No. 890,591. PATENTED JUNE 16, 1908.

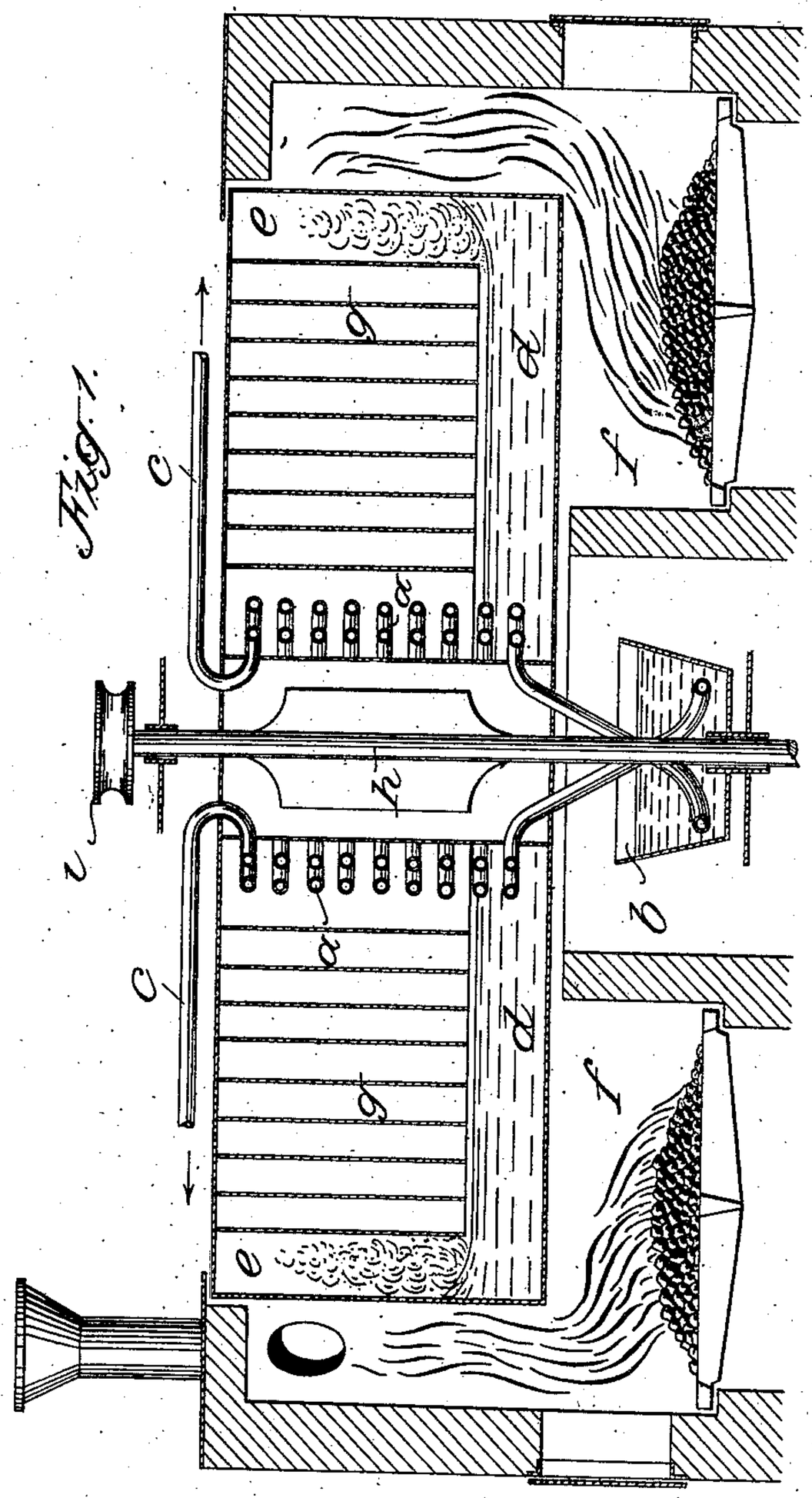
K. A. E. ANDREAS.

ROTARY ENGINE.

APPLICATION FILED MAR. 21, 1908

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

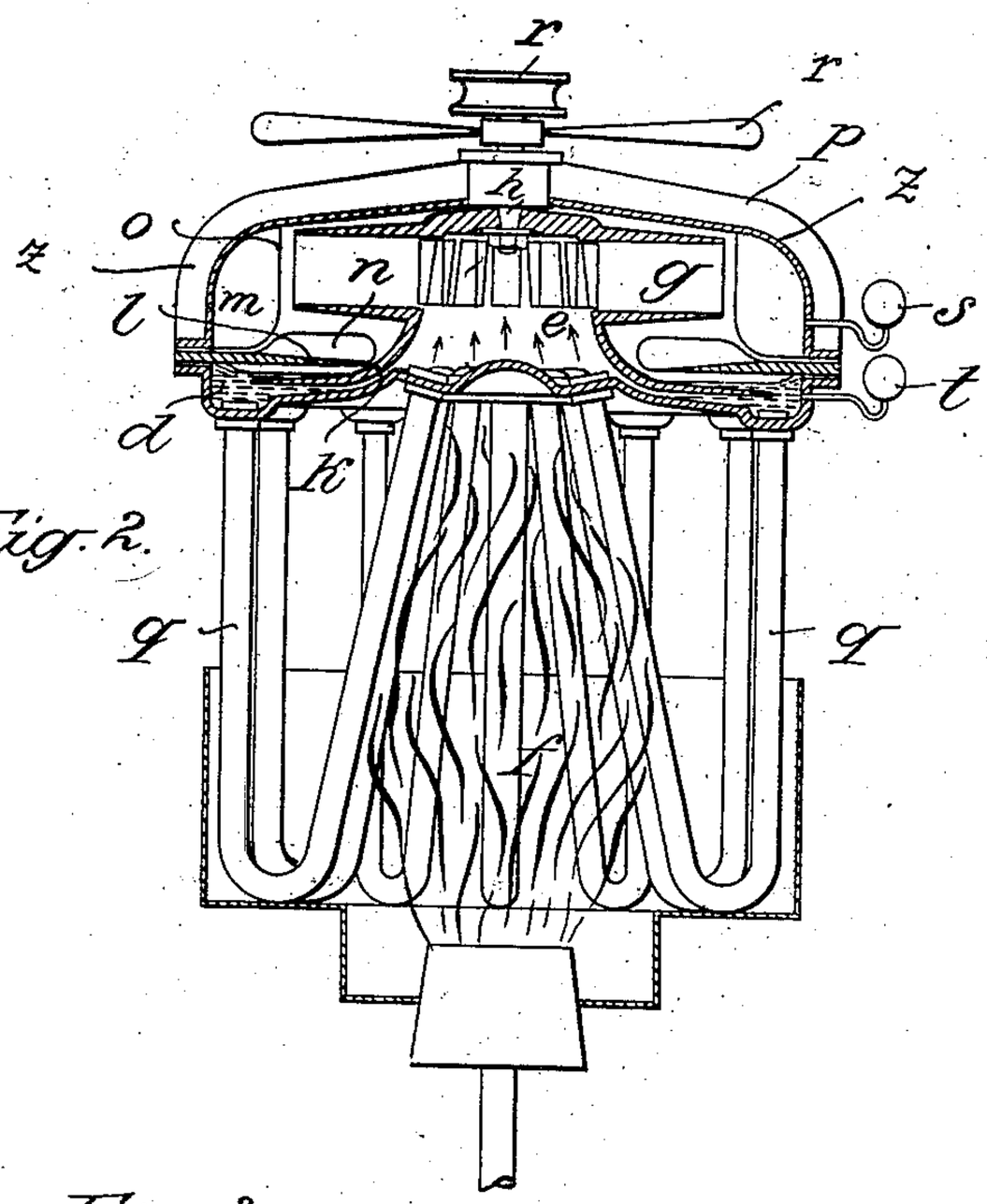
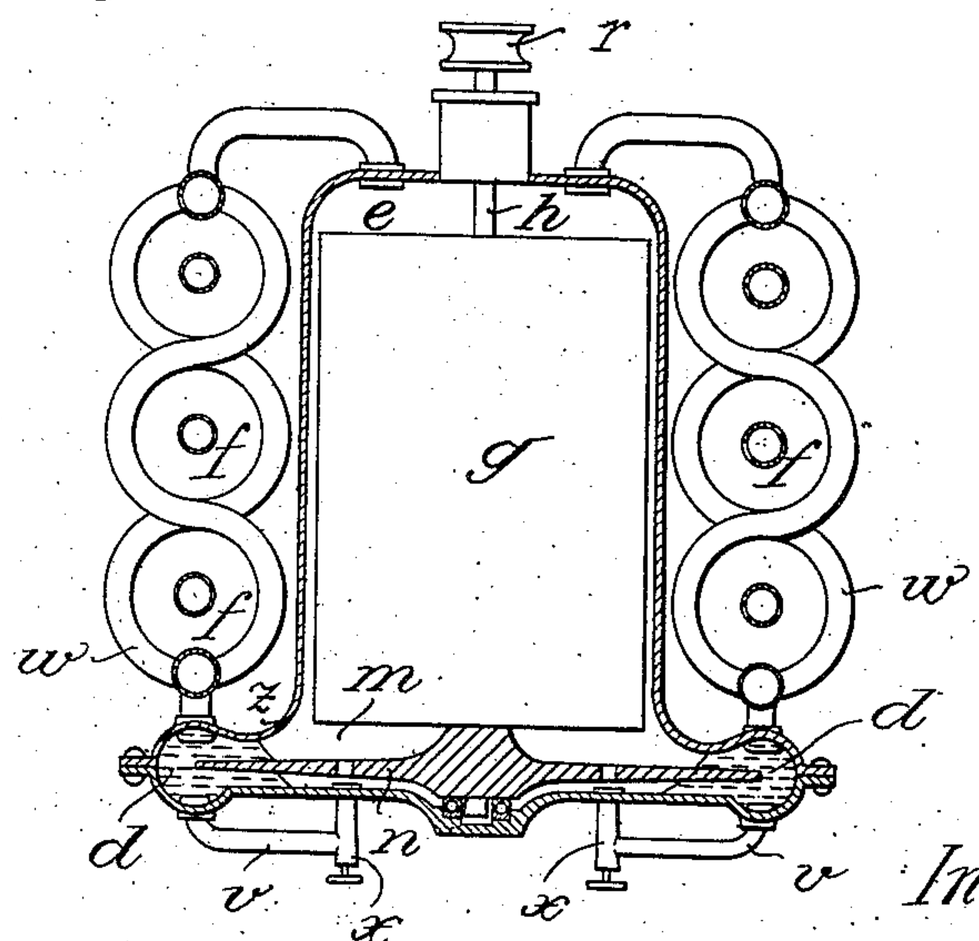


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

KARL ADOLF ERNST ANDREAS, OF BERLIN, GERMANY.

ROTARY ENGINE.

No. 890,591. Specification of Letters Patent. Patented June 16, 1908.

Application filed March 21, 1908. Serial No. 422,404.

To all whom it may concern:

Be it known that I, KARL ADOLF ERNST ANDREAS, a subject of the German Emperor, and residing at Berlin, Germany, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

The present invention relates to a rotary steam engine or turbine in which the propellant is generated at the admission end of the blades and compressed at the other end by condensation, the engine being rotated in consequence of the force acting in this manner on the blades. It is equivalent whether the housing rotates with the blade-wheel or whether the blade-wheel only rotates in the housing. The action of the rotary engine is increased when the steam is at as high pressure as possible and superheated before admission and is at as low pressure as possible or condensed after its exhaust. Therefore a high pressure steam boiler and superheater are connected in front of the rotary engine and a condenser which produces a low vacuum is connected behind. Both the steam boiler and superheater as well as the condenser are arranged around or in the rotary engine.

In order that the invention may be clearly understood reference is made to the accompanying drawing in which several embodiments are represented by way of example in elevation partly in section, and in which:—

Figure 1 shows a rotary steam engine or turbine with rotating steam generator, Fig. 2 a constructional form with stationary steam generator, whereas Fig. 3 is a modification of the constructional form according to Fig. 2.

Referring to the drawing, and particularly to Fig. 1, *a* is a tubular surface condenser which sucks up its cold water from the stationary tank *b* under the rotary engine and ejects it above through pipes *c*. *d* is the water space, *e* the annular steam space and *f* the furnace. Condenser *a*, water space *d*, steam and superheating space *e*, and blade-rim *g* rotate as one connected whole round the axle *h* from which power is taken off at pulley *i*.

The rotary engine is driven as follows:— The entire hollow body of the rotary engine is hermetically sealed from the outside. The rotary engine is filled with water somewhat above the bottom of the blade space *g* and evacuated of air. If the rotary engine is now rotated rapidly, water is thrown into the outer annular space *e* with the pressure

$$p=\frac{v^2}{2g}$$

Now when *v* the circumferential velocity is 60 meters per sec.,

$$p=\frac{60^2}{2\times 9.81}=183,$$

or round 18.3 atmospheres is obtained. If the cylindrical shell of the steam space *e* is heated by the furnace *f* to 206.8° C., that corresponds to a steam pressure which exceeds by about $\frac{1}{100}$ of an atmosphere that of 18.3 atmospheres; this pressure would not only suffice to prevent the water rising into the steam space, but the pressure in the condensing chamber would also be about 10 cms. higher than in the steam space. The steam would thus generate in the steam chamber at about 18 atmospheres, and then flow through the blade-rim to the condenser in which a vacuum will exist corresponding to the temperature of the cold water. The high speed developed by this flow of steam would be taken up by the blade-rim, and thus the rotary engine is able not only to rotate with its own power but also to give off power in addition. In this arrangement the centrifugal force acts on the mass of water in such a manner that the latter tends to collect at the periphery of the water space in the form of a hollow paraboloid. In consequence of the steam pressure developed chiefly at this place however, the mass of water is prevented or limited in its endeavor or tendency to rise at the periphery of the steam space. Now since the development of steam, the speed of rotation and the centrifugal force in this device are amounts which are dependent on one another in such a manner that with equal load they increase or decrease proportionally, the steam space remains approximately or quite constant. Steam is thus produced under like conditions at all speeds.

The advantages of this system are:—

1. Less space required.
2. Less danger, since the relatively small annular steam space is the only part under high pressure.
3. Great efficiency on account of the omission of all valves and steam pipes, as well as the employment of absolutely dry steam,

since all water is centrifuged and thrown at the hot cylinder wall.

4. Very good utilization of the hot gases on account of the great temperature differences, rapid circulation of water and impossibility of boiler-scale forming.

The form of construction represented in Fig. 2 differs from that above described in that the boiler is stationary and only the water in the same is rotated. In this figure, *g* again indicates the blade-rim which is here arranged on a bell-shaped support or holder *k*. The bottom edge of this bell rotates in the boiler or water receptacle *d*, the upper part of which is closed by an annular disk *l* from the condensing chamber *m* and hereby prevents the rotating water rising at the vertical walls. The ribs *n* which are arranged on the annular disk serve for preventing the mass of water in the condensing chamber *m* rotating. The ribs *o*, which are cast on the upper closure or cap *z* of the condensing chamber, serve as surface condenser for the steam. Cooling is brought about by the cold ribs *p* cast on the same cap, which ribs in the above form are cooled by a fan *r* attached to the axle *h*.

The rotary engine or turbine according to Fig. 2 works in the following manner:—The lower plate-shaped part of the receptacle *d* made of boiler-plate which carries the heating tubes *q* is filled up to the edge with water, and then the upper parts are put in position on the top and the whole closed hermetically and evacuated of air. If the heating tubes *q* are now heated by a flame in the conical fire-box *f*, the water in the tubes is vaporized and the steam will flow into the steam space *e*, whence it flows into the condensing chamber *m* through the upper part of the bell *k* and through the blade-rim *g*. The steam in the condensing chamber *m* is condensed to water by the surface condenser *o* and this water will flow back into the water receptacle *d* running radially along the annular disk *l* to the center. The bell is rotated rapidly by the steam passing through the blade-rim *g* at a very high velocity, and the lower edge of the bell transmits this rotation to the mass of water in the chamber *d*. In this manner a dependence is again made, in the same manner as in the rotary engine with rotating boiler previously described above, between the centrifugal pressure of the rotating mass of water and the steam pressure in the steam chamber *e* and the vacuum in the condensing chamber *m*. The bell *k* carrying the blade-rim is suspended on an axle *h* on which are likewise arranged the fan *r'* and the pulley *r*, power being able to be obtained from the latter. *s* is a vacuum-gage and *t* a manometer. The rotary steam engine or turbine is regulated solely by regulating the furnace.

The constructional form of the rotary steam engine or turbine represented in Fig. 3 likewise relates to a rotary engine or turbine with stationary boiler, but here the boiler is not arranged under the engine but at the side of or over the same. In Fig. 3 *g* again denotes the blade-rim, but here this is not flowed through by the steam in a radial, but in an axial direction. The axle *h* carrying the blade-wheel carries on the end opposite to that at which steam is admitted a flat disk *n* which serves as driver for the mass of water which is to be rotated, which water rotates in the annular water receptacle *d*. From the latter there branch off both the condenser pipes *v* and the heating tubes *w*. The condenser pipes *v* open near the axle into the housing of the turbine again and here squirt the water against the disk *n* or through holes in the same into the condensing chamber *m*. The steam turbine thus works in this manner with a water-jet injection condenser. The heating tubes *w* bent serpentine and passing out of the annular water receptacle *d* mutually cross over one another in such manner that cylindrical heating chambers or fire-boxes *f* are formed by the opposite bends of two heating tubes situated one behind the other, and these fire-boxes serve for containing the flames which are preferably produced by a burner for liquid combustible.

The rotary engine or turbine according to Fig. 3 works as follows: After the same has been filled some centimeters above the disk *n* with distlled water, the axle being arranged vertically, the whole system is hermetically closed, heated somewhat and evacuated of air. Now, if the turbine body and with it the disk *n* is rotated by driving them from an outside source of power, the water will rise in the heating tubes *w* corresponding to the centrifugal pressure which is produced in the annular water receptacle *d* on account of the rotation of the mass of water, namely to a height corresponding to the velocity of rotation. If the fuel is now burned in the fire-boxes *f*, the water in the heating tubes *w* will be vaporized, and now the steam flowing through the body of the turbine to the condensing chamber *m* continues to drive the rotary engine. The quantity of water flowing through the cooling pipes *v* is preferably regulated at the spraying-nozzles *x*. In this form of construction it is of course not necessary that the shaft of the turbine-body stand vertical; on the contrary the turbine or rotary engine will also work when the shaft is journaled horizontally; but in the latter case the steam must, of course, be conducted from the system of heating tubes to the uppermost place and water must be supplied to the system of heating tubes at the lowest place. In any case the steam pressure in

the steam chamber *e* is counterbalanced here also again by the mass of water which is rotated rapidly or by its centrifugal pressure in the water receptacle *d*. The work done is in this rotary engine also transmitted through the belt-pulley *r* on the axle *h*.

What I claim as my invention and desire to secure by Letters Patent is:—

1. The combination of a rotary engine having a rotor with admission and exhaust ports, a boiler for generating steam at the admission ports of said rotor, a furnace for heating the boiler, a condenser for condensing steam at the exhaust ports of said rotor, and means for rotating the water in the boiler, said engine, boiler, furnace and condenser forming one connected system or one whole, and the arrangement being such that the mass of rotated water acts by means of centrifugal force in such a manner that the steam must flow from the high pressure side of the system to the low pressure side through the rotor and thereby perform work.

2. The combination of a rotary engine having a rotor with admission and exhaust ports, a stationary boiler for generating steam at the admission ports of said rotor, a furnace for heating the boiler, a condenser for condensing steam at the exhaust ports of said rotor and a member on said rotor for rotating the water in the boiler, said engine, boiler, furnace and condenser forming one whole, and the arrangement being such that the mass of rotated water acts by means of centrifugal force in such a manner that the steam must flow from the high pressure side of the system to the low pressure side through the rotor and thereby perform work.

3. The combination of a rotary engine comprising a shaft carrying a holder, and a rotor having admission and exhaust ports on said holder, a boiler for generating steam at the admission ports of said rotor, a furnace for heating the boiler, a condenser for condensing steam at the exhaust ports of said rotor, the edge of said holder extending into the water in the boiler and adapted to rotate the same, said engine, boiler, furnace and condenser forming one whole, and the arrangement being such that the mass of rotated water acts by means of centrifugal force in such a manner that the steam must flow from the high pressure side of the system to the low pressure side through the rotor and thereby perform work.

4. The combination of a rotary engine comprising a shaft carrying a bell-shaped holder and a rotor having admission and exhaust ports on said holder, a water receptacle having heating tubes connected therewith forming a boiler for generating steam at the admission ports of said rotor, a furnace for heating the boiler, a cap over said receptacle inclosing said engine and forming a condensing chamber for condensing steam at the exhaust ports of said rotor, the edge of said holder extending into said receptacle, and an annular disk covering said water receptacle and preventing the water rising in, but allowing condensed water to flow into, the receptacle.

5. The combination of a rotary engine comprising a shaft carrying a bell-shaped holder and a rotor having admission and exhaust ports on said holder, a water receptacle having heating tubes connected therewith forming a boiler for generating steam at the admission ports of said rotor, a cap over said receptacle inclosing said engine and forming a condensing chamber for condensing steam at the exhaust ports of said rotor, the edge of said holder extending into said receptacle, and an annular disk covering said water receptacle and preventing the water rising in, but allowing condensed water to flow into, the receptacle, said disk carrying a plurality of ribs (*n*) for preventing water in the condensing chamber rotating.

6. The combination of a rotary engine comprising a shaft carrying a bell-shaped holder and a rotor having admission and exhaust ports on said holder, a water receptacle having heating tubes connected therewith forming a boiler for generating steam at the admission ports of said rotor, a cap over said receptacle inclosing said engine and forming a condensing chamber for condensing steam at the exhaust ports of said rotor, a plurality of ribs (*o*) on said cap in said condensing chamber, the edge of said holder extending into said receptacle, and an annular disk covering said water receptacle and preventing the water rising in, but allowing condensed water to flow into, the receptacle.

7. The combination of a rotary engine comprising a shaft carrying a bell-shaped holder and a rotor having admission and exhaust ports on said holder, a water receptacle having heating tubes connected therewith forming a boiler for generating steam at the admission ports of said rotor, said tubes forming a furnace for heating the boiler, a cap over said receptacle inclosing said engine and forming a condensing chamber for condensing steam at the exhaust ports of said rotor, a plurality of ribs (*o*) on said cap in said condensing chamber, a plurality of cooling ribs (*p*) outside said cap, the edge of said holder extending into said receptacle, and an annular disk covering said water receptacle and preventing the water rising in, but allowing condensed water to flow into, the receptacle.

8. The combination of a rotary engine comprising a shaft carrying a bell-shaped holder and a rotor having admission and exhaust ports on said holder, a water receptacle having heating tubes connected therewith forming a boiler for generating steam at the admission ports of said rotor, said heating tubes being arranged at the side of the rotary

engine and forming a furnace for heating the boiler, a cap over said receptacle inclosing said engine and forming a condensing chamber for condensing steam at the exhaust ports of said rotor, a plurality of ribs (*o*) on said cap in said condensing chamber, the edge of said holder extending into said receptacle, and an annular disk covering said water receptacle and preventing the water rising in, but allowing condensed water to flow into, the receptacle.

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

KARL ADOLF ERNST ANDREAS.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.