Clayton & Campbell,

Rotary Steam Engine.

No. 34,393. Patented Feb. 11, 1862.

Fig: 2.

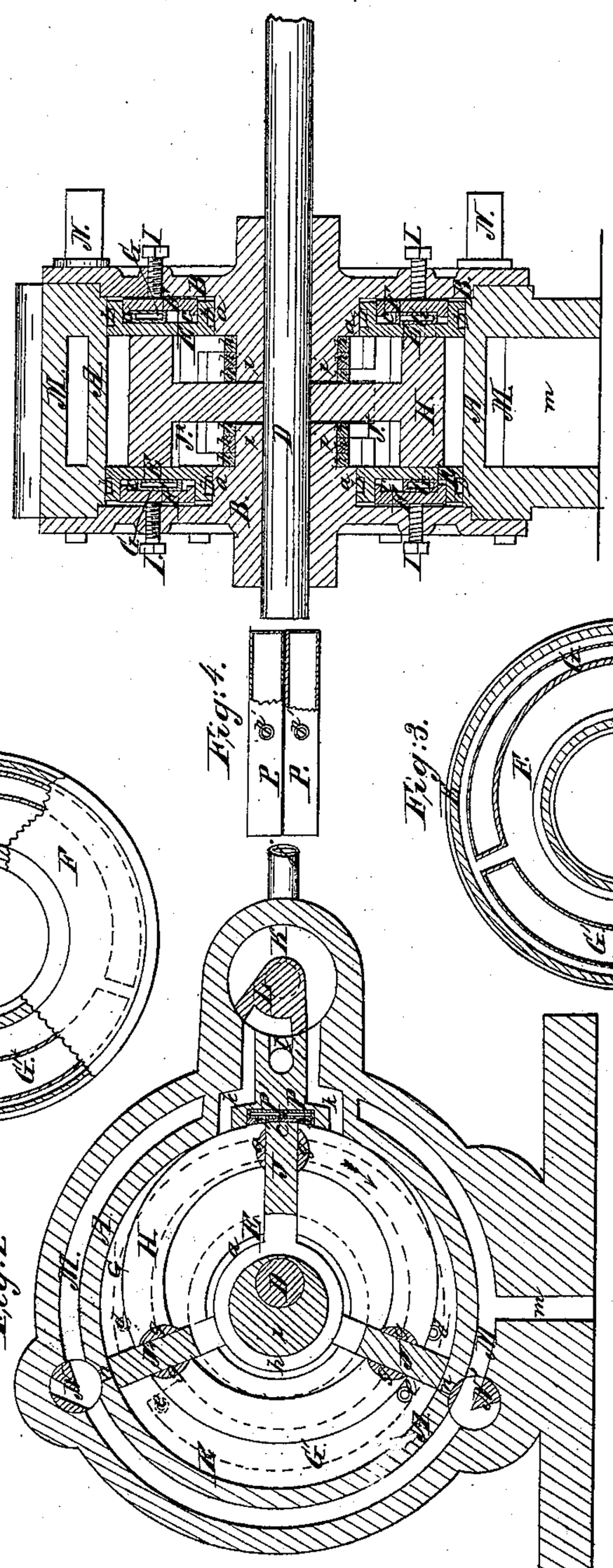

Fig: 4.

Fig: 3.

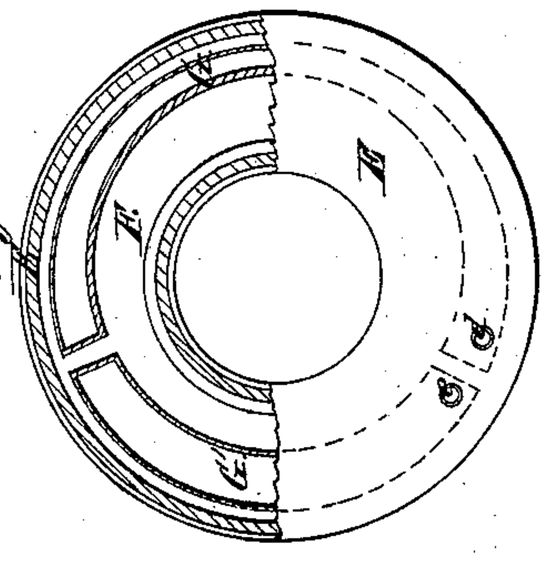

Fig: 5.

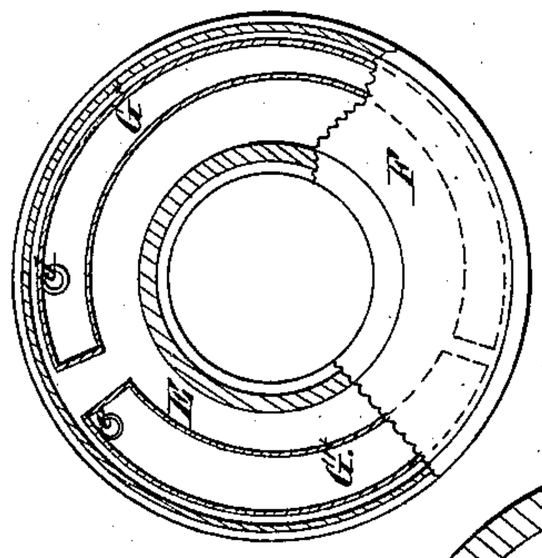

Fig: 1.

Witnesses:
Louis A Tucker
James Laird

Inventor:
James Clayton
Abraham Campbell

UNITED STATES PATENT OFFICE.

JAMES CLAYTON AND ABRAHAM CAMPBELL, OF BROOKLYN, ASSIGNORS TO THE ROOTS ROTARY STEAM ENGINE COMPANY, OF NEW YORK, N. Y.

IMPROVED ROTARY ENGINE.

Specification forming part of Letters Patent No. **34,393**, dated February 11, 1862.

To all whom it may concern:

Be it known that we, JAMES CLAYTON and ABRAHAM CAMPBELL, both of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Rotary Engines; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical section of an engine in a plane perpendicular to the axis of the shaft. Fig. 2 is an axial section of the same. Fig. 3 represents an inner face view of the side packing between the piston-drum and cylinder-head, partly in section. Fig. 4 is a face view, partly in section, of part of the cylinder-abutment packing. Fig. 5 is a section of the expanding steam-packing segments belonging on the opposite side of the cylinder to that which is represented in Figs. 1 and 3.

Similar letters of reference indicate corresponding parts in the several figures.

This invention consists in an improved kind of packing applied between the piston-drum and the cylinder-heads and to the cylinder-abutments, also in an improved system of exhaust valves and ports to be employed in combination with three or more pistons in the same cylinder.

To enable others skilled in the art to make and use our invention, we will proceed to describe its construction and operation.

A is the cylinder, bored truly, fitted at each end with a movable head B, and fitted at one side with a packing-plate C, which constitutes an abutment, such packing-plate not projecting within the inner circumference of the cylinder.

D is the main shaft, working in bearings in the cylinder-heads, such bearings being arranged eccentric to the cylinder in the direction of the abutment.

H is the piston-drum of cylindrical form and concentric with the shaft D, to which it is firmly secured, working in contact with the abutment C, but at some distance from the opposite side of the cylinder.

E E F F are metal packing-rings fitted between the ends of the piston-drum and the cylinder-heads—one pair between each cylinder-head and its corresponding end of the cylinder. The rings E E next the piston-drum are each fitted to the interior periphery of the cylinder and to the exterior periphery of a hub *a* on its corresponding cylinder-head, and has grooves turned in its own exterior and interior peripheries for the reception of vulcanized india-rubber or other packing *b b*, (see Fig. 2,) to prevent any steam passing it from the interior of the cylinder, and the said rings have concentric rectangular grooves in their outer faces for the reception of the rings F F, which are fitted into the said grooves in such manner that an annular cavity *c* is formed between the two rings E F at either end of the cylinder for the reception of the expanding steam-packing segments G G′ G* G′*, which constitute one of the important features of our invention. These segments, of which there are two in each annular cavity *c*, the two forming nearly a complete ring, are made each of two thin pieces of sheet copper or other flexible metal united at their edges to form a steam-chamber between them, and the said segments are furnished with short nozzles *d e*, which enter orifices provided in their respective ring E, as shown in Figs. 1 and 3, for conveying steam from the interior of the cylinder into the said segments.

The outer rings F F are held up to their places in the inner rings E E by means of set-screws I I screwing through the cylinder-heads, and the steam acting within the segments G G′ G* G′* tends to expand the said segments laterally, and so to make them force apart the rings E E and F F, and thereby to press the rings E E against the ends of the drum and of the pistons, thus preventing the escape of steam between the latter rings and the drum and pistons. The segments G G′ G* G′* are so proportioned in width in their different parts as to produce an aggregate pressure on the rings E E a little greater than that produced on their inner sides by the steam within the cylinder and as to distribute the pressure over the several parts of the outer sides of said rings as near as practicable to correspond with the pressure of the steam in the cylinder on the several parts of the inner sides of the said rings.

The reason for using two hollow expanding segments between each pair of packing-rings and not a complete hollow expanding ring can be better explained after other parts of the engine have been further described.

J J′ J² are the pistons, three in number, fitted to slots in the drum, with oscillating packing-pieces *g g*, and having connected with them rings *h h*, which fit to cylindrical projections *i i* on the inner hubs of the two cylinder-heads, such projections being concentric with the cylinder, and consequently eccentric to the shaft and piston-drum. This method of applying the pistons keeps the pistons, in their revolutions, always radial to the cylinder and in contact with the inner periphery thereof. We do not, however, claim such method as our invention.

K is a circular steam-chest, arranged behind the abutment C, receiving steam from the boiler by the pipe *j*, and provided with two ports *k k′*, leading to the cylinder on opposite sides of the abutment, and with an exhaust-port *l*.

L is a valve fitted to the said steam-chest and serving to admit steam to the cylinder through the port *k* or *k′* on either side of the abutment and establish communication between the cylinder and the exhaust-port *l* through the port *k′* or *k* on the opposite side of the abutment, according to which direction the engine is to be run. Fig. 1 shows steam entering the cylinder by the port *k*, and the engine to be consequently running in the direction of the arrow shown upon it.

M is a steam-jacket surrounding the cylinder except where the abutments and the ports *k k′* are situated. This steam-jacket is always in free communication with the main exhaust-pipe by an opening *m*, and two ports *n n′* (see Fig. 1) are provided to make communication between the said jacket and the cylinder, the center lines of said ports being at a distance apart and at a distance from the center line of the abutment equal to one-third the circumference of the inner periphery or bore of the cylinder, the port *n* being for the eduction of steam from the cylinder when induction is effected through *k*, and the port *n′* being for the eduction of steam when induction is effected through *k′*. Cock-valves N N′ are fitted to the steam-jacket, one opposite each of the ports *n n′*, the construction and mode of applying the said valves being such that they may open and close their respective ports without in any case obstructing the passage of the steam round the jacket. One valve is always in position to close its port according to the direction in which the engine is to run. Fig. 2 shows the port *n* open and *n′* closed. The valves N N′ may be so connected with the valve L that all may be shifted together and so always be kept in proper relation to each other. The eduction of the steam from the cylinder is effected almost entirely through the ports *n n′*, and the only purpose of the port *l* is for the escape of what little steam may be left in front of the pistons after they have passed the port *n* or *n′*. The principal exhaust-ports are arranged in the positions of *n n′* in order to permit of the expansive force of the steam being rendered available for the purpose of driving the pistons and to prevent the compression of the steam between the pistons.

The steam after each piston passes the port *n* or *n′* acts expansively upon the piston immediately in front of it until the two pistons are at equal distances from the widest part of the steam-space between the cylinder and abutment, and when the pistons arrive in this position. the eduction from between them commences through *n* or *n′*. When the engine is running in the direction of the arrow shown in Fig. 1, the hollow expanding segment G, (shown in Figs. 2 and 3, and dotted in Fig. 1,) has its orifice *d* always in communication with that part of the steam-space of the cylinder which is between the abutment and the nearest piston, and which is consequently subject to the pressure of the full head of steam, and the corresponding segment G′ has its orifice *e* in communication with the space in which the steam is expanding, so that the pressure produced against the outside of the ring E by the action of the steam in the segments is nearly in proportion to the pressure of the steam against the inner face of the said ring at any part of the cylinder. It is to enable this latter result to be obtained that we use the expanding segments and not a complete ring of expanding packing. In order to obtain the same result in running both ways the expanding segments at opposite ends of the cylinder have their orifices reversed. The position of the orifices G* and G′*, which are on the side removed by the section in Fig. 1, is indicated in red color in that figure and is also shown in Fig. 5, which view is taken looking in the same direction as Fig. 1. By this arrangement of orifices the expanding segments on one side of the piston-drum operate to keep both ends of the piston-drum and pistons tight when the engine is running in one direction and those on the other side when it is running in the opposite direction.

By reference to Fig. 1 it may be understood that in running in the direction of the arrow shown in that figure the orifices *d e* belonging to the segments G* G′* will be in communication with the exhausting-ports of the interior of the cylinder during nearly the whole revolution, never being in communication with that part of the cylinder in which there is steam and only during small portions of the revolution in communication with that part in which the steam is expanding between the pistons.

The abutment C is kept up to the piston-drum by means of two hollow expanding packing-pieces P P, (see Figs. 1 and 4,) of a similar nature to the hollow expanding segments, but of straight form, said packing-pieces be-

ing arranged in a cavity behind the abutment and on opposite sides of a line taken through the center of the abutment in a direction parallel with the main shaft. The said packing-pieces have communication with the cylinder through separate orifices in the abutment, being furnished with nozzles *p p'* to fit the said orifices, which are on opposite sides of the bearing-surface of the abutment against which the piston works. Whichever of the said packing-pieces *p* or *p'* is on the induction side of the abutment receives steam from the cylinder and the other one communicates through the cylinder with the exhaust-port *l*, and hence the abutment is only pressed toward the cylinder on that side of the center of its bearing-surface which is subject to steam-pressure on its face. The area of each of the hollow expanding packing-pieces *p p'*, it is obvious, must be somewhat greater than the area of that part of the face which is exposed to the pressure of steam.

We have throughout this specification described our invention with particular reference to steam-engines; but it is also applicable to engines impelled by other fluids or gases, and also to rotary pumps.

We do not claim the introduction of steam between the cylinder-heads and metallic packing-rings of rotary engines; but

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The hollow expanding metallic packing composed of rings or segments G G′ G* G′* or strips P P′, constructed substantially as described and applied between the cylinder-heads and their packing-rings behind the abutments or in any other part of a rotary engine, to operate substantially as herein set forth.

2. The arrangement of the orifices in the segments G G′ G* G′* with respect to the steam-spaces of the cylinder, substantially as herein described, and for the purpose set forth.

3. The arrangement of the two hollow expanding pieces *p p'* for packing the abutment, one having communication with the cylinder on one and the other on the other side of the abutment-bearing, substantially as herein specified.

4. The employment, in combination with three or more pistons and a steam-jacket surrounding the cylinder, of two eduction-ports *n n'*, fitted with separate valves N N′, and a third eduction-port *t* under the reversing-valve, the latter port to continue the eduction after the port *n* or *n'* is closed, substantially as herein specified.

JAMES CLAYTON.
ABRAHAM CAMPBELL.

Witnesses:
LEWIS A. TUCKER,
JAMES LAIRD.