

(No Model.)

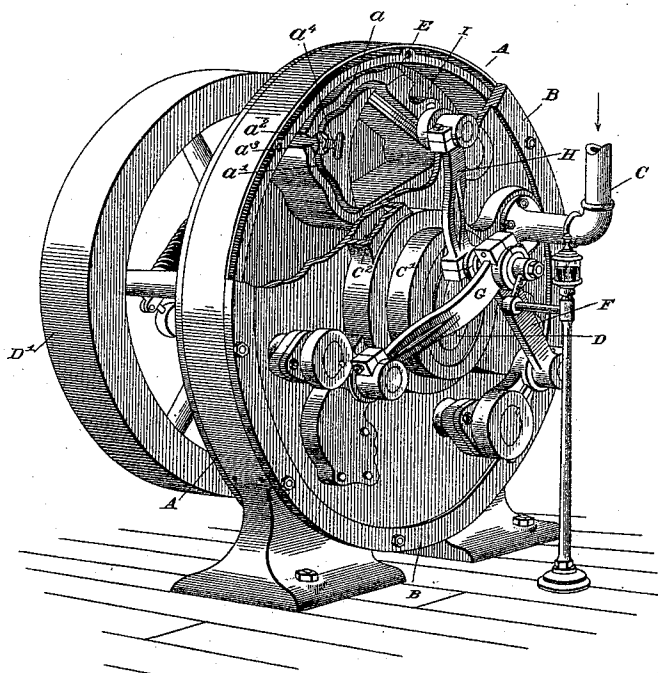
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J. V. RICE, Jr.
STEAM ENGINE.

No. 536,392.

Patented Mar. 26, 1895.

Fig. 1.



Witnesses
Edw. L. Swallow Jr.
Am L. Boyden

Inventor
John V. Rice Jr.
per Fred W. Fisher
Attorney

(No Model.)

2 Sheets—Sheet 2.

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STEAM ENGINE.

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FIG. 3.

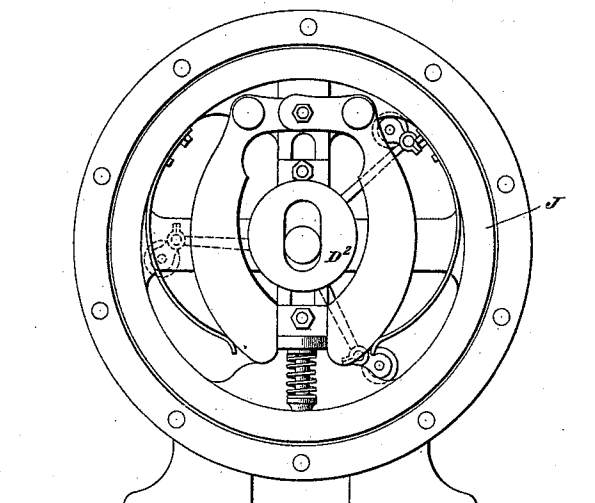
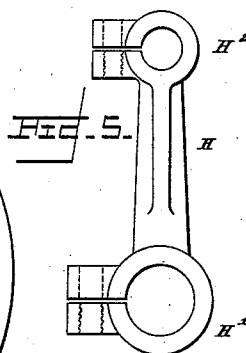
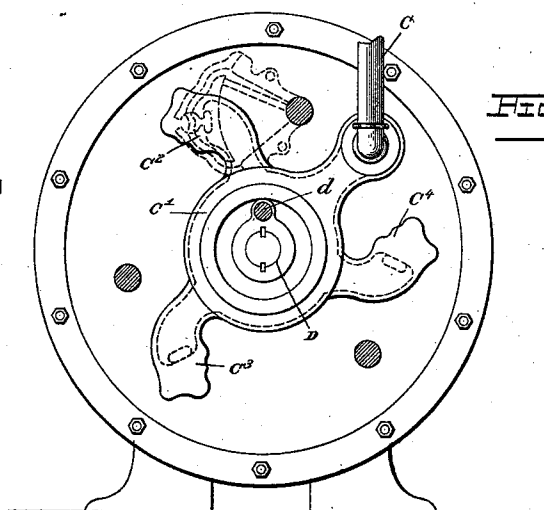
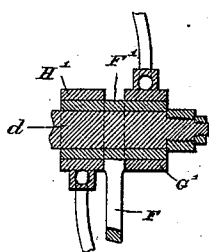


FIG. 2.

FIG. 4.



Witnesses

Edw. S. Dwyer, Jr.
Wm. L. Boyden

Inventor
John V. Rice, Jr.
per Fred. B. Fisher,
Attorney

UNITED STATES PATENT OFFICE.

JOHN V. RICE, JR., OF EDGEWATER, NEW JERSEY, ASSIGNOR TO THE TAYLOR-RICE ENGINEERING COMPANY, OF WILMINGTON, DELAWARE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 536,392, dated March 26, 1895.

Application filed April 28, 1893. Renewed January 26, 1895. Serial No. 536,381. (No model.)

To all whom it may concern:

Be it known that I, JOHN V. RICE, Jr., a citizen of the United States, residing at Edgewater Park, in the county of Burlington and State of New Jersey, have invented certain new and useful Improvements in Steam-Engines; and I do hereby 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.

My present invention relates to that class of steam engines, commonly termed sector cylinder or oscillating piston, the essential feature of engines of this class being a sector shaped working chamber, in which a rectangular flat piston oscillates to and fro like a shutter or door on its hinge, the axis of oscillation being a rocking shaft on which the piston is fixed.

The object of my present invention is to increase the efficiency of engines of this class and make them capable of doing stronger and better work.

The invention comprises numerous improvements upon the engine illustrated, described and claimed in my other pending application for patent on steam engine, filed October 1, 1891, Serial No. 407,413, one important feature of improvement being the provision of a steam-containing chamber within which the sector cylinders are arranged in such a manner that they are kept constantly surrounded by or immersed in a body of steam which keeps the working steam in a state of the highest efficiency and thereby enables the engine to achieve superior results in operation and action. In addition to these numerous improvements upon the construction of the engine as disclosed in the other application alluded to, the present invention also consists in the construction, arrangement and combination of the several parts, substantially as will be hereinafter described and then more particularly pointed out in the claims.

In the accompanying drawings illustrating my invention: Figure 1 is a perspective view of my improved steam engine, a portion of the casing cover being broken away to expose the arrangement of one of the sector cylinders within the same.

Fig. 2 is a front sectional view of the engine. Fig. 3 is a rear elevation showing the governing mechanism. Fig. 4 is a sectional detail showing the arrangement of the connecting rods on the main crank pin. Fig. 5 is an enlarged detail view of one of the connecting rods.

Similar letters of reference designate corresponding parts throughout all the different figures of the drawings.

A designates the main casing or chamber of the engine which may vary in size and shape as occasion requires, being preferably circular or cylindrical in form and serving in a large measure as the main frame of the engine, standing upright as it does on strong basal supports as illustrated in Fig. 1 and having the main shaft D of the engine supported centrally therein in a horizontal position where it is free to rotate under the actuation of the several mechanical parts to be herein presently described. The main casing or drum A, constitutes a closed cylindrical chamber one side of which is a large circular cover plate B secured to the drum by bolts or other suitable means.

Within the surrounding drum or chamber A, arranged about the central shaft D is a multiple arrangement of oscillating pistons for applying power to said shaft which pistons operate within their own sector shaped cylinders. There may obviously be any number of these sector cylinders, steam chests, chambers, receptacles, or whatever they may be termed, the name being a matter of indifference. Three is a convenient number and I have chosen three as an example simply. Obviously there may be many more. The object is to arrange a series of them around the central shaft to which their power is to be applied. These sector cylinders have two radial side walls which join at one end and radiate therefrom, an outer wall connecting the outer ends of these radial sides, which outer wall represents the fractional portion of a circle, and two end inclosing walls, so that the entire receptacle presents a sectoral-shaped steam chest, inclosed by five sides, but it is unnecessary to describe this type of cylinder more minutely than this as the same is well known.

In Fig. 1 of the drawings, the cover plate B of the main drum A is broken away so as to show one of the sector cylinders I, located operatively therein. As just stated I preferably have three cylinders I within drum A, although there may be any number of them. For convenience and explanation I will describe simply one of them. The cover plate B and the opposite side of the drum A, constitute two sides of the sector cylinder inasmuch as said cylinders are secured rigidly within the drum A in the manner shown in Fig. 1. Within the chest or cylinder I, is a flat oscillating plate or piston E, rigidly secured on a rock shaft supported in suitable bearings at the junction of the radial sides of the chest I.

a^3 denotes the valve which controls the admission of live steam into the chest I and the outlet of the exhaust steam therefrom.

a a' denote steam passages, running from valve a^3 to each end of the chest I, so as to deliver live steam at the proper times at points on either side of the oscillating piston.

A^2 denotes an outlet passage adjacent to the rim of drum A, through which outlet passage the exhaust steam passes from the sector cylinder into the interior of drum A.

a^4 designates a recess adjacent to the valve a^3 , into which live steam coming direct from the boiler through suitable conduits is supplied to the cylinder for the purpose of actuating the piston.

It will be understood that the edges of the piston plate, may be, as is the custom, provided with some suitable packing to make the engagement of said edges with the wall of the chest perfectly and completely steam tight. The intermittent impact of the steam or other fluid or liquid, alternately against the opposite sides of the piston plate E, will vibrate it and then by suitable connections between the rock shaft of said pistons and the main driving shaft, the latter will be operated. All the sector cylinders which may be arranged inside of the drum A, operate in substantially the same manner and produce substantially the same result. They all discharge their exhaust steam directly into the interior of the drum A, and this steam therefore constantly surrounds the walls of the sector cylinders, keeping said walls warm and thereby permitting a higher degree of efficiency in the working steam which is within the several sector cylinders. It is a pre-eminent and valuable advantage in having the sector cylinders with their walls constantly exposed to warm steam. Much better results and a vastly higher degree of efficiency can be obtained in this way than is possible when the sector cylinders are situated in the open air and unsurrounded with any warming medium.

C designates a steam inlet or steam conduit running to the engine from the boiler or some other suitable steam source. Said pipe C enters an annular steam chamber C' formed on the side of the plate B, which annular chamber surrounds the main driving shaft D, as

is clearly represented in Figs. 1 and 2. The annular steam chamber C' is provided with radial branches C² C³ C⁴, running to certain points on the plate B, where they may have an opening coincident with the several openings a^4 in the several sector cylinders, into which opening the live steam coming through the pipe C and following through the annular chamber C' must find an inlet passage into the working chambers of the several cylinders. Obviously the chamber C' will have as many radial steam supplying branches as there are sector cylinders to be supplied, and I have represented three such branches in Fig. 2, because in the present example of the invention the number of sector cylinders arranged about the central shaft, is three.

On the end of the main driving shaft D is a crank pin d .

F, G and H represent connecting rods, extending from the several crank arms attached to the different journals of the different oscillating pistons to the crank pin d with which they are loosely and operatively connected, so that all the pistons may apply their power to the common central shaft.

It is unnecessary to explain in further detail, the mode in which the several connecting rods are attached to the crank arms belonging to the different sector cylinders inasmuch as said connections are common and well known in sector cylinder engines. It is necessary however to describe the peculiar way in which the ends of the three connecting rods are successively applied to the common crank pin d with an economy of space. The connecting rod F is straight throughout. This straight connecting rod has a hub F'—see Fig. 4—that surrounds the crank pin d throughout its whole length. The two connecting rods G and H are both bent and they are provided with hubs G' and H' which surround the hub F' on opposite sides of the straight rod F. An example of one of the bent or crooked connecting rods, as for example, rod H, is given in Fig. 5, where it is seen that the straight rod has at one end the hub H' and at the other end the hub H², both of which are split as shown and adapted to have bolts passed through the split portions and tightened up or adjusted so that the lost motion may be taken up. All three of the hubs which surround the crank pin d , that is to say, the hubs F' G' and H' are of this character, that is, split hubs, provided with bolts and nuts, by the tightening of which upon the lips, all lost motion can be taken up and whatever wear that may occur thereby provided for. This is thought to be a valuable arrangement for combining the three connecting rods which are of necessity employed in a three-cylinder engine in conjunction with a common crank pin, it being always a matter of difficulty to so connect the three connecting rods to the crank pin that wear thereon may be reduced to the lowest possible minimum and the highest

efficiency achieved in the combination of the parts and their action in the revolution of the main driving shaft.

The mechanism for shifting the plug valves α^3 belonging to the several sector cylinders at the end of each stroke so as to insure the proper cut-off, may be of any ordinary and convenient kind and need not here be described at any length. On the engine shaft D is a balance wheel D', see Fig. 1. Also there is an eccentric D² on engine shaft D. In connection with this eccentric is arranged the governor wheel J and suitable governing mechanism. The motion of the eccentric will operate rods connected to crank arms on the plug valves α^3 . Therefore the motion of the eccentric will cause the valves α^3 to be properly shifted at the right time to allow the steam to work in the manner necessary to accomplish the rotation of the engine shaft. Any suitable kind of governing mechanism may be employed, either that shown in elevation in Fig. 3 or that briefly illustrated in the perspective view in Fig. 1. I reserve the liberty of employing any suitable governor for the purpose in view.

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

1. In a steam engine, the combination of a central main crank shaft, three or more double acting oscillating pistons for applying power to said shaft arranged around the latter, substantially equidistant from each other and from the shaft and located in substantially the same vertical plane, suitable connecting rods between said pistons and the shaft, three or more separate and independent sector-shaped steam cylinders containing said pistons and a steam-containing chamber within which the several sector shaped steam cylinders are located in such a manner that they are constantly surrounded by steam, substantially as described.

2. In a steam engine, the combination of the central main crank shaft of the engine, three

or more double acting oscillating pistons for applying power to said shaft, arranged around the latter substantially equidistant from each other and from the shaft and located in substantially the same vertical plane, suitable connecting rods between said pistons and the shaft, three or more separate and independent sector-shaped steam cylinders containing said pistons, an inclosing steam containing chamber within which the several sector-shaped steam cylinders are located in such a manner that they are constantly surrounded by steam which exhausts thereinto from the several cylinders and a steam supply chest on the face of the inclosing casing from which steam is delivered to the several cylinders, substantially as described.

3. In a steam engine, the combination of the main crank shaft of the engine, three or more double acting oscillating pistons for applying power to said shaft, arranged around the latter substantially equidistant from each other and from the shaft and located in substantially the same vertical plane, each of said pistons having its rock shaft provided with a crank arm, three or more separate and independent sector-shaped steam cylinders containing said pistons, connecting rods which connect the main engine shaft with the crank arms of each piston, an inclosing steam-containing chamber within which the several sector-shaped steam chests are located in such a manner that they are constantly surrounded by steam which exhausts thereinto from the several cylinders, a live steam chest on the face of the said casing from which steam is delivered to the several cylinders and a suitable cut-off mechanism, all arranged and combined substantially as described.

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

JOHN V. RICE, JR.

Witnesses:

GEORGE GILBERT,
R. W. DALBURY.