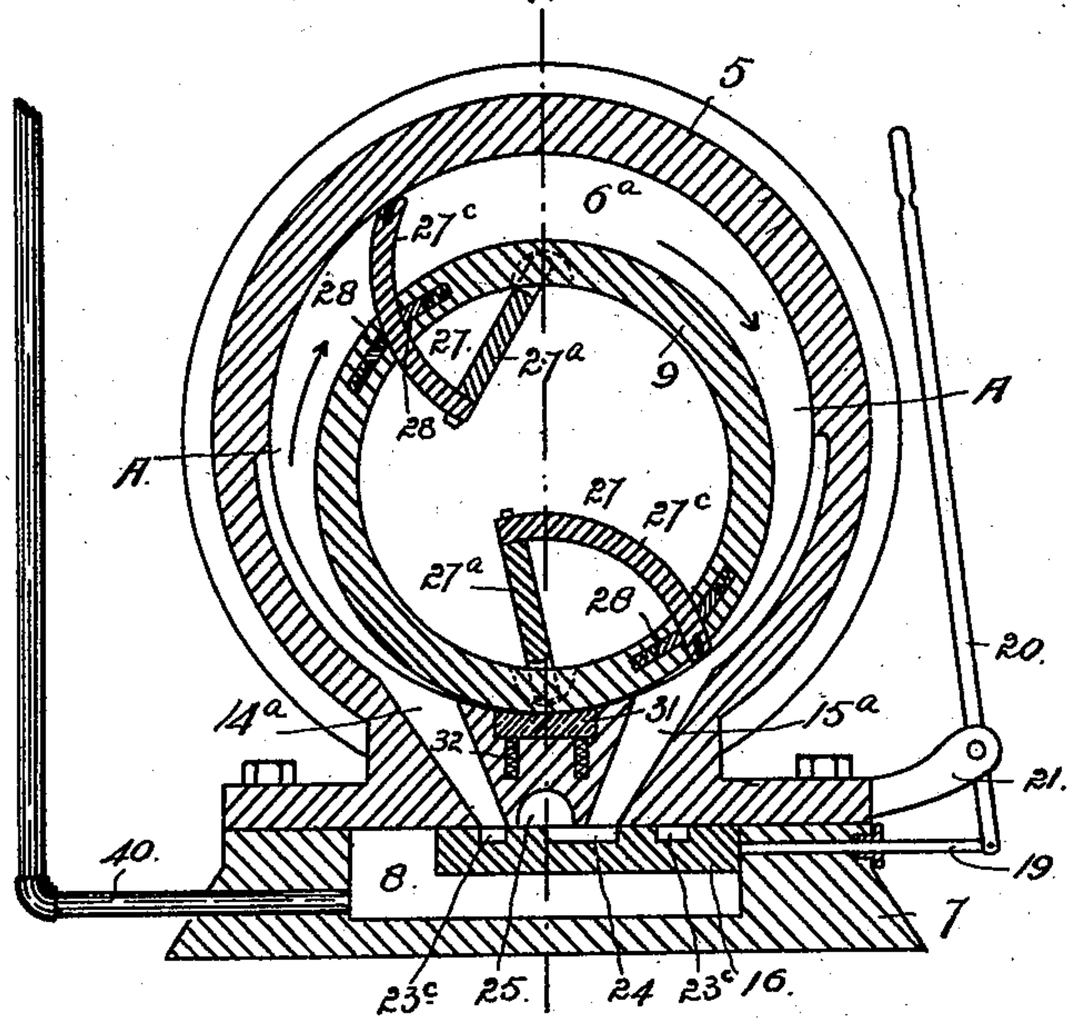

Fig. 2.

WITNESSES:
G. J. Rolland.
D. M. Sale

INVENTOR
Robt Temple
BY
A. J. O'Brien
ATTORNEY

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

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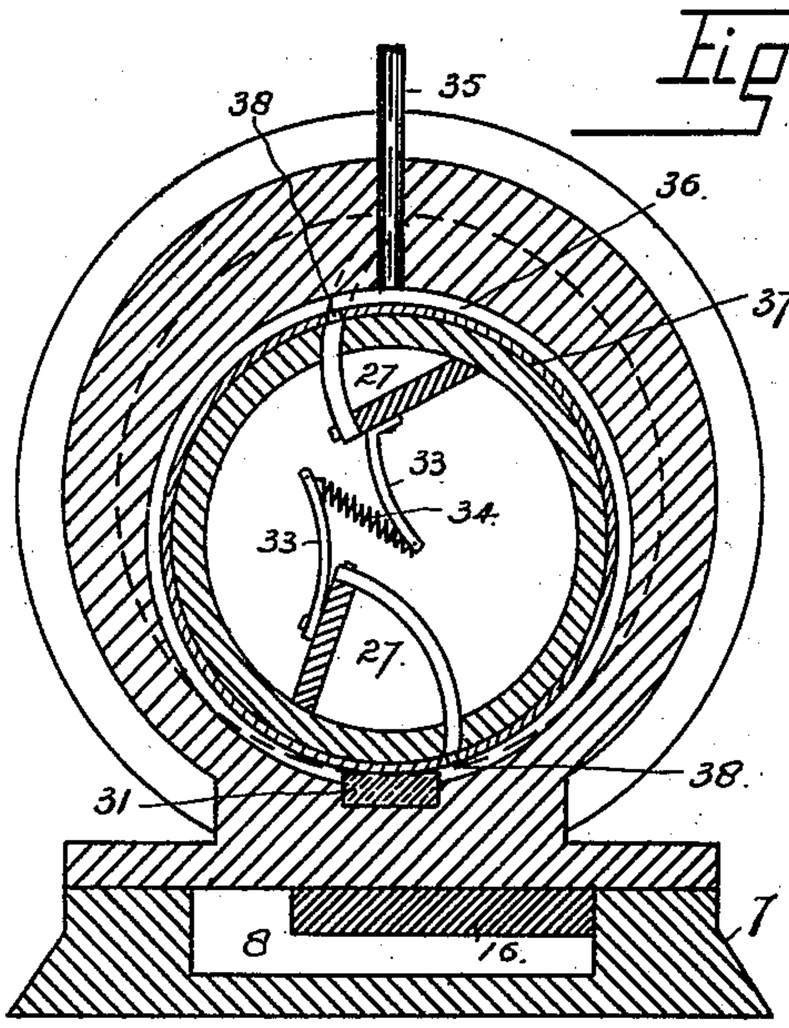
Fig. 3.



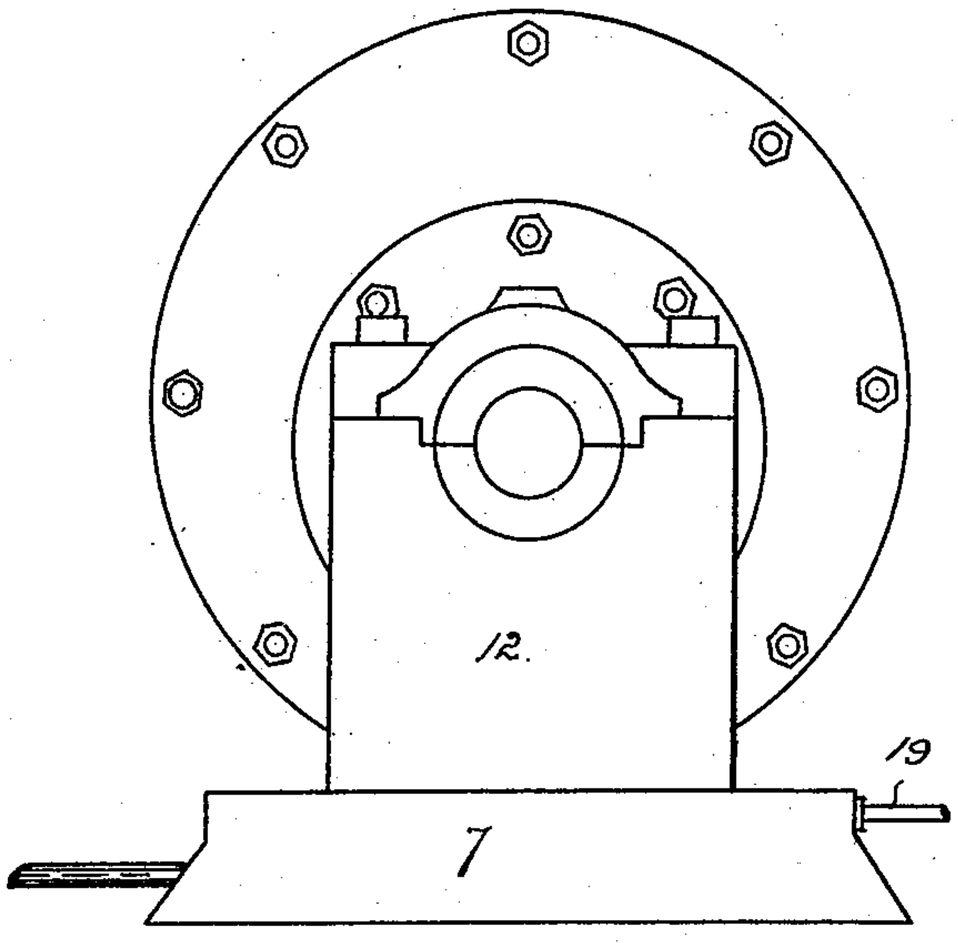


Fig. 4.

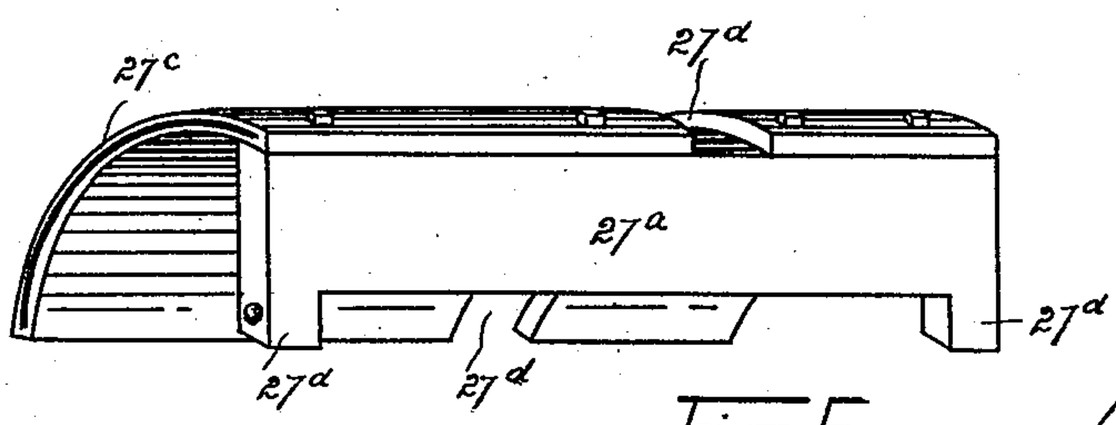


Fig. 5.

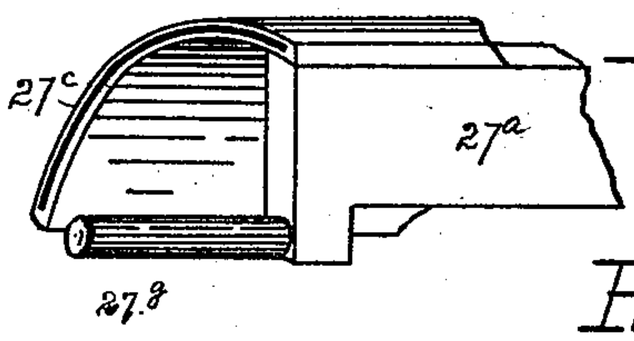


Fig. 6.

Fig. 7

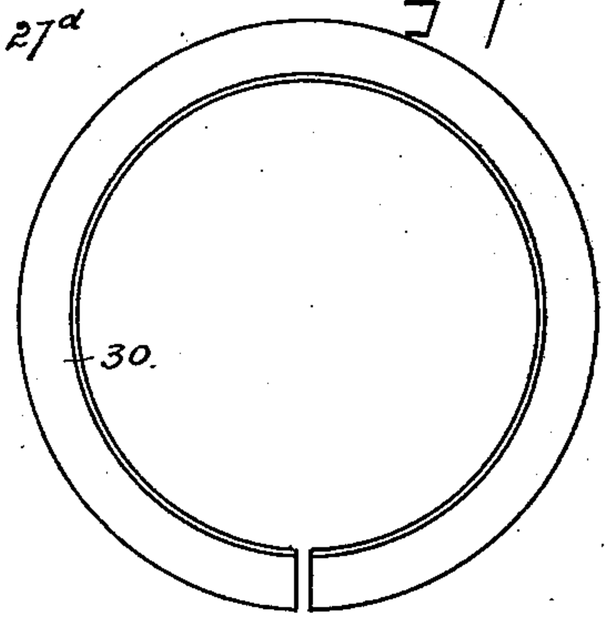
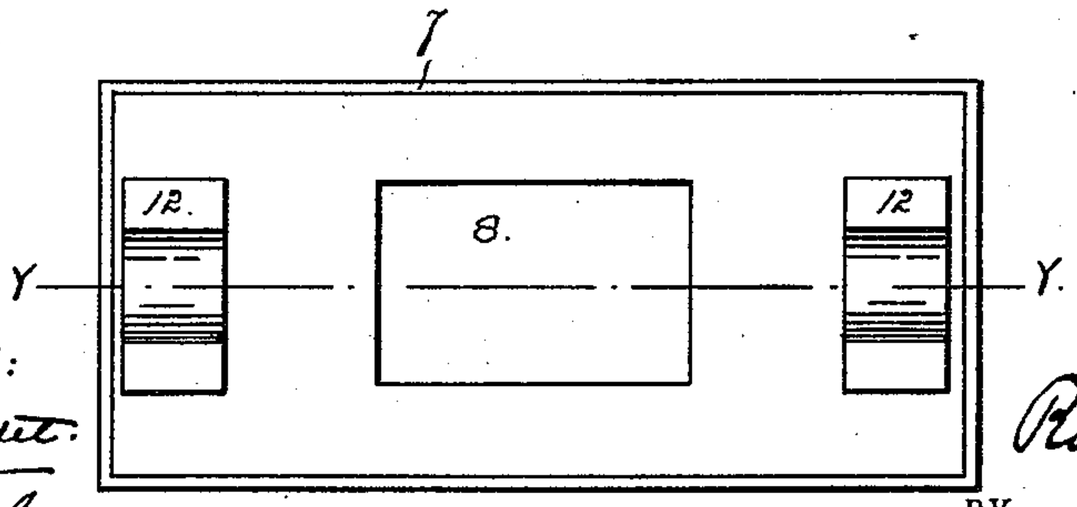


Fig 8



WITNESSES:

G. J. Rollandet.

D. M. Sale.

INVENTOR

Robt Temple

BY A. J. O'Brien

ATTORNEY

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

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Fig 13

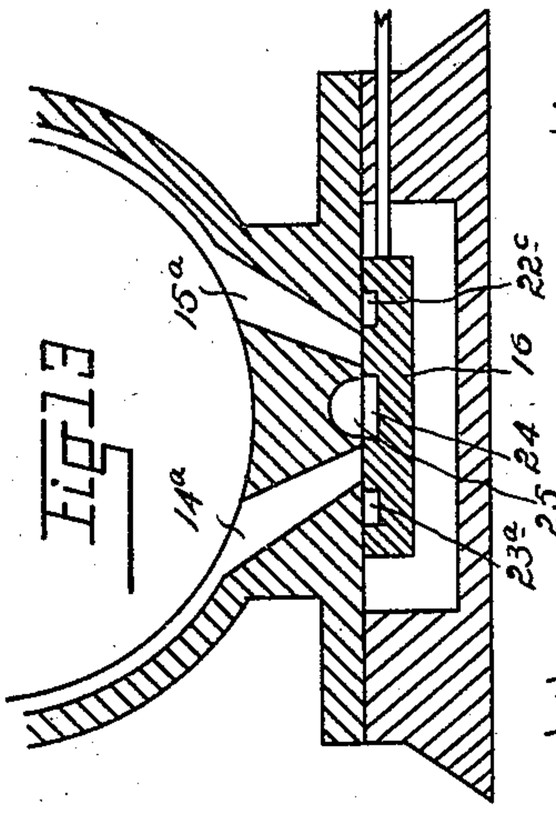

Fig 14.

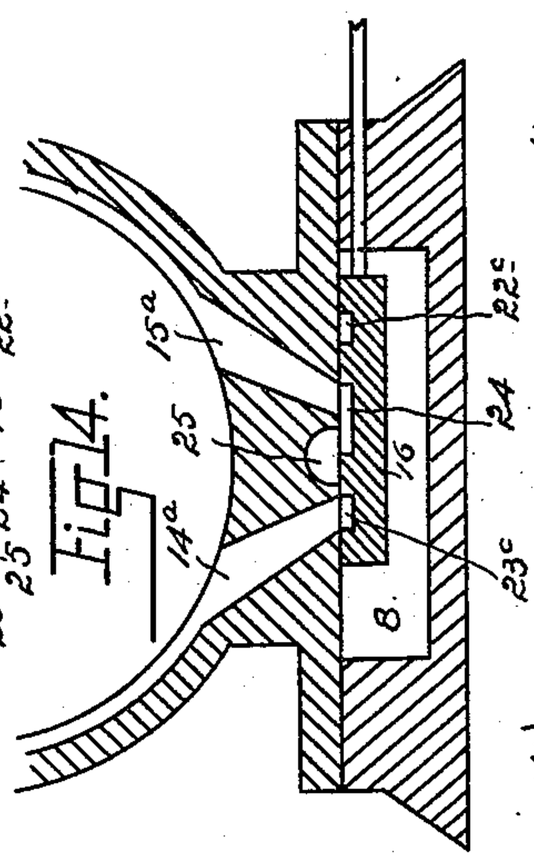

Fig 15.

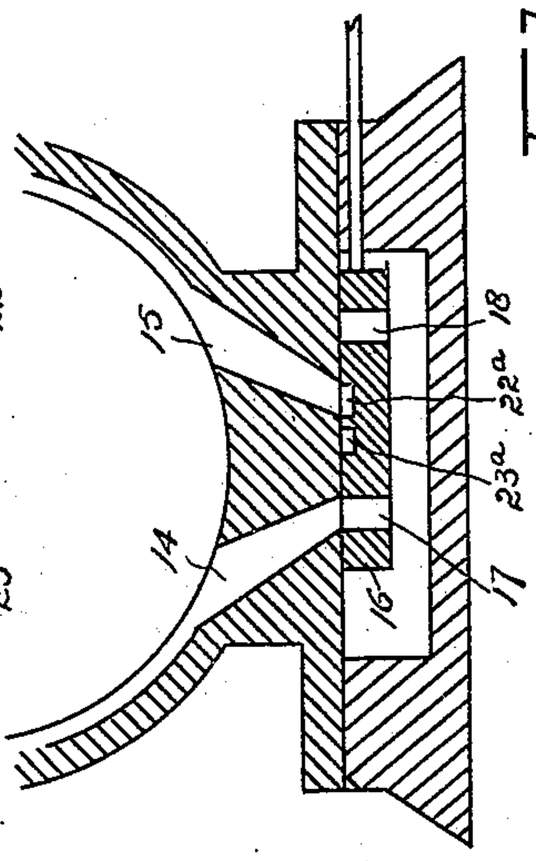

Fig 12.

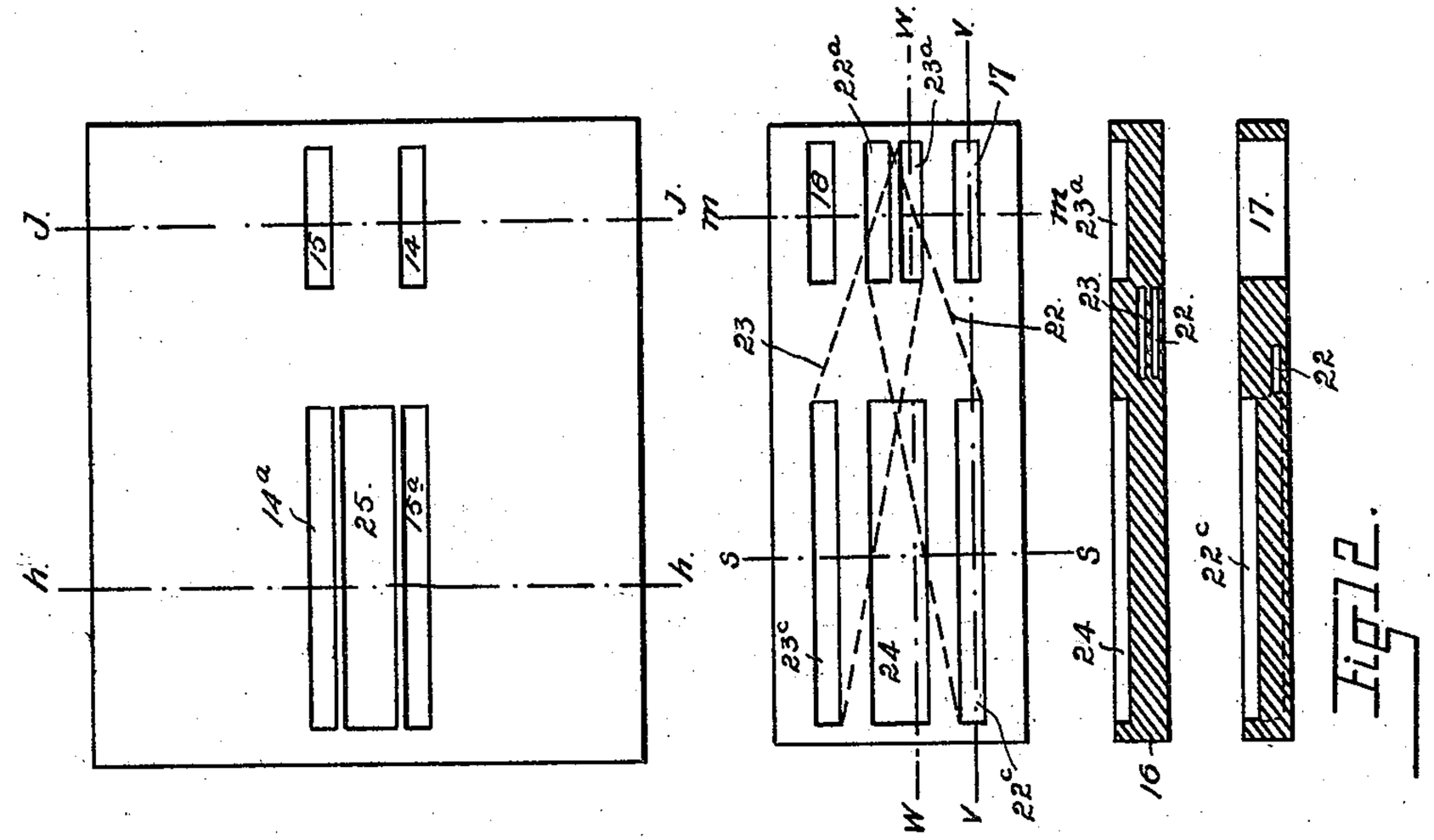

Fig 9.

Fig 10.

Fig 11.

WITNESSES:
C. J. Dorlandt.
J. M. Sale.

INVENTOR
Robt. Temple
BY
A. J. O'Brien
ATTORNEY

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ROBERT TEMPLE, OF DENVER, COLORADO, ASSIGNOR OF ONE-FOURTH TO STUART EDGAR.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 511,311, dated December 19, 1893.

Application filed June 2, 1893. Serial No. 476,337. (No model.)

To all whom it may concern:

Be it known that I, ROBERT TEMPLE, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Rotary Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary engines, and consists of the features, arrangements and combinations hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section taken on the line *x—x*, Fig. 2, which is a vertical cross section taken on the line *y—y*, Fig. 1. Fig. 3. is a section taken on the line *z—z*, Fig. 1. Fig. 4. is an end elevation of my improvement. Figs. 5. and 6. are perspective views of the pistons. Fig. 7. is a detail view of a spring packing-ring. Fig. 8 is a plan view of the steam chest. Fig. 9. is an underneath view of the casing showing the ports, the steam-chest being removed. Fig. 10. is a plan view of the valve which controls the ports leading from the steam-chest to the casing chamber. Fig. 11. is a section taken on the line *w—w*, Fig. 10. Fig. 12. is a section taken on the line *v—v*, Fig. 10. Figs. 13, 14, and 15 are cross sections taken through the steam-chest and casing showing the valve in different positions. The section of the valve shown in Figs. 13 and 14 is taken on the line *s—s*, Fig. 10., while that shown in Fig. 15 is taken on the line *m—m*, Fig. 10. The section of the casing, shown in Figs. 13 and 14, is taken on the line *h—h*, Fig. 9, while that shown in Fig. 15 is taken on the line *j—j*, Fig. 9. These views illustrate a compound engine of my improved construction.

Similar reference characters indicating corresponding parts or elements of the mechanism in the several views, let the numeral 5 indicate the casing inclosing a cylindrical chamber. This casing is flanged at the base where it is firmly secured to the steam-chest, provided with the chamber, 8. Within the casing chamber and arranged eccentrically therewith is the hollow cylinder, 9, provided with the ends or heads, 9^a, made fast to the shaft, 10, suitably journaled in upright supports or boxes, 12, made fast to the steam-chest extremities. The casing is separated into two unequal compartments, 6, and 6^a, by an interiorly projecting partition as plate 13, formed integral with the casing, and engaging the cylinder, 9, exteriorly. The compartment, 6, which is the smaller or high pressure portion of the chamber is connected with the chamber, 8, of the steam chest by the inlet and outlet ports, 14 and 15, while the larger or low-pressure chamber is provided with similar ports, 14^a and 15^a. These ports are controlled by a valve, 16, located in chamber 8 and provided with apertures, 17 and 18, adapted to register with ports 14 and 15 respectively, according to the position of the valve which is provided with a stem, 19, passing through an aperture formed in the steam-chest and connected at its outer extremity with an actuating lever, 20, fulcrumed on a projection, 21, made fast to the base of the casing. When the engine is making the forward movement the valve is in the position shown in Fig. 15, the aperture, 17, registering with port 14, in which case the steam enters the chamber, 6, *via* the port, 14, and exhausts through the port, 15. To reverse the engine or cause it to make the backward movement, the valve is so adjusted as to cause aperture, 18, to coincide with port, 15, in which case the steam would enter the chamber, 6, through port 15, and exhaust *via* port 14.

The exhaust steam from port 15 passes to chamber, 6^a, *via* a conduit, 22, in the valve, and the port, 15^a, of the casing. The conduit, 22, has an inlet aperture, 22^a, and an outlet aperture, 22^c. The exhaust steam from port, 14, passes to chamber, 6^a, through a conduit, 23, in the valve leading to the port, 14^a, of the casing. This conduit has an inlet opening, 23^a, registering with the port, 14, and an

outlet opening, 23c, registering with the port, 14a. The conduits 22 and 23 of the valve are indicated by dotted lines in Fig. 10.

When the steam enters the chamber, 6a, through the port, 15a, it exhausts through port 14a into a recess, 24, in the valve, and passes thence into a similar recess, 25, in the casing, and thence through a pipe, 26, to the atmosphere. When, however, the steam passes to the chamber, 6a, through port, 14a, it exhausts *via* port 15a, recesses, 24 and 25, and pipe 26. The cylinder, 9, is provided with two angular pistons, 27, having the straight and curved sides, 27a and 27c, respectively. These pistons fit nicely between the heads of the cylinder to which they are pivoted in any suitable manner.

As shown in Fig. 1, pointed screw bolts, 28, are passed through the cylinder heads and enter recesses formed in the ends of the sides, 27a, of the pistons and close to their outer edges. The wall of the cylinder is interiorly recessed to receive lugs, 27d, formed in the sides 27a, of the piston. The sockets for the pivots are formed in these lugs.

In large engines it is believed preferable to attach a journal, 27e, directly to the piston, as shown in Fig. 6. In this case the journals would move in suitable bearings formed in the cylinder ends. The two pistons are pivoted to the cylinder ends at diametrically opposite points. The curved sides of the pistons pass through slots formed in the cylinder and enter the chambers, 6 and 6a. On each side of the slots through which these curved sides pass are located spring actuated packing strips, 28, placed within suitable grooves, whereby a steam tight joint is formed between the cylinder and the pistons. These curved sides of the pistons are slotted, as shown at 27d, for the entrance of the partition, 13, which separates the high and low pressure chambers of the compound engine.

The ends of the casing are double, consisting of a thin inner plate, 5a, and a thicker outer plate, 5c. Between these two plates and surrounding the cylinder are located the spring packing rings, 30, which are triangular in cross section. This feature makes the casing chamber steam tight.

The lowest part of the cylinder, 9, engages the casing which is recessed to receive a packing strip, 31, held tightly against the cylinder by coil springs, 32. Each piston is provided with an arm, 33, which is attached to the side, 27a, thereof. These arms are connected by a coil spring, 34, the tension of which is so regulated that it normally presses the curved sides, of the pistons outward against the wall of the casing, thus exposing them to the action of the steam, whereby the cylinder is rotated.

The chamber or interior of the cylinder, 9, is supplied with steam from a pipe, 35, connected with the boiler. This pipe leads to an interior circumferential recess, 36, formed in the partition, 13, and adjacent to a packing-ring, 37, located in a recess formed in the cylinder and surrounding the same. This packing ring is provided with apertures, 38, through which the steam passes to the interior of the cylinder, the apertures being so located as to coincide with those portions of the slots in the cylinder between the two parts of the curved side of the pistons, as shown in Fig. 3. Hence the steam in the cylinder has the same pressure as that on the outside thereof, or the casing chamber. The function of the spring, 34, is to destroy this equilibrium and force the curved sides of the pistons outward. This feature is specially useful in starting the engine.

The steam from the boiler for operating the engine enters the steam chest, *via* pipe, 40, and assuming that the valve is in the position shown in Fig. 15, the steam passes to chamber, 6, through port, 14, and acting on the curved side of one of the pistons, which I will suppose occupy the relative positions shown in Figs. 2 and 3, drives the cylinder around in the direction indicated by the arrows. After passing the highest part of the chamber, 6, where the greatest area of surface is exposed, to the action of the steam, the piston is gradually forced inward as it moves downward or approaches the exhaust port, while the exposed surface of the other piston is gradually increasing, since while one piston is moving downward the other is moving upward. When the curved plates of these pistons have reached the points, A, on the opposite sides of the chamber, the surfaces exposed to the action of the steam are equal in area and the exhaust through port, 15, begins, since the steam between the two pistons can no longer be advantageously utilized in chamber 6. This exhaust steam now passes through the conduit, 22, of the valve to port, 14a, of chamber, 6a, and acts by expansion upon the opposite wing of the upwardly moving piston in the low pressure chamber of the compound engine. The exhaust steam from this chamber passes through port, 15a, into recess 24, of the valve and thence to recess 25, of the casing, and out through the exhaust pipe, 26. To reverse the engine or cause it to move in the opposite direction, it is only necessary to move the valve 16 so that the aperture, 18, as shown in Fig. 15, shall coincide as to position with port 15 when the steam from chamber 6 would exhaust through port 14 into conduit 23 of the valve, and thence to chamber, 6a, through port 15a, and thence through port 14a to the connecting recesses, 24 and 25, of the valve and casing respectively, and out through pipe 26, to the atmosphere.

In the simple form of engine, as distinguished from the compound construction, the part 13 will not form a partition, but will be so located as to engage one extremity of the cylinder 9 since in this case, the space within the casing and surrounding the hollow cylinder must not be divided but must form a single chamber; in which event, part 13 will

only be used as a means for introducing steam to the revolving cylinder, in connection with the steam pipe 35 and the apertures 38 formed in the packing ring 37.

Having thus described my invention, what I claim is—

1. In a rotary engine the combination of the steam-chest, the casing having the cylindrical chamber provided with inlet and exhaust ports, the hollow cylinder, eccentrically located in the casing chamber and carrying pivoted pistons projecting through slots into the outer chamber, and means for introducing steam from the boiler to the hollow cylinder, consisting of a plate 13 projecting from the interior of the casing to engagement with the cylinder and a steam conduit passing through the plate 13, the cylinder being provided with ports for conducting the steam from this conduit to the interior of the cylinder, substantially as described.

2. In a rotary engine the combination with the steam-chest, the casing having the cylindrical chamber and the inlet and exhaust ports, the hollow cylinder eccentrically located in the casing chamber and engaging the wall on one side, which is provided with a spring actuated packing strip engaging the cylinder and forming a steam-tight joint, angular pistons pivoted in the cylinder which is slotted to receive one side of each piston which projects into the surrounding chamber, the cylinder being provided on each side of the slots with spring actuated packing strips located in the grooves, and means for introducing steam from the boiler to the hollow cylinder, consisting of a plate 13 projecting from the interior of the casing to engagement with the cylinder and a steam conduit passing through the plate 13, the cylinder being provided with ports for conducting the steam from this conduit to the interior of the cylinder, substantially as described.

3. In a rotary engine the combination with the steam-chest, of the cylindrical casing provided with inlet and exhaust ports, the hollow cylinder eccentrically located with reference to the casing, the angular pistons composed of two sides, one side being curved to pass through slots formed in the cylinder, the other sides being pivoted to the cylinder-ends at diametrically opposite points and provided with arms connected by a spring whereby the curved sides are normally forced outward against the casing and means for introducing steam into the interior of the hollow cylinder, consisting of a plate 13 projecting from the interior of the casing and provided with an interior circumferential recess, a steam conduit leading from the boiler and passing through plate 13 to the recess therein, the hollow cylinder being provided with an exterior recess engaging the plate 13, and apertures leading therefrom to the interior of the casing, substantially as described.

4. In a rotary engine the combination with the steam-chest, provided with a suitable chamber to which leads a supply pipe from the boiler, a reciprocating valve located therein and provided with apertures, the casing inclosing the cylindrical chamber and provided with inlet and outlet ports controlled by the valve, a hollow cylinder provided with angular pistons, each composed of two plates, one of which is located wholly within the chamber of the cylinder, while the other is curved and projects through a slot formed in the cylinder and means for introducing steam into the interior of the hollow cylinder, consisting of a plate 13 projecting from the interior of the casing and provided with an interior circumferential recess, a steam conduit leading from the boiler and passing through plate 13 to the recess therein, the hollow cylinder being provided with an exterior recess engaging the plate 13, and apertures leading therefrom to the interior of the casing, substantially as described.

5. In a compound rotary engine the combination of the steam-chest, the cylindrical casing, the eccentric cylinder, the pistons located therein and normally forced outward against the casing, a partition engaging the cylinder and dividing the corresponding chamber into two unequal compartments, each of which is provided with inlet and outlet ports, the outer plates of the piston being slotted to receive said partition, an apertured valve located in the steam-chest and through which steam is fed to the inlet port of the high-pressure chamber, said valve being provided with a conduit leading from the exhaust port of the smaller chamber to the inlet port of the larger or low-pressure chamber.

6. In a compound rotary engine the combination of the steam-chest, the cylindrical casing, the hollow cylinder eccentrically located in this casing chamber and provided with suitable pistons projecting into the surrounding chamber which is unequally divided by a partition projecting from the casing to engagement with the cylinder, each chamber being provided with inlet and exhaust ports, the pistons being slotted to receive said partition, a packing ring located in a circumferential recess surrounding the cylinder and apertured to allow the steam to enter the interior of the cylinder, said ring being in engagement with the partition which is provided with a recess to which a steam pipe from the boiler leads, and a valve located in the steam-chest and apertured to allow the steam to enter the high pressure chamber, and a conduit leading from the exhaust port of the high pressure chamber to the inlet port of the low pressure chamber, substantially as described.

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

ROBERT TEMPLE.

Witnesses:
BRINTON GREGORY,
STUART EDGAR.