

(No Model.)

2 Sheets—Sheet 1.

J. GAMBETTA & C. D. HARSIN.  
COMPOUND ROTARY ENGINE.

No. 487,217.

Patented Nov. 29, 1892.

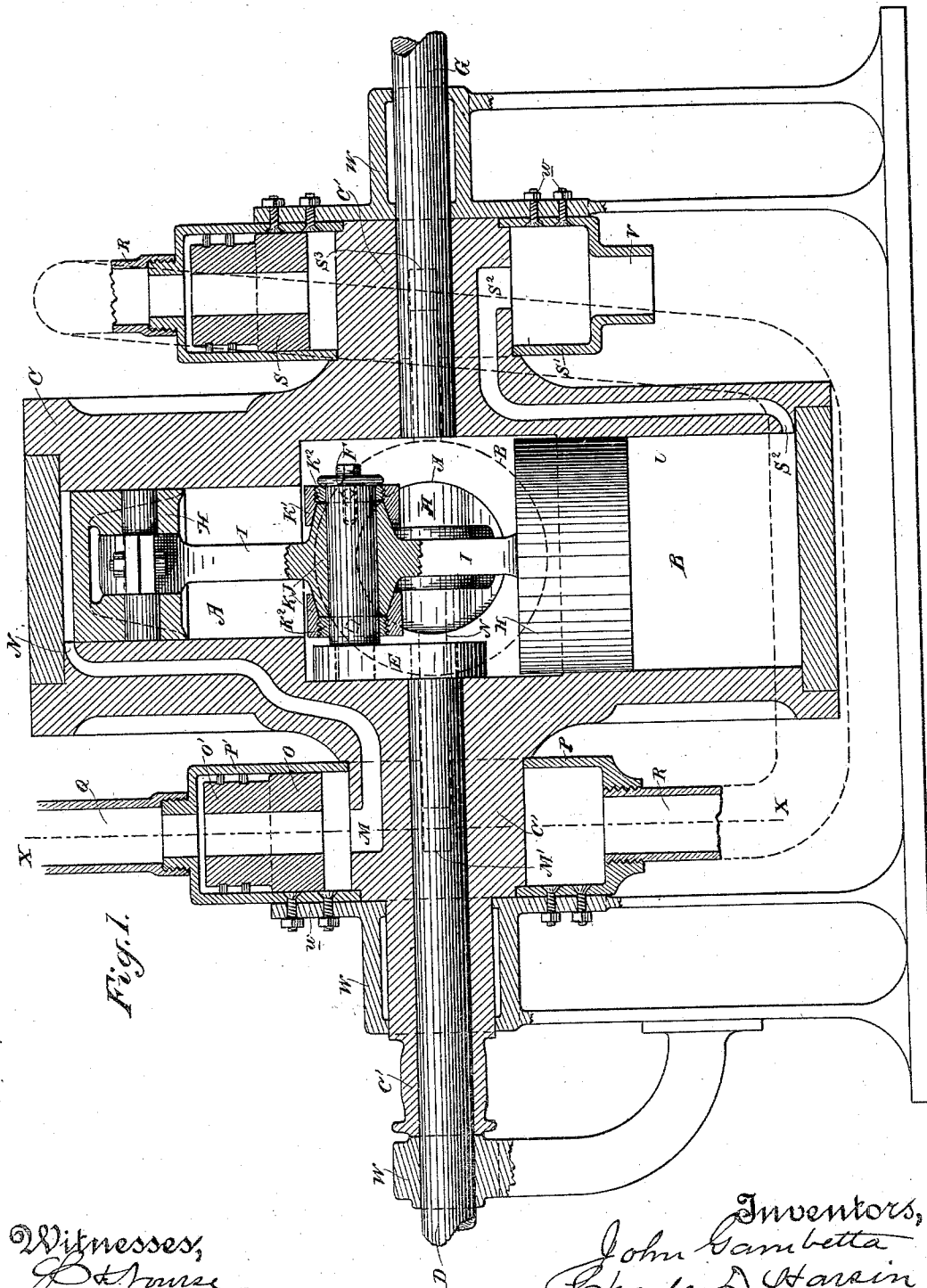


Fig. 1.

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Inventors,  
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(No Model.)

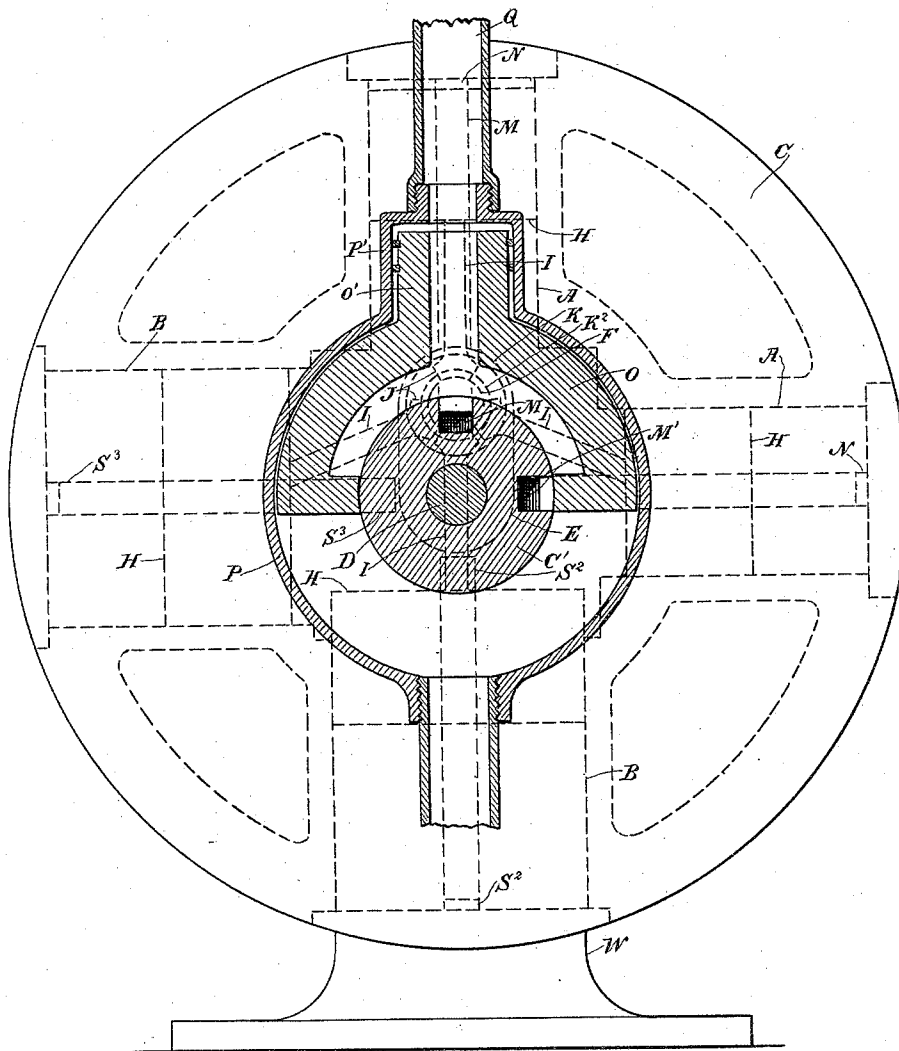
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Fig. 2.



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# UNITED STATES PATENT OFFICE.

JOHN GAMBETTA AND CHARLES D. HARSIN, OF STOCKTON, CALIFORNIA.

## COMPOUND ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 487,217, dated November 29, 1892.

Application filed February 26, 1892. Serial No. 422,926. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN GAMBETTA and CHARLES D. HARSIN, citizens of the United States, residing at Stockton, San Joaquin county, State of California, have invented an Improvement in Compound Rotary Engines; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to improvements in rotary engines; and it consists in certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical cross-section through our engine. Fig. 2 is a vertical cross-section on line *xx* of Fig. 1.

In our invention we have shown two pairs of cylinders fixed at equal distances apart around the interior of a rim or casing which rotates upon a central axis. The outer ends of these cylinders are closed and the inner ends are open. The pistons of these cylinders are connected by suitable pitmen with a stationary crank-pin, which is eccentric to the center about which the rim and cylinders revolve, and it will be manifest that as the rim and cylinders revolve about this crank-pin the pistons will be alternately reciprocated within their cylinders, and when steam or other pressure is applied behind these pistons they will act upon this stationary crank-pin to rotate the cylinders and the rim.

In our present invention each pair of opposing cylinders A and B is compounded—that is, one of the cylinders receives steam directly at high pressure, and when it has acted so as to carry the cylinder and rim one-half a revolution the steam is exhausted through suitable passages into the opposing cylinder B, which is of larger diameter and within which the steam acts upon its piston expansively.

C is the casing within which the cylinders are secured. We prefer to make this peripheral rim or casing and the cylinders in a single casting. The cylinders are then bored out by cutters upon a mandrel which extends directly through two opposing cylinders and the rim of the wheel. After the cylinders have been bored out the outer ends are permanently closed by a cap which fits the opening in the rim, these caps forming cylinder-heads.

D is a shaft which is fixed in a suitable support or framework W, and has the crank E and crank-pin F standing in line between the cylinders. One side of the rim or casing which carries the cylinders has a hub C', supported upon the shaft D, and the other side is similarly supported upon a corresponding shaft G, which is axially in line with D and supported upon the opposite pillar-block. The length of the fixed crank E is such that the pistons H will be caused to reciprocate the full length of their stroke within their cylinders when the latter are rotated around the crank.

The connecting-rods I have the ends which abut against the crank-pin in the form of segments, as shown at J. Each of these segments occupies about one-fourth of the circumference of the crank-pin, so that when all are in their place they nearly surround and inclose the crank-pin. Upon the inner end of the crank-pin is a collar K<sup>2</sup>, screw-threaded upon the outside and having a ring K fitted upon it and held at any point of adjustment by a set-screw. The inner periphery of this ring, which projects over the adjacent ends of the segments J, is beveled or tapered, and the ends of the segments are correspondingly beveled to fit beneath it, these ends being thus held in place. Upon the outer end of the crank-pin is a corresponding annular collar K<sup>2</sup>, carrying a similar ring K', which latter projects over the opposite ends of the segments J and is similarly beveled to fit the corresponding beveled ends of the segments. These rings K and K' may be adjusted with reference to the segments, so as to compensate for any wear and keep a tight joint between them and the crank-pin by screwing said rings to or from each other upon the fixed rings or collars K<sup>2</sup>, which are secured to the crank-pin.

The hub C' of the casing C turns upon the shaft D, and along the face of this hub are made the ports M M', which extend into the interior of the casing C, where they connect with ports N, formed in the casing and leading to the outer ends of each of the high-pressure cylinders. As this hub revolves upon the shaft it will be manifest that as each of the ports M and N in the hub and revolvable rim comes into the proper position with

relation to the valve steam will be admitted into the corresponding cylinder.

O is the valve, which is in the form of a segment surrounding the hub C' from above to about half-way down its diameter, where it fits closely against the sides of the hub. This valve O has a vertical extension O', which fits within a correspondingly-shaped portion P' of the exterior casing. The cylindrical part P of this casing surrounds the valve and the hub C', as shown in transverse section, Fig. 2. The extension O' fits inside of the extension P' of the casing, with suitable packing-rings, as shown, so that no leakage will take place around the outside of the valve, and when steam is admitted into the upper part of P' through the steam-pipe Q it will be manifest that its pressure upon the upper end of O' will cause the valve to fit snugly and at all times maintain a tight joint between the valve and the hub. Steam passes down through the central opening of O' to the interior of the valve, and thence when the ports M or M' arrive within the part inclosed by the segment of the valve the steam will be conveyed through these ports and the ports N to the cylinders. As soon as either of the ports M or M' pass the lower edge of the segment in the direction in which the apparatus is rotating this port will be in communication with the lower part of the casing P, which connects with the pipe R. This pipe R leads, as shown, to a corresponding valve S and valve chamber or casing S', which surrounds the opposite hub of the rotary casing C and the opposite shaft G, upon which the hub turns. This opposite valve-casing and connections are in all respects similar to those previously described of the valve O, and its passages and ports S<sup>2</sup> S<sup>3</sup> connect with the low-pressure cylinders.

The operation will then be as follows: Steam being admitted through the pipe Q and valve O passes through one of the ports M into one of the small high-pressure cylinders of the apparatus, and acting within that cylinder upon its piston and through that and the connecting-rod upon the stationary crank-pin F the rim or casing C will be rotated by this pressure until the high-pressure cylinder has reached the point opposite that at which it commenced taking steam. The ports M and N, which connect with it, will then be in position to allow the steam to exhaust from this cylinder into the lower part of the casing P, whence it passes through the pipe R and is delivered to the corresponding valve S upon the opposite side of the casing C. From this valve the steam passes through the hub C' upon that side, thence through the passage S<sup>2</sup> upon that side of the casing, and is delivered into the low-pressure cylinder, which has at this time reached the same point in its rotation that was occupied by the high-pressure cylinder when it commenced to receive steam. The steam thus exhausted from the high-pressure cylinder and delivered into the

low-pressure cylinder is expanded therein and acts upon its piston through its connecting-rod upon the stationary crank-pin in the same manner as previously described, thus continuing the rotation of the rim and the cylinders about the common center until the low-pressure cylinder has reached the point opposite that at which it receives steam. The ports of this cylinder and the hub will then be in position to exhaust into the lower part of the casing S', which surrounds the valve S, and through this it is delivered into the exhaust-pipe V, which connects with the air-pump in the usual manner for this class of engines. It will be manifest that the other pair of high and low pressure cylinders which stand at right angles with the pair just described will receive steam in the same manner as described for the first pair, and the rotation will then be made continuous and will be assisted by each of the four cylinders.

The casings P and S' are attached rigidly to the supporting-frame W at w, so that they will not rotate with the hubs C', but remain stationary.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In an engine, a circular rim with hubs on opposite sides, shafts at opposite sides upon which said hubs rotate, casings surrounding said hubs, steam and exhaust ports entering said casings at opposite sides thereof, a valve fixed in each of said casings, controlling the admission of steam, ports formed in the hub, extending inwardly and connecting with ports or passages in the main rim or casing, cylinders fixed within said casing in pairs opposite to each other, the high-pressure cylinder receiving steam from the inlet-valve through which steam is admitted directly from the boiler and the low-pressure cylinder receiving steam from the valve upon the opposite side, and a pipe connecting the exhaust from the high-pressure-cylinder valve with the inlet-opening of the low-pressure valve, whereby steam is transmitted from one to the other, substantially as herein described.

2. In an engine, a rotary casing having hubs projecting and supported upon axes at opposite sides, radial cylinders fixed within said casing opposite to each other in pairs, rods by which the pistons of said cylinders are connected with a common crank-pin which is fixed out of line of their center of rotation, passages connecting one of said cylinders with the hub upon one side of the casing and the opposite cylinder with the hub upon the other side of the casing, segmental valves inclosing each of the hubs with passages through which steam is admitted through the valves and hubs to the respective cylinders and other passages through which steam is exhausted from each of the cylinders after a half-revolution has been completed, and a pipe connecting the exhaust-passage of the initial cylinder with a supply-passage of the

second or low-pressure cylinder, substantially as herein described.

3. In an engine, a circular casing having radial cylinders fixed within its rim, hubs projecting from its ends and surrounding shafts which form its center of rotation, a crank-pin fixed out of line of this center of rotation and rods connecting the pistons of the cylinders with said crank-pin, a casing surrounding one of the hubs, a segmental valve within said casing through which steam is admitted from the boiler and ports by which it passes from said casing to the high-pressure cylinders, a similar casing and valve surrounding the opposite hub, a pipe connecting the exhaust-passage of the first-named valve with the inlet-passage of the second, whereby the exhaust-steam of the high-pressure cylinders is transmitted to the low-pressure cylinders, and an exhaust-passage by which the steam is discharged from the low-pressure cylinder through its valve and ports, substantially as herein described.

4. A revoluble rim with radial cylinders fixed therein, projecting hubs with ports communicating, respectively, with the oppositely-placed cylinders in the rim, casings surrounding said hubs, having extensions connecting with the steam-supply pipes, segmental valves fitting within said casings and partially sur-

rounding the hubs, said valves having extensions projecting into the extensions of the casings, and packing-rings whereby tight joints are maintained between the valves and the hub, substantially as herein described.

5. In an engine, the combination of a revoluble rim and casing having high and low pressure cylinders fixed radially within it opposite to each other, means for supplying steam to the outer ends of said cylinders and transmitting it from the high to the low pressure cylinder of each pair, pistons reciprocating within the cylinders, the crank-pin F, the connecting-rods having segmental ends inclosing said crank-pin and having tapered outer ends, collars secured upon the crank-pin exterior to the ends of the segments having screw-threads upon their outer peripheries, and rings screw-threaded upon the inside and adjustable upon said collars, said rings having tapered inner ends projecting over and fitting the tapered outer ends of the segments, substantially as herein described.

In witness whereof we have hereunto set our hands.

J. GAMBETTA.  
CHARLES D. HARSIN.

Witnesses:

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C. O. MCCORMICK.