(No Model.)

E. HAMMESFAHR.

ROTARY ENGINE.

No. 477,363. Patented June 21, 1892.

Fig. 1.

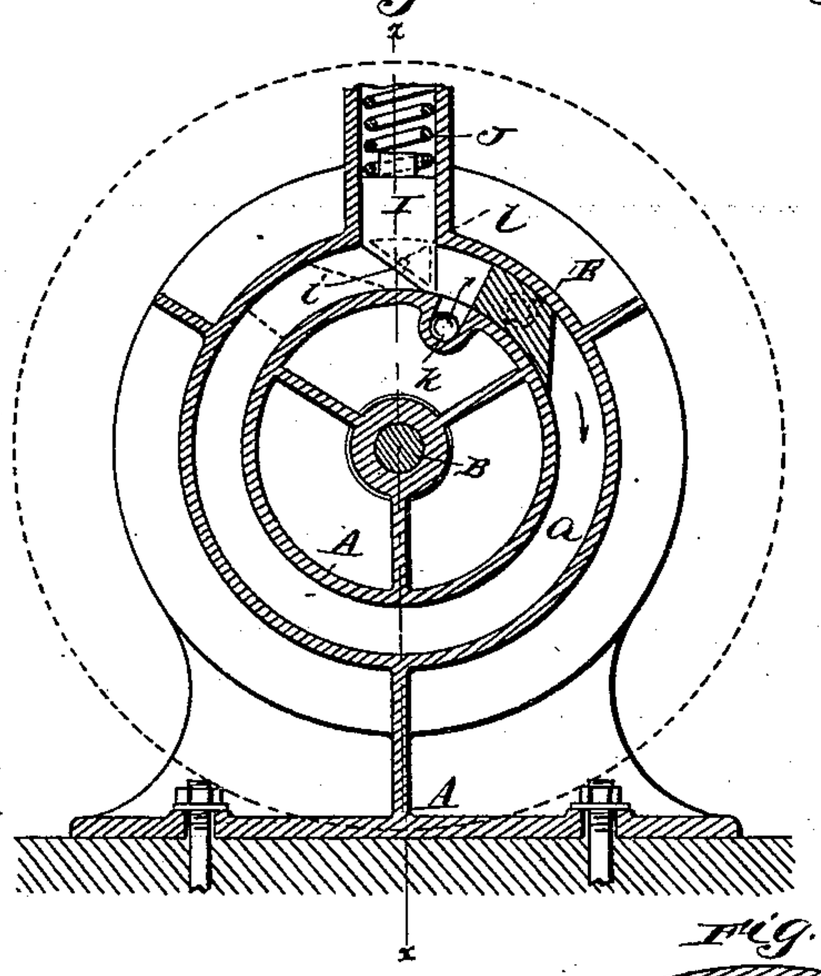

Fig. 1a.

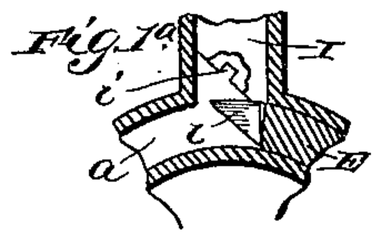

Fig. 2.

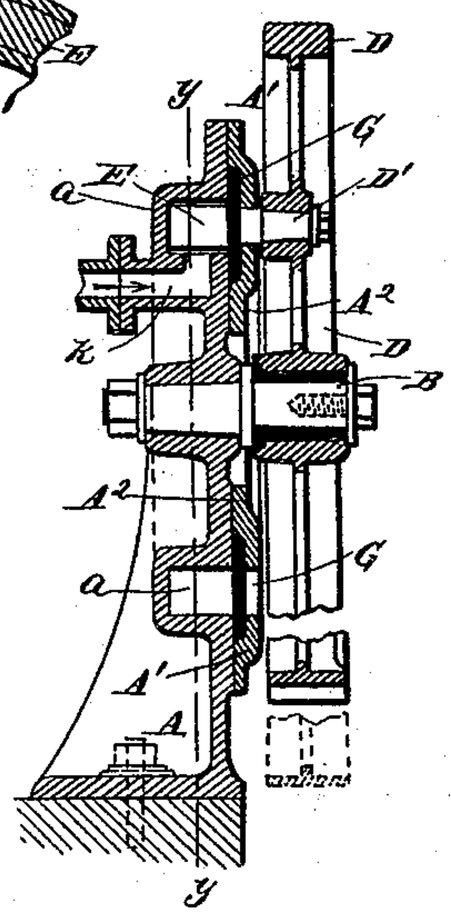

Fig. 3.

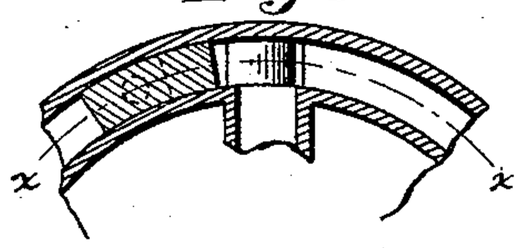

Fig. 4.

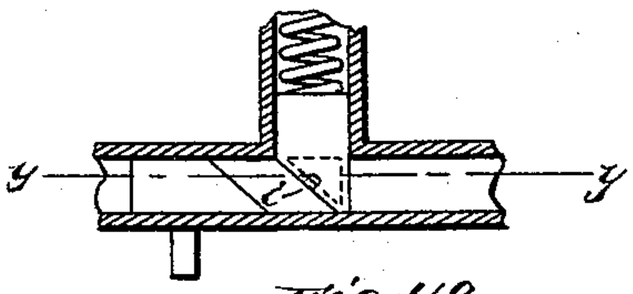

Fig. 4a.

Fig. 6.

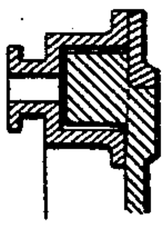

Fig. 7.

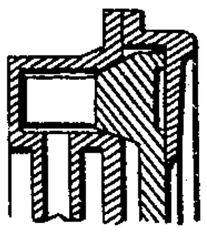

Fig. 5.

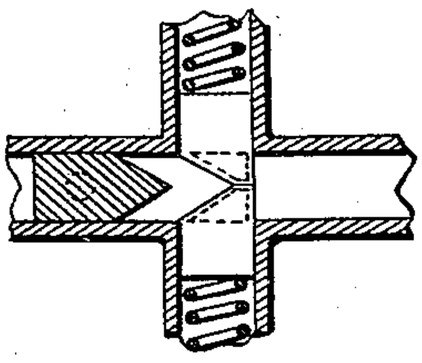

Fig. 8.

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Thomas Drew Stetson

UNITED STATES PATENT OFFICE.

ERNST HAMMESFAHR, OF SOLINGEN, GERMANY.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 477,363, dated June 21, 1892.

Application filed March 14, 1891. Serial No. 384,992. (No model.)

To all whom it may concern:

Be it known that I, ERNST HAMMESFAHR, a subject of the Emperor of Germany, residing at Solingen-Forhe, in the country of the Rhine, Prussia, Germany, have invented a certain new and useful Improvement in Rotary Engines, of which the following is a specification.

My engine is adapted to be operated by steam or by analogous fluid having sufficient pressure. I will describe it as operating by steam. The surface against which the pressure acts usefully, and which I will term the "piston," may be of various forms; but I will describe it as rectangular. It traverses around in an annular groove in a substantially stationary casting firmly held alongside of the wheel on which the piston is mounted and which the pressure against the piston causes to actively revolve. The open side of the annular channel is covered by an annular plate, which is attached to the wheel with liberty for a little play. This annular plate is held in steam-tight contact with the casting by overlapping thereupon on both the inner and the outer edges and is held into steam-tight contact therewith by an overlapping lip bolted to the stationary frame on the outer edge and another corresponding overlapping lip bolted on the inner edge. The abutment is adapted to slide into and out of the annular channel as required. It may so move either radially or in a direction parallel to the axis.

In what I esteem the best form of the invention the piston is formed with an oblique front face and the abutment is formed with a corresponding surface, which receives the action wedgewise and forces the abutment outward when required for the passage of the piston, the abutment being brought promptly back by the action of a sufficient spring. The passage for the induction of steam is preferably just within the channel; but this may be varied. The passage for the eduction of the steam is in the channel and is arranged to be covered and closed by the abutment during a great portion of the revolution.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a vertical section on the line *y y* in Fig. 2. This figure shows the abutment in position for effective work. Fig. 1ª is a section of a portion corresponding to Fig. 1, but with the piston in the act of passing the abutment which it has displaced. Fig. 2 is a section on the line *x x* in Fig. 1. Figs. 3, 4, and 4ª show the abutment moving in a line parallel to the axis. Fig. 3 is a vertical section on the line *y y* in Fig. 4. Fig. 4 is a section on the curved line *x x* in Fig. 3. This figure shows but a single abutment. Fig. 4ª is a corresponding view showing two abutments moving in opposite directions to allow the passage of a correspondingly-formed piston. Fig. 5 is a section corresponding to Fig. 2, but showing the apparatus duplicated. Fig. 6 is a corresponding section of a portion showing a modification. Fig. 7 is a corresponding section of a portion showing another modification. Fig. 8 is a corresponding section of a portion showing another modification.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

Referring to Figs. 1, 1ª, and 2, A is a strong casting bolted firmly upon a foundation. It supports a central pin B and is equipped with a smoothly-finished annular groove *a*, concentric to the axis of the pin B.

A′ is an exterior lip, and A^2 is the interior lip bolted firmly upon the casting A and adapted to fit tightly and easily upon the ring to be presently described.

D is a wheel fitted to revolve on the pin B and having a stout pin D′, which supports a piston E, which either directly or by the aid of packing (not represented) tightly and easily stops the channel *a*. An annular ring G, something wider than the annular channel *a*, is fitted over it and is held tightly and easily in place by the lips A′ A^2, before described.

I is an abutment mounted in a smoothly-finished housing, and J is an efficient helical spring inclosed in the housing and urging the abutment inward to close the channel *a* at one point. The bottom or end of the abutment I is beveled and the front face of the piston E is correspondingly beveled.

A sufficient passage or port *k* is provided connected to a steam-boiler, (not shown,) through which passage steam is admitted at full pressure, and *l* is an exhaust-port open-

ing into a suitable exhaust-pipe, (not shown,) through which steam may be discharged at proper intervals. The abutment I covers the exhaust-port *l*, except for a short period in each revolution.

When the engine is in operation, the steam admitted through the port *k* fills the portion of the annular passage *a* between the piston E and the abutment I. Its pressure against the rear face of the piston E causes the piston to move, turning the wheel D. As the piston moves more and more of the channel *a* is presented to be filled with steam. As it approaches the completion of its revolution the compression of the steam before it in the annular chamber *a* tends to lift the abutment and ultimately its inclined face strikes the inclined and lower face of the abutment I and lifts it. While the abutment is being moved outward the exhaust-port *l* is covered by the piston; but as the rear face of the piston commences to pass the port it is uncovered and all the steam in the channel *a* is free to escape through the exhaust-port. The piston E must be so shaped that before this exhaust period occurs the piston has covered the steam-port *k* and temporarily prevented the induction of steam. After the piston has passed the abutment I is moved rapidly inward by the force of the spring J, and when it has quite moved across the passage and at the moment that it completes its traverse across and completely stops the passage *a* the piston E by its movement uncovers the steam-port *k* and allows fresh steam from the boiler to again act between the piston and the abutment, and the entire round of operations is thus repeated indefinitely.

The motion may be regulated by a throttle-valve in the passage at any convenient point. (Not shown.) The action of the steam is continuous and uniform through a great portion of the revolution. The wheel D should be of sufficient weight to serve as a fly-wheel to maintain the motion during the brief interim while the power is suspended, which is while the piston is traversing over the passage *k*.

There may be provisions (not shown) for adjusting the force of the spring J. It must be sufficient to move the abutment rapidly inward so soon as the piston has passed. The efficient pressure of the steam which induces the motion is that on the rear face of the piston E. The pressure of the steam against the stationary surfaces is balanced. The pressure of the steam against the ring G is received by the lips A′ A². The outer and inner edges of the ring G are beveled, and the adjacent surfaces of the lips A′ A² are beveled to insure tightness.

There may be suitable provisions for lubricating and for adjusting and taking up wear of parts.

It will be seen that in the operation of this engine, while the rotary wheel is impelled in a forward direction by the pressure of the entering live steam or other fluid between the straight rear side of the piston E and the straight front side of the abutment I the air, steam, vapor, or other fluid which remains in advance of the piston, between the latter and the abutment, will be steadily compressed, because the exhaust-port is during the greater portion of the time closed by the abutment. The latter is positively operated only during the brief periods when it is acted upon by the piston; but when the fluid between the beveled surfaces of the piston E and abutment I becomes strongly compressed, its pressure will tend to force the latter open against the pressure of its actuating-spring, thus partly opening the exhaust-port for the escape of the compressed fluid. I produce a channel *i* in the abutment I, adjacent to the exhaust-port *l*, as seen in Figs. 1, 1ª, and 3, to permit a slight escape of the exhaust before the abutment is moved.

In the forms shown in Figs. 3 and 4 the abutment is arranged to move laterally or in a direction parallel to the axis instead of radially thereto, and the bevel on the piston is correspondingly made lateral. The exhaust-passage *h* in these figures is radially inward. In the form shown in Fig. 4ª there are two abutments and two springs acting one on each, each moving laterally instead of radially, and the single piston is made with two beveled faces adapted to act one on each piston. This construction gives, in effect, two pistons, beveled in opposite directions, each serving for its respective abutment. It is in a sense a double engine of the same character as the single engine shown in the preceding figures.

In the form shown in Fig. 6 there are two wheels (not shown) and two pistons, one for each wheel, the pistons traversing in annular grooves, which are counterparts of each other. Fig. 7 shows a single piston on a single wheel. Fig. 8 shows a single piston on a single wheel. In these forms of the invention a single lip bolted on the rim of the main casting extends inward behind that part or the whole of the ring which corresponds to G, and I consider it the equivalent of the lips A′ A² in the preceding figures.

Fig. 8 shows a single piston carried on a stout arm keyed on the shaft. In this figure the lips corresponding to A′ A² are of the precise construction and are arranged as shown in Fig. 1. The arm *i*² in this figure I consider an equivalent of the wheel D in the preceding figures.

In all the forms of the parts there may be other means, as an eccentric or cam, and suitable connections on the exterior to give the proper motion to the abutment. I prefer the means shown in Figs. 1, 1ª, and 2. There may be packing on the under face of the ring G.

I claim as my invention—

1. In a rotary engine, the abutment I, having a beveled inner face and channel *i* adjacent to the exhaust-port, in combination with the operating-spring J and with the casting A, having the annular channel *a*, induction-

passage *k*, and eduction-passage *l*, and with the piston E, having a beveled front face adapted to act directly on the abutment, and with the ring G, and holding lips A′ A², all arranged to serve as herein specified.

2. A rotary engine having the casting A, with lips A′ A², and annular channel *a*, and suitable induction-port *k*, and having an eduction-port *l*, arranged, as shown, so as to to be covered by the abutment during the main effective portion of each revolution, in combination with each other and with the abutment I, having a beveled inner face and channel *i* adjacent to the exhaust-port, and the piston E, having a beveled front face adapted to act directly on the abutment, and said piston being rigidly connected to the wheel D, and with the ring G, engaged under the lips A′ A², all arranged for joint operation, as herein specified.

In testimony whereof I have hereunto set my hand, at Berlin, this 21st day of January, 1891, in the presence of two subscribing witnesses.

ERNST HAMMESFAHR.

Witnesses:

PAUL KUHNE,

WILHELM GROTSCH.