

No. 658,199.

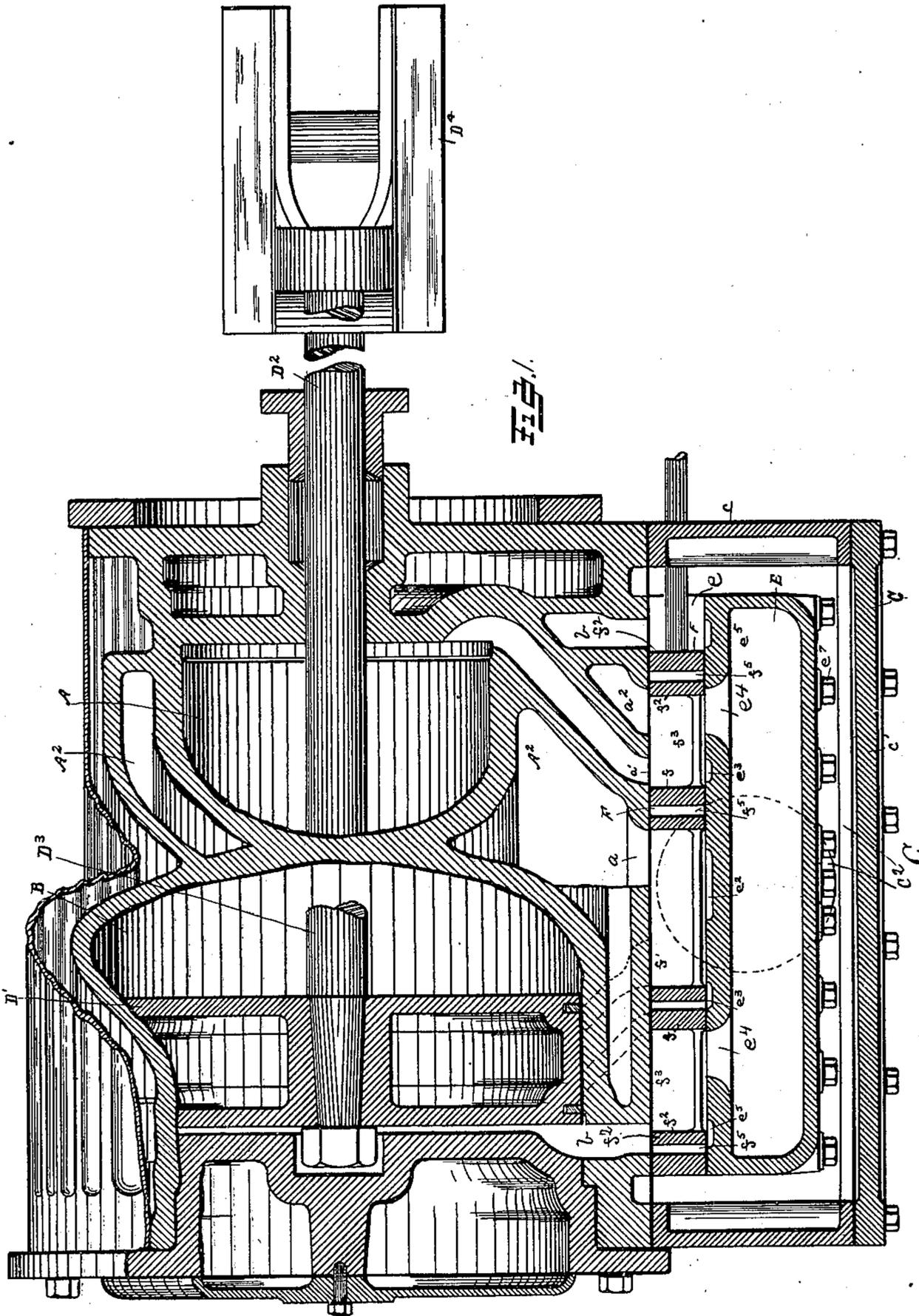
Patented Sept. 18, 1900.

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

(Application filed Jan. 30, 1900.)

(No Model.)

2 Sheets—Sheet 1.



WITNESSES

Albert Popkin
Ramsey Williams

INVENTORS,
Frank H. Ball
and
Fredrick O. Ball

BY

H. C. Lind
ATTORNEY

No. 658,199.

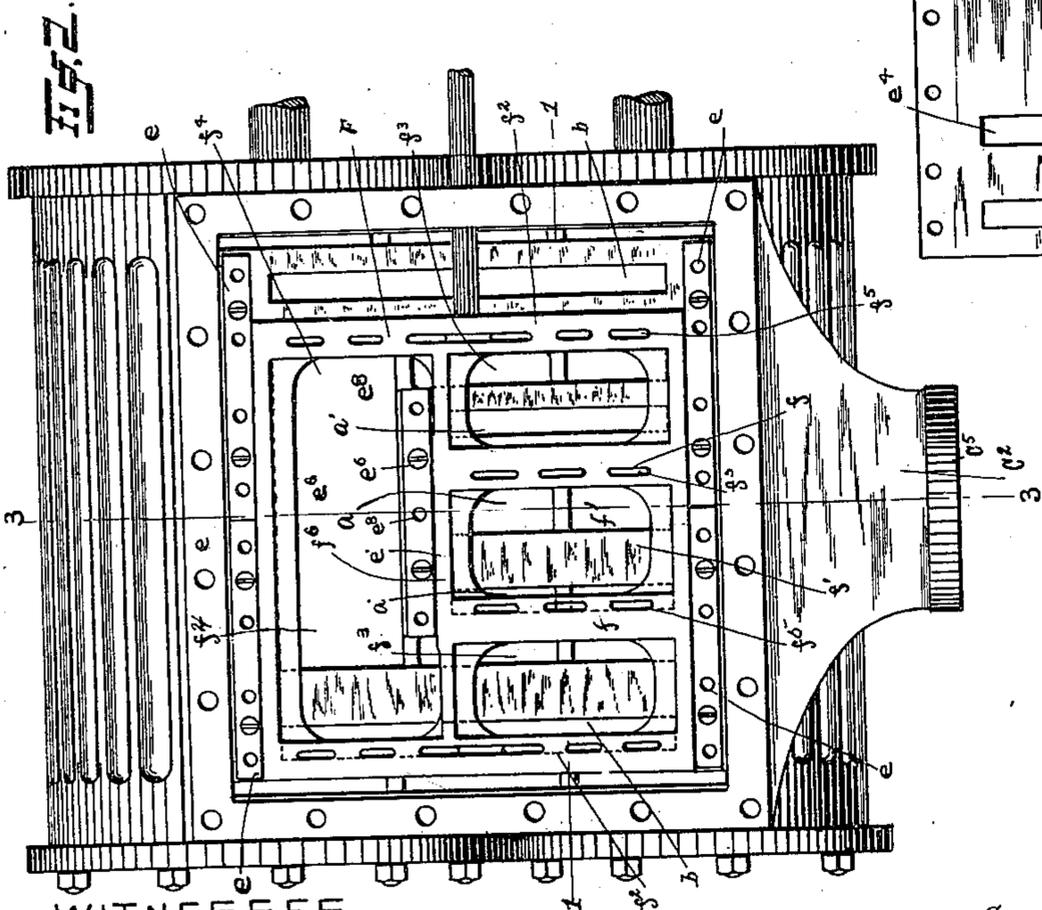
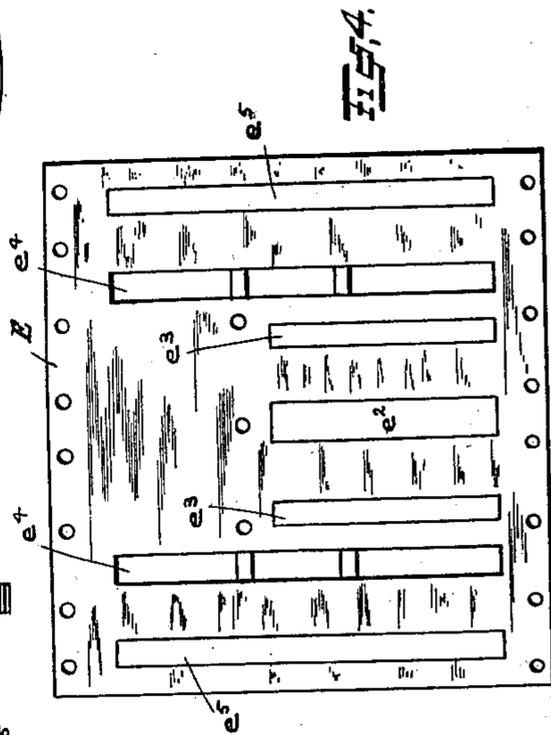
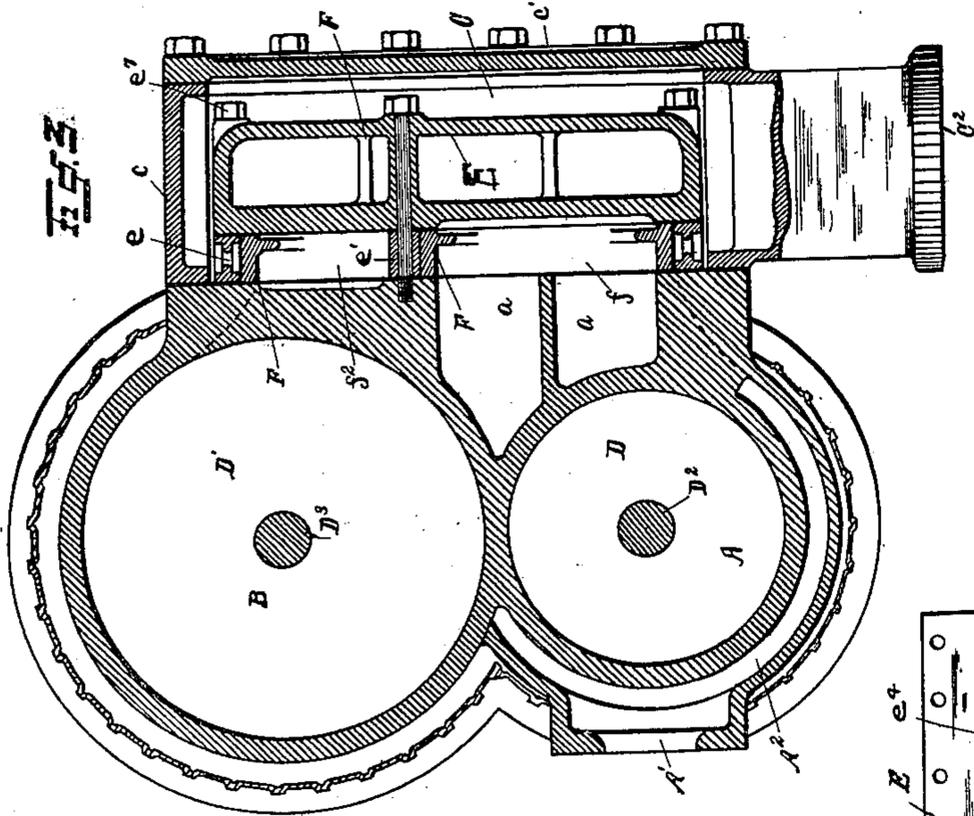
Patented Sept. 18, 1900.

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

(Application filed Jan. 30, 1900.)

2 Sheets—Sheet 2.

(No Model.)



WITNESSES

Albert Popkins
Ramsey Williams

INVENTORS,
Frank H. Ball
and
Frederick O. Ball
BY *H. C. Lovel*
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. 658,199, dated September 18, 1900.

Application filed January 30, 1900. Serial No. 3,350. (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 appertains 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 our invention relates to compound engines, and it 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:

Figure 1 shows a broken section of the cylinders and valve mechanism, the metal being broken away through the low-pressure cylinder to the center of the high-pressure cylinder, the steam-chest being in section on the line 1 1 in Fig. 2. Fig. 2 shows a side elevation of the cylinders and steam-chest with the steam-chest cover removed. Fig. 3 shows a section on the line 3 3 in Fig. 2. Fig. 4 shows an elevation of the inner side of the receiver.

A marks the high-pressure cylinder, and B the low-pressure cylinder. These cylinders are preferably cast in one piece and are arranged side by side in cross-compound relation. The pistons of the high and low pressure cylinders D and D', respectively, are connected by their rods D² and D³ with the common cross-head D⁴. The steam-chest C is of ordinary construction, having the side c, cover c', and exhaust-port c². The steam-inlet A' extends by the passage A² around the cylinder A to the steam-port a, which is at the center of steam-chest over the high-pressure cylinder. The ports a' a' open into the steam-chest at each side of the steam-port a and adjacent thereto and extend from the

steam-chest to the high-pressure cylinder. Ports b b, extending practically across the valve surface of the steam-chest, lead from the steam-chest to the low-pressure cylinder. Supported in the steam-chest in a position opposite the valve-surface is the receiver E. It is supported on the parallel bars e e'. These parallel bars are secured to the valve-surface of the chest by means of screws e⁶. They are also provided with the perforations e⁸, through which are passed the bolts e⁷ for securing the receiver in place. The valve F is arranged to work between the valve-surface of the steam-chest and the inner surface of the receiver, so that the receiver operates as a balance-plate for the valve. The receiver is provided with two ports e⁴, one at each end. The entire inner part of the receiver communicates with these ports.

The valve is of the gridiron variety and is of just sufficient thickness to completely fill the space between the valve surface of the steam-chest and the inner surface of the receiver. It is provided with two cross-bars f f, forming the steam-chamber f' between them. These bars f are so arranged relatively to the ports a a' that the port a is put into communication with one of the ports a' and cut off from the other of said ports when the valve is in its extreme position in either direction. At the end of the valve are the cross-bars f², which extend entirely across the valve, forming the chamber f³ between them and the bars f. The chamber f⁴ forms the rest of the valve. The chamber f⁴ is separated from the chamber f' by the longitudinal partition f⁶. The valve-bars f² are so arranged relatively to the ports b that the ports b are brought alternately into the chamber f³ f³ and into the steam-chest outside of the valve. The ports e⁴ are so arranged relatively to the bars f f² that they are at all times in communication with the chambers f³ f⁴. The result of this construction of the valve in controlling the flow of steam through the engine is as follows: Steam enters through the port a and in the position shown in the drawings passes through the port a', at the left in Fig. 1, into the high-pressure cylinder back of the piston D. At the same time the steam from the re-

ceiver E passes through the port e^4 at the left, chamber f^3 at the left, and port b at the left into the low-pressure cylinder back of the piston D'. While the valve is at the left, as above, the port a' at the right is brought into communication with the chamber f^3 at the right and the port e^4 at the right and the exhaust-steam from the right of the high-pressure piston passes into the receiver. At the same time the exhaust-steam from the right of the low-pressure piston passes through the port b at the right into the steam-chest and out of the steam-chest at the exhaust-opening e^2 .

The valve-surface of the receiver E is provided with the depressions e^2 , e^3 , and e^5 , which are arranged opposite the port a , a' , and b , respectively, to facilitate the balancing of the valve and to permit a double entrance of steam through the secondary passage f^5 in the valve. The purpose of these secondary passages and depressions are well known. There is also arranged in the valve-surface of the steam-chest a depression a^2 opposite the port e^4 for the same purpose.

It will be noted that the receiver E forms a passage exterior to the valve for conveying steam from the exhaust of the high-pressure cylinder to the end taking steam in the low-pressure cylinder, and that the same ends of both the high and low pressure cylinders take steam at the same time. By this construction the piston-rods may be attached to a common cross-head, thus saving materially in the expense of the construction of the engine. This type of engine is also much superior to the "tandem compound engines" because all the parts are readily accessible. It will be noted also that by arranging the receiver E in the steam-chest the condensation of steam in the receiver is brought to a minimum.

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; the double-acting piston mechanism for each; a common cross-head for said piston mechanism; a single valve for controlling the flow of steam to and from the said high and low pressure cylinders; and a passage exterior to the valve forming a receiver for conveying the steam from the end of the high-pressure cylinder exhausting to the opposite end of the low-pressure cylinder, said passages being also controlled by said valve.

2. In a compound engine, the combination of the high and low pressure cylinders arranged in cross compound relation; double-acting piston mechanism for each; a common cross-head for said piston mechanism; a steam-chest; a receiver arranged within the steam-chest between the high and low pressure cylinders; a single valve for controlling the flow of steam to and from the

high and low pressure cylinders and to and from said receiver.

3. In a compound engine, the combination of the high and low pressure cylinders arranged in cross compound relation, double-acting piston mechanism for said cylinders, a common cross-head for said piston mechanism, a steam-chest, a receiver arranged within said steam-chest between the high and low pressure cylinders, and a valve mechanism for controlling the flow of steam from the high and low pressure cylinders and to and from said receiver.

4. In a compound engine, the combination of a high and a low pressure cylinder arranged in cross compound relation; double-acting piston mechanism for said cylinders; a common cross-head for said piston mechanism; a steam-chest; a receiver arranged within said steam-chest and provided with passages for conveying steam from the end of the high-pressure cylinder, exhausting to the opposite end of the low-pressure cylinder; and a valve mechanism for controlling the flow of steam to and from said high and low pressure cylinders and to and from said receiver.

5. In a compound engine, the combination of a high and low pressure cylinder arranged in cross compound relation; double-acting piston mechanism for said cylinders; a common cross-head for said piston mechanism; a steam-chest; a receiver arranged within said steam-chest; and provided with passages for conveying steam from the end of the high-pressure cylinder exhausting, to the opposite end of the low-pressure cylinder; and a single valve arranged to control the flow of steam to and from said high and low pressure cylinders and to and from said receiver.

6. In a compound engine, the combination of a high and low pressure cylinder; steam-chest having the ports a a' and b , leading to the steam-supply; the high-pressure cylinder and the low-pressure cylinder respectively; the receiver E, arranged over the valve-surface of the steam-chest and having the ports, e^4 , said receiver having passages for conveying steam by the port, e^4 , from the end of the high-pressure cylinder exhausting, to the opposite end of the low-pressure cylinder; the valve, F, having cross-bars f and f^2 , arranged relatively to the ports in the steam-chest and receiver, to effect a passage of steam from the exhaust end of the high-pressure cylinder to the opposite end of the low-pressure cylinder.

7. In a compound engine, the combination of a high and a low pressure cylinder, A B; piston mechanism arranged in said cylinders; a common cross-head for said piston mechanism; steam-chest, C, having the ports, a , a' , b , to the steam-supply, the high-pressure cylinder and the low-pressure cylinder respectively; the parallel bars, e , e' ; the receiver

E, arranged on said bars and having the ports, e^4 , and said receiver forming a connecting-passage therein; the valve, F, arranged to operate between the inner surface of receiver, 5 E, and the valve-surface of the steam-chest; said valve having the bars, $f f^2$, arranged in relation to the ports, e^4, a, a', b , as described.

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.