(No Model.) 2 Sheets—Sheet 1.

P. KIRCHHOFF.

ROTATING STEAM ENGINE.

No. 421,728. Patented Feb. 18, 1890.

Fig. 2.

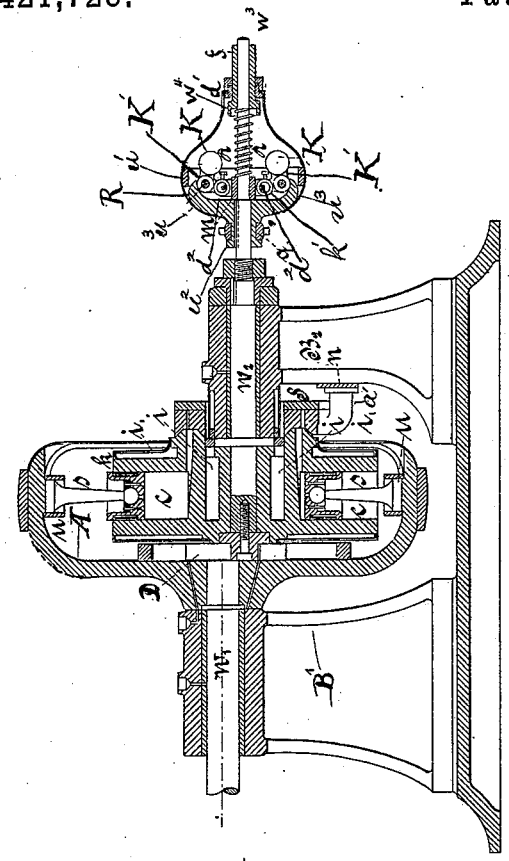


Fig. 5.

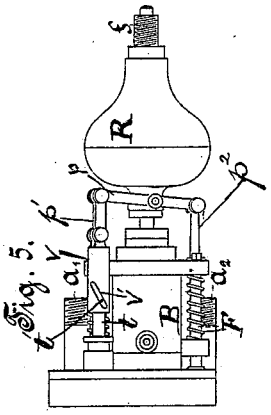


Fig. 4.

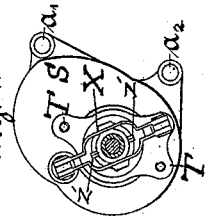


Fig. 1.

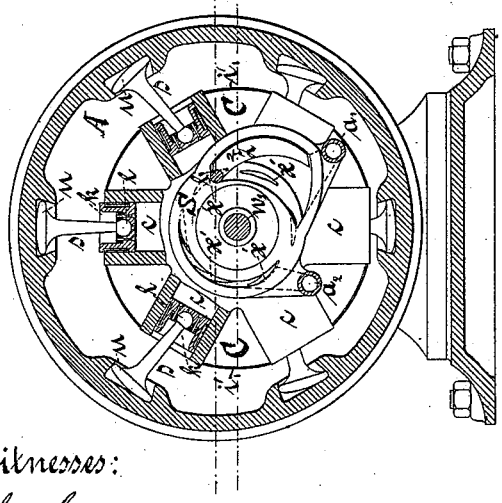
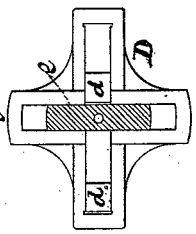


Fig. 3.



Witnesses:
Paul Fischer
Carl Gregor.

Inventor:
Paul Kirchhoff.
by Munn & Co
Attys.

(No Model.) 2 Sheets—Sheet 2.

P. KIRCHHOFF.

ROTATING STEAM ENGINE.

No. 421,728. Patented Feb. 18, 1890.

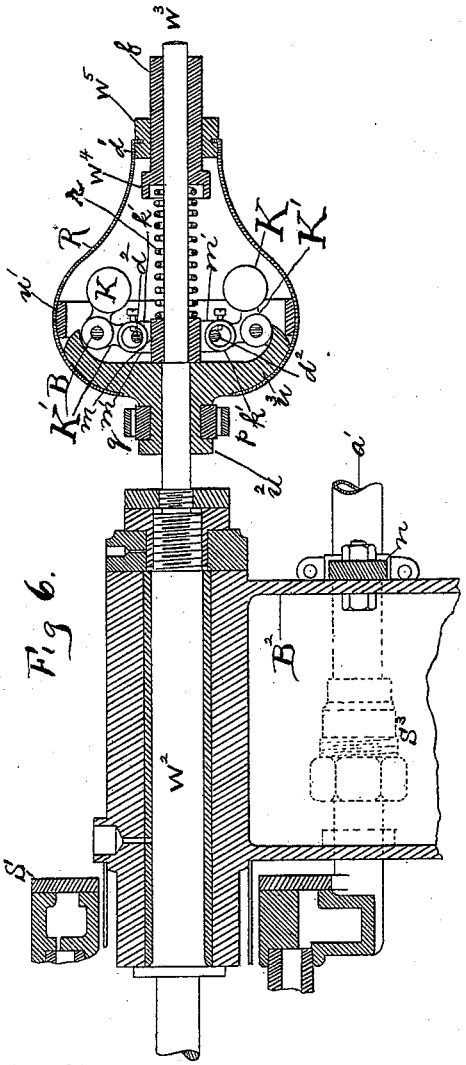


Fig 6.

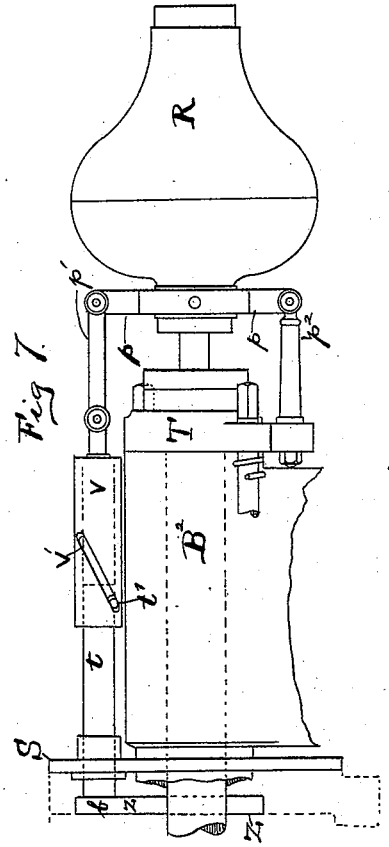


Fig 7.

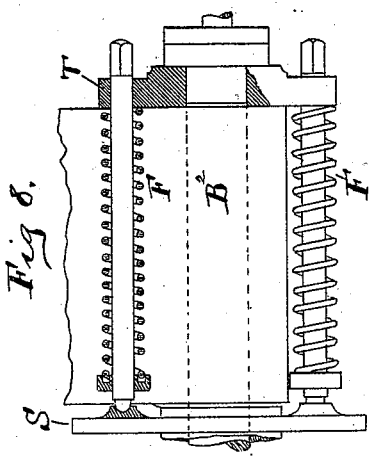


Fig 8.

Witnesses.
A. Zichtl
H. Middeldt

Inventor.
Paul Kirchhoff
by Wm H Babcock
Attorney

UNITED STATES PATENT OFFICE.

PAUL KIRCHHOFF, OF MITTWEIDA, SAXONY, GERMANY.

ROTATING STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 421,728, dated February 18, 1890.

Application filed August 1, 1887. Serial No. 245,890. (No model.) Patented in Germany April 3, 1887, No. 41,187; in England April 30, 1887, No. 6,354, and in France October 3, 1887, No. 183,381.

To all whom it may concern:

Be it known that I, PAUL KIRCHHOFF, of Mittweida, in the Kingdom of Saxony and German Empire, have invented certain new and useful Improvements in Rotating Steam-Engines, of which the following is a specification, reference being had to the accompanying drawings.

This invention has been patented in Germany by Letters Patent No. 41,187, dated April 3, 1887; in Great Britain by Letters Patent No. 6,354, of April 30, 1887; in France by Letters Patent No. 183,381, of October 3, 1887.

The object of this invention is to improve the construction and operation of rotating steam-engines in which the steam acts on pistons projecting from a drum or cylinder and in contact with an exterior hollowed disk or casing.

To this end the said invention consists in the construction and combination of parts hereinafter set forth.

In said drawings, Figure 1 represents a vertical cross-section taken through an engine embodying my invention on a plane parallel and proximate to the valve-plate S, hereinafter described. Fig. 2 represents a longitudinal vertical section of the same, taken in a plane parallel and proximate to the shafts. Fig. 3 represents in detail elevation the coupling between the shafts. Fig. 4 represents a cross-section through the steam-governing devices. Fig. 5 represents a plan view of the same. Fig. 6 represents, on a larger scale, a longitudinal vertical section through the same and certain proximate devices. Fig. 7 represents a plan view of the same on a similar scale. Fig. 8 represents a detail view, in elevation, of the springs F and their proximate parts.

A designates a cup-shaped disk or casing open on one side, which is mounted on a horizontal shaft W′, having its bearing in a standard B′, and C designates a cylinder or drum mounted on a horizontal shaft W^2, which has its bearings in a shaft B^2. These shafts are not in line, and consequently the drum C, although located within the cup-shaped casing A, is eccentric thereto. The connection between said shafts is by an Oldham coupling D, (illustrated in Fig. 3,) having cross-slots which slide on tenons *d* and *e* of said casing A and drum C.

The steam enters at *a′* and passes through openings in a stationary valve-plate S, and then through one of several openings X′ in the rotating-seat of said valve-plate to one of several radial cylinders *c*, which are set into the drum C. The steam enters these cylinders under pistons *k*, which work therein, and afterward escapes through outlet a^2. Each of these pistons is connected by a ball-and-socket joint *l* to the inner end of an outwardly-extending rod or arm *s*, provided at the other end with a head *u* in the form of a segment of a cylinder which fits loosely into a recess in the inner face of the casing or cup-shaped disk A and has a rolling motion in contact therewith as the shafts rotate. This causes the thrust of the pistons to be always exerted in the same direction as the centrifugal force. On the return or inward stroke of the piston the steam is discharged through one of the openings X′ aforesaid and escapes through outlet a^2, as already stated. As the disk or casing A and drum C rotate about the stationary valve-plate S, the said pistons are successively acted on in this manner and the steam admitted and discharged.

The valve-plate S is pressed against its seat by springs F, which bear against a transverse bar T, attached to standard B^2. Said plate S is held by plates which are fixed to standard B^2. The inlet and outlet pipes pass through them. One of these plates (marked *n*) is shown in Fig. 2 supporting the inlet-tube.

The steam-supply is governed by the following devices: Within a casing R governor-balls K are mounted on the free ends of bell-crank levers K′, which are pivoted at their angles to a ring *u′*, which is fixed to the inside of said casing. A spindle W^3, extending outerward from shaft W^2, has a bushing *f* fixed on its outer end. On this bushing is a collar *d′*. The said casing R, which is preferably pear-shaped, is secured at one end to said collar and at the other end to an enlargement u^3 of a sleeve u^2 on the spindle W^3. The inner end of bushing *f* is provided with a cup-shaped enlargement W^4, which receives one end of a spring *r*, the

other end of said spring bearing against a collar m, having radial lugs m', provided with lateral pins d^2. These pins enter rings or eyes k', formed on the inner ends of said angular governor-levers K'.

The centrifugal action of the governor-balls K will cause the said rings to draw on the said pins in such a manner as to move collar m outward against the pressure of spring r. The sleeve u^2 moves outward with said collar. Said sleeve is grooved peripherally to receive a ring q, to which a lever p is connected at its middle, said lever having rods p' p^2 attached to its ends. The rod p^2 is fixed and serves as a fulcrum. The rod p' is connected to one end of a cylindrical obliquely-slotted casing v, the slot v' of which receives a pin or stud t' on a shaft t. The said shaft is of course partly rotated by the action of the walls of said slot on said pin as said cylinder moves longitudinally. This shaft carries an eccentric Z, having two cams z', which by the rocking of said shaft come into contact with the inner periphery of a yoke X. This yoke has tongue-shaped valve z^2 attached to it at b. When this valve is carried by said yoke across the opening x', through which steam is passing to one of the pistons, it cuts off the supply of steam. If the action of the governor be only sufficient to move said valve across a part of said opening, the steam will be cut off only in part. Thus the governing devices above described and said valve constitute together an efficient means for automatically regulating the steam-supply and the action of the engine.

The sleeve f is preferably screw-threaded, as shown in Fig. 5. As indicated in Fig. 2, the collar d' is then divided into a pair of clamping-nuts holding the end of the casing between them. By adjusting these nuts backward or forward on said collar the tension of spring r is increased or diminished, the action of the governor being made correspondingly more or less delicate as a consequence.

The central part of drum C is separated from the basis of the cylinder c by any heat-insulating material occupying spaces i, Fig. 2. Said drum is also covered, except said cylinders, with a coating of this material, (marked i'.)

The inlet-pipe a' and the outlet-pipe a^3 are preferably provided with telescopic connections, one of which S^3 is indicated in Fig. 6. Of course any suitable vapor or liquid may be substituted for steam in working this engine.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary engine, the combination of cup-shaped disk or casing having recesses in the inner face of its peripheral wall, with piston-rods having rounded heads which work in said recesses, pistons to which said rods are attached, a drum having radial steam-cylinders in which said pistons reciprocate, inlets and outlets for steam to and from the spaces within said cylinders behind said pistons, the shafts of said disk and drum arranged eccentrically with respect to each other, and supports for the shafts and their actuating mechanism above described, all operating substantially as set forth.

2. The combination of cup-shaped disk or casing A with drum C, turning eccentrically therein and having steam-cylinders c, provided with steam inlets and outlets, pistons reciprocating in said cylinders and having piston-rods which are provided with rounded heads working in recesses of said disk or casing, shafts for said drum and disk, and an Oldham coupling connecting said shafts, for the purpose set forth.

3. The combination of the drum C, provided with radial steam-cylinders c, with the pistons working in said cylinders and the rods attached thereto by ball-and-socket joints, and provided with rounded heads which are free to turn in contact with the inner face of said cup-shaped disk, substantially as set forth.

4. In a rotary engine, the fixed valve-plate S, in combination with a drum C, provided with cylinders c and openings x', through which the steam passes to the said cylinders, the pistons and piston-rods actuated thereby, inlet and outlet pipes for said steam, and the rotary cup-shaped disk A in contact with the heads of said piston-rods, substantially as set forth.

5. In combination with the disk or casing A, the drum C, provided with cylinders c, the pistons operating in said cylinders, the stationary valve-plate S, the tongue-like valve for closing partly or wholly the passage of steam through said valve-plate and the openings x' in its seat, and regulating mechanism for turning said valve axially, substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

P. KIRCHHOFF.

Witnesses:
E. E. BRAMLETTE,
RICH. KELLER.