F. C. KRÜGER.

ROTARY ENGINE.

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**898,658.** Patented Sept. 15, 1908.

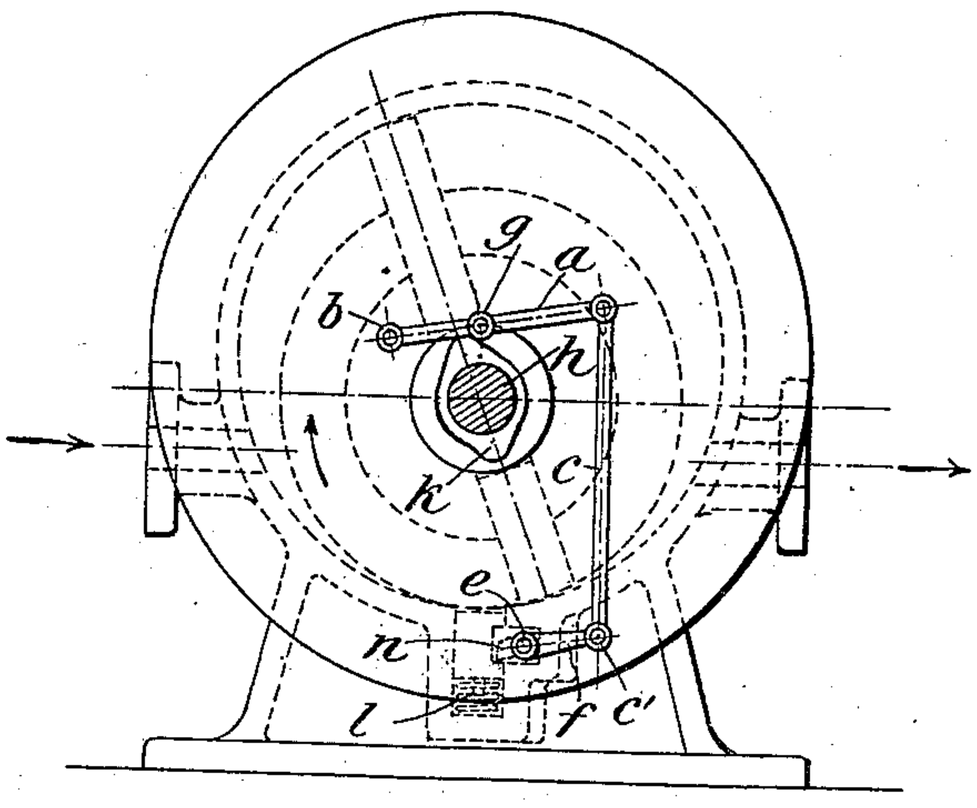


Fig. 3.

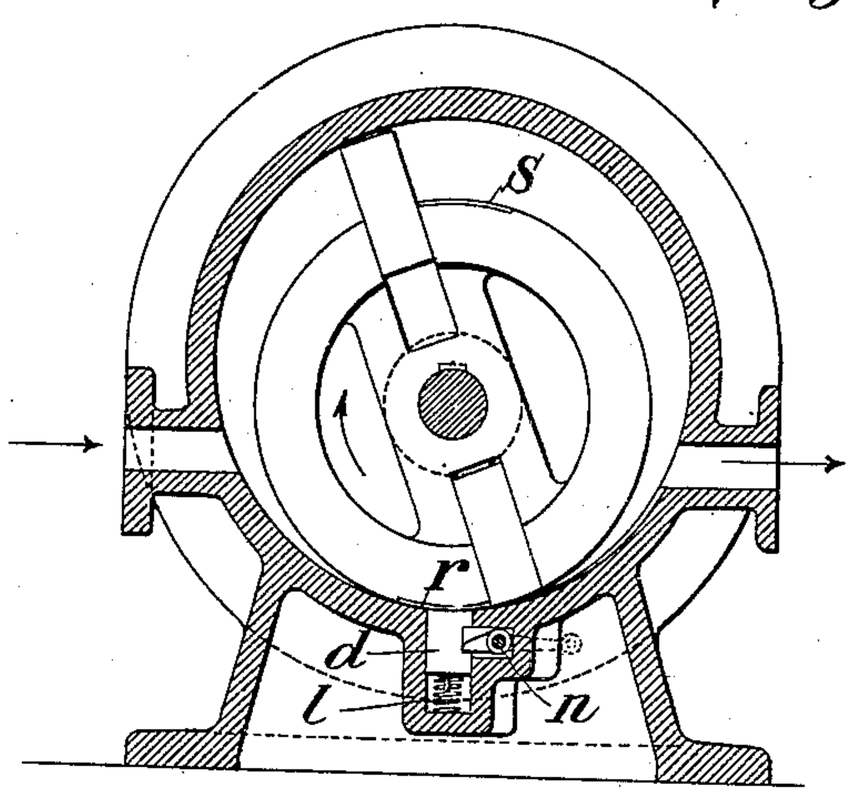


Fig. 1.

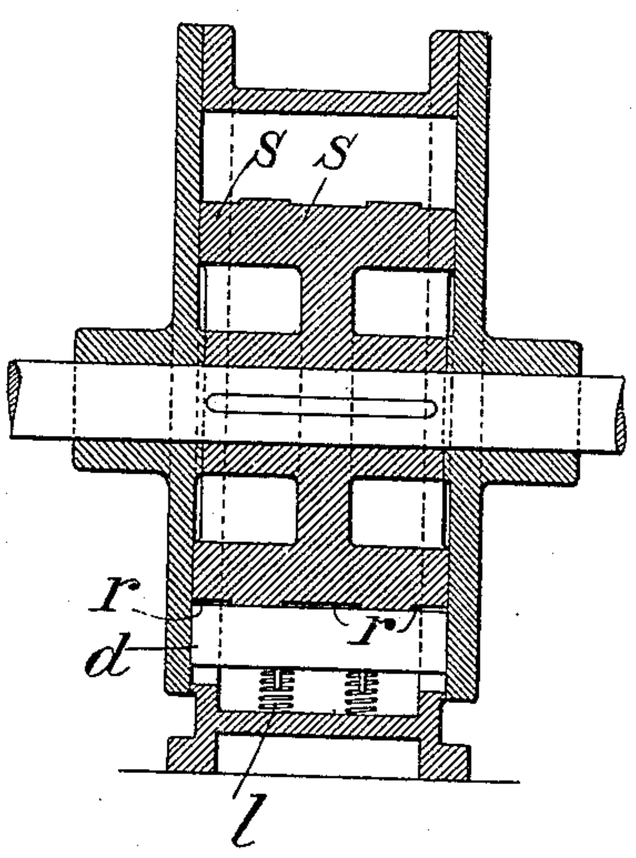


Fig. 2.

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# UNITED STATES PATENT OFFICE.

FRIEDRICH CARL KRÜGER, OF HANOVER, GERMANY.

## ROTARY ENGINE.

No. 898,658. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed May 7, 1907. Serial No. 372,346.

*To all whom it may concern:*

Be it known that I, FRIEDRICH C. KRÜGER, of Hanover, Germany, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to power engines or pumps having rotating wing pistons. The usual practice in such engines having rotating pistons is to provide in the cylindrical casing or cylinder at the line of contact between the piston body and the cylindrical casing a special packing or tightening bar or strip pressing against the piston drum and adapted to improve the tightness of the said contact. The mounting of such packing strips has hitherto encountered that drawback that the piston wings when passing over the said packing strips unavoidably produce shocks.

The object of this invention is to provide a device adapted to do away with the aforesaid drawback. To this end the packing strip instead of being abandoned to itself, is periodically shifted outwards an instant before the passage of the piston wing and immediately afterwards again freed, the said outward motion of the packing strip being produced by means of a special actuating mechanism. In order to avoid for such actuating of the packing strip the employment of an outside mechanism one may make use of the following arrangement, when the engine is for instance to be worked as a steam engine.

The piston drum is provided at its periphery for a certain distance with grooves starting from the wing guides and directed in the direction of rotation of the drum, these grooves being adapted to allow the gaseous or liquid fluid an instant before the arrival of each of the wings to pass from the working side of the wing over the sliding surface of the packing strip and to exert periodically a pushing action on the strip so that the latter is always pushed radially outwards in due time, and is consequently automatically actuated in due course and in the right manner and either of these means for forcing the packing strip outward may be used separately or they may be used together.

The annexed drawing shows the above stated arrangement applied to a rotary engine which by reversal of action, and when properly driven may of course be used as a rotary pump, Figure 1 showing a vertical cross section of this engine this view disclosing especially the mechanical means for actuating the packing strip. Fig. 2 is a vertical longitudinal section of same, and Fig. 3 is a side or end view of my invention showing the mechanism for mechanically actuating the packing strip.

As clearly shown by Fig. 1 the mechanical means for actuating the packing strip *d* comprises the lever or finger *n* rotatably mounted in the cylindrical casing and engaging a groove provided in the packing strip *d*, this lever being adapted to push radially outwards the packing strip pressed inwardly against the piston drum by the springs *l*, the said outward thrust being carried out each time that a wing approaches and the packing strip being again freed during or shortly after the passage of the piston wing over the tightening place. The said lever *n* is actuated by a suitable mechanism actuated by the engine shaft so as to produce the aforesaid motions.

In order to prevent the wing from leaving the cylindrical casing when the packing strip is pushed outwards, the wings must be made larger than the guide groove of the said strip.

A good, efficient and simple mechanism for mechanically actuating the packing strip is shown in Fig. 3, wherein *a* designates a lever pivoted to the casing at *b*, having the friction roller *g*, acted upon by the cam *k* secured to the main shaft *h*. Connected to the outer end of the lever *a* is a connecting rod *c* pivoted at *c'* to a lever *f*, secured to the outer end of the vibrating shaft *e* to which is rigidly secured within the casing the lever *n* which forces back the packing-strip against the tension of the spring *l*, when the lever *a* is lifted by the action of the wings of the cam *k*, which wings it will be seen are on the same axial lines as the two sliding piston wings of the rotary piston, as shown in Fig. 3. When it is desired to move automatically the said tightening strip in power engines of the kind described the peripheral surface of the piston drum is provided with a great number of grooves *r* and *s* or with a smaller number of such grooves which are then larger. As readily seen the said grooves, when the piston occupies the position shown by Fig. 1, already communicate with the working chamber which for instance is at the left hand side of the shaft when the engine is used as a steam engine and works in the direction of the arrows. The tension of the steam which then exists in the said chamber

and with it the steam itself consequently arrives over the packing strip over the whole width of the grooves and lifts the said strip from the piston, at the same moment the pressure is exerted on the strip on the whole sliding surface of the latter. The springs *l* are constructed in such a manner that they are not adapted to resist such pressures. Each of these automatically produced charges consequently pushes the packing strip radially outwards and that at the desired moment and without any outer help thus enabling the piston wing to slide over this place without impediment or shocks. In the meanwhile the tension escapes owing to the fact that the abutting side of the packing strip is freed, whereby the charge applied to the said strip disappears. Consequently the strip, immediately after the passage of the wings automatically shoots against the drum, under the influence of the springs, thus performing again the tightening operation. This process is repeated at each passage of the piston wings over the tightening place. It is readily seen that the tightening is performed there temporarily in the described device by the passing piston wing.

Having now fully described my said invention what I claim and desire to secure by Letters Patent is:

1. In a device of the class described, the combination with a cylindrical casing, having a suitable inlet and outlet of a rotary piston arranged in the said cylindrical casing and provided with radially slidable wings, a packing strip slidably arranged in the said cylindrical casing and yieldingly pressed against the peripheral surface of the piston, means for causing the said packing strip to be forced radially outward an instant before the passage of a piston wing, and means for immediately forcing it in again, after the passage of the wing.

2. In a device of the class described, the combination with a cylindrical casing, having a suitable inlet and outlet of a rotary piston arranged in the said cylindrical casing and provided with radially slidable wings, a packing strip slidably arranged in the said cylindrical casing and yieldingly pressed against the peripheral surface of the piston, mechanical means for causing the said packing strip to be forced radially outward an instant before the passage of a piston wing, and means for immediately forcing it in again after the passage of the wing.

3. In a device of the class described, the combination with a cylindrical casing provided with suitable inlet and outlet ports, of a rotary piston inclosed in the said cylindrical casing and provided with radially slidable wings, a radially slidable packing strip yieldingly pressed inward against the piston, and automatic means for shifting the said packing strip radially outward an instant before the passage of a piston wing and to free it again immediately afterwards.

4. In a device of the class described, the combination with a cylindrical casing provided with suitable inlet and outlet ports, of a longitudinal radially slidable packing strip yieldingly pushed inward toward the axis thereof, a rotary piston inclosed and journaled in the said cylindrical casing and provided with radially slidable wings, this piston being adapted to be engaged by the said packing strip, of mechanical means adapted to shift the said packing strip radially outward an instant before the passage of a piston wing over the said packing strip, and to free it again immediately afterwards.

5. In a device of the class described, the combination with a cylindrical casing having suitable inlet and outlet ports, of a longitudinal radially slidable packing strip yieldingly pushed inward toward the axis thereof, a rotary piston inclosed and journaled in the said cylindrical casing, this piston being provided with radially slidable wings and adapted to be engaged at its peripheral surface by the said packing strip, of mechanical means actuated from the outside of the cylindrical casing and adapted to shift the said packing strip radially outward an instant before the passage of a piston-wing over the said packing strip, and to free it again immediately afterwards.

6. In a device of the class described, the combination with a cylindrical casing, closed by two cylinder heads and provided with suitable inlet and outlet ports and with a longitudinal radially slidable packing strip yieldingly pushed inward, of a shaft rotatably journaled in the said cylinder heads, a rotary piston secured to the said shaft inside the said cylindrical casing provided with radially slidable wings and adapted to be engaged at its peripheral surface by the said packing strip, of mechanical means adapted to shift the said packing strip radially outward an instant before a piston wing passes over the said packing strip and to free it again immediately after and means for actuating the said mechanical means from the said piston shaft.

7. In a device of the class described, the combination with a cylindrical casing closed at its ends by two cylinder heads and provided with suitable inlet and outlet ports, of a rotatable shaft journaled in the said cylinder heads, a rotary piston secured to the said shaft inside the said cylindrical casing provided with radially slidable wings, a radially slidable packing strip longitudinally mounted in the said cylindrical casing and yieldingly pushed inwardly so as to engage the peripheral surface of the said piston, a groove in the side of the said packing strip, a finger fulcrumed in the wall of the said cylindrical casing adjacent to the grooved side of the

said packing strip engaging the said groove of the packing strip, and means connected with the said shaft and adapted to cause the said finger to radially move the said packing strip outward an instant before a piston wing passes over the latter and to release it immediately afterwards.

8. In a device of the class described, a cylinder provided with suitable inlet and outlet ports and a radially slidable longitudinal packing strip yieldingly pushed inward, a cylindrical piston rotatably mounted in the said cylinder, and adapted to be engaged by the said packing strip, provided with radially movable piston wings adapted to divide the cylinder into a pressure fluid receiving chamber and an exhaust chamber, and means arranged on the periphery of the said piston adjacent to the pressure receiving side of each of the said piston wings adapted to automatically cause the said packing strip to be moved radially outward an instant before a piston wing passes over the said strip, and to free it again immediately afterwards.

9. In a device of the class described, the combination with a cylindrical casing provided with suitable inlet and outlet ports and with a radially slidable longitudinal packing strip arranged inside the cylindrical wall and yieldingly pushed inward, of a piston drum rotatably mounted in the said cylinder and adapted to be engaged by the said packing strip, provided with radially movable piston wings adapted to divide the cylinder into a pressure fluid receiving chamber, and a pressure relieving chamber, a plurality of peripheral grooves arranged on the outer peripheral surface of the said piston drum and extending a suitable distance from the pressure receiving side of each of the said piston wings.

10. In a device of the class described, the combination with a cylindrical casing provided with suitable inlet and outlet ports and with a radially slidable longitudinal packing strip arranged inside the cylindrical wall, and yieldingly pushed inward, of a piston drum rotatably mounted in the said cylinder and engaged by the said packing strip, this piston being provided with radially movable piston wings adapted to divide the cylinder into a pressure fluid receiving chamber, and a pressure relieving chamber, of a small number of relatively wide peripheral grooves arranged in the peripheral outer surface of the said piston drum and extending from the pressure receiving side of each of the said piston wings.

11. In a device of the class described, the combination with a cylindrical casing provided with suitable inlet and outlet ports and with a radially slidable longitudinal packing strip arranged inside the cylindrical wall, and yieldingly pushed inward, of a piston drum rotatably mounted in the said cylinder and engaged by the said packing strip, this piston being provided with radially movable piston wings adapted to divide the cylinder into a pressure fluid receiving chamber and a pressure relieving chamber, of a small number of relatively wide peripheral grooves arranged in the peripheral outer surface of the said piston drum and extending from the pressure receiving side of each of the said piston wings, and mechanical means for also driving the packing strip outward at the proper moment.

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

FRIEDRICH CARL KRÜGER.

Witnesses:

PAUL R. THOMPSON,

ROBERT v. BÜLOW.