(No Model.)

W. W. TURNER.

ROTARY ENGINE.

No. 344,020. Patented June 22, 1886.

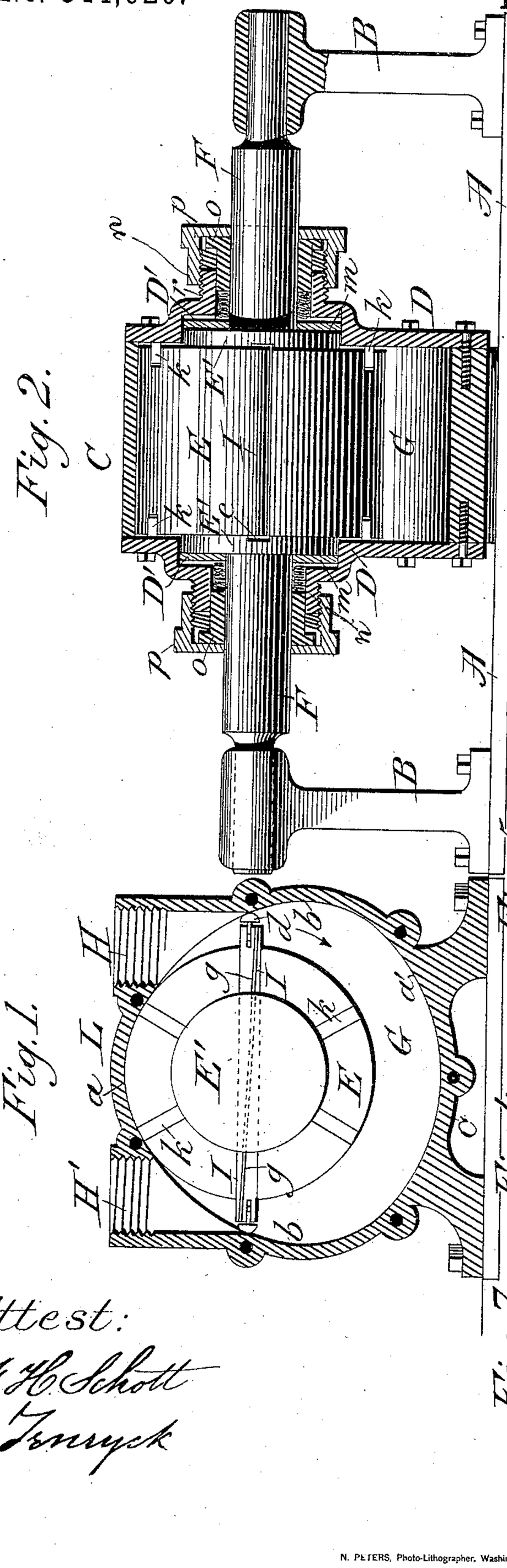


Fig. 2.

Fig. 3.

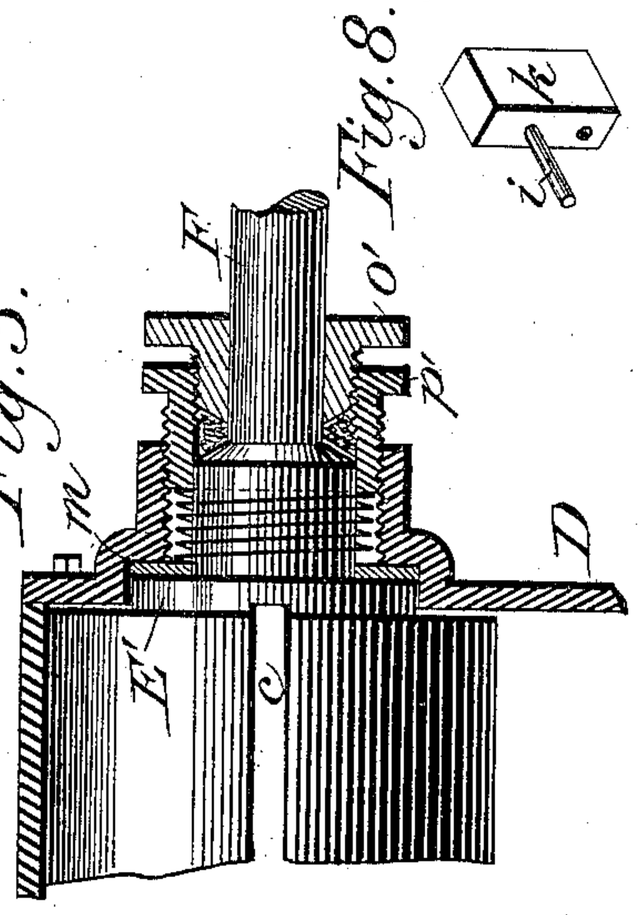


Fig. 5.

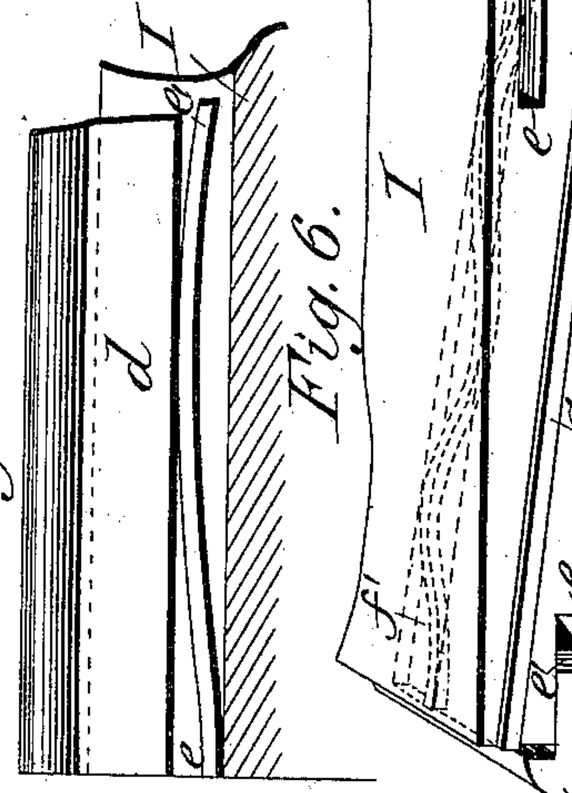


Fig. 6.

Fig. 4.

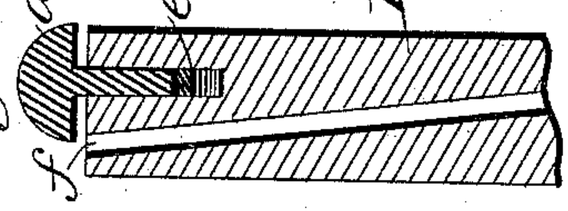
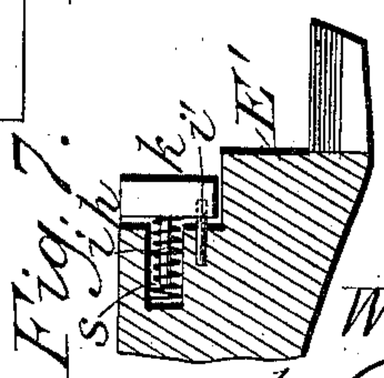


Fig. 1.

Fig. 7.



Attest:

F. H. Schott

M. Tanzyck

Inventor:

William W. Turner

by Albert G. Wood

ATTY.

UNITED STATES PATENT OFFICE.

WILLIAM WEAVER TURNER, OF LA GRANGE, GEORGIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 344,020, dated June 22, 1886.

Application filed November 9, 1885. Serial No. 182,255. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WEAVER TURNER, a citizen of the United States of America, residing at La Grange, in the county of Troup and State of Georgia, 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in that class of rotary steam-engines in which a sliding piston is employed in connection with a cylinder having its inner surface formed of curves of varying radii, so arranged as to give for a great part of the circumference between the head carrying the pistons and the cylinder a space rectangular in cross-section, having nearly the same area at all points for at least one-third of the revolution. The preferred mode of giving the proper form to the interior of this cylinder is to strike one curve of the same radius as the piston-head for a distance equal to about one-sixth the circumference of said head. Then from the same center strike another curve with an increased radius equal to the breadth of the steam-space for a distance equal to at least one-third of the whole inner circumference of the cylinder. Then unite these two curves at their ends by such others as will produce the same diametrical distance from the point opposite when measured through the axis of the piston-head. This form of cylinder exposes the same piston-area to the full pressure of the steam for a much longer time than is possible in those engines wherein the internal circumference of the cylinder is a true circle. It also gives a long bearing-surface of the same curvature as the periphery of the piston-head to act as an abutment to sustain the back-pressure of the steam. Although cylinders have been constructed with internal curves approaching the form of mine, yet the engines of which they formed a part have proved as a general thing inoperative, owing to the lack of proper construction and arrangement of details.

The object of this invention is therefore to so improve the details of construction as to form a patentable improvement over those engines which have been heretofore constructed upon this principle by others, as well as that for which I have made application for patent, said application having been filed on the 11th day of August, 1885, being Serial No. 174,089.

My invention therefore consists in the means used for preventing the improper escape and consequent waste of steam, and, further, in the general construction and arrangement of parts, as hereinafter fully described, and then specifically stated in the claims.

In the accompanying drawings, Figure 1 is a vertical transverse section through the cylinder, showing the piston-head and other operative parts. Fig. 2 is a side view, partly in section, showing the arrangement of the parts occupying the interior of the cylinder. Fig. 3 is a similar view of one end of the piston-head and adjacent parts, showing a modification of the method of packing the ends of the piston-head and shaft where it passes through the cylinder-heads. Fig. 4 is a sectional edge view of one end of the piston, showing the arrangement of the packing therein. Fig. 5 is a sectional view of a part of the piston, on an enlarged scale, illustrating the method of applying the spring-packing to its ends. Fig. 6 is a perspective view of the piston, the packing being removed from one end, but shown in place on the side and other end. Fig. 7 is a sectional view of a part of the piston-head, showing the construction and arrangement of the end packing; and Fig. 8 is a perspective view of one of the piston-head packing-blocks.

In these figures, A represents the bed-plate, and B B the pedestals secured to the bed-plate near its ends, and carrying in suitable journal-bearings the shaft F. Between these pedestals, and firmly secured to the bed-plate, is the cylinder C, through which the shaft passes.

As shown in the drawings, the bed-plate, pedestals, and cylinder are in separate pieces secured together by bolts; but it will be evident that, if desired, they may be cast integral,

thus forming one piece of metal, insuring stability, and rendering it impossible for the parts to get out of line.

The interior of the cylinder, as heretofore stated, does not present a true circle, but is formed by the union of three curves of different radii. One of these curves (indicated by the letter *a*) is of the same radius as the piston-head E, which forms a part of or is secured upon the shaft F. This curve *a* forms that part of the cylinder with which the piston-head is in contact, and takes the place of the abutment commonly used in rotary engines to sustain the back-pressure of the steam. Another curve, *a'*, is struck from the same center as the curve *a*, but with a greater radius, thus leaving a space between it and the periphery of the piston-head, which forms the chamber G. Connecting these curves *a a'* are the curves *b b*, thus giving to the interior of the cylinder its irregular form, for the purposes hereinbefore stated. From the curves *b b* proceed the steam and exhaust openings H H', thus causing the working part of the cylinder to consist, mainly, of the chamber G, included between the periphery of the piston-head and the curve *a'*. Through this piston-head E is formed a diametrical slot or mortise, *c*, which receives the piston I. This piston is preferably formed as a plate of steel or other suitable metal, having a length nearly equal to the internal diameter of the cylinder and of a width equal to the length of said cylinder between the cylinder-heads D D. As the axis of the piston-head does not conform to that of the cylinder, it is evident that as the piston-head revolves the piston will have a sliding or reciprocating movement in the mortise *c* through the head. It therefore becomes necessary to so form the mortise and piston that steam shall not pass through said mortise, and at the same time allow a free movement to the piston. This I accomplish by making the mortise larger than the piston and filling the vacant space with melted Babbitt metal, it having been practically demonstrated that this forms not only a cheap but steam-tight joint. The wear of the piston being at opposite sides of the mortise on the opposite sides of the head causes it to stop off the passage of steam through said mortise completely.

It is evident that, if desired, the piston could be brought to a perfect fit, metal to metal, or spring-packing might be used to produce a steam-tight joint; but both these methods are costly, and do not present any practical advantage over the Babbitt-metal facing applied as above described, while the readiness with which it may be renewed when worn out or defective renders its use in this connection preferable. As the ends of the piston are always in contact with the inner surface of the cylinder, and therefore subject to much wear, especially at those points where the curves forming its internal surface intersect, it becomes necessary to protect the ends of said piston with a readily-removable elastic packing, which may be renewed whenever so worn as to allow a leakage of steam, or for other reasons. This packing I apply to the piston by forming in each end thereof a slot, *e*, in which is placed a T-shaped packing-strip, *d*, the tongue of which enters the slot, while the broad portion, which is rounded on the outside, covers the end of the body of the piston and forms the wearing-surface which comes in contact with the cylinder. In order to give a proper degree of elasticity to this packing-strip, a curved or bow spring, *e'*, is placed in the bottoms of the slots *e*, and tends to continually force the strip *d* against the cylinder. As steam is also liable to pass the edges of the piston where they come in contact with the cylinder-heads, it becomes necessary to provide some means for packing these also. This I accomplish by forming in each edge of the piston a groove, *f*, passing diagonally from one corner to the other, so that it shall not interfere with the slots *e*, carrying the end packing, *d*. Into these slots is placed the packing-strips *g*, with a spring, *f'*, behind them, which forces them outward and causes them to always remain in contact with the inner surface of the cylinder-heads.

As the piston-head E comes in contact with the inner surface of the cylinder-heads and the shaft F passes through them, it becomes necessary to provide these parts with suitable packing, to prevent the escape of steam around the shaft or its passage from the steam side of the piston to the exhaust side of the same along the sides of the piston-head. To accomplish these results each cylinder-head is provided with a recess, D', into which project the extensions E' of the piston-head E, thus forming a cut-off or stop between the periphery and shaft at each end of the piston-head, and giving additional strength to allow the forming of a long mortise to receive the piston. Within the space between the periphery of the piston-head and extensions E' of the same are formed a series of radial slots, *h*, sufficient in number to insure that when the piston is not within the arc of the curve *a*, against which part of the cylinder the piston-head impinges, one or more of these slots will be within that arc. Within these recesses *h* are placed the packing-blocks *k*, each of which is provided with guide-pins *i* and *i'*, entering suitable orifices formed in the bottom of the slot to receive them, one or both of said recesses being made large enough to allow a coiled spring, *s*, to surround the pin or pins for the purpose of forcing the block outward and keeping it in contact with the cylinder-head. As these blocks *k* extend the whole distance from the end projection, E', to the periphery of the piston-head, and are in sufficient number to always keep one or more of them in the arc forming the abutment between the steam and exhaust openings at all times when the piston is not within that arc, it is evi-

dent that all leakage at the sides of the piston-head by said abutment will be prevented to insure a steam-tight joint around the shaft, and to retain the revolving piston-head in its proper relative position to the cylinder-heads, as the journals of the shaft F are preferably without shoulders, the head and shaft being only controlled in their longitudinal movements by the packings, which, so far as they relate to the joint about the shaft, consist of washer-shaped packing-rings *m*, surrounding the shaft in the bottom of the recesses D′, one side of said washers or rings being in contact with the projections E′ of the piston-heads, against which they are held by an adjustable pressure produced by the elastic packing *n*, which is forced forward as may be needed by the gland *o* within the screw-cap *p*, which cap screws upon the outside of the stuffing-box *r*, forming a part of each cylinder-head. It will be seen that the elastic packing here serves a double purpose—that of preventing the passage of steam and keeping the rings *m* pressed against the piston-head.

In Fig. 3 is shown a modification of these devices, in which the washer or ring *m* is retained in contact with the piston-head ends by means of a coil-spring encircling an enlargement of the shaft, said spring being adjusted by the annular screw *p′*, while the tightness of the joint against any leakage of steam is insured by the gland *o′*, which surrounds the shaft and compresses the packing against the shoulder on the same, thus insuring a ready means of adjustment for the rings *m* and a steam-tight joint.

The operation of the engine will be readily understood by an inspection of Fig. 1 of the drawings, in which the steam is supposed to enter the cylinder through the port H, and being prevented from passing directly to the exhaust-opening by the abutment L, against which the piston-head E impinges, it must necessarily pass downward in the direction of the arrow, carrying or pushing before it the piston I, which, acting upon the head, revolves the shaft F, from suitable connections with which power is taken to drive any desired machinery. When the end of the piston which is being pushed forward by the steam reaches the exhaust-opening H′, the opposite end has already passed the steam-port, and the steam between the two ends of the piston in the chamber G passes out through the exhaust-port. By a repetition of this proceeding continued rotation is given to the piston-head and shaft.

It will be apparent that the whole machine is simple in construction, thus making it one of the cheapest engines for the power produced yet devised, and one that will fill the demand for a cheap and powerful engine.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. In a rotary engine, the combination of a cylinder the inside curvature of which is of varying radius, one portion being of the same radius as the piston-head, with a revolving piston-head having projections at its ends, and provided with spring-actuated packing in radial grooves extending from the periphery of said projections to the periphery of the piston-head, and sufficient in number to insure one or more being within the arc of that portion of the curve of the cylinder which forms the abutment for the piston-head at all times when the piston is not within that arc, and a sliding piston having end and side packing-strips, arranged and operating substantially as set forth.

2. In a rotary engine, the combination, with recessed cylinder-heads, of a revolving piston-head provided with end extensions entering said recesses, and spring-pressed rings placed in said recesses and bearing against said extensions, as and for the purpose specified.

3. In a rotary engine, a revolving piston-head having a Babbitt-lined mortise passing through it, in combination with a reciprocating piston having end packing and edge packing, the latter arranged diagonally and extending from end to end of said piston, substantially as and for the purpose set forth.

4. In a rotary engine, the sliding piston I, provided with end grooves, *e*, and diagonal edge grooves, *f*, in combination with the T-shaped end packing, *d*, edge packing, *g*, and springs *e′ f′*, arranged and operating substantially as specified.

5. In a rotary engine, the revolving piston-head having end projections, in combination with recessed cylinder-heads and spring-pressed rings *m*, arranged to retain said piston-head in its proper relation to the cylinder-heads, as set forth.

6. In a rotary engine, the piston-head E, shaft F, and ring *m*, surrounding the shaft and forming the bottom of the stuffing-box, in combination with the cylinder-head D, spring packing-gland *o*, and cap *p*, arranged and operating as and for the purpose specified.

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

WILLIAM WEAVER TURNER.

Witnesses:

EUGENE J. DOBBS,

CHAS. J. KEITH.