(No Model.)

M. ULRICH.

STEAM ENGINE.

No. 484,069. Patented Oct. 11, 1892.

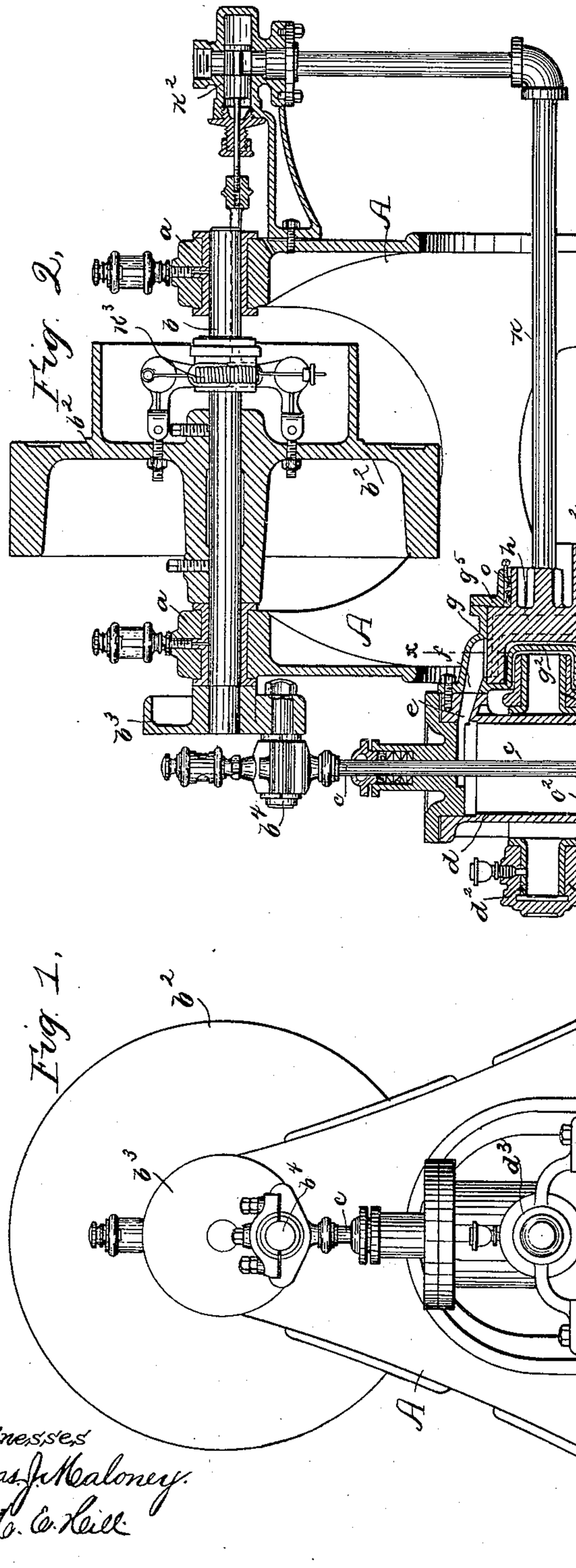

Fig. 2.

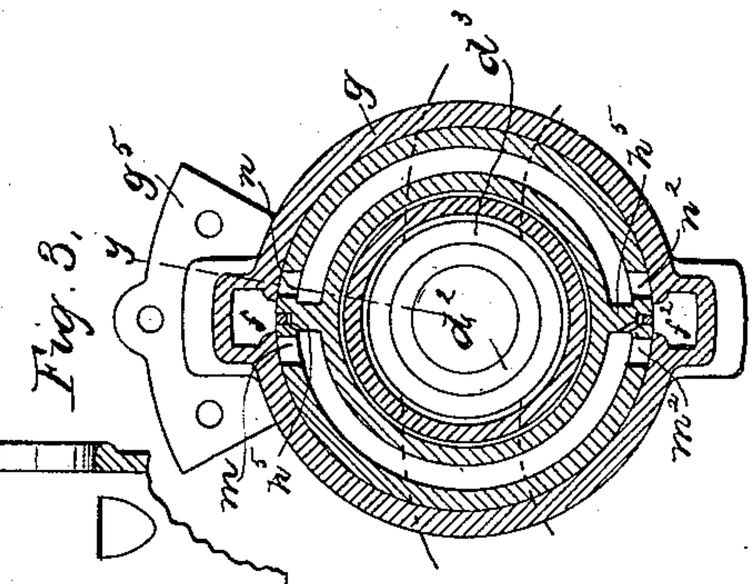

Fig. 3.

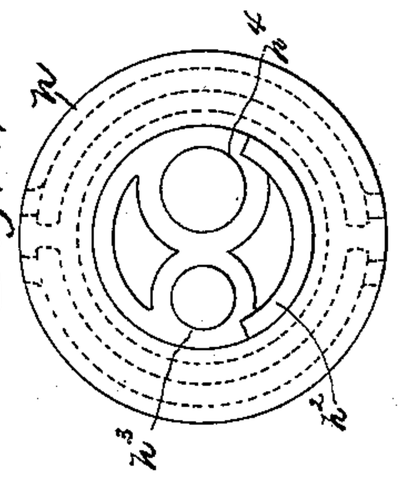

Fig. 4.

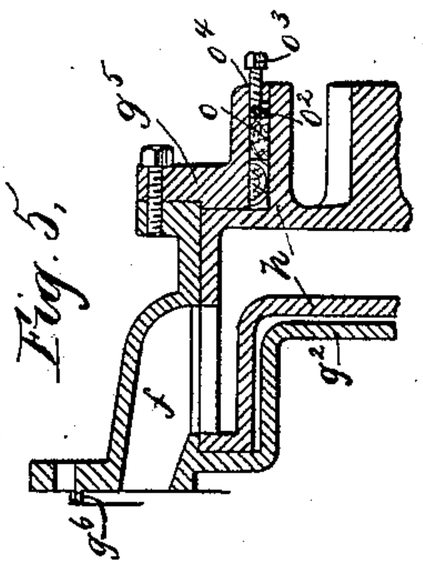

Fig. 5.

Fig. 1.

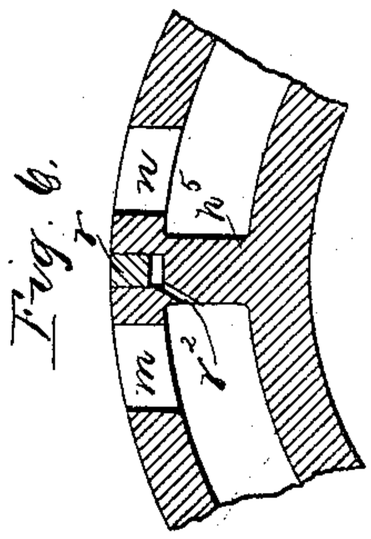

Fig. 6.

Witnesses
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UNITED STATES PATENT OFFICE.

MAX ULRICH, OF NORTHAMPTON, MASSACHUSETTS, ASSIGNOR TO ARTHUR G. HILL, OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 484,069, dated October 11, 1892.

Application filed March 12, 1890. Serial No. 343,647. (No model.)

To all whom it may concern:

Be it known that I, MAX ULRICH, of Northampton, (Florence,) county of Hampshire, State of Masachusetts, have invented an Improvement in Steam-Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention is embodied in an oscillating-cylinder steam-engine, and relates, mainly, to the construction of the valve mechanism and ports by which the steam is conveyed to and exhausted from the engine. The engine is double-acting, and the cylinder is pivoted substantially at the middle of its length upon trunnions that support it and receive the thrust or reaction of the steam that impels the piston, and the valve-action depends upon the oscillation of the cylinder, by which port-openings in a valve-piece carried by and oscillating with the cylinder are caused to alternately register with live-steam and exhaust ports in a stationary steam-chest. The engaging surfaces in which the said port-openings are formed are substantially cylindrical and coaxial with the axis of oscillation of the steam-cylinder. The said steam-chest is separated by a partition substantially in line with the axis of the engine-cylinder when in dead-center position into live-steam and exhaust chambers, and live-steam and exhaust port-openings are formed at either side of said partition, so that the port-opening that accompanies the cylinder is placed first in connection with one and then with the other as the cylinder oscillates. The port-openings carried by the cylinder that co-operate with the port-openings in the steam-chest are for convenience of construction and assemblage of the parts formed in a separate piece from the cylinder and connected therewith, and the steam-chest is so constructed that the ports between the steam-chest and cylinder are very short, reducing the clearance to a minimum.

There are several advantages derived from the above-mentioned construction, which will be hereinafter pointed out.

Figure 1 is a front elevation of an engine embodying this invention; Fig. 2, a longitudinal vertical section thereof; Fig. 3, a vertical sectional detail of the steam-chest and valve mechanism on line x of Fig. 2 on a larger scale; Fig. 4, an elevation of the rear side of the valve-chest; Fig. 5, a sectional detail on broken line y of Fig. 3 on a larger scale, and Fig. 6 an enlarged detail to be referred to.

The main framework A may be substantially a single casting, having bearings at a, Fig. 2, for the main shaft b, provided with the fly-wheel or pulley b^2 and wrist or crank plate b^3, having the crank-pin b^4 engaged by the piston-rod c, all of which may be of usual construction.

The piston-rod c is connected with the piston c^2, operating in the cylinder d, which is provided with trunnions d^2, working in bearings d^3, properly supported upon the framework, the said construction permitting the oscillations of the cylinder d as the end of the piston-rod c moves in the circle of the crank-pin b^4, and said trunnions receiving the thrust or pressure of the steam upon the cylinder as it actuates the piston.

Steam is admitted to and exhausted from the ends of the steam-cylinder at the proper times through ports e e^2, which communicate with and form, substantially, the extensions of ports f f^2 in the valve-piece g, rigidly connected with the said cylinder and itself having a substantially-cylindrical portion, the axis of which is at right angles to that of the steam-cylinder d and in line with the axis of the trunnions d^2, as clearly shown in Figs. 2 and 3, and said portion might be made tapering or conical instead of cylindrical, it being necessary only that it should be coaxial with the cylinder-trunnions and of proper shape to receive and co-operate with the steam-chest, which will be hereinafter described.

The bottom of the cylindrical extension g from the main cylinder—that is, the portion adjacent to the main cylinder—is provided with a pocket or depressed portion g^2 to afford a space for the adjacent trunnion d^2 and its bearing, as clearly shown in Figs. 2 and 3.

The ports f f^2 open from the inner cylindrical surface of the piece g, connected with the cylinder d, which surface surrounds and incloses the steam-chest h, which has a pro-

jecting portion or boss h^2, by which it is securely fastened upon a bracket i, connected with the main framework. The said steam-chest is substantially in the form of a cylinder having inner and outer walls connected at their ends, so as to inclose a space or chamber within them, the outer cylindrical wall having a working fit in the valve-piece g, connected with the engine-cylinder, while the inner cylindrical wall and one head or end are shaped to fit over the projection g^2, that incloses the main cylinder-trunnion, and the other head is provided with the extension h^2, by which the steam-chest is connected with the framework, as before stated, and which contains bosses h^3 h^4, the former of which is connected with a steam-pipe k (see Fig. 2) and the latter of which is connected with the exhaust-pipe, by which the exhaust-steam may be conveyed to any desired point.

The space inclosed in the steam-chest h is divided by a partition h^5 into two separate chambers communicating with the passages through the bosses h^3 h^4, respectively, the former constituting a live-steam chest or chamber and the latter an exhaust-steam chest or chamber. The plane of section on which Fig. 2 is drawn lies in this partition, and the shape of the chamber at the farther side of the partition position is indicated in dotted lines.

Suitable port-openings m m^2 for live steam and n n^2 for exhaust-steam (see Fig. 3) are formed in the outer cylindrical wall of the chest h close to the partition h^5, as shown, so that the ports f f^2 oscillate with the engine-cylinder d, while the steam-chest remains stationary. The said ports f f^2 are each brought alternately into connection with the ports m n and m^2 n^2, respectively, causing steam to be admitted to and exhausted from the ends of the cylinder at proper times to actuate the piston.

In order to secure a tight joint between the engaging surfaces of the steam-chest and portion g, connected with the engine-cylinder, which is herein called the "valve-piece" of the engine, as its movement controls the communication between the port-openings, and thus governs the flow of steam to and from the ends of the cylinder, the said portion g is provided with a head or bonnet g^5, that fits over the projection h and against the outer head of the valve-chest, and is constructed to constitute with the said projection h a stuffing-box o, the construction of which is best shown in Fig. 5. The packing in said stuffing-box is compressed by a follower o^2, operated by bolts o^3, working in a flange o^4 of the bonnet g^5.

In order to insure that the valve-piece g shall be concentric with the axis of oscillation of the cylinder, the engaging face of the said portions may be provided with a tongue and groove, said tongue being represented at g^6, Fig. 5, which may be turned in the cylinder at the same time that the bearing-surfaces of the trunnions are turned and may be turned in the valve-piece at the same time that its cylindrical surface is bored or turned, thus insuring the concentricity of these parts.

As the cylinder is efficiently supported on its trunnions and as the valve construction is such that the steam-pressure is balanced on the surfaces of the chest h and valve-piece g, there will be but little wear on the said surfaces; but in order to compensate for such wear as may take place and to maintain a steam-tight barrier or packing between the live-steam and exhaust portions of the apparatus the said chest is provided with a packing-piece r, (see Fig. 6,) working in a groove between the live-steam and exhaust-port openings, as shown, and acted upon by steam admitted through passages r^2 from the live-steam chamber to act on the under inner surface of the packing-piece and force them radially outward against the inner surface of the valve-piece, so that they will afford an efficient packing to prevent the escape of steam from the live-steam chest through the joint between the steam-chest and valve-piece into the exhaust-chamber of the chest. The passage of steam to the steam-chest through the steam-pipe k is controlled by a valve k^2, operated by a suitable governor k^3, the construction of which need not be herein described, as it constitutes no part of the invention herein claimed.

It will be seen that by the construction of the steam-chest and valve-piece herein set forth several important advantages are attained, among which are the reduction of clearance in the ports f f^2, which are very short; also, the absence of lateral pressure against the cylinder, such as is produced when the valve-operating port-openings are in a plane at right angles to the axis of oscillation, instead of in a cylindrical surface concentric with the axis of oscillation; also, a complete balancing of steam-pressure so far as the valve operation is concerned, and facility in securing and maintaining steam-tight joints in the working parts.

I claim—

1. The combination of the oscillating cylinder and valve-piece connected with said cylinder and having a bore coaxial with the axis of oscillation of the cylinder and port-openings extending from points diametrically opposite one another in the said bore of the valve-piece to the ends of the cylinder with a steam-chest having a curved surface that has a working fit in the bore of said valve-piece, said steam-chest being divided by a longitudinal partition into live-steam and exhaust chambers and having ports adjacent to said partition at diametrically-opposite points, co-operating with the ports in the valve-piece, substantially as and for the purpose described.

2. The combination of the cylinder provided with trunions and supporting-bearings for said trunions with a valve-piece having a bore coaxial with the truninons, said valve-piece being secured to the cylinder and hav-

ing ports leading from its bore to the ends of the cylinder, said valve-piece having a recess adjacent to the side of the cylinder, in which recess one of the cylinder-trunnions and its bearing is located, and a steam-chest contained within the said valve-piece and divided by a longitudinal partition into inlet and exhaust chambers, said steam-chest having ports adjacent to said partition and diametrically opposite one another, co-operating with the ports in the valve-piece, substantially as described.

3. The oscillating cylinder provided with trunnions and supporting-bearings for said trunnions, combined with a valve-piece connected with said cylinder near its ends and recessed to receive one of the cylinder-trunnions and its bearing between the said valve-piece and the side of the cylinder, said valve-piece having a bore coaxial with the cylinder-trunnions, and a stationary steam-chest contained in the bore of said valve-piece, and a cap or bonnet detachably connected with said valve-piece and engaging the said steam-chest to confine the latter in the bore of the valve-piece, substantially as described.

4. The oscillating cylinder provided with trunnions and bearings therefor, combined with the valve-piece provided with a bore, said valve-piece and cylinder being provided with an interlocking tongue and groove, as g^6, turned concentric with the trunnion on the cylinder and concentric with the bore in the valve-piece, as described, whereby when the said cylinder and valve-piece are engaged at said tongue and groove the bore of the valve-piece is concentric with the trunnion of the cylinder, substantially as described.

5. The combination of the oscillating cylinder and valve-piece connected therewith, having a bore coaxial with the cylinder-trunnions, and ports leading from said bore to the ends of the cylinder, with a steam-chest having a working fit in the bore of said valve-piece and divided by a longitudinal partition into live-steam and exhaust chambers and provided with ports immediately adjacent to said partition, and a packing-strip interposed between the said ports in the steam-chest, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MAX ULRICH.

Witnesses:
ARTHUR G. HILL,
EDWARD BUNTING.