

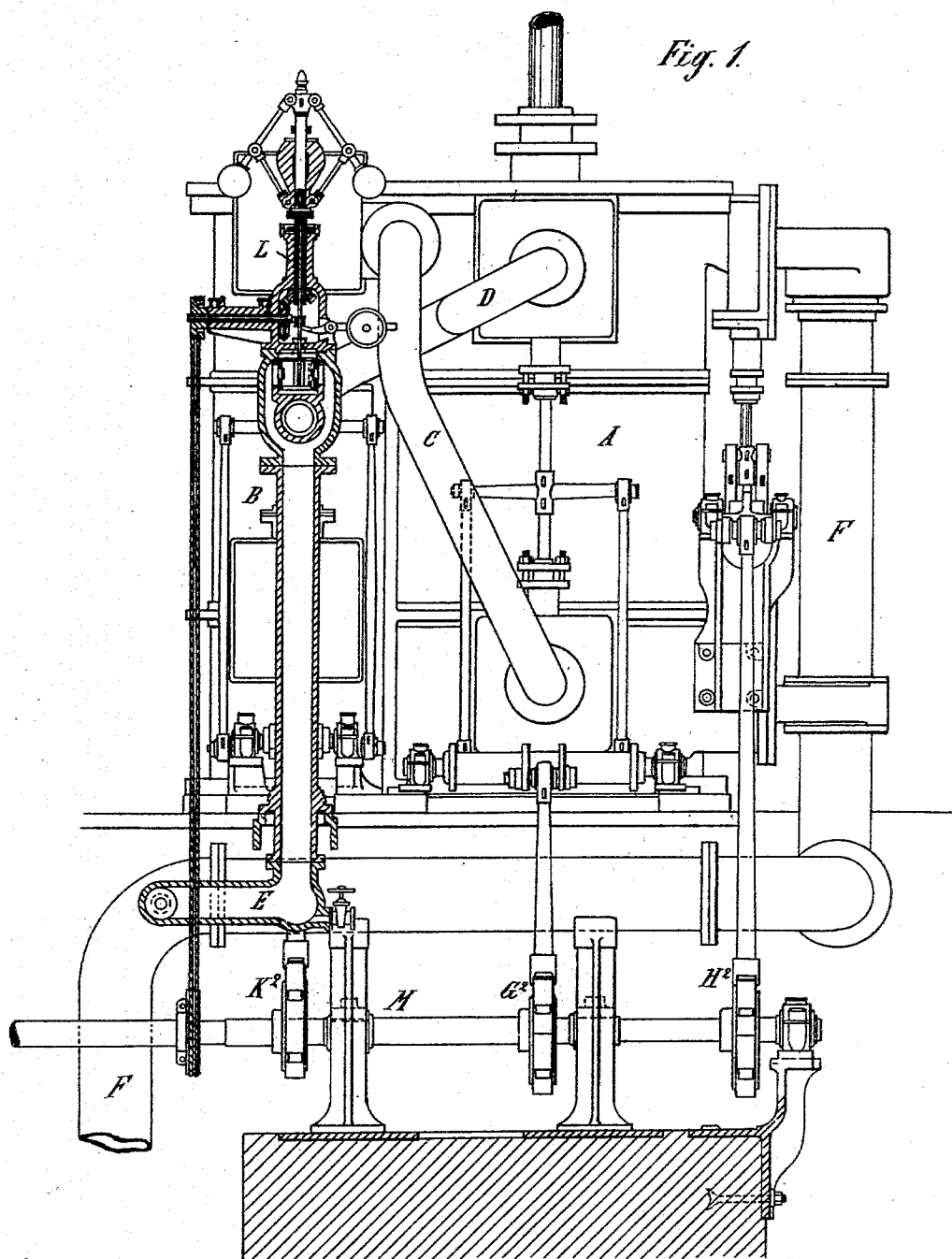
(No Model.)

5 Sheets—Sheet 1.

E. SCHWOERER.
COMPOUND ENGINE.

No. 515,975.

Patented Mar. 6, 1894.



Witnesses:

Benj. W. Tucker Jr.
A. Faber du Faur

Inventor:

Emil Schwoerer,
by A. Faber du Faur
Atty

(No Model.)

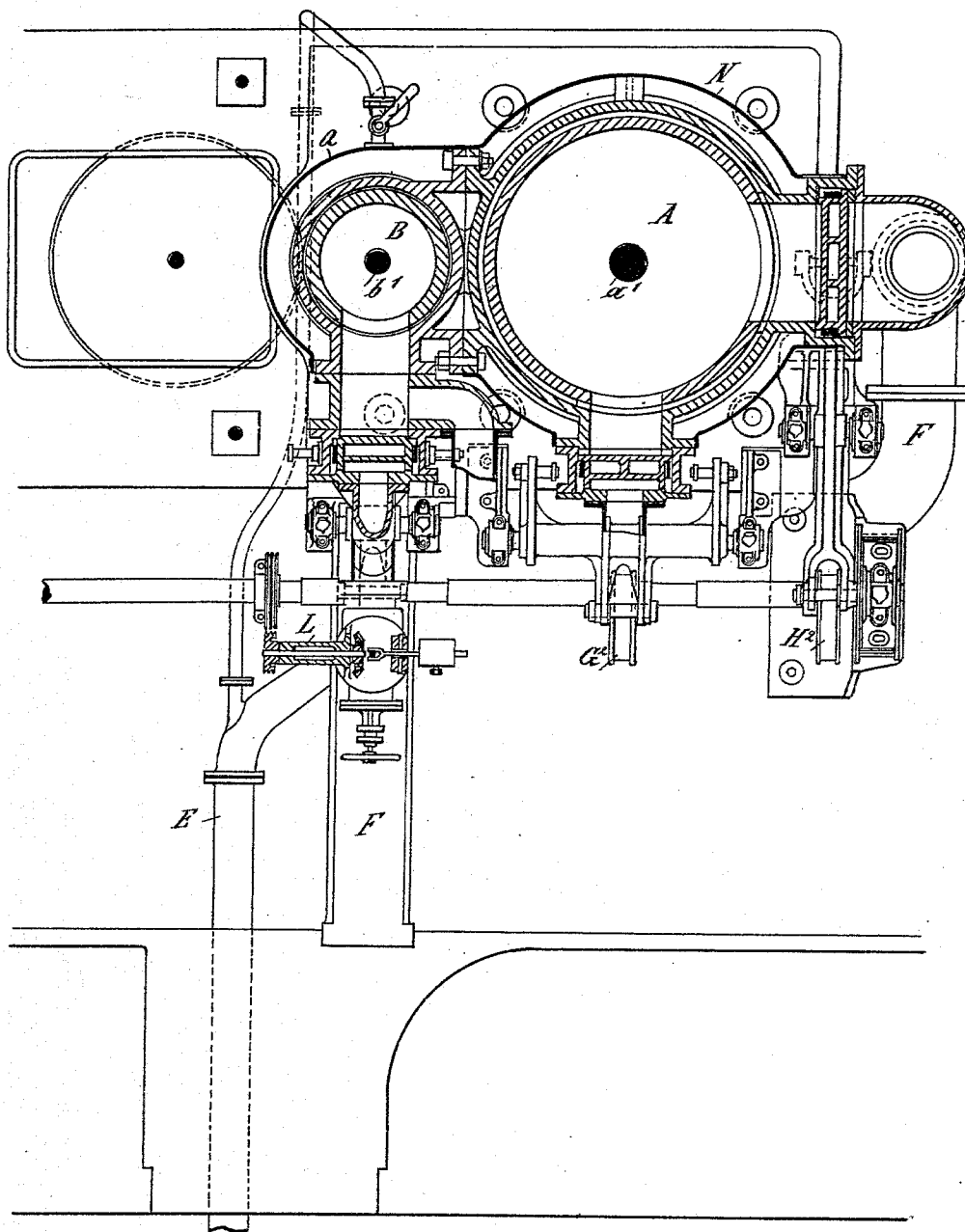
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Fig. 2.



Witnesses:

Benj. W. Tucker Jr.
A. Parker du Faour

Inventor:

Emil Schwoerer,
by Ataber du Faurf.
Atty.

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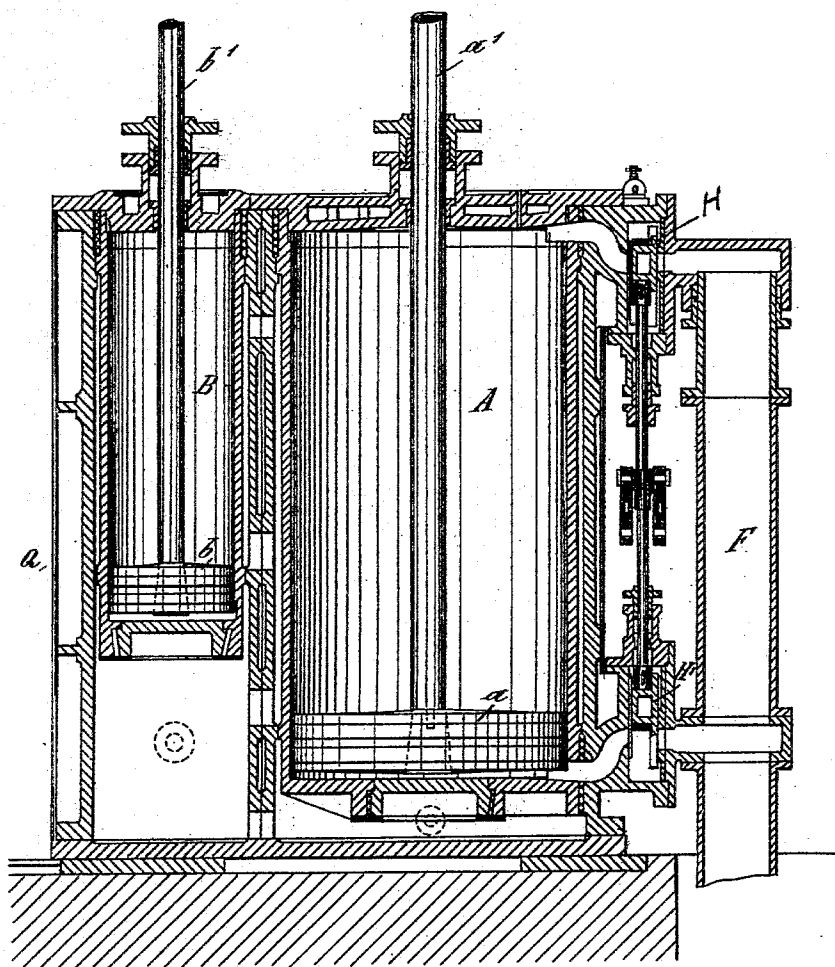
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Fig. 3.



Witnesses:

Benj. W. Tucker, Jr.
A. Faber du Faur

Inventor:

Emil Schwoerer,
by A. Faber du Faur, Jr.
Att'y.

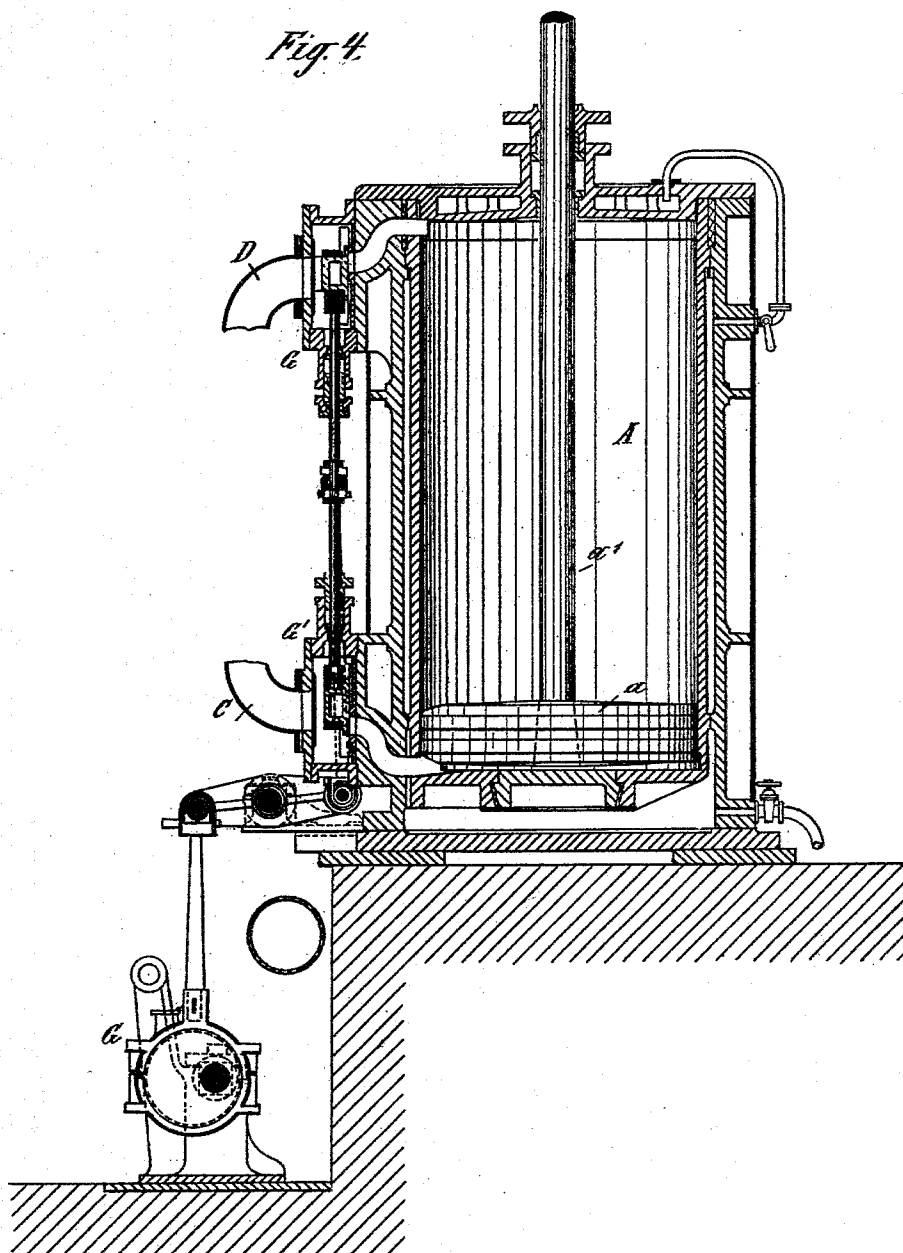
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Emil Schwoerer,
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Atty.

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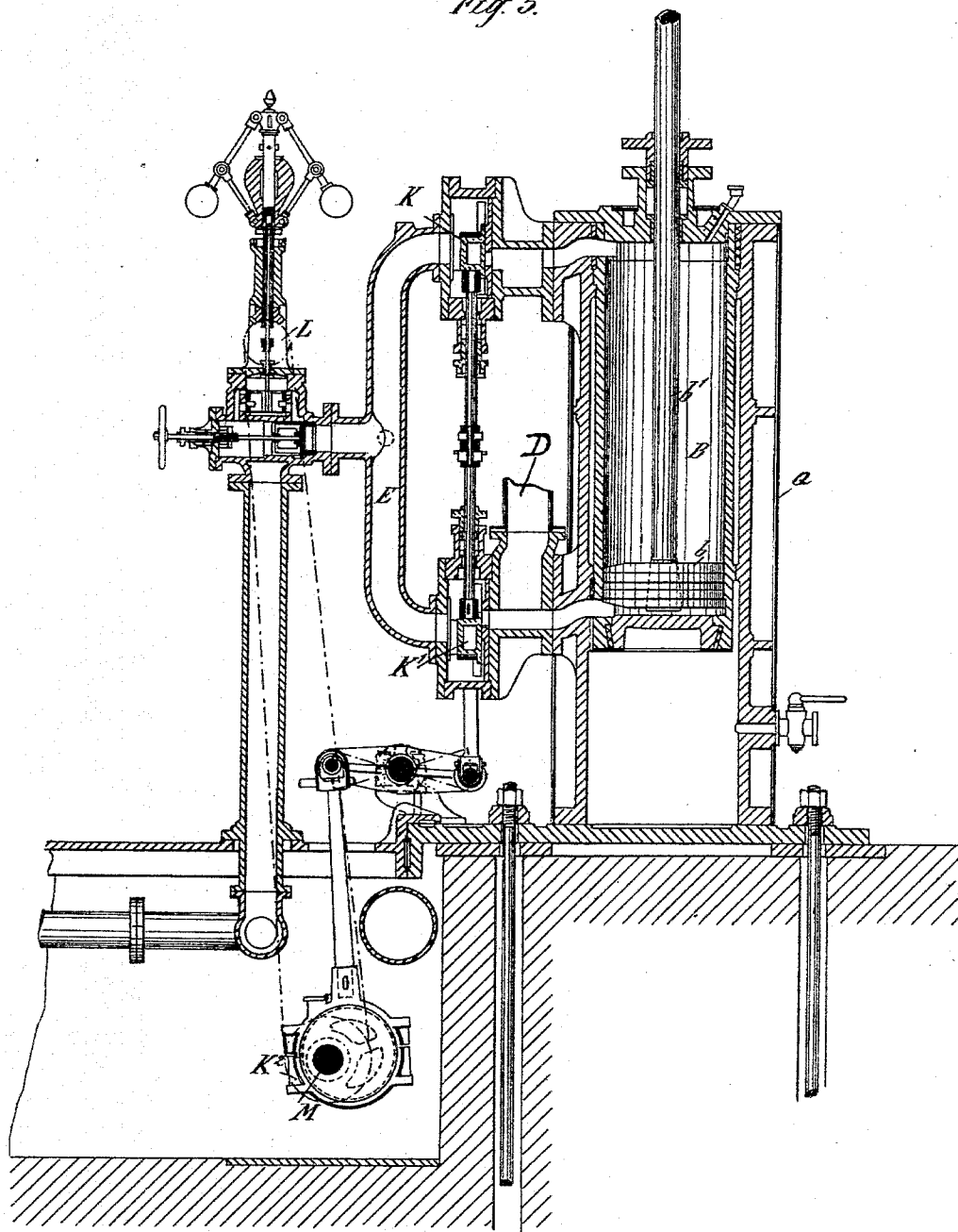
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Fig. 5.



Witnesses:

Benj. W. Tucker Jr.
A. Faber du Faur

Inventor:

Emil Schwoerer,
by A. Faber du Faur
Att'y.

UNITED STATES PATENT OFFICE.

EMIL SCHWOERER, OF COLMAR, GERMANY.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 515,975, dated March 6, 1894.

Application filed October 12, 1891. Serial No. 408,480. (No model.)

To all whom it may concern:

Be it known that I, EMIL SCHWOERER, a subject of the Emperor of Germany, residing at Colmar, Alsace, German Empire, have invented new and useful Improvements in the Distribution of Steam in Double or More Cylinder Engines, of which the following is a specification.

In the Woolf system of compound engines as heretofore designed, the exhaust steam from the high pressure cylinder is conducted to the low pressure cylinder through large steam pipes or tubes and the exhaust valves of the high pressure cylinder are located at the said high pressure cylinder, consequently considerable expansion and condensation take place within the said pipes or tubes, with a corresponding loss of power.

My invention has for its object to prevent this expansion and condensation, and to so construct and arrange the parts as to cause the steam to enter the low pressure cylinder at the final pressure in the high pressure cylinder,—and to this end it consists essentially in a compound engine having its admission valves arranged to admit live steam alternately into the respective connections between the high and low pressure cylinders combined with valves located at the low pressure cylinder for preventing the live steam when admitted to the said connections from entering into the low pressure cylinder and for controlling the admission of the exhaust steam thereto, all of which is more fully pointed out in the following specification and claims and illustrated in the accompanying drawings, in which—

Figure 1 represents a sectional side elevation of an engine constructed according to my invention. Fig. 2 is a sectional plan of the same. Fig. 3 is a vertical section taken through the two cylinders. Fig. 4 is a vertical section taken through the low pressure cylinder. Fig. 5 is a vertical section taken through the high pressure cylinder.

Similar letters indicate corresponding parts. In the drawings the letter A designates the low pressure cylinder and B the high pressure cylinder,—a and b being the respective pistons and a' and b' the piston rods. Steam is conducted to the opposite ends of the cylinder B by the branched steam pipe E, its en-

trance being controlled by admission valves K and K'.

C and D are the connecting pipes or tubes, the one C leading from the upper end of the cylinder B to the lower end of cylinder A, while the other D is led from the lower end of cylinder B to the upper end of cylinder A. To prevent expansion of the exhaust in these pipes C and D, they are caused to open into the steam ports of the cylinder B between the cylinder and the steam pipe E Fig. 5, so that live steam can enter the same alternately when the valves K K' are shifted. The low pressure cylinder A (Fig. 4) is provided with similar valves G G' which control the inlet of the exhaust steam to the low pressure cylinder through the connecting pipes C and D, said valves being so arranged and operated that when live steam is admitted to either of the connecting pipes, the entrance of said live steam into the low pressure cylinder is prevented by the corresponding valve controlling the inlet to the low pressure cylinder at the discharge end of the pipe. When the high pressure piston has completed its stroke, the valve opens and admits the exhaust steam to the low pressure cylinder.

The live steam which enters the low pressure cylinder and the respective connecting pipe expands as a whole when the high pressure valve cuts off, the whole volume being at the same pressure at the end of the stroke, which pressure will of course vary with the point of cut off. The exhaust steam from the high pressure cylinder enters the low pressure cylinder at the said terminal pressure in the high pressure cylinder, for the reason that when the exhaust takes place the respective connecting pipe is filled with steam at the same pressure as that in the cylinder and no expansion takes place in the same. Of course if steam is not cut off at the high pressure cylinder the terminal pressure in the said cylinder will be substantially that of the live steam.

The exhaust from the low pressure cylinder through pipe F is controlled by valves H H'. The several valves may be actuated in any usual manner, such for instance as here illustrated, from a shaft M (Fig. 1) by the respective eccentrics K² G² and H², said shaft being rotated by a connection with the governor L.

The cylinders A and B are preferably provided with steam jackets N and Q respectively, while the connecting pipes or tubes should likewise be provided with a suitable jacket, or if desired suitable means may be provided for causing the steam to be heated or superheated in the said connecting pipes or tubes.

It is evident that the invention can equally well be applied to types of compound engines other than the one here shown and also that various modifications in the manner of admitting steam to the connecting pipes or tubes may be devised without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a compound engine, admission valves for the high pressure cylinder arranged to admit live steam into the connections between said cylinder and the low pressure cylinder, simultaneously with the admission of live steam to the high pressure cylinder, valves for the low pressure cylinder for preventing the entrance of the live steam admitted to said connections into the said cylinder and for

controlling the high pressure exhaust through said connections, and exhaust valves for the low pressure cylinder substantially as described.

2. In a compound engine, admission valves for the high pressure cylinder arranged to admit live steam alternately into the connections between said cylinder and the low pressure cylinder simultaneously with the admission of live steam to the high pressure cylinder, valves for the low pressure cylinder located at the low pressure end of said connections for preventing the entrance of the live steam admitted to the connections into the low pressure cylinder and for controlling the high pressure exhaust through said connections, and exhaust valves for the low pressure cylinder substantially as described.

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

EMIL SCHWOERER.

Witnesses:

LUDWIG GLASER,
G. HULSMANN.