F. PASQUALE & P. G. B. ZANINI.

ROTARY ENGINE.

No. 188,752. Patented March 27, 1877.

Fig. 1.

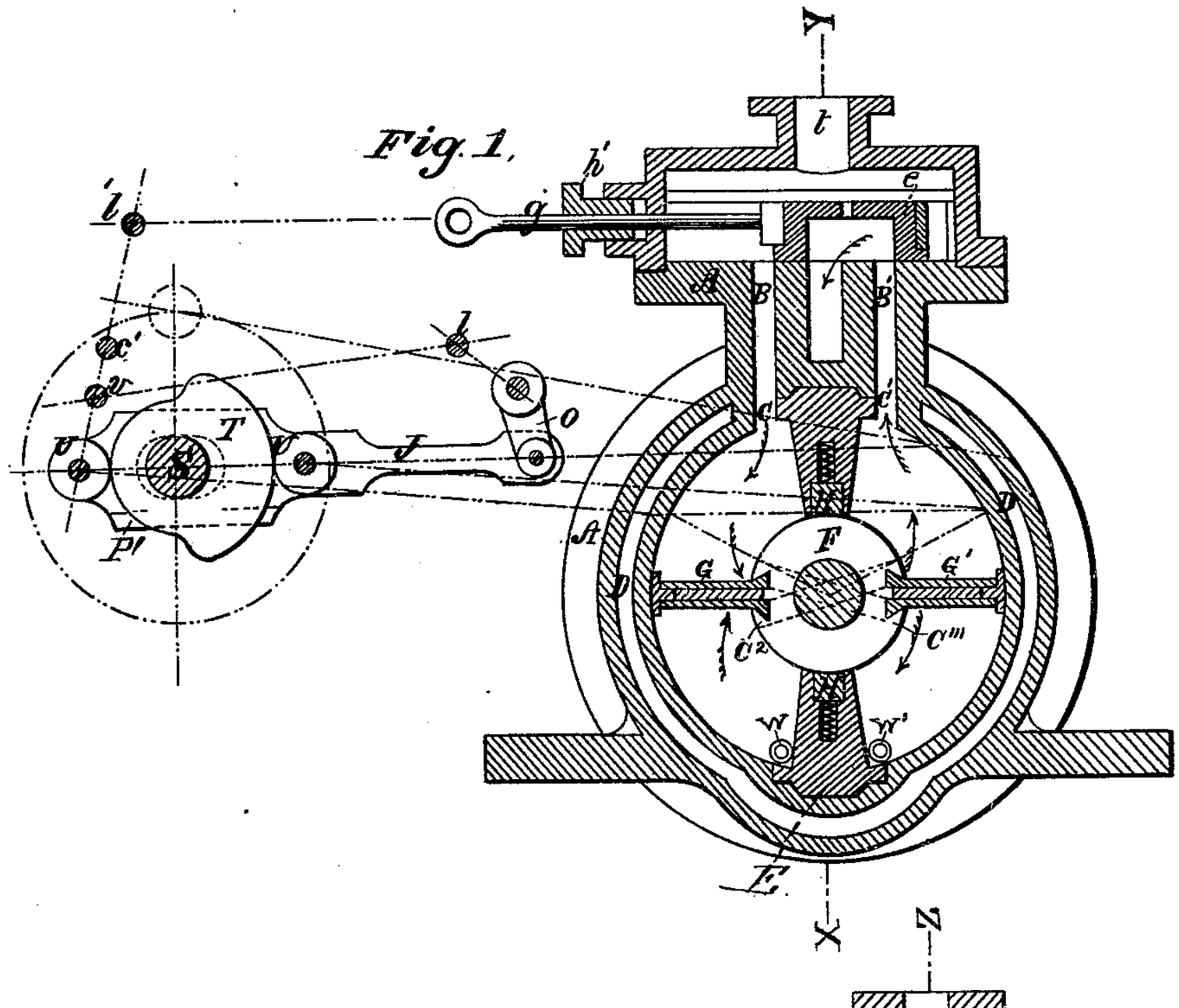


Fig. 2.

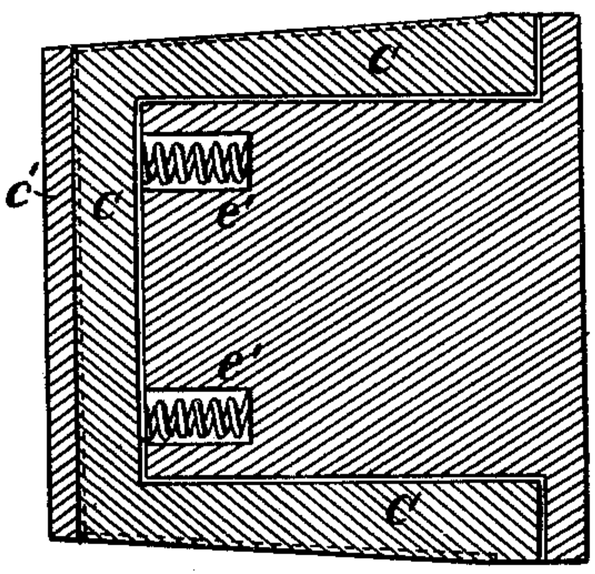
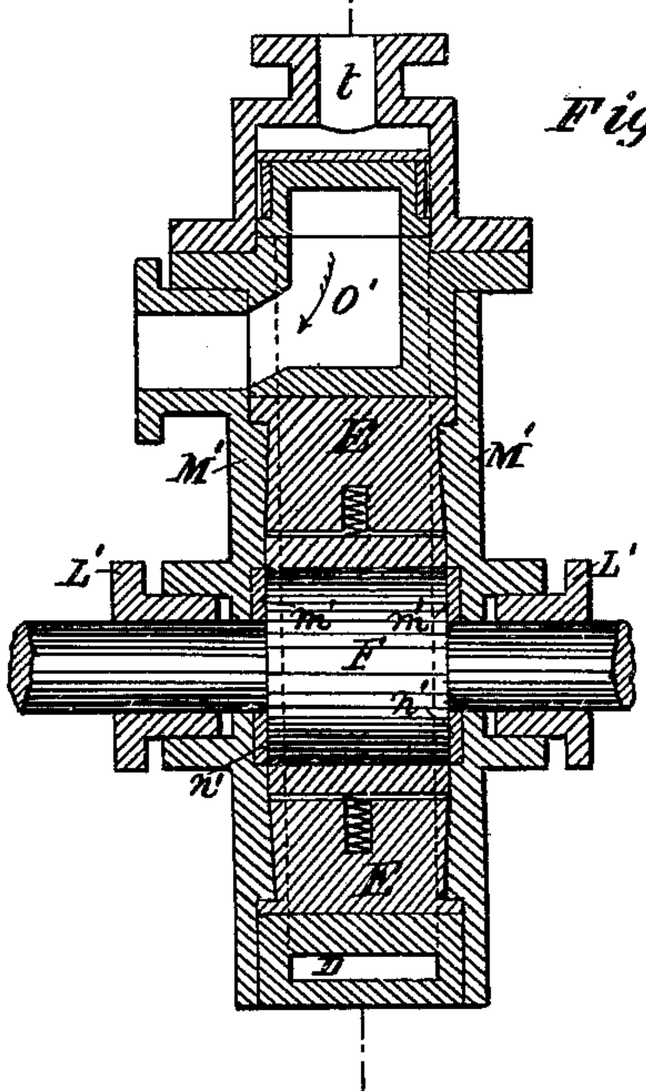


Fig. 3.



Witnesses
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UNITED STATES PATENT OFFICE.

FRANCISCO PASQUALE, OF STELLA, AND PIETRO GIOVANNI BATTISTA ZANINI, OF DIANO-MARINA, ITALY.

IMPROVEMENT IN ROTARY ENGINES.

Specification forming part of Letters Patent No. **188,752**, dated March 27, 1877; application filed June 3, 1876.

To all whom it may concern:

Be it known that we, FRANCISCO PASQUALE, of Stella, Provincia di Savona, and PIETRO GIOVANNI BATTISTA ZANINI, of Diano-Marina, in the Kingdom of Italy, have invented certain new and useful Improvements in Steam-Engines; and we declare that the following is a full and exact description thereof, reference being made to the nine figures of the two accompanying drawings, and to the letters of reference marked thereon.

These improvements have reference to a motive-power engine, working with a double oscillating piston, and consist in the hereinafter described construction and operation of the piston and its accessory parts; and in order that they may be clearly understood we proceed to describe them, having reference also to the accompanying drawings, in which—

Figure 1 is a lateral elevation of the cylinder, the slide and its eccentric or cam, with accessory parts, taken in section through the line V Z, Fig. 3. Fig. 2 shows two different sections of one of the oscillating pistons; and Fig. 3 a front elevation of the cylinder in section through the line X Y, Fig. 1.

The steam enters the slide-box nozzle *t*, Fig. 1, and from thence, passing through the port B, it enters the cylinder A, successively, by the two port-holes C and C‴, the latter being cut through the oscillating piston-shaft F, and acts on opposite faces of the wings G and G′ of the piston, causing them to rotate simultaneously in the same direction in the cylinder; when this stroke, consisting of a partial rotation or oscillation, is completed, live steam is admitted in a similar manner on the other faces of these wings by the ports C^1 and C^2, while appropriate ports are opened for the escape of the steam previously used, and thus an alternating oscillating motion is obtained. W W′, Fig. 1, are openings or blow-off cocks adapted to the cylinder. E E are abutments serving to separate the chambers in which the wings of the piston oscillate. When the latter, impelled by the steam admitted through the port B, arrives near the points C^1 and W, the slide *e* closes rapidly the port B, and consequently opens the port B′, and then the steam, entering by the ports C^1 and C^2, forces the wings to oscillate in the opposite direction. This rapid action of the slide is due to the form of the eccentric or cam T, Fig. 1, which is keyed on the shaft S, and which acts alternately on one of the anti-friction rollers U U, attached to the rod J, thus imparting to this rod a rectilinear to-and-fro motion, which is transmitted to the slide by levers jointed at *v′*, *c′*, b^1, and *l*, Fig. 1. *h′* is the stuffing-box, and *g* the slide-rod. P′, Fig. 1, is a cap on the under side of the connecting-rod J.

To prevent the waste of steam, and more particularly the passage of the steam from one chamber of the cylinder to the other, the wings of the piston are constructed as follows, and shown at Fig. 2: The conical part thereof is slid in the boss of the cylinder-shaft F, and thereto firmly fixed by a key inserted at K, Fig. 2, so as to form a solid and an air-tight connection.

Within each wing G G′ of the piston we place a packing-piece, b^2, of a trapezoidal shape, the sides of which are accurately fitted to the cylinder-covers, and the outer extremity of each to the inner periphery of the cylinder. This packing, which answers the same purpose as the piston-rings in an ordinary engine, is ground in the wings, and is provided externally on one face with a beveled packing-piece, *c*, and above this, preferably, a thin plate, *c′*, which is attached to the wing by a sufficient number of screws. Two spiral springs, *e′ e′*, constantly push this packing-piece against the inner diameter of the cylinder, and consequently laterally against its two covers, on account of their trapezoidal shape; and for the same reason, when advanced to compensate the wear, this packing will always remain tight.

In the same manner the abutments E E, Fig. 1, are provided with two gun-metal packing pieces, H H, which are pushed against the boss of the cylinder-shaft F by two spiral springs, with the view of preventing steam from passing from one chamber to the other, and again for the same purpose within the cylinder-covers M′, Fig. 3, we box two gun-metal rings, *m′ n′*, having the same diameter as the boss on the shaft F, and by means of springs

they are made to press against the boss of the piston, and form a steam-tight joint. The jacket D, Figs. 1 and 3, which is cast with the cylinder, is supplied with steam from the boiler for the purpose of maintaining the heat in the latter. L′ L′, Fig. 3, are two stuffing-boxes to prevent leakage of steam, which might occur at these places after the machine has been at work some little time.

We claim the following advantages as resulting from these improvements: First, no steam is lost or wasted in its working; secondly, simplicity of construction, excessive facility of driving; thirdly, increased power from a given quantity of steam; fourthly, diminution of volume and space occupied—which render these engines specially applicable for marine purposes.

In the actual steam-engines the conversion of the reciprocal rectilinear motion of the piston into a rotary motion gives rise to a great loss of power, to avoid which many attempts have been made to construct rotary engines.

Our engine differs from other rotary engines by the oscillating motion of its piston or pistons on their axis; hence the appellation "double oscillating piston." It is by the natural effect of this oscillating motion that power is acquired in this engine without loss, as in engines with a rectilinear-acting piston, for as the fly-wheel crank approaches the center of gravity, and although it thereby loses part of its force, at the same time the piston-shaft augments its own, so that the loss of power in the one is compensated by the augmentation of power in the other. By means of this compensation the pistons act with an equal and constant power on the fly-wheel shaft, excepting two dead-centers, which being, however, separated by an arc of one hundred and seventy degrees, are thus insignificant, and need not be taken into consideration. The almost instantaneous action of the slide is also a source of power, for it is well-known that in actual engines much power is consumed and a certain proportion of the steam wasted.

Having thus explained the nature of our invention, as well as the best means we are acquainted with for putting it into practice, we reserve for a future application or applications such features and details of construction herein shown or described as are not embraced in the following clauses of claims:

We claim—

1. The double oscillating piston, constructed as shown and described, having wings G G′ inserted in the boss of the shaft, and provided with beveled packing-pieces *c*, and the springs *e′ e′*, substantially as and for the purpose set forth.

2. In combination, the double oscillating piston, wings G G′, beveled metallic packing *c*, springs *e′ e′*, and the steam passages through the shaft, substantially as shown and described.

3. In combination, the double oscillating piston, wings G G′, beveled packing-pieces *c*, springs *e′ e′*, steam-passages through the shaft, and the abutments E E, provided with spring-packing, substantially as shown and described.

FRANCISCO PASQUALE.
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In presence of—
GEORGE W. WURTS,
GUISEPPE ARTOIN.