(No Model.) 3 Sheets—Sheet 1.

# W. SMITH.

## ROTARY ENGINE.

No. 517,985. Patented Apr. 10, 1894.

Fig. 16.

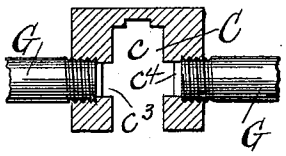
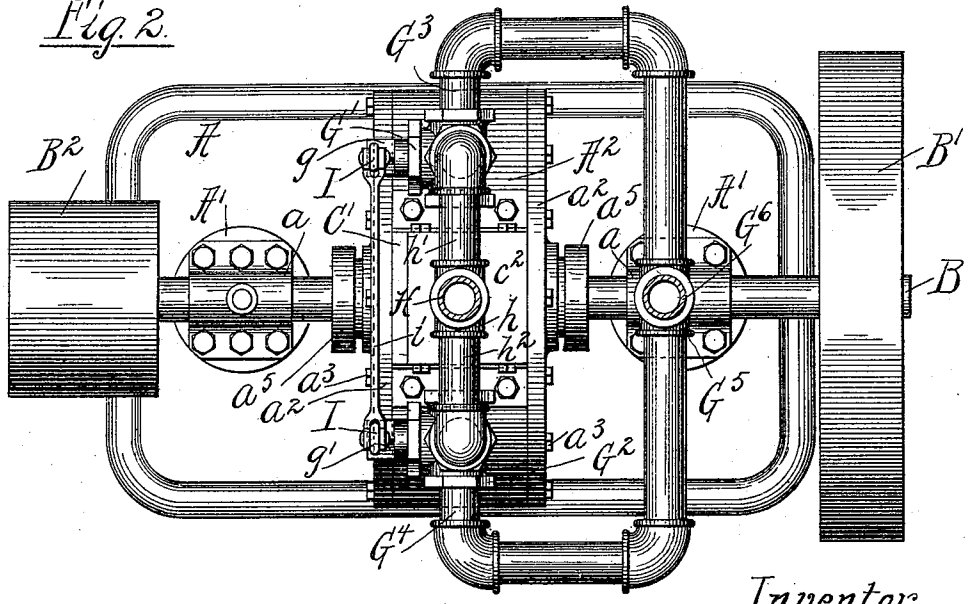



Fig. 1.




Fig. 2.




Witnesses
John W. Adams
Louis M. Whitehead.

Inventor
William Smith.
by Dayton, Poole & Brown
his Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

# W. SMITH.

## ROTARY ENGINE.

No. 517,985. Patented Apr. 10, 1894.

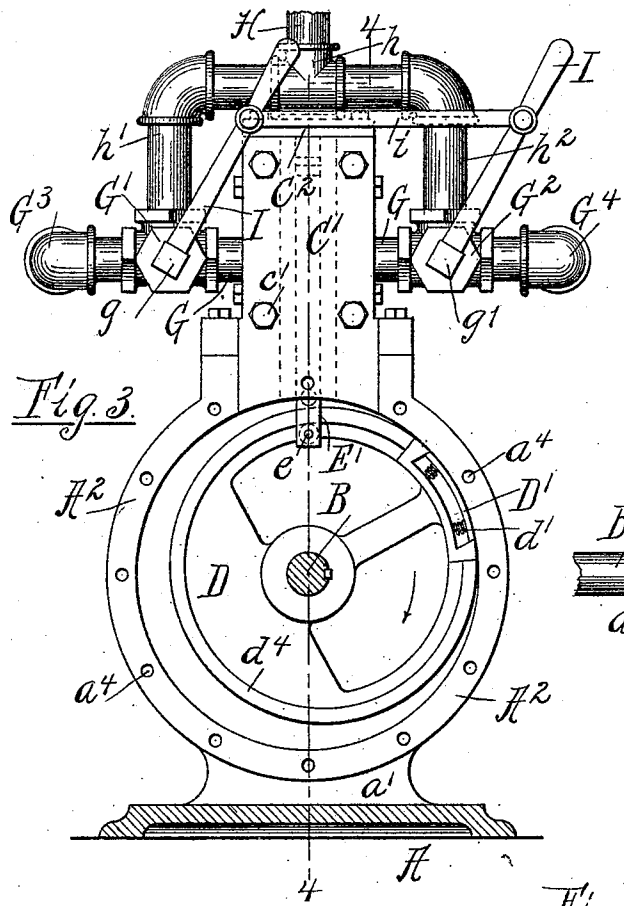



Fig. 3.

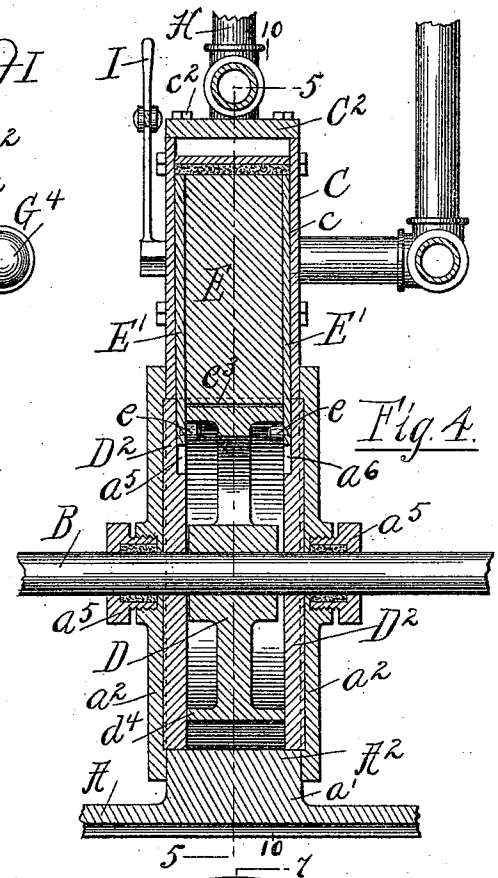



Fig. 4.

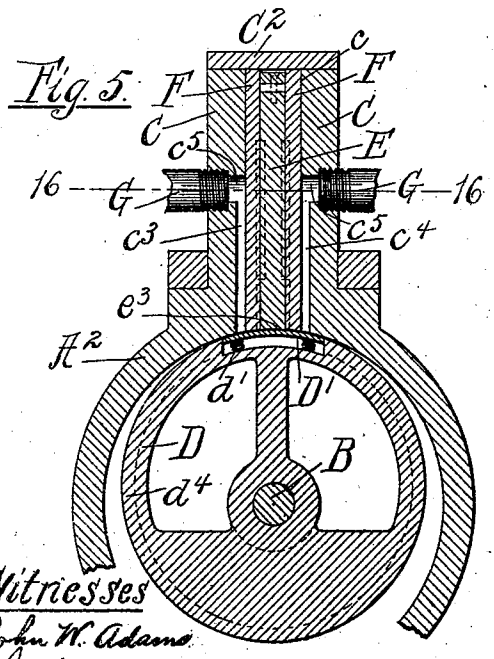



Fig. 5.

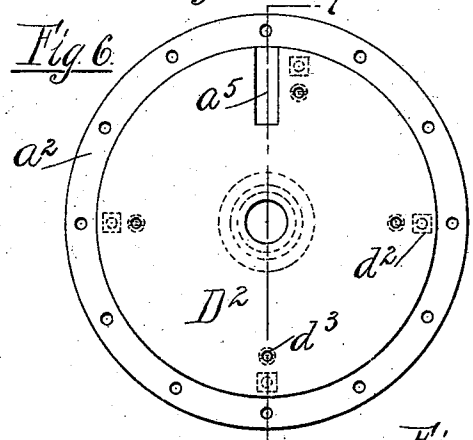



Fig. 6.

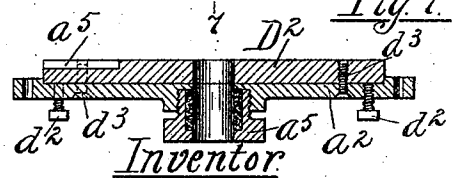



Fig. 7.

Witnesses
John W. Adams
Louis M. F. Whitehead.

Inventor
William Smith.
by Dayton, Robertson & Brown
his Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

# W. SMITH.

## ROTARY ENGINE.

No. 517,985. Patented Apr. 10, 1894.

Fig. 8.

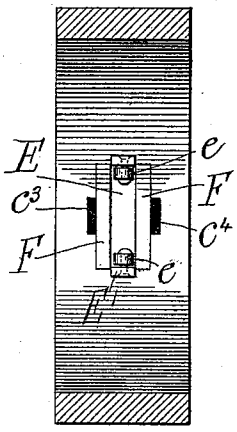



Fig. 9.

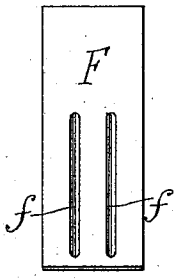



Fig. 10.

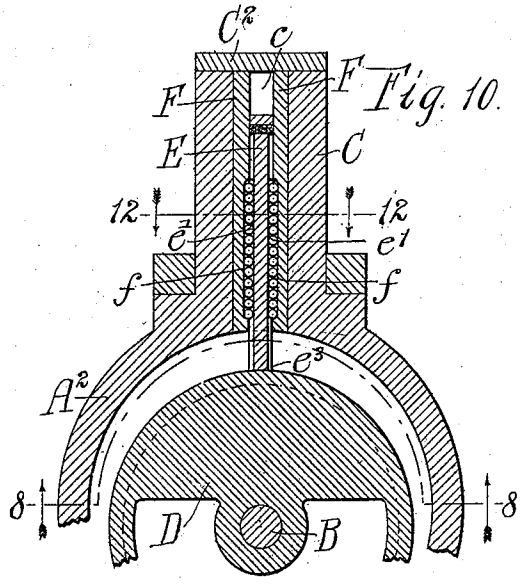



Fig. 11.

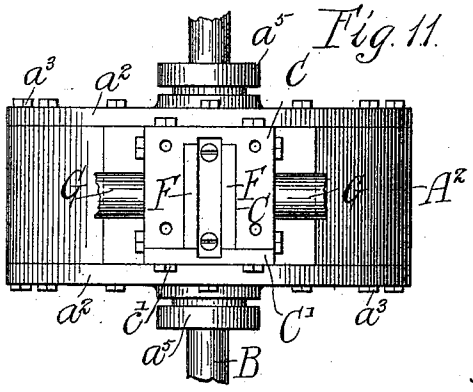



Fig. 12.

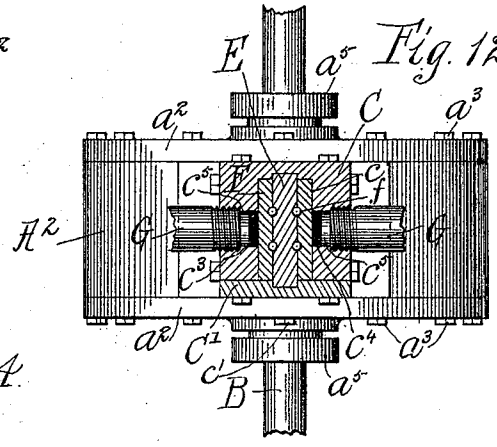



Fig. 13.

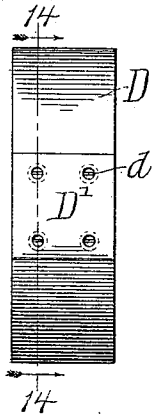



Fig. 14.

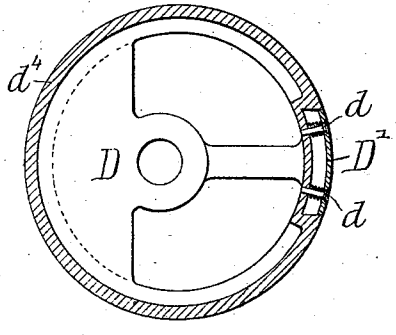
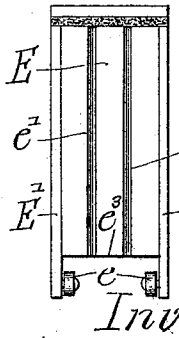



Fig. 15.




Witnesses.
John W. Adams.
Louis M. Whitehead.

Inventor.
William Smith.
by Dayton, Cooke & Browne
his Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY.
WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

WILLIAM SMITH, OF CLARINDA, IOWA, ASSIGNOR OF ONE-HALF TO ALONZO D. SMITH, OF CHICAGO, ILLINOIS.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 517,985, dated April 10, 1894.

Application filed March 3, 1893. Serial No. 464,494. No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM SMITH, of Clarinda, in the county of Page and State of Iowa, 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in reversible rotary engines, and the object of the invention is to devise a cheap and simple construction by which steam under boiler pressure may be utilized to attain the maximum amount of power. All of the rotary engines heretofore devised, so far as I am aware, have depended upon a very high rate of speed for the production of a given amount of power at the shaft; which high rate of speed has been accomplished only by the expenditure of a large quantity of high pressure steam and by the use of complicated and expensive machinery.

By the use of the invention presently to be described I have demonstrated by actual experiments and tests the feasibility of using boiler pressure steam in a rotary engine of relatively low speed for the purpose of obtaining great power.

The invention will be more fully described with reference to the accompanying drawings, and will then be more specifically pointed out in the appended claims.

In said drawings: Figure 1 is an end elevation of a rotary engine embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is a side elevation of the engine, partially in section, showing one of the cylinder heads removed. Fig. 4 is a transverse vertical sectional view of the engine taken upon line 4—4 of Fig. 3. Fig. 5 is a central longitudinal vertical sectional view taken upon line 5—5 of Fig. 4. Fig. 6 is a view showing the inside face of one of the heads of the cylinder with the adjusting plate secured thereto. Fig. 7 is a sectional view of the same, taken upon the line 7—7 of Fig. 6. Fig. 8 is an interior view of a portion of the cylinder looking up at the ports. Fig. 9 is a face view of a steel plate presently to be described. Fig. 10 is a longitudinal vertical sectional view of a portion of the upper part of the engine, taken upon the line 10—10 of Fig. 4. Fig. 11 is a plan view of the upper part of the cylinder with the top plate removed. Fig. 12 is a similar view partially in section, the section being taken upon line 12—12 of Fig. 10. Fig. 13 is a face view of the interior revolving head. Fig. 14 is a vertical sectional view of the same, taken on line 14—14 of Fig. 13. Fig. 15 is a side view of a vertically reciprocating plunger. Fig. 16 is a horizontal section taken on line 16—16 of Fig. 5, with the lining plate and plunger removed.

In said drawings A represents the base of the engine frame, upon which are mounted at convenient places the standards A′ A′, carrying suitable journals *a*, in which journals the horizontal shaft B is movably secured. Upon one end of the shaft B are located the fly-wheel B′, and suitable governing devices not herein shown. Upon the other end is the pulley $B^2$ by which power is communicated as desired, by means of a suitable belt or otherwise. Power may be transmitted directly from the shaft B, if desired, by connecting said shaft in any familiar manner to the machine to which power is to be transmitted.

$A^2$ is a cylinder, supported from the bed-plate A by the web or bracket *a*′ between the two standards A′. The cylinder $A^2$ is provided with a head $a^2$ at either side, which heads are secured by suitable bolts $a^3$ passing through apertures in the head and entering internally screw-threaded apertures $a^4$ in the face of the cylinder $A^2$. The heads $a^2$ are each centrally apertured in order that the shaft B may be passed therethrough, the apertures being closed and packed by any convenient form of stuffing box, as $a^5$.

Secured to and preferably formed integral with the cylinder $A^2$ is an upwardly extending elongated box C, provided throughout its length with a rectangular U-shaped recess *c*, the latter communicating at its lower end with the interior of the cylinder $A^2$. The side of the box C into which the recess *c* opens throughout its length is closed by the plate C′, which latter is secured to the box C by means of bolts *c*′.

Upon the top of the box C is placed a cap

$C^2$ securely bolted to the box by means of bolts $c^2$.

Within the recess $c$ and at opposite sides thereof are the grooves $c^3$ $c^4$, extending from about the center of the vertical length of the box C downwardly until they open into and communicate with the interior of the cylinder $A^2$. These grooves $c^3$ $c^4$ constitute the inlet and exhaust ports of the engine, as will be presently explained.

Within the cylinder $A^2$ a piston head D is rigidly secured to the shaft B by means of a key, or in other suitable manner; said piston head having the form of a smooth cam-wheel of less diameter than the interior of the cylinder, but secured on said shaft sufficiently out of center to constantly engage with a portion of its perimeter the interior of the cylindric wall of said cylinder. Such engaging portion of the perimeter of the piston is in this instance formed by a separate plate D′ recessed into the piston and adjustably secured thereto by screws $d$. The surface of said plate D is turned upon the same radius as the interior of the cylinder, and said plate is constantly pressed outward by coil springs $d'$ provided on the screws $d$ to normally engage throughout its entire area the interior cylindric wall of said cylinder. The length of the engaging portion of the perimeter, (in this instance the plate D′) is greater than the distance between the remote edges of the ports $c^3$ $c^4$, so that the steam supply is cut off at each revolution before the exhaust port is operated to discharge the steam just previously admitted.

In order that the head D may fit tightly against the heads $a^2$ of the cylinder $A^2$, I secure to the inside of one of said heads a disk or plate $D^2$ by means of a plurality of screws or bolts arranged in pairs. The bolts $d^2$ pass through suitable apertures in the heads $a^2$ and engage the surface of the plate $D^2$ and tend to press the plate $D^2$ away from the head $a^2$ and against the adjacent side of the piston head D, while the bolts $d^3$, passing through suitable apertures in the heads $a^2$ and engaging internally screw-threaded apertures in the plate $D^2$ tend to draw said plate toward the head $a^2$. By adjusting one or the other set of bolts $d^2$ $d^3$ it is clear that the plate $D^2$ can be drawn away from or pressed against the adjacent side of the piston head D, and when pressed against said head will cause the latter to similarly press against the head $a^2$ on the opposite side of the cylinder and thus afford a tight joint.

On either side of the piston head D there is formed a rim or flange $d^4$, engaging the under surface of which flanges are the anti-friction rollers $e$ secured upon the adjacent surfaces of the lower ends of downward projecting lateral arms E′ secured by screws or in other suitable manner to the plunger E. The plunger E extends vertically within the recess $c$ in the box C, and the lower ends of said arms E′ reciprocate in radial slots $a^5$ and $a^6$, provided respectively in the plate $D^2$ and opposite head $a^2$. Said plunger is provided on each of its sides with two elongated grooves or recesses $e'$ which register with similar grooves or recesses $f$ in anti-friction plates F, which latter are interposed between the sides of the plunger E and the sides of the recess $c$ in the box C, a plurality of balls being inserted in said grooves $e'$ $f$ whereby an anti-friction ball-bearing is afforded between the stationary lining plates F and the vertically reciprocating plunger E.

It will be observed by reference to Figs. 4 and 12 that the backs of the lining plates F cover the faces of the recesses $c^3$ $c^4$, thereby constituting the fourth walls for said recesses and permitting their use as inlet and exhaust steam passages. By securing the lower end of the plunger E by means of the engagement of the anti-friction rollers $e$ with the under side of the rim or flange $d^4$ of the piston head D, it will be manifest that the plunger E will be reciprocated vertically back and forth upon each revolution of the piston head. The lower edge or face $e^3$ of the plunger E is thus constantly maintained in close contact with the surface or periphery of the piston head D.

Lateral passages $c^5$ extending through the side walls of the box C communicate at their inner ends with the upper ends of the ports $c^3$ $c^4$, and are each provided with enlarged interior screw-threaded portions into which the ends of the pipes G are secured. The pipes G each lead to a three-way valve G′ $G^2$, and then extend, as shown by the pipes $G^3$ $G^4$, through the T-coupling $G^5$ to the pipe $G^6$. A pipe H leads from the source of steam supply through the steam coupling $h$, through the pipes $h'$ $h^2$ into the three-way valves G′ $G^2$. The plugs $g$ $g'$ of said three-way valves are connected by upwardly extending hand levers I, the upper ends of which levers are joined by a link or links $i$, by which construction it will be noted that the movement of either of the hand levers I in one direction will move the other hand lever in the same direction, and that consequently both plugs $g$ $g'$ will be actuated simultaneously and in the same direction.

As shown in Figs. 1, 2, and 3 the levers I are turned to the right hand side and thus steam from the boiler will pass through the pipe H, the coupling $h$, the pipe $h^2$, the three-way valve $G^2$, the pipe G, the passage way $c^5$ and port $c^4$ into the cylinder. We will assume that at this moment the piston head D is positioned as shown in Fig. 3 of the drawings. The ports $c^4$ will then communicate only with a very small portion of the interior of the cylinder $A^2$, to wit, the triangular shaped space bounded by the right hand face of the plunger E, the upper portion of the periphery of the piston head D next in rear of the plate D′, and the corresponding inner surface of the face of the cylinder $A^2$. The steam will exert a downward pressure upon the piston-head D at this time, and by

reason of said pressure and the fact that said piston head is located eccentrically upon the shaft, the said head will be caused to revolve in the direction indicated by the arrow Fig. 3, the momentum caused by the revolution of the piston head together with the continued inflow of steam through the port $c^4$ being sufficient to carry said piston head D past the dead center during that portion of its revolution when the plate D′ completely closes the inlet port $c^3$. It will be observed that during the revolution of the head D the plunger E will first be carried bodily downward to the lowermost limit of its movement and then will be gradually raised, thus at all times preventing steam from passing from the port $c^4$ past said plunger and exhausting directly through the exhaust port $c^3$. It will also be observed that the steam that is upon the opposite side of the plunger D is being exhausted through the port $c^3$, passage-way $c^5$, pipe G, the three-way valve G′, the pipe $G^4$, the T-coupling $G^5$ and the pipe $G^6$, and will continue to be exhausted until such time as in the revolution of the piston head D the plate D′ will cover and close said exhaust port $c^3$.

To reverse the engine I simply move the hand levers I in the direction opposite to that in which they appear in Fig. 2 in which case the steam will pass into the cylinder through the port $c^3$ and exhaust through the port $c^4$.

By the construction hereinabove described I am enabled to obtain four-horse power by means of a steam inlet port sufficient to give in a reciprocating piston engine one horse power only, and this too without imparting to the piston head D the maximum speed usually attained and in fact required in rotary engines as heretofore constructed. I thus save wear and tear upon the machinery as well as economize in the use of steam.

The engine is simple, effective and very durable.

I claim as my invention—

1. A rotary steam engine comprising a steam cylinder provided with inlet and exhaust ports, of a smooth faced cam-wheel or piston rotatively mounted at the center of the said cylinder, a reciprocatory plunger mounted in the said cylinder and secured to said piston so that its lower end shall positively engage the perimeter thereof, said piston being provided on its perimeter with a concentric portion sufficient in length to simultaneously and at the desired time, close both of said ports, substantially as described.

2. A rotary steam engine comprising a cylinder provided with inlet and exhaust ports, a cam-wheel or piston rotatively mounted in the said cylinder, a reciprocatory plunger mounted in said cylinder between said ports and secured at its lower end to said piston and an adjacent head or plate interposed between the piston and one of the cylinder heads, and means, substantially as described, for adjusting said head toward and from the piston, said adjusting plate being provided with a radial recess or groove, as $a^5$, $a^6$, substantially as and for the purpose specified.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

WILLIAM SMITH.

Witnesses:
FRANK L. BLAIR,
LAVIS W. WARD.