No. 664,480. Patented Dec. 25, 1900.

G. R. IBACH.

ROTARY ENGINE.

(Application filed Nov. 9, 1899.)

(No Model.) 3 Sheets—Sheet 1.

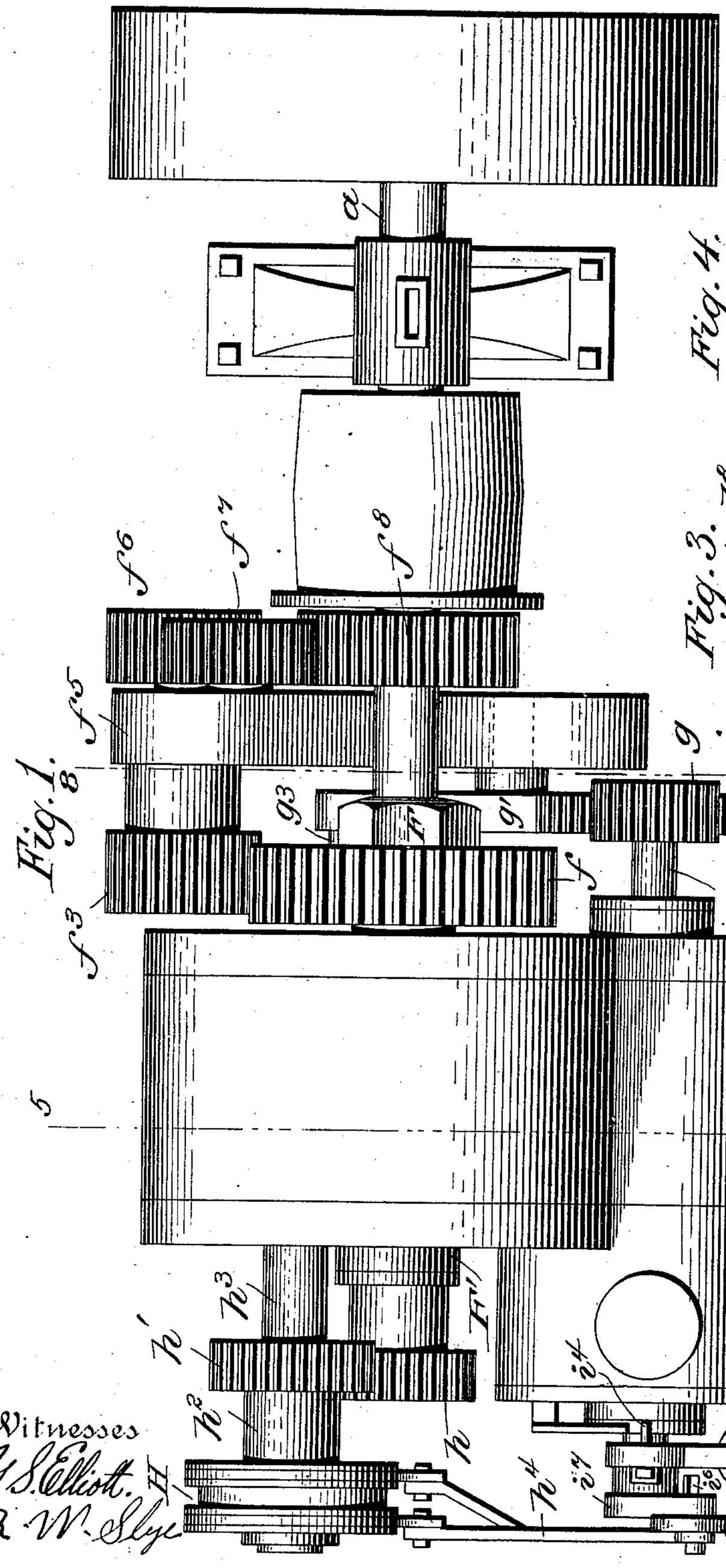


Fig. 1.

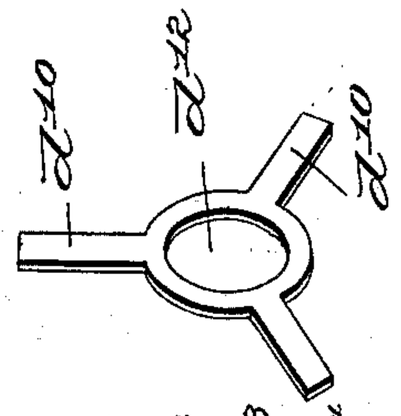


Fig. 4.

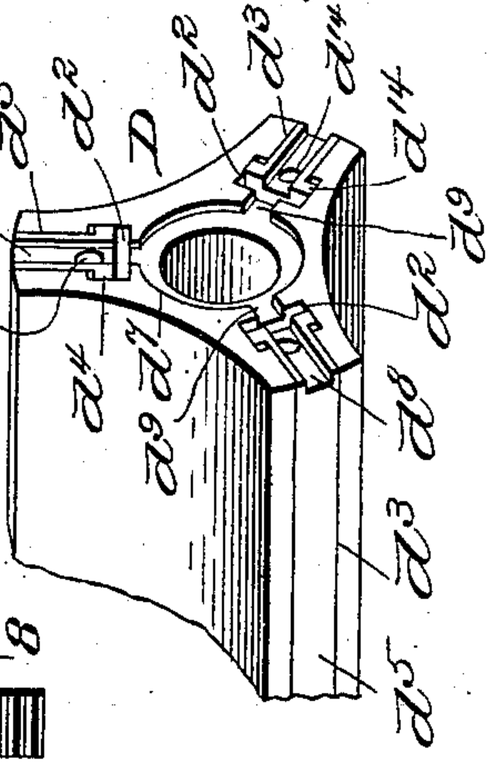


Fig. 3.

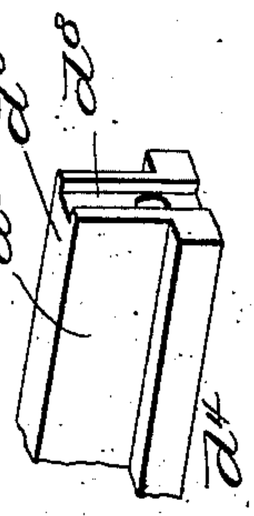


Fig. 2.

Witnesses
H. S. Elliott.
R. W. Slye.

Inventor
G. R. Ibach,
by H. S. Duvall.
Attorney.

No. 664,480.

Patented Dec. 25, 1900.

G. R. IBACH.

ROTARY ENGINE.

(Application filed Nov. 9, 1899.

(No Model.)

3 Sheets—Sheet 2.

Fig. 5.

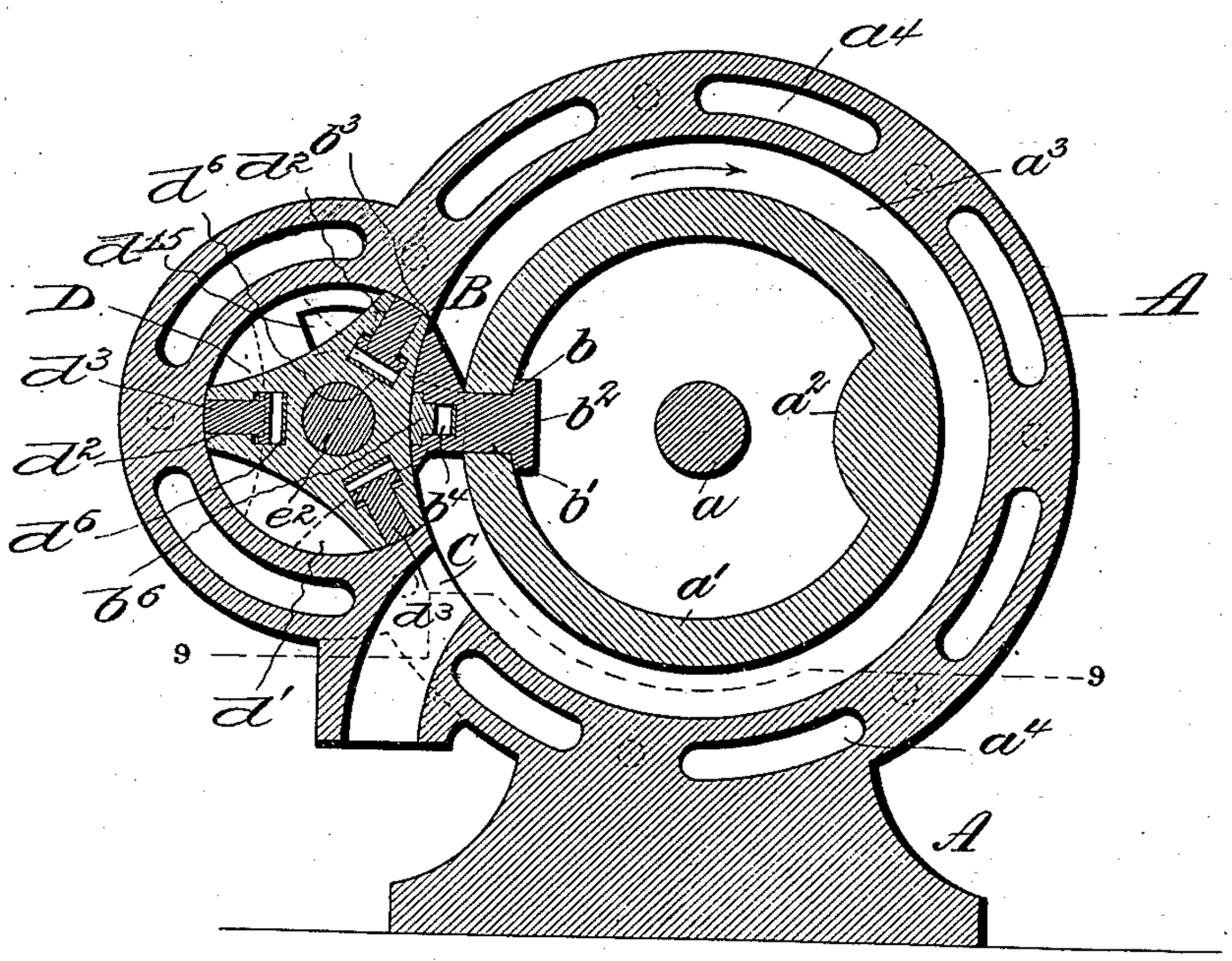


Fig. 10.

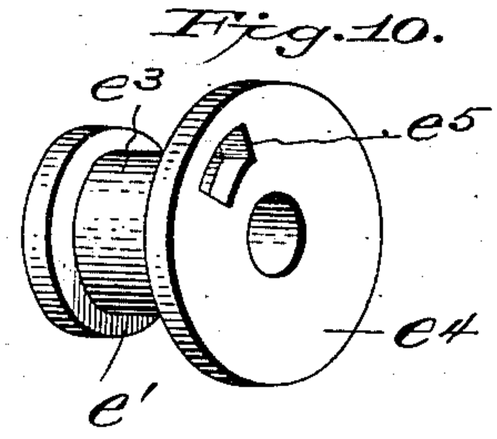


Fig. 6.

Witnesses
G. S. Elliott.
R W Slye

Inventor:
G. R. Ibach,
by W. S. Duvall.
Attorney.

No. 664,480.

Patented Dec. 25, 1900.

G. R. IBACH.

ROTARY ENGINE.

(Application filed Nov. 9, 1899.)

(No Model.)

3 Sheets—Sheet 3.

Fig. 7.

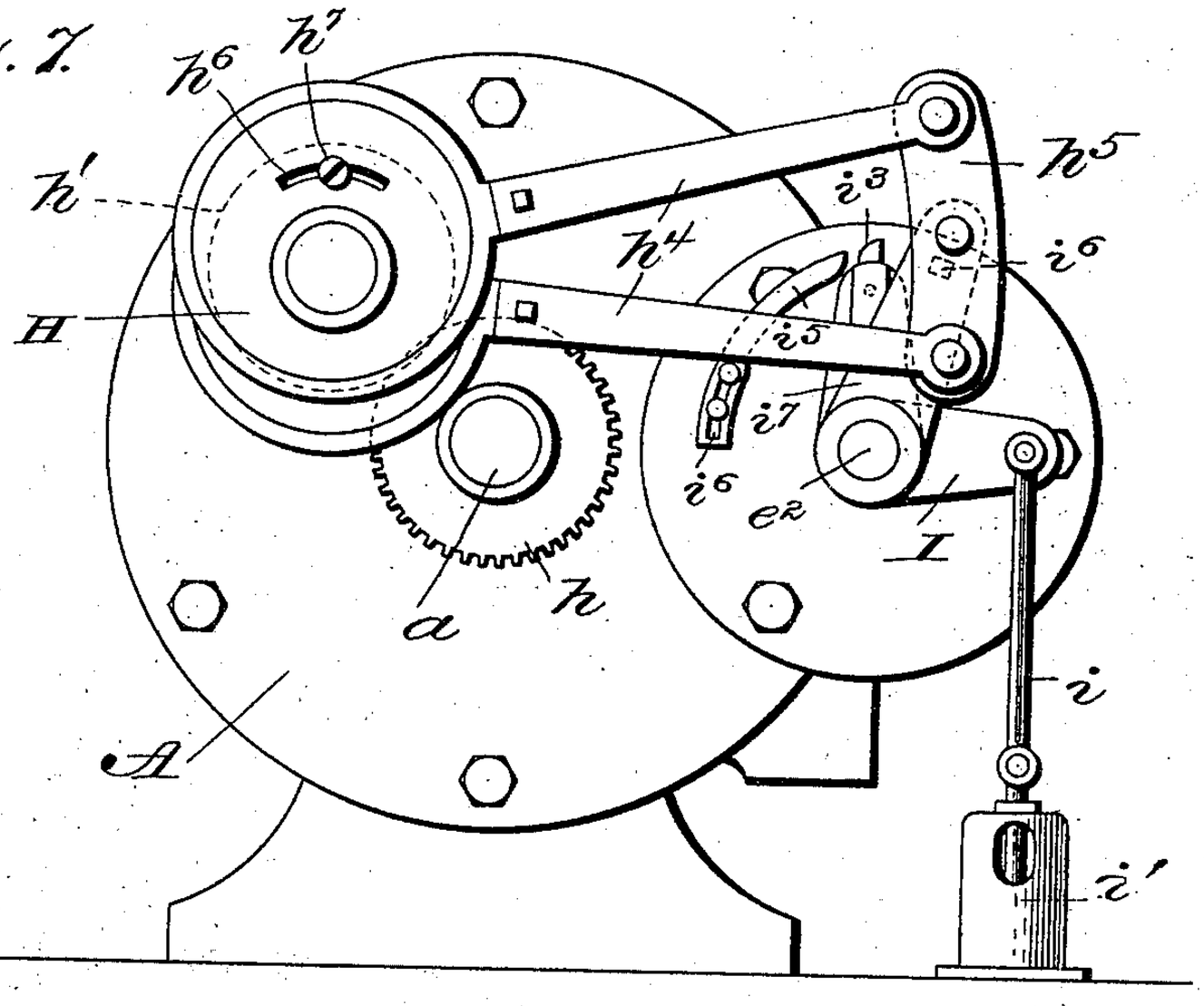


Fig. 8.

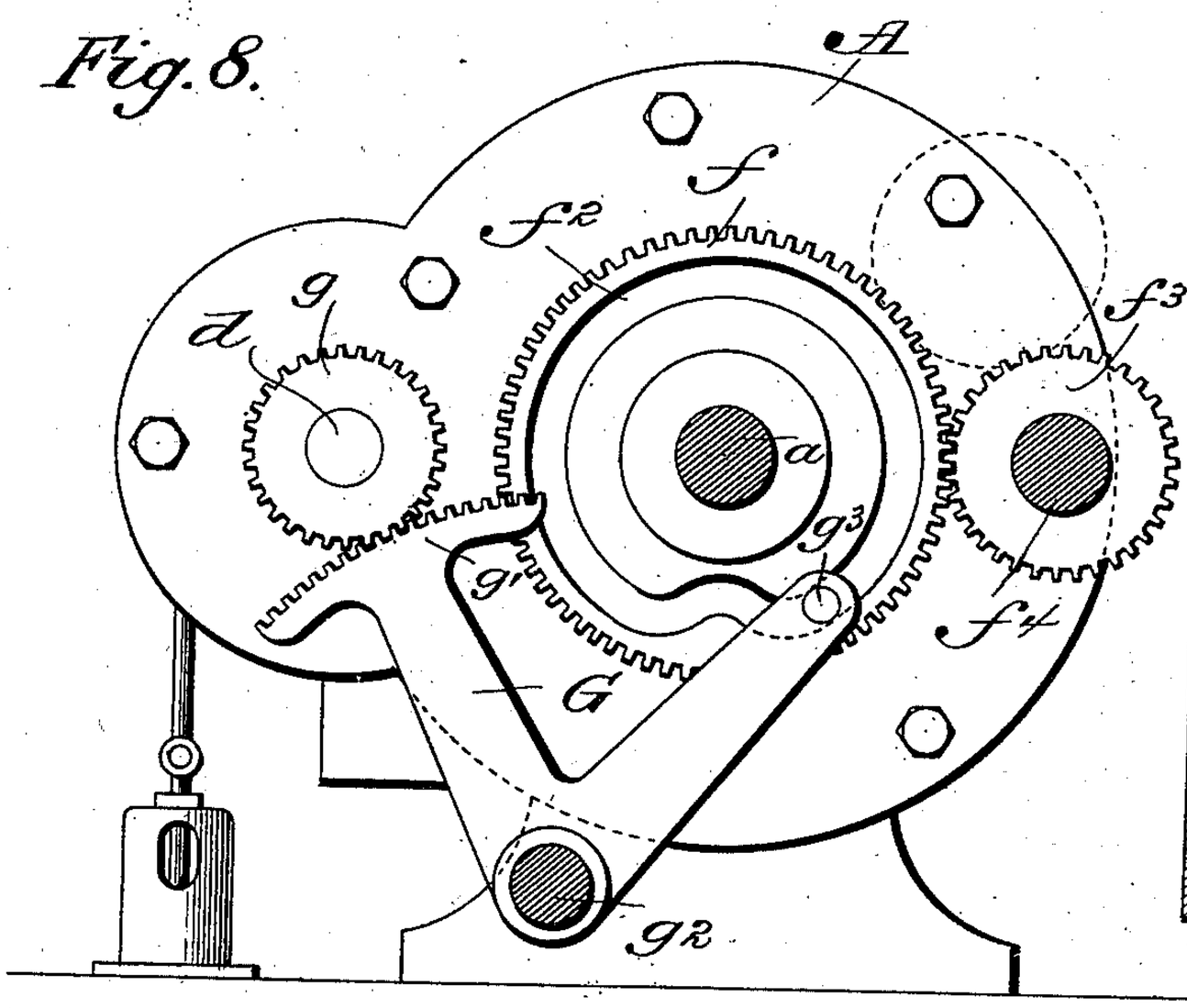
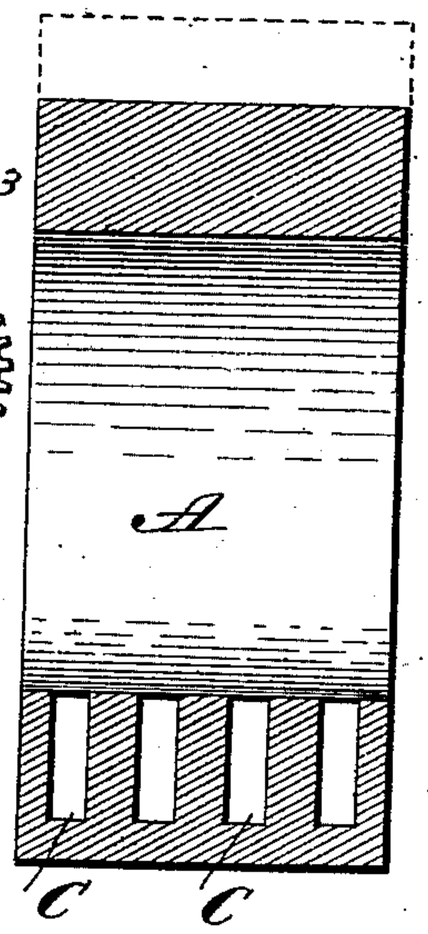


Fig. 9.



Witnesses
G. S. Elliott.
R. W. Slye

Inventor:
G. R. Ibach,
by M. J. Duvall.
Attorney.

UNITED STATES PATENT OFFICE.

GIDEON R. IBACH, OF NEW YORK, N. Y.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 664,480, dated December 25, 1900.

Application filed November 9, 1899. Serial No. 736,376. (No model.)

To all whom it may concern:

Be it known that I, GIDEON R. IBACH, a citizen of the United States, residing at New York, (Brooklyn,) in the county of Kings and State of New York, have invented certain new and useful Improvements in Rotary Engines; and I do hereby 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.

This invention relates to certain new and useful improvements in rotary engines.

The invention has for one object the production of simple and efficient means for introducing steam or the like to the cylinder, whereby the piston is continuously rotated.

A further object is to produce a liquid-valve which is so constructed that all wear due to friction is automatically taken up and leakage thereby prevented.

A further object is to provide simple and efficient means for automatically admitting steam or the like to the valve-chamber at predetermined periods prior to its admission to the cylinder.

A further object is to provide a new and improved piston and connections between the same and its carrying-drum, means being provided to automatically take up any wear upon said piston.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a plan view illustrating my improved rotary engine. Figs. 2, 3, and 4 are detail views of the main valve. Fig. 5 is a cross-sectional view on the line 5 5, Fig. 1. Fig. 6 is a horizontal sectional view on the line 6 6, Fig. 5. Fig. 7 is an end view. Fig. 8 is a sectional view on the line 8 8, Fig. 1. Fig. 9 is a detail of the exhaust-outlet. Fig. 10 is a detail view of the auxiliary valve.

Referring to the drawings, A designates the main cylinder, through which extends a main or power shaft a, on which is mounted a hollow piston a', carrying the shoe B. Said piston is provided with a longitudinal slot b, designed to receive the contracted portion b' of the shoe, the latter being provided with an enlarged or T-shaped end b^2, forming shoulders bearing against the inner circumference of said hollow piston. Said piston is also provided with a weighted portion a^2, opposite to the shoe B and designed to counterbalance the latter. The projecting portion of shoe B is enlarged to form a packing-head b^3, which bears against the inner circumference of the main cylinder A, within which the piston a' is designed to rotate. In the head b^3 is formed a T-shaped slot b^4, having an elongated pocket designed to receive a bowed plate-spring b^5, the ends of which bear against the bottom of packing b^6, secured within slot b^4 and corresponding in shape thereto. The main cylinder A may be provided with surrounding water-spaces a^4 and also with a series of exhaust-openings C. By forming the exhaust in series the wear upon the packing b^6 and upon the edges of the exhaust-openings is reduced to a minimum. In the ends of piston a' are formed annular grooves, which are designed to receive corresponding flanges a^6 of end pieces a^7, the latter being firmly held against the sides of the cylinder A by means of coil-springs a^8, located in pockets a^9 of said grooves. By this means all leakage around the ends of the piston is prevented. Corresponding plates b^7 extend over the ends of the shoe B and are held against the sides of the cylinder by means of springs b^8, as shown in Fig. 6

D designates the main valve, on a shaft d, extending through a valve-chamber d', communicating at one side with the cylinder A. The valve D is of approximately triangular form in cross-section and provided with three concaved faces, the curvature of which is on the same radius as the inner circumference of the main cylinder A and designed to form a continuation of the latter. Said valve is also provided with a series of longitudinal slots d^2, of approximate inverted-T shape, in which are fitted packing-strips d^3, having enlarged portions d^4, corresponding to the shape of said slots. The outer edges d^5 of said packing-strips are held firmly in contact with the inner walls of the valve-chamber by means of bowed plate-springs d^6, located in the enlarged portions of said slots and bearing against the enlarged portions of said packing. The ends of said valve are provided with annular pockets or depressions d^7, from which radiate slots or recesses d^9. The ends

of packing-strips d^3 are also grooved at d^8 in continuation of slots or recesses d^9 and are designed to receive the radiating arms d^{10} of a circular or ring-like plate d^{12}. Said plates are held normally against the ends of the valve-chamber by means of springs d^{13}, located in recesses d^{14}, formed in grooves d^8 and bearing against the inner faces of the arms d^{12}. By this means a tight joint is maintained between the ends of the main valve and its chamber. Said valve-chamber is provided with an inlet-opening d^{15}, and may be surrounded by water-spaces, as shown.

By providing the valve D with the concaved faces, as above described, it will be noted that in the event of any one of said faces becoming unfit for use by reason of wear or otherwise said valve can be so adjusted as to bring any one of the remaining concaved portions into register with the inner circumference of the main cylinder. By this means the life of the valve is greatly prolonged.

Auxiliary-valve chamber d' is preferably formed contiguous to the main-valve chamber E, which communicates with the former by means of port d^{15}, normally closed by a rotary valve e', keyed to a shaft e^2. Said valve consists of a cylindrical body e^3, provided with an annular flange e^4, in which is formed a segmental port or opening e^5, designed to register with port d^{15}.

The main shaft a is extended through suitable stuffing-boxes F F', the former having a spur gear-wheel f loosely mounted thereon and provided with a cam-groove f^2 in its outer face. Said gear meshes with a pinion f^3, keyed to a shaft f^4, mounted in suitable bearings f^5 and having at its other end a second gear-wheel f^6, which is rotated by means of a pinion f^7, meshing with a gear-wheel f^8, keyed to shaft a. Meshing with a pinion g, keyed to the outer end of shaft d of the main valve, is a toothed segment g', formed on one arm of a bell-crank lever G, pivoted at g^2 to a suitable support, the other end of said bell-crank lever carrying a pin g^3, fitting within the cam-groove f^2 of gear-wheel f. On the opposite end of shaft a is keyed a pinion h, which meshes with a corresponding pinion h', keyed to a sleeve h^2, loosely mounted on an arm or projection h^3 of main cylinder A. To the outer end of sleeve h^2 is keyed an eccentric H, having diverging arms h^4, the ends of which are united by a plate h^5. The eccentric H is provided with a curved slot h^6, in which works a set-screw h^7, whereby the same may be adjusted to any desired angle, and thus regulated to cut off the supply of liquid at any point. A bell-crank lever I is keyed to the projecting end of shaft e^2, one end of said lever being connected by an arm or pinion i to a dash-pot i', the other arm thereof having a slot i^2 in its end, in which is mounted a spring-pressed dog i^3, having a laterally-projecting pin i^4, designed to engage a curved guide i^5, secured to the main cylinder. This guide is adjusted at will by means of a slot and set-screw connection i^6. An arm i^7 is loosely mounted on one end of shaft e^2, the other end thereof being pivoted to plate h^5 and having a lug i^6, designed to engage the dog i^3.

The operation is as follows: As the shoe of piston B approaches the main valve D the cam-groove f^2 of gear-wheel f causes bell-crank lever G to rock, whereupon the toothed segment of the latter, through the medium of gear g, causes said valve to move to the position indicated in Fig. 5. As this transpires the momentum of the piston carries the same beyond the valve, allowing steam or the like already within the cylinder to pass out through exhaust C. By the time the piston has passed the valve the cam-groove f^2 has caused lever G to return to its normal position, thereby moving the main valve to the position indicated in dotted lines, Fig. 5. When the valve is in this position, steam or the like is admitted from port d^{15} into cylinder a^8 to the rear of the shoe of the piston B, exerting the necessary pressure to cause another revolution thereof. Simultaneous with this action the eccentric H causes the lug i^8 to engage dog i^3, moving the same so as to bring the pin i^4 into engagement with the guide i^5, thus causing the port e^5 of the valve e' to register with the opening d^{15} in the valve-chamber, thereby admitting steam or the like to the latter. At this stage the guide i^5 has depressed the dog i^3, so that the same will disengage itself from lug i^8, allowing valve e' to return to its normal position, thus cutting off, the shock of the return of said valve being broken by the dash-pot i', as usual.

From what has been said it will be observed that my improved rotary engine is exceedingly simple and inexpensive, and being composed of but few parts is not liable to readily get out of order or become deranged. It will be particularly observed that steam or the like is automatically admitted to the cylinder just after the piston passes the main valve, and the latter is so constructed that all leakage is prevented and any wear due to friction is taken up automatically. Another advantage lies in the construction of the piston and its shoe, whereby a new shoe may be readily substituted with expenditure of but a minimum amount of time and labor.

I claim as my invention—

1. In a rotary engine, a main cylinder, a piston mounted therein and having a longitudinal slot, a shoe having an enlarged head and a contracted portion fitting within said slot and provided with inner bearing-shoulders, and means for admitting steam or the like to said cylinder.

2. In a rotary engine, a main cylinder, a rotary piston mounted therein and having a longitudinal slot, a shoe secured within said slot and provided with inner bearing-shoulders and an outer enlargement having a longitudinal T-shaped slot, a packing-strip

corresponding to the shape of said slot and located therein, a plate-spring interposed between the bottom of said slot and the under side of said packing, and means for admitting steam or the like to said cylinder.

3. In a rotary engine, a main cylinder, a hollow cylindrical piston mounted therein and provided with a longitudinal slot, a shoe having a contracted portion fitting within said slot, and provided with bearing-shoulders fitting against the inner periphery of said piston, a spring-pressed packing-strip carried by said shoe, and means for admitting steam or the like to said cylinder.

4. In a rotary engine, a main cylinder, a hollow cylindrical piston mounted therein and having a longitudinal slot, a shoe secured within said slot and also having a longitudinal slot, said shoe having shoulders bearing against the inner periphery of said piston, a packing-strip located in the slot of said shoe, a spring interposed between said packing-strips and the bottom of said slot, and means for admitting steam or the like to said cylinder.

5. In a rotary engine, a main cylinder, a rotary piston mounted therein and having a longitudinal slot, said piston having annular grooves in its ends, a shoe secured to the slot in said piston, end plates having flanges fitting in the grooves of said piston, springs bearing against said end plates, corresponding end plates carried by said shoe, and means for admitting steam or the like to said cylinder.

6. In a rotary engine, a main cylinder, a rotary piston mounted in said cylinder, a rotary main valve of approximately triangular form arranged to control the admission of steam or the like to said cylinder, the longitudinal faces thereof being concaved on the same radius as the inner circumference of said cylinder, whereby when one of said faces becomes unfit for use by reason of wear, the remaining faces may be successively presented, and means operated by said piston for automatically operating said valve.

7. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve of approximately triangular form and carrying spring-pressed packing-strips, the longitudinal faces of said valve being concaved on the same radius as the inner circumference of said cylinder, whereby when one of said faces becomes worn, the remaining faces may be successively presented, and means for admitting steam to said valve-chamber.

8. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve of approximately triangular form provided with longitudinal grooves, the longitudinal faces of said valve being concaved on the same radius as the inner circumference of said cylinder, whereby when one of said faces becomes worn or otherwise unfit for use the remaining faces may be successively presented, spring-pressed packing-strips located in said grooves, means for rotating said valve, and means for admitting steam or the like to said valve-chamber.

9. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein and having longitudinal grooves formed therein and provided with lateral enlargements, packing-strips located in said grooves and having shoulders fitting within said enlargements, springs bearing against said packing-strips, means for operating said valve, and means for admitting steam or the like to said main-valve chamber.

10. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main rotary valve mounted therein and having radiating recesses formed in its ends, spring-pressed plates located in said recesses, means for rotating said valve, and means for admitting steam or the like to said main-valve chamber.

11. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein having recesses formed in its ends, said recesses being provided with pockets or depressions, coil-springs located in said pockets or depressions, plates located in said grooves or recesses and engaged by said springs, means for rotating said main valve, and means for admitting steam or the like to said cylinder.

12. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve located in said chamber and having annular pockets in its ends provided with radiating slots or recesses, a ring-like plate fitting in each of said annular pockets, and having radiating arms corresponding to said slots or recesses, springs bearing against said plates, means for rotating said main valve, and means for admitting steam or the like to said main-valve chamber.

13. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve located in said chamber and having longitudinal grooves, packing-strips secured in said grooves and having grooves formed in their ends, said valve having annular pockets in its ends provided with radiating slots or recesses in alinement with the slots or grooves formed in said packing, a ring-like plate fitting in each of said annular pockets and having radiating arms corresponding to said slots or recesses, springs bearing against said plates, means for rotating said valve, and means for admitting steam or the like to said valve-chamber.

14. In a rotary engine, a main cylinder, a

rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve located therein, means for automatically rotating the same, an auxiliary-valve chamber arranged on a horizontal plane with said main-valve chamber, a partition-wall separating said valve-chambers and having a port or opening, a shaft mounted in said auxiliary-valve chamber, a valve keyed to said shaft and provided with a flange having a port designed to register with said port or opening, and means for rocking said shaft.

15. In a rotary engine, a main cylinder, a main shaft mounted in said cylinder, a rotary piston keyed to said shaft, and located within said cylinder, a main valve arranged to control the admission of steam or the like to said cylinder, a cam-wheel loosely mounted on a projection of said main cylinder, gearing operated by said main shaft and meshing with said cam-wheel, and a lever operated by said cam-wheel arranged to reciprocate said main valve.

16. In a rotary engine, a main cylinder, a main shaft mounted in said cylinder, a rotary piston keyed to said shaft and located within said cylinder, a main-valve chamber communicating with said cylinder, a shaft mounted therein, a main valve keyed to said shaft, a pinion also keyed to said shaft, a cam-wheel loosely mounted on said main cylinder, gearing operated by said main shaft and meshing with said cam-wheel, and a bell-crank lever pivoted to said main cylinder and having a toothed segment at one end in engagement with the pinion of said main-valve shaft, the opposite end of said bell-crank lever being in engagement with said cam-wheel and operated thereby.

17. In a rotary engine, a main cylinder, a main shaft mounted in said cylinder, a rotary piston keyed thereto and located within said cylinder, a main-valve chamber communicating with said cylinder, a main valve mounted therein, means for rotating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the auxiliary-valve chamber, a valve keyed thereto, an arm projecting from said main cylinder, a sleeve loosely mounted thereon and carrying a pinion, a second pinion meshing therewith and keyed to said main shaft, an eccentric keyed to said sleeve, and connections between said eccentric and said auxiliary-valve shaft.

18. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein, means for rotating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the former, a valve keyed to said shaft, an eccentric operated by said piston, a lever keyed to said valve-shaft and designed to be engaged by said eccentric, and means for automatically disengaging said bell-crank lever from said eccentric.

19. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein, means for rotating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the former, a valve keyed to said shaft, an eccentric operated by said piston, an arm or member loosely mounted on said auxiliary-valve shaft and having pivotal connection with said eccentric, a lever keyed to said valve-shaft and designed to be engaged by said arm or member, and means for automatically disengaging said lever from said arm or member.

20. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein, means for rotating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the former, a valve keyed to said shaft, an eccentric operated by said piston and having diverging arms, a plate connecting the ends of said arms, an arm or member loosely mounted on said auxiliary-valve shaft and pivotally connected to said plate, a lever keyed to said valve-shaft and designed to be engaged by said arm or member, and means for automatically disengaging said lever from said arm or member.

21. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein, means for operating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the former, a valve keyed to said shaft, an eccentric operated by said piston, a lever keyed to said auxiliary-valve shaft and having a spring-pressed dog, an arm loosely mounted on said valve-shaft and pivotally connected to said eccentric, a lug carried by said arm and designed to engage said dog, and means for automatically disengaging said dog from said lug.

22. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a main valve mounted therein, means for operating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the former, a valve keyed to said auxiliary-valve shaft and having a spring-pressed dog provided with a lateral pin, an arm loosely mounted on said shaft and pivotally connected to said eccentric, a lug carried by said arm and designed to engage said dog, and a guide designed to engage said pin, whereby said dog will be depressed.

23. In a rotary engine, a main cylinder, a rotary piston mounted therein, a main-valve chamber communicating with said cylinder, a

main valve mounted therein, means for operating the same, an auxiliary-valve chamber communicating with said main-valve chamber, a shaft mounted in the former, a valve keyed to said shaft, an eccentric operated by said piston, means for adjusting the same, a lever keyed to said auxiliary-valve shaft and having a spring-pressed dog, an arm loosely mounted on said shaft and pivotally connected to said eccentric, said arm being designed to engage said dog, a curved guide designed to depress said dog, and means for adjusting said guide.

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

GIDEON R. IBACH.

Witnesses:
A. B. HUTCHINSON,
ERNEST H. WAY.