

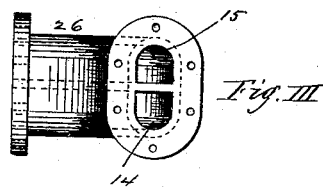
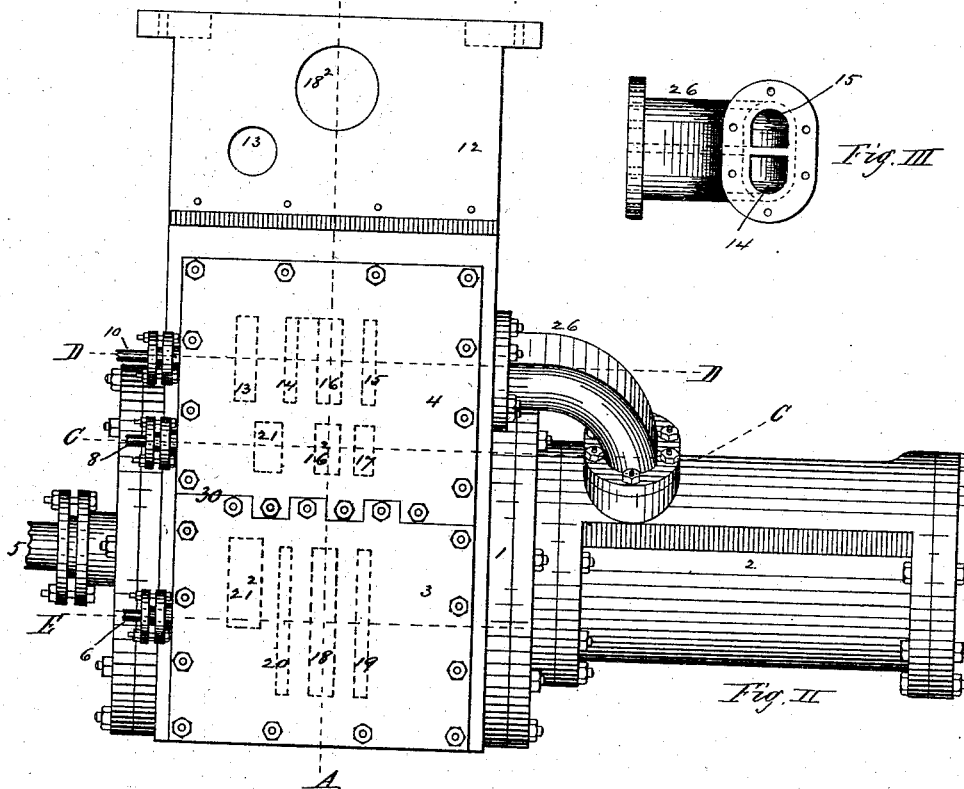
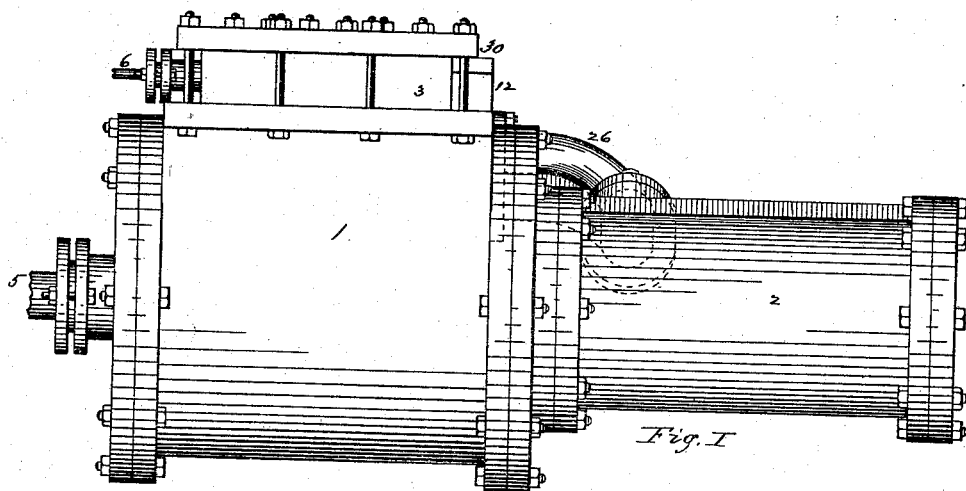
(No Model.)

H. D. DUNBAR.
COMPOUND ENGINE.

3 Sheets—Sheet 1.

No. 264,937.

Patented Sept. 26, 1882.



Witnesses.
Chas H. Wood
W. C. Stebbins

Inventor.
Henry D. Dunbar
Res. J. A. Curtis.
his atty.

(No Model.)

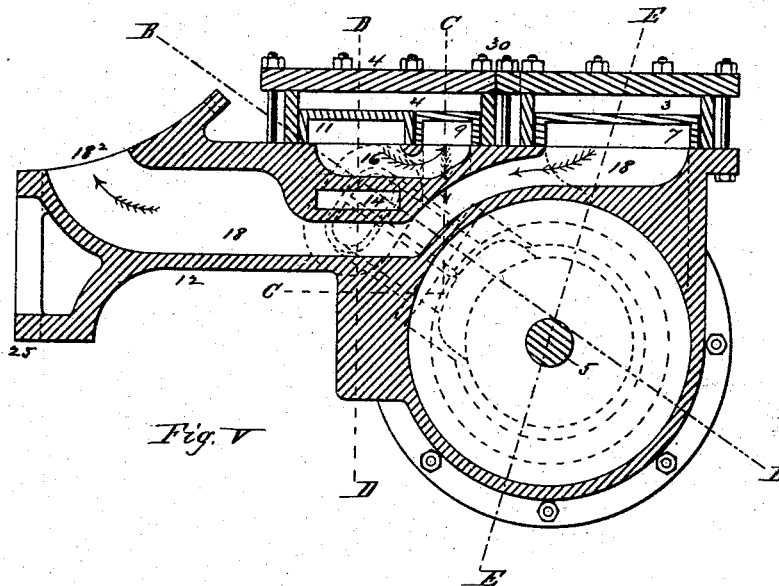
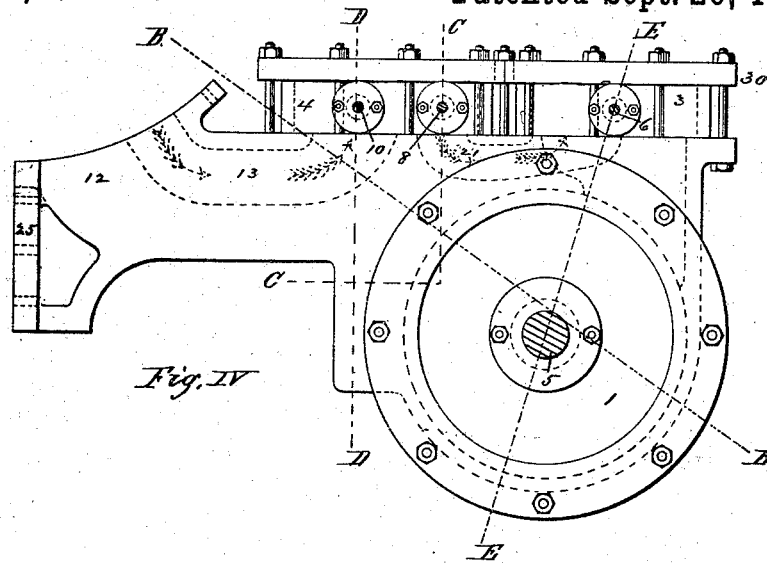
3 Sheets—Sheet 2.

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Chas. H. Wood.
W. C. Stebbins

Inventor.

Henry D. Dunbar.
By T. Alenitis.
his atty.

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3 Sheets—Sheet 3.

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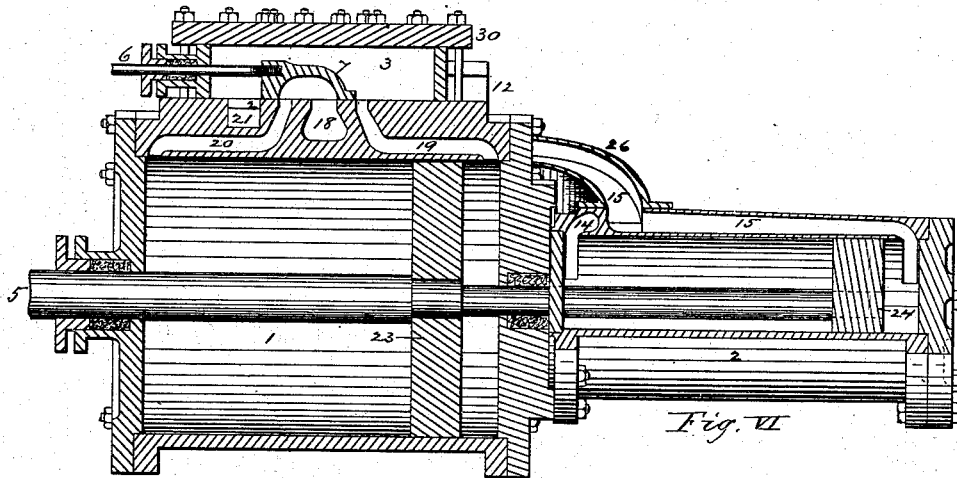


Fig. VI

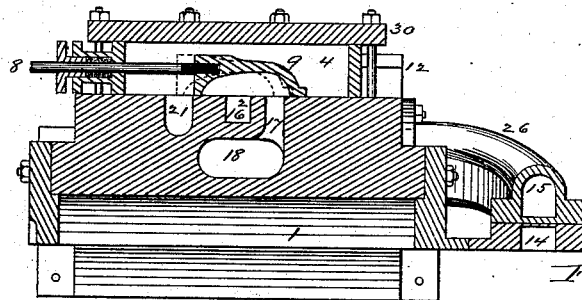


Fig. VII

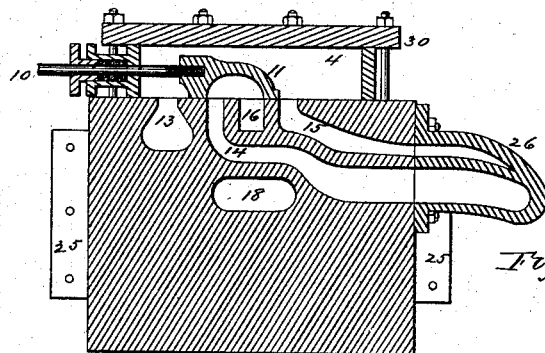


Fig. VIII

Witnesses.

Chas H. Wood
W. C. Stebbins

Inventor.

Henry D. Dunbar,
By T. A. Leitch,
his Atty.

UNITED STATES PATENT OFFICE.

HENRY D. DUNBAR, OF NORTH HARTLAND, VERMONT.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 264,937, dated September 26, 1882.

Application filed December 29, 1881. (No model.)

To all whom it may concern:

Be it known that I, HENRY D. DUNBAR, of North Hartland, in the county of Windsor and State of Vermont, have invented a new and useful Improvement in Compound Engines, of which the following is a specification.

The object of my invention is to increase the working-power of an engine, when desired, by providing two cylinders and two steam-chests, or a single steam-chest with two steam-chambers arranged side by side, and connected with each other and with the cylinders by ports or passage-ways, and two pistons attached to a single rod common to both, whereby one or both said pistons may be actuated by live steam; or one piston may be actuated by live steam and the other by exhaust-steam admitted through one of said chambers by a port controlled by a distributing-valve operated by the engineer, and I accomplish this by the mechanism hereinafter described, and illustrated in the accompanying drawings, in which—

Figure I is a side view of two cylinders arranged according to my invention. Fig. II is a plan view of the same, and connected with the saddle of a locomotive, as made in two parts bolted together. Fig. III is a reverse plan view of a separate piece containing the ports or passage-ways connecting one of the steam-chambers with one of the cylinders. Fig. IV is an end view of one of the cylinders and the steam-chamber and saddle-piece connected therewith, in which are made a portion of the steam-passages. Fig. V is a transverse vertical section at line A of Fig. II. Fig. VI is a longitudinal vertical section of the larger cylinder and its steam-chamber and valve at line E of Figs. II, IV, and V, and also a longitudinal section of the smaller cylinder and its steam-passages at line B of Figs. IV and V. Fig. VII is a vertical section of a portion of the cylinder and saddle-piece and steam-chamber connected therewith at line C of Figs. II, IV, and V; and Fig. VIII is a vertical section of the saddle-piece and steam-chamber connected therewith at line D of Figs. II, IV, and V, showing the arrangement of the ports forming communication between the smaller cylinder and the steam-chamber.

In the drawings, 12 represents one-half of

a saddle-piece for a locomotive-engine, two of which such pieces may be bolted together at 25 to form the saddle, and 1 represents a cylinder, which may be cast in the same piece with the saddle 12, and the upper side of this saddle, as 12, may be made plane and smooth to receive the steam-chest, as 30, which consists of two steam-chambers, as 3 and 4, arranged side by side, the chamber 3 containing a valve, as 7, being an ordinary slide-valve with a rod, as 6, attached thereto and extending out through an ordinary stuffing-box, and the chamber, as 4, contains an ordinary slide-valve, as 11, also provided with a similar rod, as 10, and this chamber also contains another valve, as 9, also having a similar rod, as 8, attached.

A smaller cylinder, as 2, is secured to one end of the larger cylinder, as 1, and a piston-rod, as 5, extends through the larger cylinder and into the smaller cylinder, with a piston, as 23, in the larger cylinder, and also a piston, as 24, in the smaller cylinder, both secured to the said piston-rod, the pistons occupying the same relative positions each in its respective cylinder, and the axes of the piston-rod, pistons, and cylinders all being coincident.

A port or passage-way, as 13, is cast in the saddle, with an opening at one end, at the inner portion of the saddle, at a convenient point for the adjustment of a steam-pipe thereto, and with an opening at the other end, within the steam-chamber, as 4, as shown in dotted lines in Fig. II; and a port, as 14, is made from the chamber 4 in the saddle and through the casting, as 26, opening into that end of the smaller cylinder adjacent to the large cylinder, and also a similar port, as 15, extending to the opposite end of the smaller cylinder, as shown in Figs. VI and VIII. The port, as 16, between the ports 14 and 15, extends down and out to one side and opens up into the valve-seat at 16² a little to one side of its opening 16, as shown in dotted lines in Fig. II, and a port, as 21, extends down beneath the valve-seat of the chamber, as 4, and terminates in the port-opening 21² in the valve-seat of the chamber, as 3.

The ports 20 and 19 communicate with the respective ends of the larger cylinder, as 1, in the ordinary manner, and as shown clearly in

Fig. VI, and the exhaust-port, as 18, located in the valve-seat of the chamber, as 3, and between the openings 20 and 19, extends down and through the saddle-piece, as 12, and terminates in the exhaust-opening, as 18², at a convenient point to receive an exhaust-pipe.

A port or opening, as 17, is made in the valve-seat of the chamber, as 4, at one side of the port, as 16², which port, as 17, extends down and communicates with the exhaust port or passage 18, all as shown clearly in Figs. II and VII.

An ordinary slide-valve, as 7, may cover and operate in connection with the ports, as 18, 19, and 20, in the chamber, as 3, and any similar valve, as 11, may cover and operate in connection with the ports, as 14, 15, and 16, in the chamber, as 4.

The openings or ports, as 16², 17, and 21, in the valve-seat of the chamber, as 4, are provided with, and the passage of steam therethrough controlled by, a distributing-valve, as 9, which may be of the ordinary slide-valve pattern; and the exhaust-cavity in its lower side may be of such length that when the valve is in the position shown in dotted lines in Fig. VII there may be communication between the ports 17 and 21 through said exhaust-cavity, said ports then being only partially closed; but the valve, as 9, may be moved farther over in the direction of the dotted lines, or so as to completely close the said ports, as 17 and 21, from the chamber, as 4, in which case communication between the steam-chambers 3 and 4 will be completely cut off or closed. Of course the apertures in the ends of the cylinder through which the piston-rod operates are suitably packed, so that steam cannot pass from one cylinder to the other around the rod.

If it is desired to use live steam in both cylinders, the distributing-valve, as 9, is moved into the position shown in full lines in Fig. VII, and with the slide-valves, as 7 and 11, in the position shown in Figs. VI and VIII, (as both valve-stems, as 6 and 10, may be attached to and moved by one and the same valve-rod,) the live steam may enter the pipe at 13 in the inner portion of the saddle-piece and pass into the chamber, as 4, through the port 13 in said chamber, and thence through the port, as 15, into that end of the smaller cylinder farthest from the larger one, and both pistons, with their common rod, as 5, are forced in a direction toward the opposite end of the cylinders, and the exhaust-steam on the other side of the small piston, as 24, in the smaller cylinder, passes out through the port 14 and through the exhaust-cavity in the valve, as 11, into the port, as 16, out the port, as 16², through the exhaust-cavity in the distributing-valve, as 9, down through the port, as 17, and out through the exhaust-passage, as 18, and opening, as 18². At the same time that live steam passes in through the port, as 15, into the smaller cylinder, it also passes out from the steam-chamber, as 4, through the port, as 21, into the

chamber, as 3, through the opening, as 21², and thence through the port, as 19, into the same end of the larger cylinder 1, so that at the same time the live steam in the smaller cylinder is exerting its force against the smaller piston, as 24, the live steam in the larger cylinder is exerting its force against the same side of the larger piston, as 23, while the exhaust-steam on the opposite side of the larger piston passes out through the port, as 20, through the exhaust-cavity in the valve, as 7, down and out through the port or passage, as 18, and aperture, as 18².

If it should be desired to use live steam only in the smaller cylinder and exhaust-steam in the larger cylinder, the distributing-valve, as 9, is drawn back, so as to close or shut both the ports, as 17 and 21, from communication with the chamber, as 4. If live steam be then admitted through the port, as 13, it will pass into the extreme end of the smaller cylinder through the port, as 15, as before, and the exhaust-steam on the opposite side of the piston, as 24, will pass out through the port, as 14, through the exhaust-cavity in the valve, as 11, into the port, as 16, and up through the port, as 16², and through the exhaust-cavity in the valve, as 9, down through the port, as 21, and thence through the opening, as 21², into the steam-chamber, as 3; thence through the port, as 19, into the same end of the larger cylinder, so that while the live steam is exerting its force against the side of the piston, as 24, the exhaust-steam from the opposite end of that cylinder is exerting its force against the same side of the larger piston, as 23, both forces operating to move both pistons in the same direction.

It will thus be seen that when little power is wanted both pistons on the same piston-rod may be operated, the smaller one by live steam and the larger one by the exhaust-steam from the small cylinder, and that at full stroke as well as when cut off at any point in the stroke, according to the power required; or both cylinders may be used with live steam and at either "full" stroke or cut off at any point in the stroke, according to the greater degree of power required above that developed by the two cylinders used with live steam and exhaust-steam.

When it is desired to shut off steam entirely from both cylinders the distributing-valve, as 9, may be moved into the position shown in dotted lines in Fig. VII, so that the ports, as 16², 17, and 21, will communicate, and the air will then circulate freely through the chambers, as 3 and 4, and steam-passages, and into the larger cylinder on both sides of the larger piston, and any back-pressure from partial vacuum created by the "pumping" action of the larger piston will be prevented. This is an important feature in my invention, inasmuch as no inconsiderable annoyance has been experienced by this action of the pistons in pumping air and creating back-pressure.

Of course it is not essential that the pas-

sages, as 14 and 15, should be cast in a separate piece, as 26, and the latter secured to the cylinders, as they may be cast in the saddle and shell of the cylinders themselves.

5 If this invention of compound engine is applied to a locomotive, it is evident that the two valve-stems, as 6 and 10, may be united, or attached to a single rod to actuate both valves, as 7 and 11, simultaneously, and the rod, as 8, 10 may be extended to or be connected with the cab of the engine, so that the distributing-valve, as 9, may be operated therefrom by the engineer, in any convenient manner, so that no change will be required in the ordinary construction of 15 the parts of the machinery or valve motion from that now practiced, the only change necessary to the use of the invention being that of the cylinder and steam-chest castings.

As applied to a locomotive, the whole arrangement of saddle-piece, as 12, and two cylinders connected therewith may be duplicated— 20 one pair of cylinders on one side the locomotive and another pair on the other side, and the two saddle-pieces bolted together at the 25 flange, as 25, and the boiler fitted and secured to the saddle above this flange.

Having thus described my invention, what I claim as new is—

1. In an improved compound engine, a chest 30 having two steam-chambers arranged side by side and communicating one with the other by a single port or passage-way controlled by a governing-valve adapted to be operated by the engineer, with the valve-seat in each chamber provided with the ordinary induction and 35 exhaust ports, controlled in each chamber by a slide-valve, and both moved simultaneously, two cylinders, one of which communicates directly with one of said steam-chambers, and the 40 other cylinder with the other chamber through said induction-ports, and each cylinder contain-

ing a piston secured to a single piston-rod common to both, whereby both said pistons may be actuated by live steam at the same time, or one be actuated by live steam and the other 45 by exhaust-steam, substantially as described.

2. In an improved compound engine, a chest having two steam-chambers arranged side by side and communicating one with the other by a single port or passage-way, in combination 50 with a distributing or governing valve to control said port, and whose actuating-rod extends out through said chest and is adapted to be operated by the engineer, whereby said valve may be moved by the engineer to control 55 the passage of live steam or of exhaust-steam through said port, substantially as described.

3. In an improved compound engine, a chest having two steam-chambers arranged side by 60 side and communicating one with the other by a single port or passage-way controlled by a governing-valve adapted to be operated by the engineer to control the passage of live steam or of exhaust-steam through said port, 65 a saddle-piece having the seats for the valves in said chambers made on its upper surface and the seat in each chamber provided with induction and exhaust ports, controlled in each 70 chamber by a slide-valve, both moving simultaneously, two cylinders, one made integral with said saddle-piece and communicating with one chamber, and the other cylinder with the other chamber through said induction-ports, 75 and each cylinder containing a piston, both secured to the same piston-rod, substantially as described.

HENRY D. DUNBAR.

Witnesses:

T. A. CURTIS,
CHAS. H. WOOD.