G. C. RICHARDS.

COMBINED COMPOUND CRANK AND ROTARY ENGINE.

APPLICATION FILED NOV. 15, 1910.

1,006,276. Patented Oct. 17, 1911

2 SHEETS—SHEET 1.

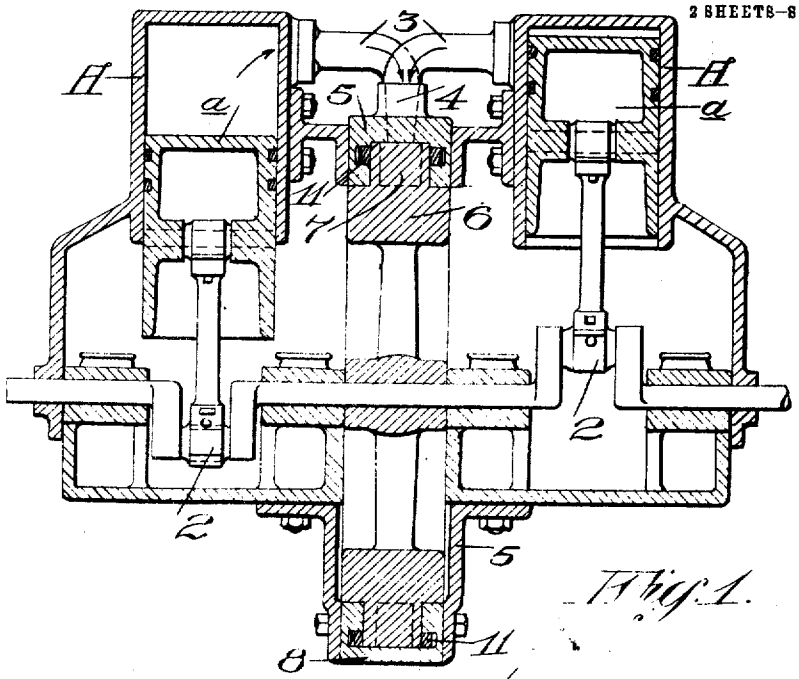
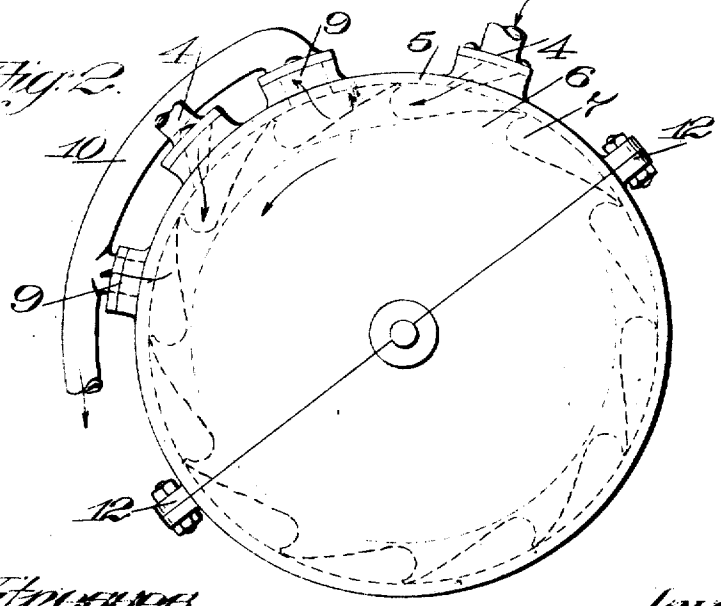


Fig. 1.

Fig. 2.



Witnesses.
Thos. Cushberg
F. E. Maynard

Inventor:
George C. Richards
by E. H. Strong
Attorney

G. C. RICHARDS.

COMBINED COMPOUND CRANK AND ROTARY ENGINE.

APPLICATION FILED NOV. 15, 1910.

1,006,276.

Patented Oct. 17, 1911.

2 SHEETS—SHEET 2.

Fig. 3.

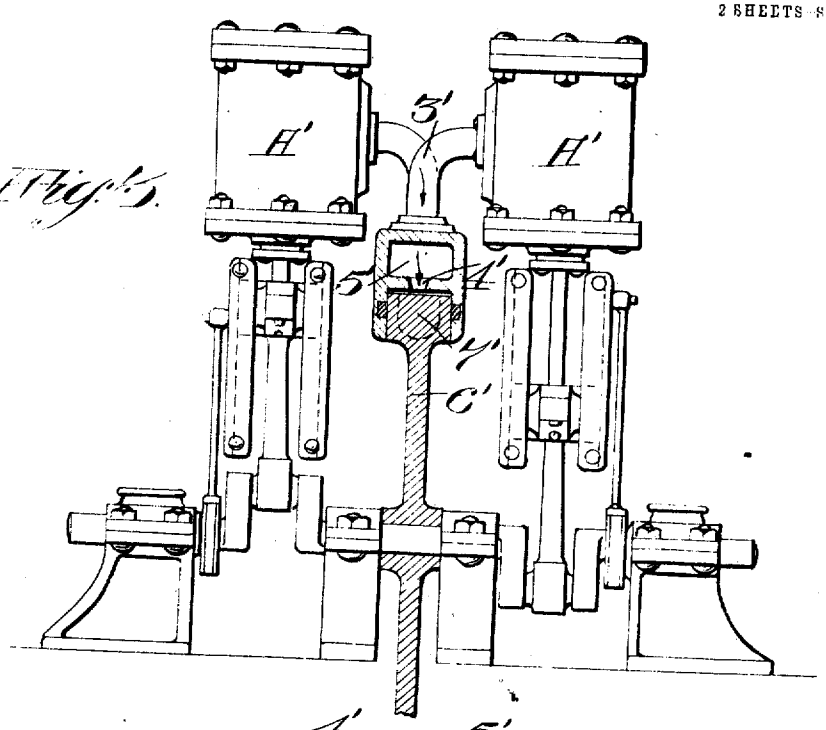
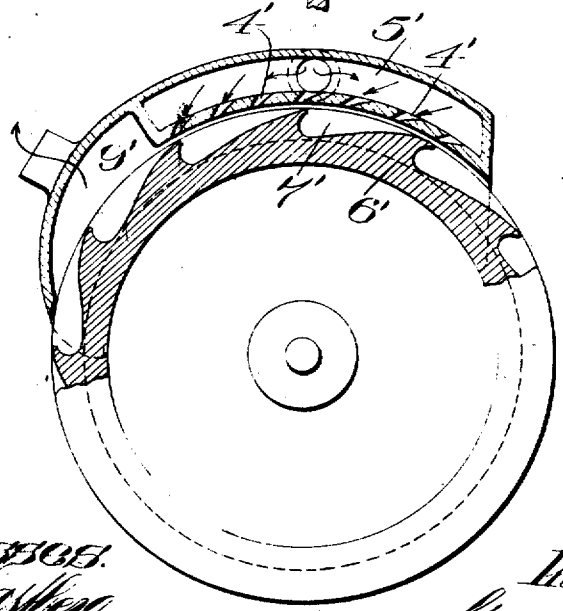


Fig. 4.



Witnesses.
Thos. Cushing.
F. E. Maynard.

Inventor.
George C. Richards.
by G. H. Strong.
his Atty.

UNITED STATES PATENT OFFICE.

GEORGE C. RICHARDS, OF BERKELEY, CALIFORNIA.

COMBINED COMPOUND CRANK AND ROTARY ENGINE.

1,006,276. Specification of Letters Patent. Patented Oct. 17, 1911.

Application filed November 15, 1910. Serial No. 592,433.

To all whom it may concern:

Be it known that I, GEORGE C. RICHARDS, citizen of the United States, residing at Berkeley, in the county of Alameda and State of California, have invented new and useful Improvements in Combined Compound Crank and Rotary Engines, of which the following is a specification.

My invention relates to engines, either gas or steam, and pertains especially to means for utilizing the exhaust of the engine for propelling purposes.

The invention consists of the parts and the combination and construction of parts hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is an elevation and partial section of the invention as applied to an internal combustion engine. Fig. 2 is a side elevation of the rotor employed in Fig. 1. Fig. 3 represents the invention applied to twin reciprocating steam engines. Fig. 4 is a side elevation of the rotor of Fig. 3.

As shown in Fig. 1, A represents one or more reciprocating gas engines operating with a crank shaft 2. 3 is an exhaust pipe leading from each engine and each pipe having a nozzle or inlet 4 delivering into a casing 5 in which is the rotor 6. The latter is of any suitable description and is preferably disposed between the engines and secured to the crank shaft 2, as shown in Fig. 1. The periphery of the rotor is provided with a series of buckets or pockets 7 which run inside of a stationary rim or housing 8; the pockets being adapted to receive the intermittent jets from the exhaust through the nozzles 4, and later to release these gases through suitable exhaust ports 9, into a common exhaust pipe 10. The sides of the rotor running in the stationary rim 8 may be packed on either side by suitable yielding or spring-pressed packing rings 11, for the purpose of maintaining a tight joint and confining the gases in the pockets between an inlet 4 and a succeeding exhaust port 9.

The rim 8 may be made in sections and bolted together, as shown at 12, Fig. 2, and suitably secured on the engine frame.

In practice, the exploded gases in the cylinder of an engine A acts, first, under expansion to drive the piston *a* forward to operate the crank shaft like in any ordinary reciprocating engine. On the return stroke of the piston *a*, exhaust takes place through pipe 3 and it is the utilization of this exhaust by the means herein employed that constitutes the essence of the present invention. The exhaust from pipe 3 is delivered through its nozzle 4 against the buckets 7 of the rotor 6, after the fashion of an impulse water wheel. The reactance on the rotor due to the jet impulses is proportionate to the force of the jet and the diameter of the rotor. In many cases these exhaust jets are made with a great deal of force from the engine, and where there is a plurality of cylinders operating in unison the combined effect of the exhaust from all of them is practically continuous, and the nozzles may be arranged so as to deliver these exhaust jets around a considerable portion of the circumference of the rotor. Thus, I utilize the otherwise lost power latent in the exhaust gases, positively to drive the engine. The result of this construction is the combined compound crank and rotary internal combustion engine.

In Figs. 3 and 4, while steam is used the principle of compounding is essentially the same. In this latter case the exhaust steam from the cylinders A′ is delivered to the exhaust pipes 3′ into an exhaust chamber 5′, which has a series of outlets or nozzles 4′ adapted to discharge at a suitable incline into the peripheral pockets 7′ of the rotor 6′. The expanded compounded steam is trapped in the pockets by the inner wall of the chamber 5′ until the pockets pass beyond, and exhaust at 9′.

It is manifest that there may be any number of engines working either singly or in pairs, or according to any other desired group arrangement, and the rotor 6 or 6′ may be secured at any suitable place on the crank shaft.

Not only is the exhaust utilized to drive a fluid impulse rotor, but the latter in turn with its buckets and casing operates as a muffler, and all without materially retarding the speed of the engine.

The rotor is in effect a supplemental engine operated by the exhaust and acting conjointly with the main engine to drive the crank shaft.

It is manifest that the principle would be the same in regard to the supplemental engine if a part of the original explosive or impelling charge were directed against the rotor. In fact the rotor may be impelled from any source of fluid pressure generated

in, resulting from or co-acting with the main engine.

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

1. The combination in an engine, of a crank shaft, a series of internal combustion engines connected to the shaft, a casing having bearings supporting the shaft, a rotor between the engines on the shaft, a ring in the casing circumferentially inclosing the rotor and having jet openings whereby exhaust gas from the engines may be projected against the rotor, and yieldable packing devices interposed between the ring and the faces of the rotor to prevent leakage.

2. The combination in an engine, of a crank shaft, a series of internal combustion engines connected to the shaft, a casing having bearings supporting the shaft, a rotor between the engines on the shaft, a ring in the casing circumferentially inclosing the rotor and having jet openings whereby exhaust gas from the engines may be projected against the rotor, and yieldable packing devices interposed between the ring and the faces of the rotor to prevent leakage, said devices comprising bands mounted for transverse movement in under cut recesses in the casing ring and adapted to bear upon the side faces of the rotor.

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

GEORGE C. RICHARDS.

Witnesses:
CHARLES EDELMAN,
A. P. LATHROP.