No. 631,882. Patented Aug. 29, 1899.

J. STEEN.

ROTARY ENGINE.

(Application filed July 26, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

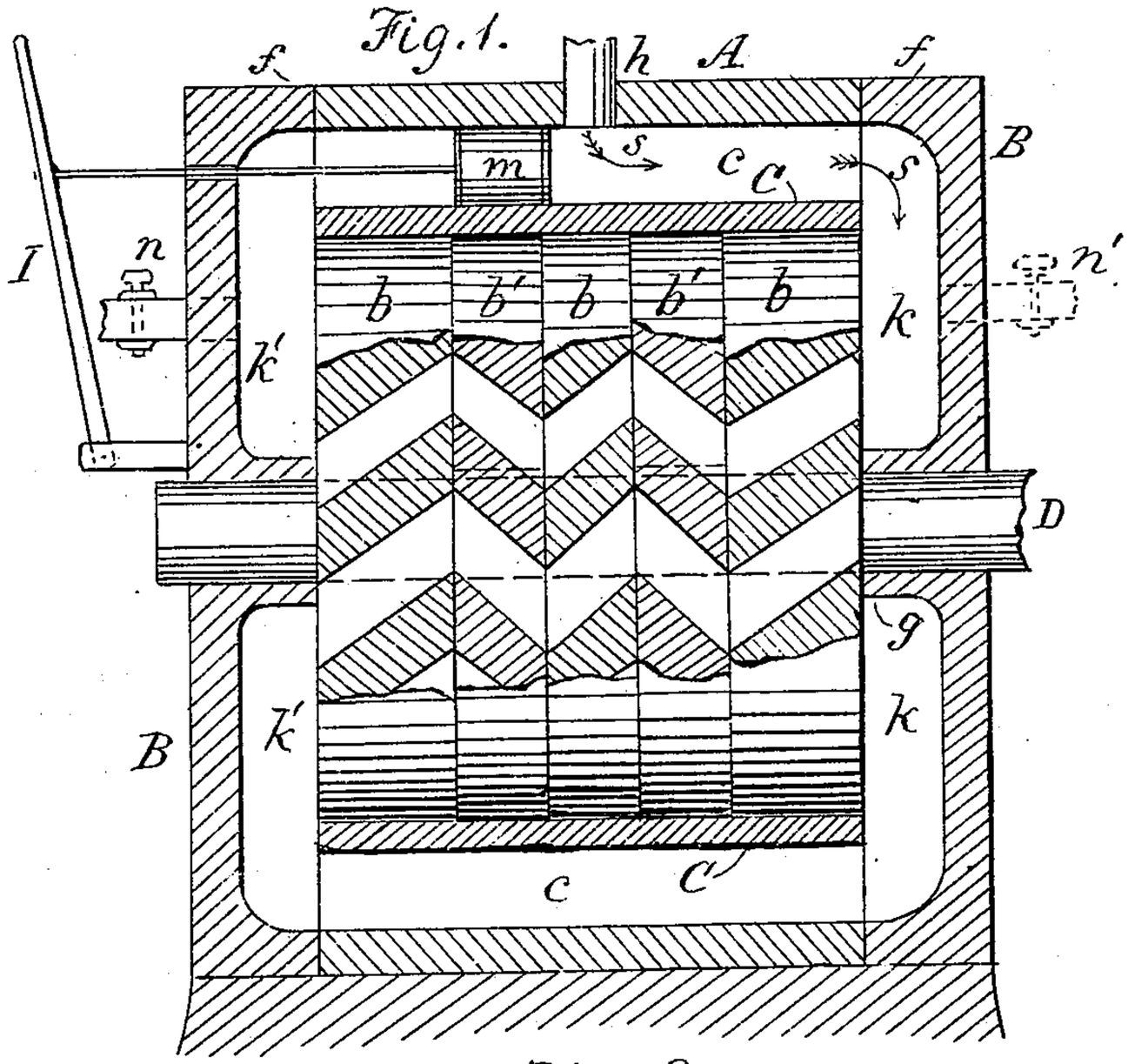
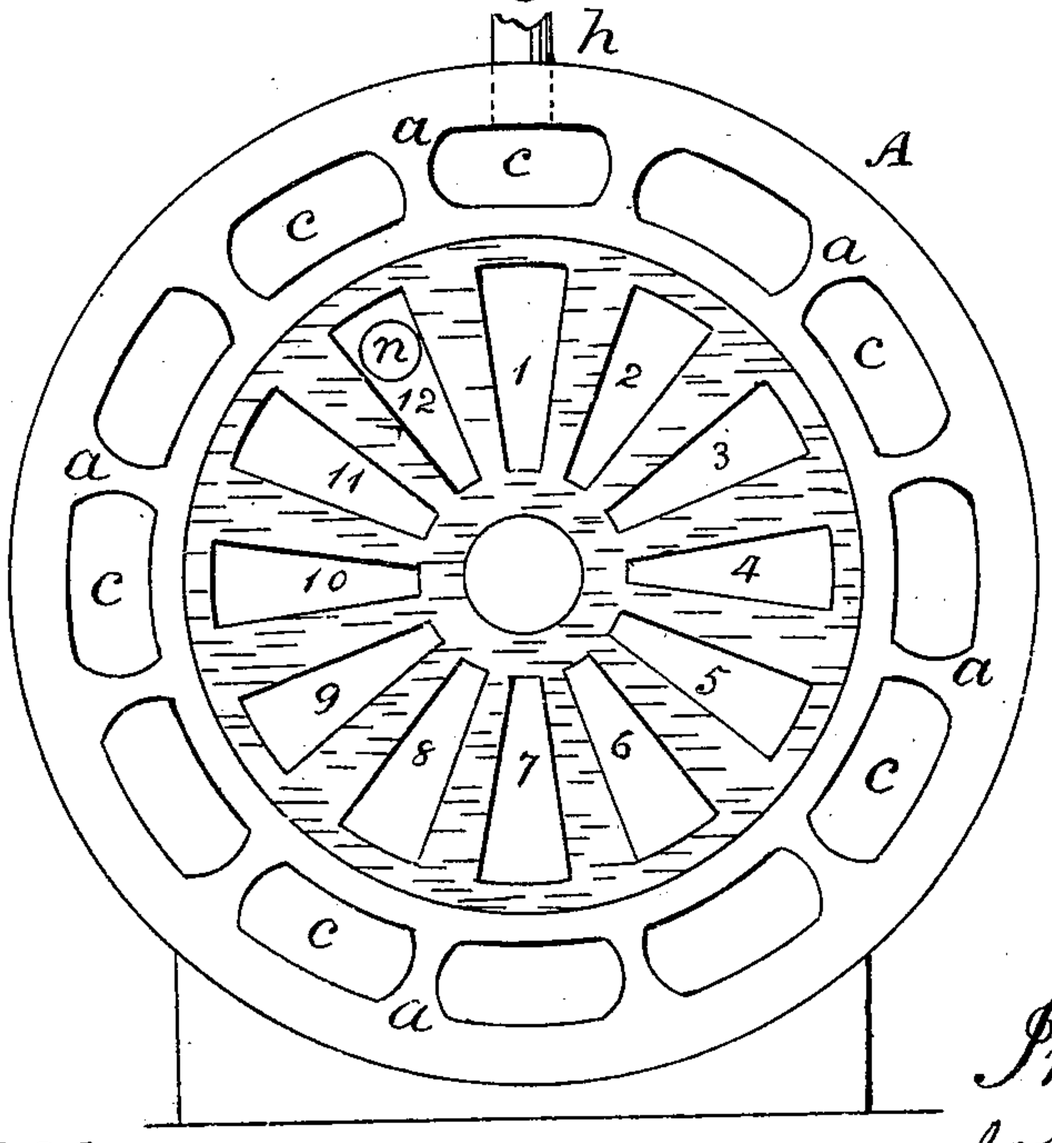


Fig. 2.



Witnesses:
G. B. Towles
H. A. Daniels

Inventor:
Joseph Steen
By Thomas P. Simpson
Attorney

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Fig. 3.

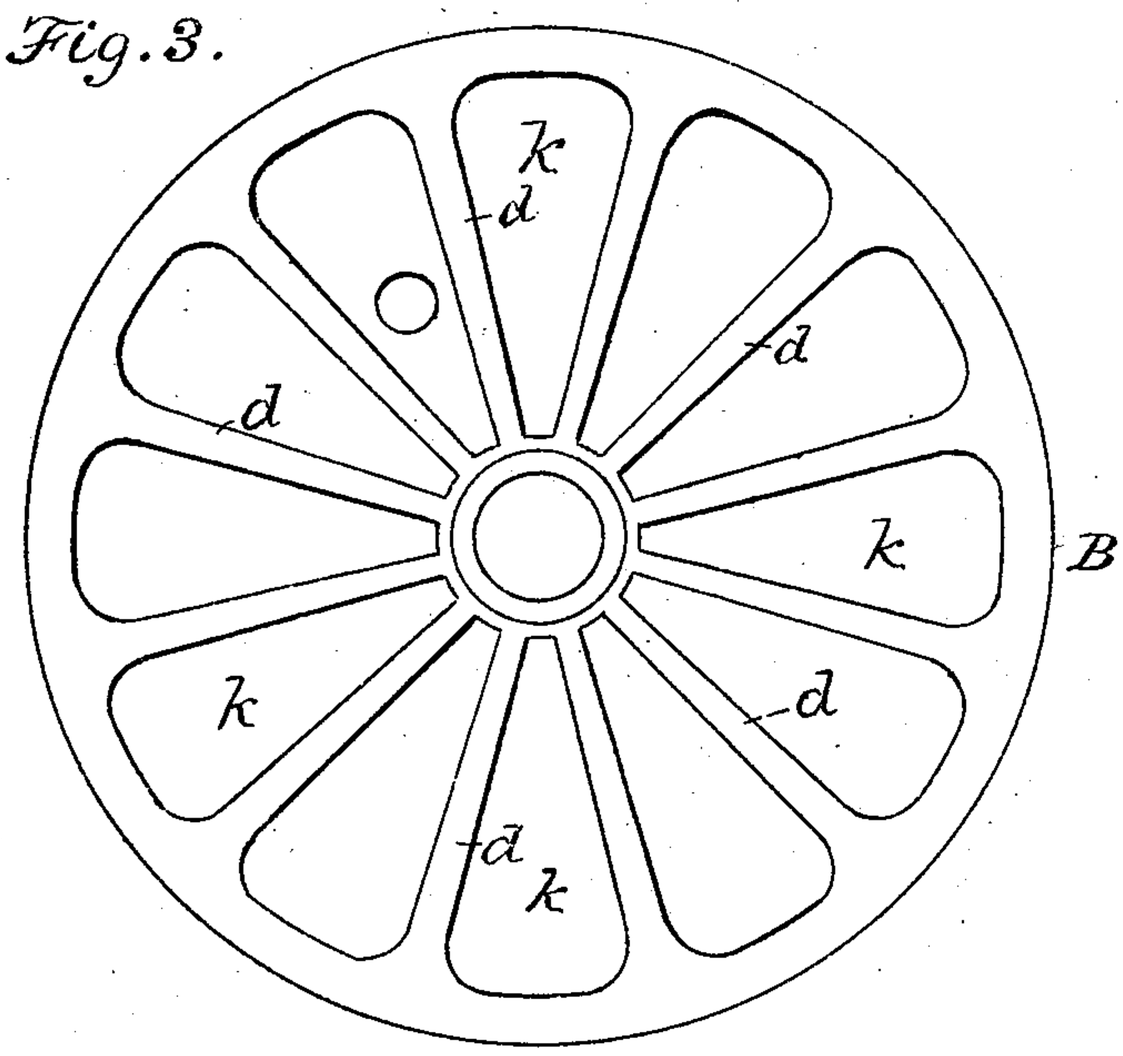
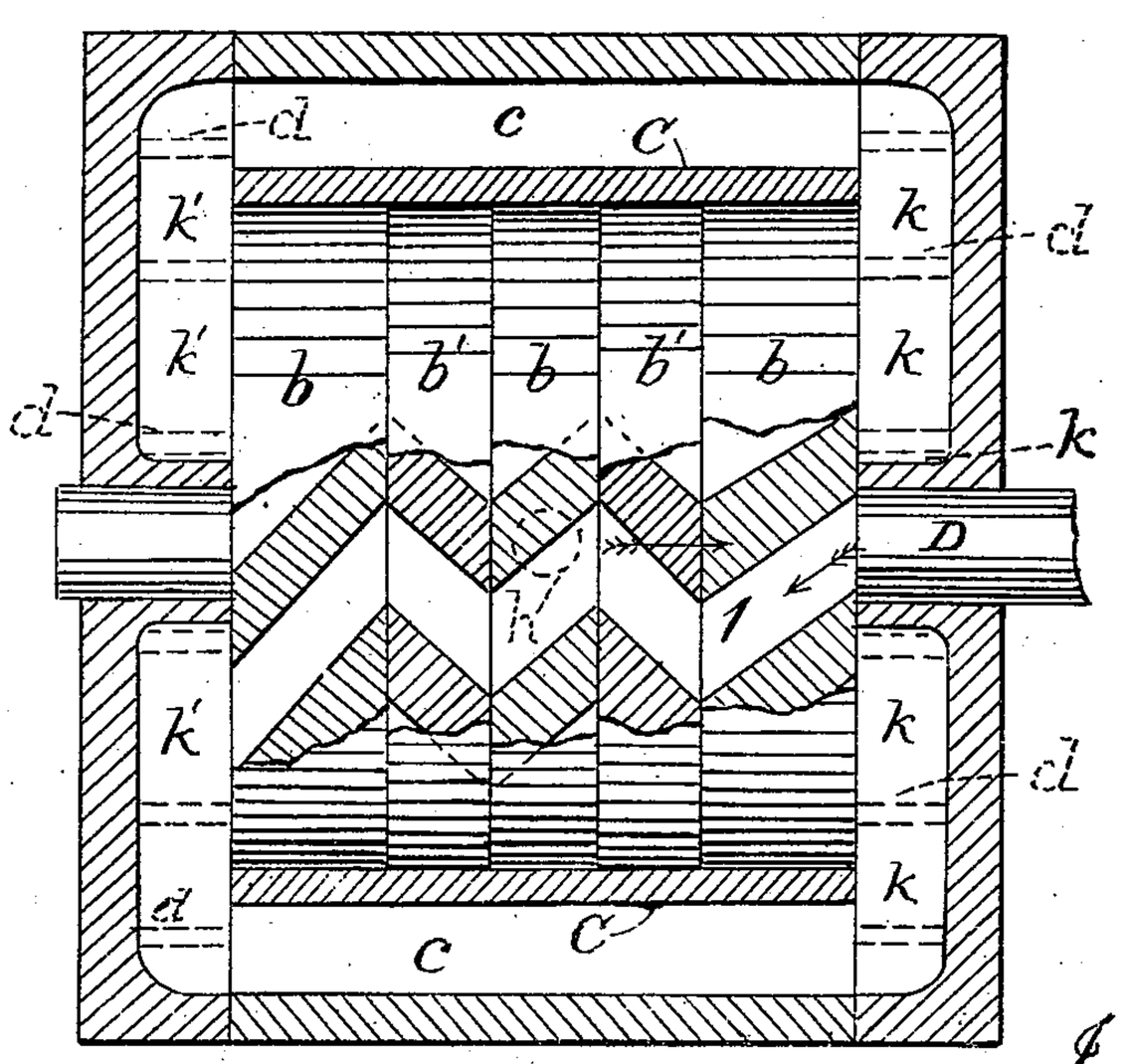


Fig. 4.



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Attorney

UNITED STATES PATENT OFFICE.

JOSEPH STEEN, OF HADDAM, CONNECTICUT.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 631,882, dated August 29, 1899.

Application filed July 26, 1898. Serial No. 686,965. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH STEEN, a citizen of the United States, residing at Haddam, in the county of Middlesex and State of Connecticut, have invented certain new and useful Improvements in Rotary Engines; and I do 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 the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to rotary engines; and it consists in certain improvements in the construction of such machines, as hereinafter described and claimed.

In the accompanying drawings, Figure 1 represents a central sectional elevation of a rotary engine constructed according to my invention. In this figure the circular disks which form the piston of the engine are shown in elevation, except portions of the peripheries of said disks, which are broken away to show passages through said disks, as hereinafter described. Fig. 2 is an end view of the engine, a cylinder-head being removed. Fig. 3 represents the inner face of a cylinder-head. Fig. 4 is a horizontal sectional view, the disks forming the piston being shown in elevation, except that portions of said disks are broken away to show passages through the disks.

A designates the main cylinder, which forms the casing of the engine and has heads B.

C indicates an inner cylinder, which is concentric with the cylinder A and is connected therewith by a series of partitions *a*, which extend lengthwise between the cylinders and form passages *c* for steam, as hereinafter set forth.

D indicates a rotative shaft on which, within the cylinder C, are placed a series of disks which together form the piston, five disks being employed in the device as represented. Of these, three are stationary and are marked *b*, and two disks *b'* are secured to the shaft and revolve therewith. The stationary and rotative disks are arranged alternately on the shaft D. Passages for steam are made through the piston and are arranged around the center, said passages being indicated by numerals 1 to 12 in Fig. 2. These steam-passages are not direct, but are laterally zigzag in form, as shown in Figs. 1 and 4. Thus a diagonal passage through an outer disk *b* connects with a diagonal passage through a rotary disk *b'*, which passage connects with a diagonal passage in another stationary disk, and so on through the piston. The diagonal passages through the outer disks *b* extend outward in opposite directions for the purpose hereinafter stated.

Each of the heads B of the main cylinder is provided on its inner side with projecting radial ribs *d*, which are adapted to close against the radial partitions of an outer disk *b* when the head is in place, said partitions separating the steam-passages in said disk. An inward flange *f* on the periphery of the head B registers with the main cylinder, and a central annular flange *g* extends to the disk *b* about the shaft D. Steam-passages *k* and *k'* are thus formed between the ribs *d*, each of said passages communicating with one of the passages *c* and also with one of the passages through the piston.

h indicates a steam-supply pipe at the top of the engine, and *m* indicates a cut-off valve, by means of which the steam-inlet may be closed or the course of the steam may be directed in either direction from the inlet, and the action may be reversed. An exit-port is shown at *n*, it being on the same vertical plane with the valve *m*. Another exit-port in the opposite end of the engine (indicated by *n*) is employed in marine engines, but is not necessary in stationary engines.

The zigzag passages through the piston are so formed that each of said passages connects with a passage *k* at one end of the cylinder and with a passage *k'* at the opposite end of the cylinder, the said two passages *k* and *k'* not being directly opposite each other. Thus, supposing the machine to be at a standstill with the valve *m* in the position shown in Fig. 1, an open passage would extend from the inlet *h* in the direction of the arrows *s*, from a passage *c* at the top of the engine through a passage *k* to zigzag passage 1, through the piston, (see Fig. 4,) said passage 1 connecting at the opposite end of the piston with a passage *k'*, which connects with a passage *c* outside of

the inner cylinder and next to the passage *c*, which leads from the inlet *h*, and said open passage continues through a passage *k* to zigzag passage 2, and so on through all the several passages outside of the inner cylinder and the passages through the piston to the exhaust-port. So in operation the steam passing from the inlet *h* through all of said passages repeatedly acts against the disks *b* and *b'* before reaching the exhaust-port, so that its force is fully utilized.

I indicates a hand-lever by means of which the valve *m* may be shifted in position, so that the steam will pass in the opposite direction from the inlet-port, reversing the action of the engine, the steam passing to the zigzag passage 12 and making its exit from 1.

By this construction of disks and steam-passages, the steam passing through said disks a number of times in succession, considerable power is gained by the repeated action of steam against the rotary disks and steam is considerably economized.

I claim—

1. In a rotary engine, the combination with a main cylinder, provided with an inlet-port and an exit-port, of an inner cylinder, a central shaft, stationary disks *b* and rotary disks *b'*, placed alternately on said shaft to form a piston in said inner cylinder, the two outer disks being stationary, longitudinal passages *c*, formed outside of said inner cylinder, openings in said disks forming zigzag passages through said piston, radial passages at each end of the engine, connecting passages *c* with zigzag passages in said piston, and a shut-off valve by means of which the action of the engine may be reversed; the several passages being so constructed that steam is conducted, during operation, repeatedly through the piston before reaching the exit-port, substantially as and for the purposes described.

2. The combination, with a central shaft, of a main cylinder, an inner cylinder, stationary disks *b* and rotary disks *b'*, forming a piston and being provided with openings which form zigzag passages through such piston, longitudinal passages *c*, outside of said inner cylinder, flanged cylinder-heads, each of which is secured to one end of the main cylinder and is provided with radial ribs which form passages connecting said passages *c* with said zigzag passages in the piston, an inlet-port, which connects with one of said passages *c*, and an exit-port, substantially as and for the purposes described.

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

JOSEPH STEEN.

Witnesses:

BENJAMIN W. KELSEY,

ANN A. SMITH.