

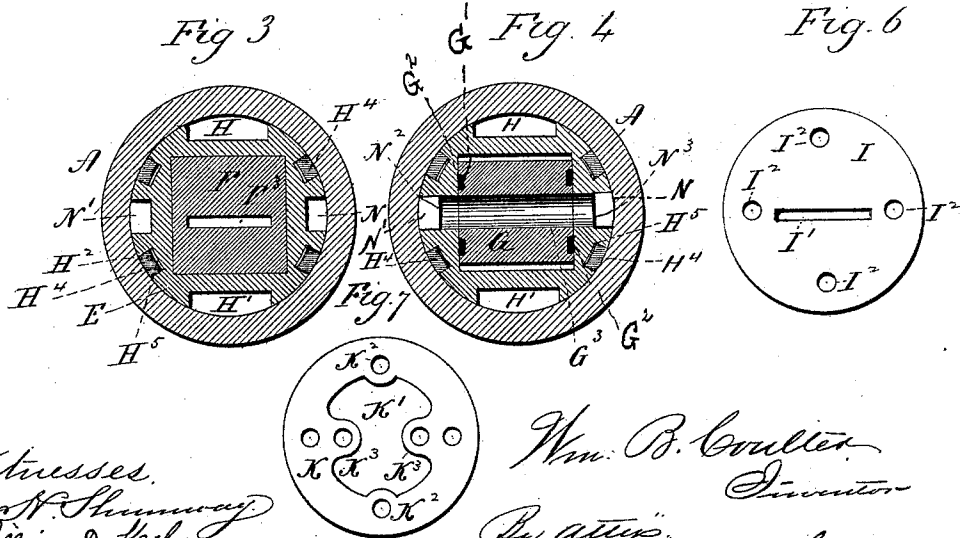
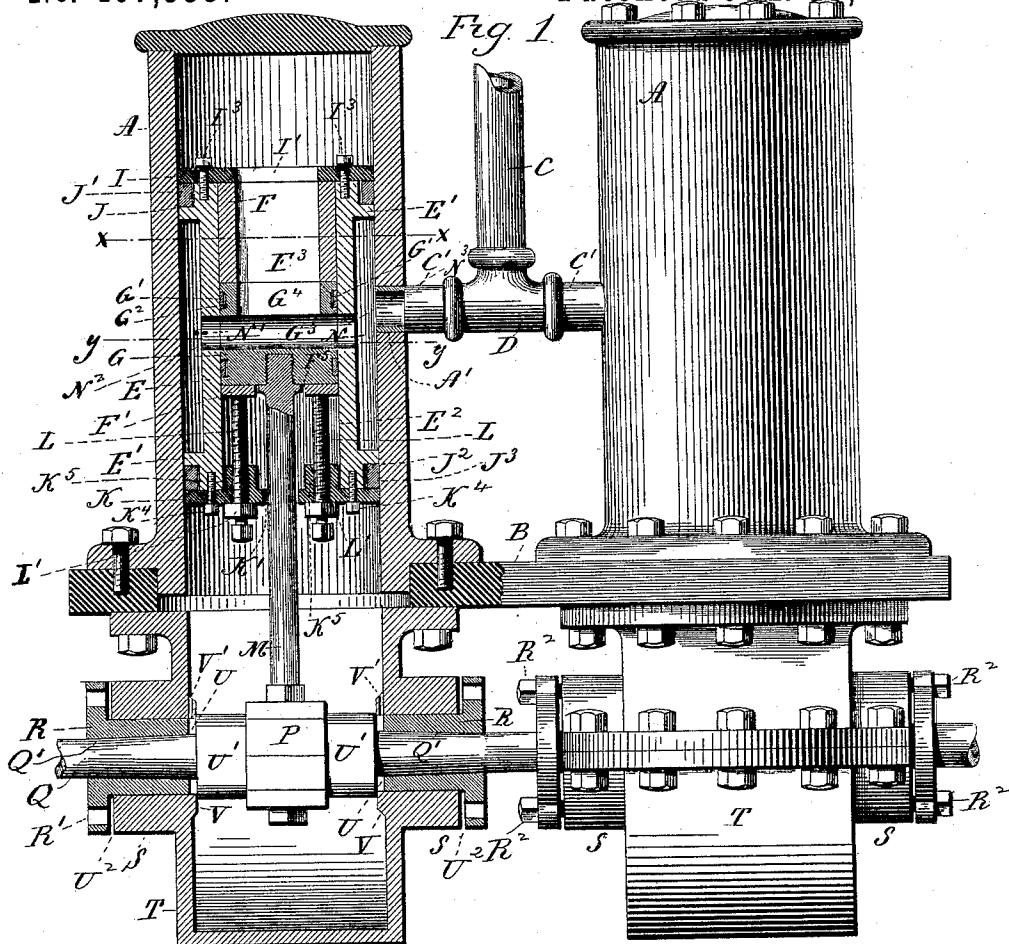
(No Model.)

2 Sheets—Sheet 1.

W. B. COULTER.
STEAM ENGINE.

No. 467,333.

Patented Jan. 19, 1892.



Witnesses.
J. W. Shumway.
Lillian D. Kelby.

Wm. B. Coulter
Director
By attys.
Earle & Seymour

(No Model.)

2 Sheets—Sheet 2.

W. B. COULTER.
STEAM ENGINE.

No. 467,333.

Patented Jan. 19, 1892.

Fig. 2

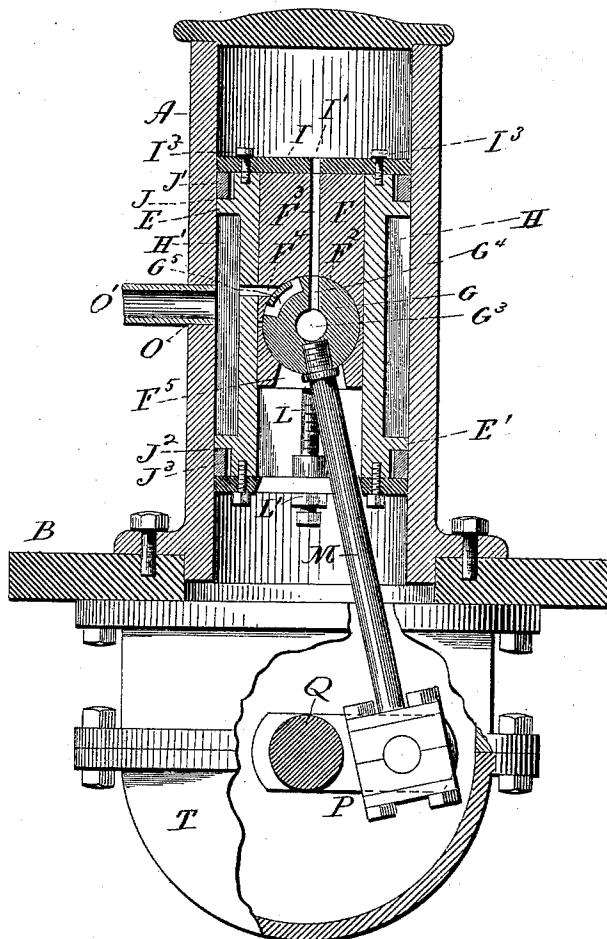
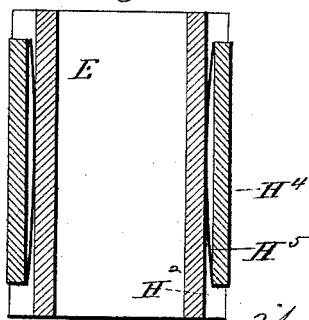


Fig. 5



Witnesses:
J. S. Shumway.
Lillian D. Kellogg.

Wm. B. Coulter.
Inventor.
By Atty.
Earle & Seymour

UNITED STATES PATENT OFFICE.

WILLIAM B. COULTER, OF WATERBURY, CONNECTICUT, ASSIGNOR OF ONE-HALF TO NELSON C. OVAITT AND MERRICK GALLOND, OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 467,333, dated January 19, 1892.

Application filed March 27, 1891. Serial No. 386,594. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. COULTER, of Waterbury, in the county of New Haven and State of Connecticut, have invented a new Improvement in Steam-Engines; and I do hereby declare the following, when taken in connection with accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a view, partly in side elevation and partly in vertical section, of an engine constructed in accordance with my invention; Fig. 2, a view in vertical section of one of the cylinders on the line *a b* of Fig. 1; Fig. 3, a view in transverse section on line *x x* of Fig. 1. Fig. 4, a similar view on line *y y* of the same figure; Fig. 5, a detached view, in vertical section, of one of the piston-heads and showing the longitudinal packing-ribs thereof; Fig. 6, a plan view of the upper follower of the piston-head; Fig. 7, a similar view of the lower follower thereof.

This invention relates to an improvement in multiple-cylinder direct-acting steam-engines, the object being to produce a simple, compact, durable, and highly-efficient device.

With these ends in view my invention consists in the combination, with a cylinder having suitable steam connections, of a piston therefor having steam-ports, an oscillating valve mounted in the piston and having ports to register with those therein, a piston-rod connected directly at one end with the said valve, which it oscillates, and a crank-shaft with which the other end of the piston-rod is connected, both the piston and valve being constructed to be balanced as to steam-pressure. My invention further consists in certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

The two cylinders *A A* are of any approved construction and secured side by side to the bed *B* of the engine. A steam-pipe *C*, located between the two cylinders, terminates in a two-armed elbow *D*, from which branch pipes *C' C'* lead into the two cylinders, respectively, through ports *A'* formed in them. Inasmuch as

the cylinders and all of the parts respectively connected with them are duplicates of each other, it will be sufficient to describe the parts of one of them. Each cylinder is provided with a piston having a cylindrical piston-head *E*, provided near each of its ends with a flange *E'* and constructed with a central longitudinal opening *E²*, which is square in transverse section. A valve-box composed of two parts *F* and *F'* is located in the said opening *E²* of the piston, each of the said parts conforming to the opening in transverse section. The inner and adjacent ends of the said valve-box parts are concaved, as at *F² F²*, to receive a cylindrical valve *G*, which is interposed between them in a horizontal position, the ends of the said valve being fitted to play against opposite faces of the opening *E²* in the piston-head and being thereto provided with packing-rings *G' G'*, located in annular recesses formed for them in the ends of the valve. Springs *G² G²*, located back of the said packing-rings, exert a constant effort to force the same into contact with the walls of the opening *E²*. The valve is provided with a central circular longitudinal bore or passage *G³* and with steam-ports *G⁴ G⁵*, which respectively register with steam-ports *F³ F⁴*, formed in the valve-box part *F*, the port *G⁴* being a radial live-steam port leading directly from the central passage *G³*, which is always filled with live steam, and the port *G⁵* being formed in the periphery of the valve and constituting an exhaust-steam port. Of these two ports the port *F³* extends with the length of the said valve-box part *F* and opens into the upper end of the cylinder, while the port *F⁴* is a transverse port and opens into a long exhaust-pocket *H*, formed in the face of the piston-head, as will be hereinafter described.

By making the valve-box in two parts the lower part thereof may not only be lifted to compensate for wear in the upper part, on which the greatest wear falls, but also the said upper part may, when necessary, be replaced without replacing the lower part.

A disk-shaped follower *I*, (shown by Fig. 6 of the drawings,) provided with an oblong port-hole *I'*, conforming in shape to and registering with the port *F³*, before mentioned, 100

and also provided with bolt-holes I², is secured by bolts I³ to the upper end of the piston-head. This follower prevents the upward displacement of the part F of the valve-box and also co-operates with the upper flange E' of the piston-head in forming a chamber J to receive the packing-ring J', which forms the upper packing of the piston and is itself elastic, so as to exert a constant tendency to open, whereby it is adapted to compensate for wear. A disk-shaped follower K, (see Fig. 7,) conforming in diameter to the follower I, before mentioned, is constructed with a central clearance-opening K', with bolt-holes K², and with two perforated ears K³ K³, located opposite each other. This follower is attached by bolts K⁴ to the lower end of the piston-head and co-operates with the lower flange E' thereof in forming a chamber J² to receive a packing-ring J², corresponding in construction to the ring J', before mentioned. Two long screw-bolts L L, passing through the perforated ears K³ K³, before mentioned, and through hubs or bosses K⁵ K⁵, formed upon the inner face of the follower K, impinge against the lower face of the valve-box part F' and hold the same in place. These screw-bolts are furnished with jam-nuts L' L' and provide for taking up the wear in the valve-box parts. The part F' of the valve-box is provided with a clearance-opening F⁵ to permit the upper end of the piston-rod M to be screwed into the valve-box and to clear the rod as the same is oscillated. The opening K', formed in the lower follower, registers with the said opening F⁵ in the valve-box part F' and is for the same purpose.

The piston-head E is provided on opposite points in its surface with two longitudinal steam-pockets N N', the pocket N being arranged to register with the inlet-opening A', formed in the cylinder, and being intersected midway of its length by an opening N², which registers with the bore G³ of the valve. An opening N³, formed in the piston-head at a point opposite the opening N², leads from the opposite end of the bore G³ into the steam-pocket N', which is provided for equalizing the steam-pressure in the cylinder. The exhaust-steam pocket H, formed in the outer face of the piston-head and extending with the length thereof, is made considerably wider than the steam-pockets N and N' and communicates through an opening O, formed in the cylinder, with an exhaust-steam pipe O' applied thereto. A corresponding pocket H' is formed in the piston-head at a point opposite the pocket H and may be used as an exhaust-pocket or may be made simply to make the piston lighter. The said pockets H H' and N N' are located quartering to each other, as well shown by Fig. 3 of the drawings.

Four longitudinal grooves H², respectively arranged between the live-steam pockets N and N' and the pockets H and H', are adapted to receive packing-bars H³, normally pressed against the walls of the piston-head by springs

H⁴, as shown by Fig. 5. These packing-bars, which may be of any desirable material, effectually prevent any live steam from leaking into the pockets H and H'.

Instead of conducting away the exhaust-steam through the pipe O', I may prefer to cast a projection upon the outer face of the cylinder and leading from the opening O therein to the base B, the said projection to be bored out and the bore to be connected with a pipe located in the base. From the foregoing description it will be seen that the piston is virtually a moving steam-chest. When the engine is in motion, it constantly contains boiler-pressure.

The lower end of the piston-rod N is connected in any approved manner with a crank P, mounted upon the crank-shaft Q, which is journaled in tapered sleeves R, the outer ends whereof are provided with flanges R', receiving bolts R², entering the outer faces of the hubs S, formed integral with cases T, bolted to the lower face of the base B. The said shaft Q is common to both of the cylinders and has both of the piston-rods connected with it. Where it passes through the tapered sleeves R, before mentioned, it is tapered to correspond to them, as at Q'. The sleeves R are adapted in length to leave a space U between their inner ends and the collars U', placed on the shaft on the opposite sides of the piston-rod, and a corresponding space U² is provided for between the flanges R' of the sleeves and the outer faces of the hubs S of the cases T. These spaces U and U² therefore provide for the inward adjustment of the sleeves for taking up the wear of the shaft Q. Each of the cases T is provided with an inward projection V, encircling the bearing of the shaft Q', and each of these projections is provided upon its upper face with a small oil-passage V', leading into the compensation-spaces U. The oil with which the cases T are partially filled is dashed by the action of the cranks P into the said oil-passages, for it will be understood that the shafts and cranks run in oil. I do not, however, limit myself to any particular way of mounting the shaft Q and compensating for the wear thereof, as other means than those shown may be employed in connection with my invention, which relates to the construction of the pistons and the connection of the oscillating valves thereof with the crank-shaft.

It will be understood, of course, that the outer ends of the piston-rods of the two cylinders are connected with the crank-shaft at different quarters thereon in the usual manner.

By constructing the piston-head with live-steam pockets in its opposite faces it is balanced as to steam-pressure, whereby it operates with the minimum of friction and wear. Furthermore, by making the valve with a central longitudinal passage and keeping the same always filled with live steam an equilibrium of pressure is always maintained

as to the valve with the same advantages as before mentioned for the piston-head. It is true that the exhaust-steam port of the valve is located in its periphery; but the pressure of the exhaust-steam is so inconsiderable that it does not practically disturb the balance of the valve, although it acts upon the same from a point near the surface thereof. The packings in the end of the valve keep it tight, while the packings alternated between the live steam and the other two pockets formed in the piston-head effectually prevent the live steam from working from one to another when the parts become worn.

I would have it understood that I do not limit myself to the exact construction shown and described, but hold myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of my invention. I do not, however, broadly claim an oscillating valve located in the head of a piston and rocked by the piston-rod.

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

1. The combination, with a cylinder having suitable live and exhaust steam connections, of a piston having two live-steam pockets located opposite each other, a valve-box mounted in the piston and having ports for live and exhaust steam, a cylindrical valve placed horizontally in the said box and having a central longitudinal passage communicating at its opposite ends with the said steam-pockets, a live-steam port leading from the said passage to the live-steam port of the valve-box, and a peripheral exhaust-steam port communicating with the exhaust-steam port of the valve-box, and a piston-rod directly connected with the said valve and oscillating it, substantially as set forth, and whereby both the piston and valve are balanced as to steam-pressure.

2. The combination, with a cylinder having suitable live and exhaust steam connections, of a piston having live-steam pockets located opposite each other, a two-part valve-box the upper part whereof is constructed with a live and an exhaust steam port and the lower part adapted to be vertically adjusted and made with a clearance-opening, a cylindrical valve placed horizontally between the two parts of the box and having a central longitudinal passage communicating at its opposite ends with the said steam-pockets, a live-steam port leading radially out of the said passage to the live-steam port of the valve-box, and a peripheral exhaust-steam port leading to the exhaust-steam port of the said valve-box, and a piston-rod passing through the clearance-opening of the lower part of the valve-box and connected directly with the valve to oscillate it, substantially as set forth, and whereby both the piston and the valve are balanced as to steam-pressure.

3. The combination, with a cylinder having

suitable live and exhaust steam connections, of a piston having two live-steam pockets located opposite each other, and a square cylindrical opening, a two-part valve-box adapted in cross-section to fit into the said opening, the upper box part being constructed with a live and an exhaust steam port, a cylindrical valve placed horizontally between the two box parts and constructed with a central longitudinal passage communicating at its opposite ends with the said pockets, a live-steam port leading radially from the said passage to the live-steam port of the valve-box, and a peripheral exhaust-steam port communicating with the exhaust-steam port of the valve-box, and a piston-rod directly connected with the valve to oscillate it, substantially as described, and whereby both the piston and valve are balanced as to steam-pressure.

4. The combination, with a cylinder having suitable steam connections, of a piston-head having two longitudinal live-steam pockets respectively located in its opposite faces and two similar pockets located midway between the live-steam pockets and one forming a pocket for exhaust-steam, a valve-box located in the said head and constructed with a live-steam and an exhaust-steam port, a longitudinal oscillating valve located horizontally in the said box and constructed with a central longitudinal passage communicating at its opposite ends with the said live-steam pockets, a live-steam port leading radially from the said passage to the live-steam port of the valve-box, and a peripheral exhaust-steam port communicating with the exhaust-steam port of the valve-box, and a piston-rod directly connected with the valve, substantially as set forth, and whereby both the piston-head and valve are balanced as to steam-pressure.

5. The combination, with a cylinder having live and exhaust steam connections, of a piston-head having two longitudinal live-steam pockets located in its opposite faces, two similar pockets located between the live-steam pockets and one receiving the exhaust-steam, four longitudinal grooves alternated between the said pockets, packings located in the said grooves and engaging with the cylinder, a two-part valve-box located in the head, the upper box part having a live-steam port and an exhaust-steam port, a cylindrical valve placed horizontally between the two box parts and having a central longitudinal passage communicating at its opposite ends with the said live-steam pockets, a live-steam port leading radially from the said passage to the live-steam port of the valve-box, a peripheral exhaust-steam port leading to the exhaust-steam port of the valve-box, and annular grooves formed in its ends concentric with its central passage, packings located in the said grooves, and a piston-rod directly connected with the said valve to oscillate it, substan-

tially as set forth, and whereby the piston-head and the valve are balanced as to steam-pressure.

5 6. A cylindrical oscillating valve having a central longitudinal passage open at both ends, a radial live-steam port leading therefrom, a peripheral exhaust-steam port, and an annular groove formed in each of its ends concentric with its central passage, in combi-

nation with packings fitted in said annular 10 grooves, substantially as described.

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

WILLIAM B. COULTER.

Witnesses:

EDWARD F. COLE,
A. A. TRION.