

No. 658,200.

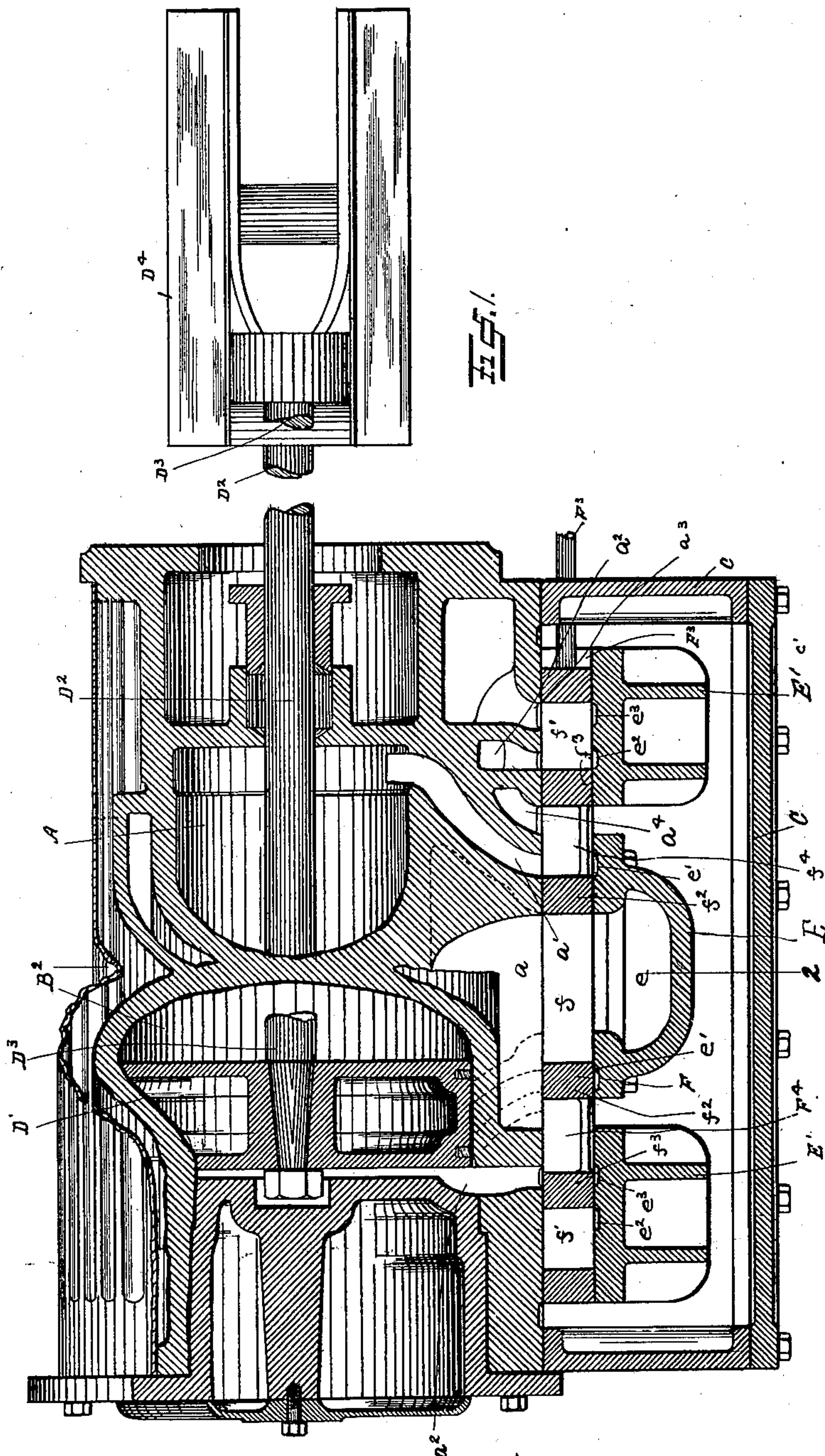
Patented Sept. 18, 1900.

F. H. & F. O. BALL.
STEAM ENGINE.

(Application filed Jan. 30, 1900.)

(No Model.)

2 Sheets—Sheet 1.



WITNESSES

Albert Popkema
Ramsay Airlman

INVENTORS.
Frank H. Ball
and
Frederick O. Ball
BY *W. C. Lord*
ATTORNEY

No. 658,200.

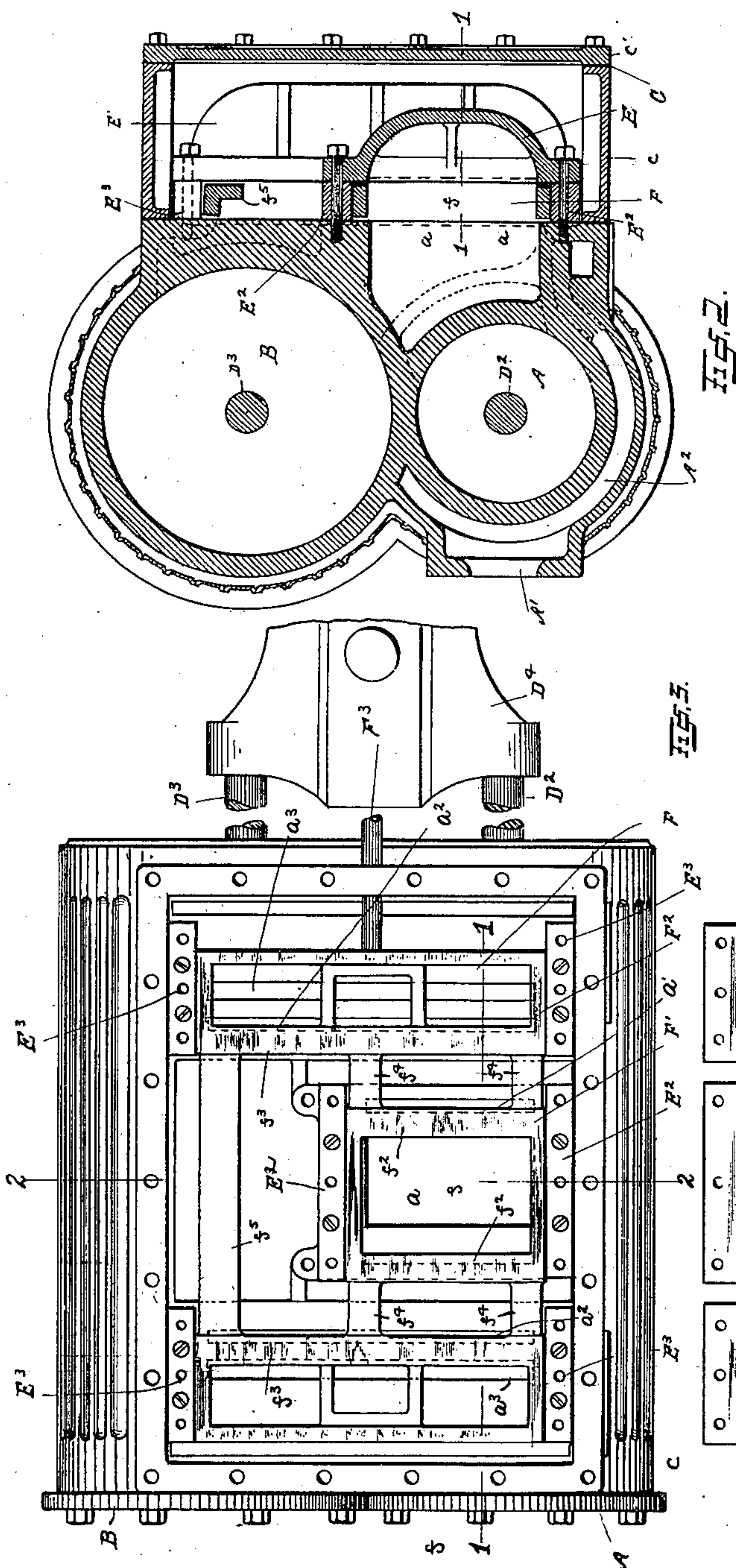
Patented Sept. 18, 1900.

F. H. & F. O. BALL.
STEAM ENGINE.

(Application filed Jan. 30, 1900.)

(No Model.)

2 Sheets—Sheet 2.



WITNESSES

Albert Pophins
Russell Williams

INVENTORS
Frank H. Ball
and
Frederick O. Ball
BY
H. C. Lord.
ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK H. BALL AND FREDERICK O. BALL, OF PLAINFIELD, NEW JERSEY.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 658,200, dated September 18, 1900.

Application filed January 30, 1900. Serial No. 3,351. (No model.)

To all whom it may concern:

Be it known that we, FRANK H. BALL and FREDERICK O. BALL, citizens of the United States, residing at Plainfield, in the county of Somerset and State of New Jersey, have invented certain new and useful Improvements in Steam-Engines; and we 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 ap-

10 pertains to make and use the same.

This invention relates to steam-engines; and it consists in certain improvements in the construction thereof, as will be hereinafter fully described, and pointed out in the claims.

More particularly the invention relates to compound engines, and is especially adapted to compound engines the cylinders of which are set side by side and which operate upon a common cross-head. This style of compound engine we have termed a "duplex compound engine."

The invention is illustrated in the accompanying drawings, as follows:

25 Figure 1 shows a broken section, the section through the valve and steam-chest being on the line 1 1 in Fig. 3. Fig. 2 shows a section on the line 2 2 in Figs. 1 and 3. Fig. 3 shows an elevation of the cylinder and cross-head, the steam-chest cover being removed, exposing the valve. Fig. 4 shows the pressure-plates for the valve.

A marks the high-pressure cylinder; B, the low-pressure cylinder; C, the steam-chest; 35 D', the low-pressure piston; D² and D³, the high and low pressure piston-rods, respectively, and D⁴ the cross-head. The piston-rods D² and D³ are attached to the same cross-head D⁴, and the pistons of the two cylinders 40 operate in unison. The cylinders are arranged side by side in cross compound relation. The steam-chest is arranged with the removable wall *c* and the cover *c'*.

Arranged in the valve-surfaces of the steam-chest are the ports *a*, which lead from the steam admission, ports *a'*, leading to the high-pressure cylinder, ports *a² a²*, leading to the low-pressure cylinder, and ports *a³ a³*, leading to the final exhaust. Steam enters 50 through the opening A' and moves through

the passage A², which extends around the cylinder A to the port *a*.

Opposite the ports leading to the high-pressure cylinder and the inlet-ports is the pressure-plate E, which is arranged on the parallel bars E² E², and opposite the ports controlling the admission of the exhaust-steam to and from the low-pressure cylinder are the pressure-plates E', which are arranged on parallel bars E³.

60 The single valve F operates all ports. The portion F' controls the high-pressure ports and the portion F² controls the low-pressure ports. Arranged in the part F' is the chamber *f*, which is constantly in communication 65 with the inlet-port *a*. The pressure-plate E has an opening *e* opposite the inlet-port *a*, the purpose of which is to balance the valve. The cross-bars *f²* at the ends of the chamber *f* pass over the ports *a'*, bringing the chamber *f* into 70 and out of communication alternately with the ports *a'*. During the time the said chamber is out of communication with said ports and when the valve is at one end of its travel the port out of communication with the chamber *f* is opened to the steam-chest, so that the steam from the high-pressure cylinder is exhausting into the steam-chest.

The low-pressure parts of the valve comprise the chambers *f'*, the inner side of said 80 chambers being formed by the bars *f³*. These bars *f³* are so arranged relatively to the ports *a²* as to pass over said ports in the traverse of the valve. The chamber *f'* is so arranged 85 relatively to the port *a³* as to be kept constantly in communication therewith, so that when the chamber is brought into communication with the port *a²* an exhaust from the low-pressure cylinder is permitted, and when the bar *f³* passes beyond the port *a²* steam is 90 admitted from the steam-chest to the low-pressure cylinder. Opposite the ports *a' a² a³* are arranged the depressions or balance-cavities *e' e² e³*, the purpose of which is well understood.

95 In the operation of the engine steam is admitted by the inlet A' through the port *a*. It then passes from the chamber *f* through the port *a'*, in communication therewith, to one end of the high-pressure cylinder. At the 100

same time the opposite port a' is opened to the steam-chest, so that the exhaust end of the high-pressure cylinder is in communication with the steam-chest. The port a^2 toward the end of the high-pressure cylinder taking steam is also uncovered by the bar f^3 , so that the exhaust from the high-pressure cylinder which is stored in the steam-chest passes to the low-pressure cylinder. At the same time the chamber f' at the opposite end of the cylinder is in communication with both the ports a^2 a^3 , thus effecting the exhaust from the low-pressure cylinder. It will be noted, therefore, that the steam-chest forms a receiver and that the steam passing through the steam-chest passes from the high-pressure cylinder by a way exterior to the valve to the opposite end of the low-pressure cylinder.

What we claim as new is—

1. In a compound engine, the combination of the high and low pressure cylinders arranged in cross compound relation; double-acting piston mechanism therefor; a common cross-head for said piston mechanism; a steam-chest and a single valve for controlling the flow of steam to and from said high and low pressure cylinders, said valve being arranged to admit steam to the high-pressure cylinder and to exhaust steam from the high-pressure cylinder into the steam-chest and to admit steam from the steam-chest to the low-pressure cylinder.

2. In a compound engine, the combination of the high and low pressure cylinders arranged in cross compound relation; double-acting piston mechanism therefor; a common cross-head for said piston mechanism; and a valve comprising a high-pressure part and a low-pressure part, the high-pressure part comprising the chamber, f , and the low-pressure part comprising the chambers, f' , f' , said chambers and their walls being so arranged relatively to the ports as to admit steam through the chamber, f , to the high-pressure cylinder, exhaust steam to the

steam-chest, and admit steam to the low-pressure cylinder and exhaust steam through the chamber, f' .

3. In a compound engine, the combination of the high and low pressure cylinders; piston mechanism therefor; a common cross-head for said piston mechanism; a valve comprising a high-pressure part and a low-pressure part, the high-pressure part comprising the chamber, f , and the low-pressure part comprising the chambers, f' , f' , said chambers and their walls being so arranged relatively to the ports as to admit steam through the chamber, f , to the high-pressure cylinder, exhaust steam to the steam-chest, admit steam to the low-pressure cylinder and exhaust steam through the chamber, f' ; and the pressure-plates, E and E' , arranged over the valve and forming the closure for the chambers, f , f' .

4. In a compound engine, the combination of the cylinders, A and B ; piston mechanism therefor; a common cross-head attached to the said piston mechanism; steam-chest C , having in its valve-surface the port, a , extending from the steam-inlet, the ports a' , a' , leading to the high-pressure cylinder, the ports, a^2 , a^2 , leading to the low-pressure cylinder, and the ports, a^3 , a^3 , leading to the final exhaust; the valve F , comprising the high-pressure part, F' , and the low-pressure part, F^2 ; the high-pressure part comprising the chambers, f , with the walls, f^2 , f^2 , the low-pressure part comprising the chambers, f' , and the inside walls, f^3 , said chambers and walls being arranged relatively to the several ports as described; and the pressure-plates, E , and E' .

In testimony whereof we affix our signatures in presence of two witnesses.

FRANK H. BALL.

FREDERICK O. BALL.

Witnesses:

HOWARD I. BRAMPTON,
ROBT. T. BRAMPTON.