

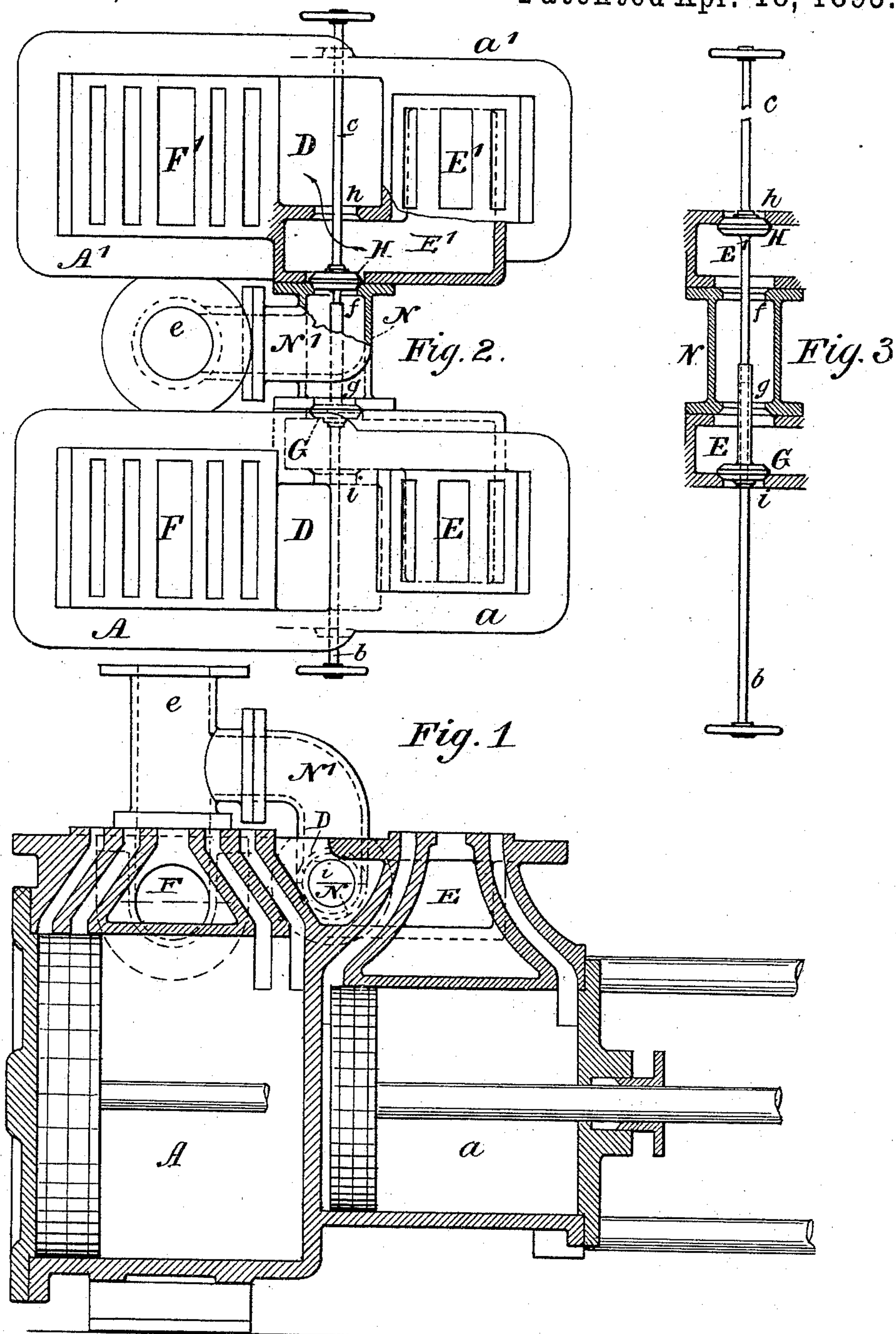
(No Model.)

G. DE LAVAL.
STEAM ENGINE.

2 Sheets—Sheet 1.

No. 495,742.

Patented Apr. 18, 1893.



Witnesses,
Chas. H. Smith
J. Staib

Inventor,
George de Laval
per Lemuel W. Ferrell

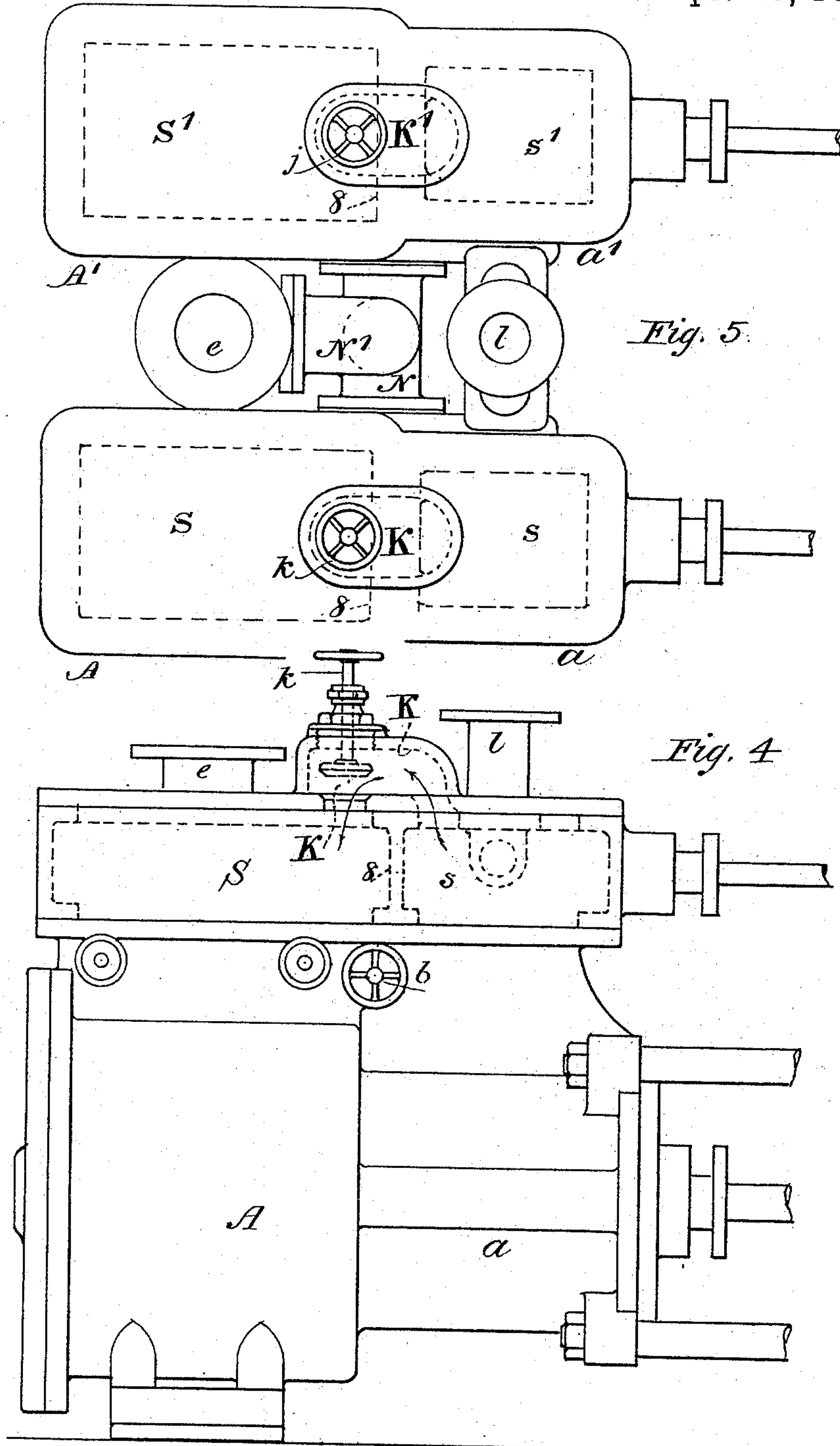
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UNITED STATES PATENT OFFICE.

GEORGE DE LAVAL, OF WARREN, MASSACHUSETTS, ASSIGNOR TO THE GEO.
F. BLAKE MANUFACTURING COMPANY, OF NEW YORK, N. Y.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 495,742, dated April 18, 1893.

Application filed November 3, 1892. Serial No. 450,812. (No model.)

To all whom it may concern:

Be it known that I, GEORGE DE LAVAL, a citizen of the United States, residing at Warren, in the county of Worcester and State of Massachusetts, have invented an Improvement in Steam-Engines, of which the following is a specification.

Engines have heretofore been constructed with ports and valves in such a manner that the steam from the high pressure cylinder can pass to the low pressure cylinder, or high pressure steam can be used in both cylinders, but the arrangement of the ports and valves have been complicated and difficult to construct.

I make use of high pressure and expansion cylinders and steam ports and valves arranged in such a manner that the steam can be admitted to the high pressure cylinders and pass from the same to the low pressure cylinders for working expansively, or the live steam can be admitted to both cylinders and pass to the exhaust and thence to the air or to a condenser, and my invention relates to the combination of valves and passages as hereinafter more fully described and claimed.

In the drawings, I have represented the improvements as applied to a duplex compound engine:

Figure 1 is a vertical section through the cylinders of one engine, the valves and chest being removed. Fig. 2 is a plan view partially in section with the engine valves and chests removed. Fig. 3 is a detached view representing the steam passages and the valve for controlling the action of the steam. Fig. 4 is an elevation, and Fig. 5 is a general plan view of the compound duplex engine cylinders.

The high pressure steam cylinders $a a'$ are of less diameter than the cylinders $A A'$ in order that the steam may be worked expansively as usual in this class of engines, and I remark that the pistons, piston rods, main steam valves and connections for moving the same are of any ordinary or desired character and are not represented herein in their details as they are not necessary to the understanding of the present invention.

In Fig. 1 the ports for the respective cylinders A and a are represented together with the valve seats, and these valve seats are in-

dicated in Fig. 2 and the valve chests are of ordinary character except in the particulars hereinafter named, and these valve chests are shown in elevation and plan in Figs. 4 and 5; the portions $S S'$ of said valve chests contain the valves for the cylinders $A A'$ and the portions $s s'$ of such valve chests contain the valves for the cylinders $a a'$.

Upon the top of each valve chest a steam port is provided as at $K K'$, preferably cast with the covers of the valve chests, there being openings through the covers and ports, so that the steam can pass from one side of the division S in the valve chest to the other, and one of these openings or ports forms a valve seat, and the valves j and k are applied to the valve seats in the respective chest covers, as shown in Figs. 4 and 5, and live steam is admitted by the pipe l into the respective valve chests $s s'$.

There are exhaust ports $E E'$ to the cylinders $a a'$, and these ports are connected together by the cross pipe N , see Figs. 2 and 3, and there is a branch pipe N' from this cross pipe N to the main exhaust pipe e that opens either into the atmosphere or into a condenser, and from the exhaust ports of the cylinders $A A'$ the exhaust passages $F F'$ open to this main exhaust pipe e . There are ports D opening upward into the respective valve chests $S S'$ adjacent to the valve seat thereof, and in the walls of the ports $E E'$ are valve seats f, g, h, i , and there is a valve G operated by a rod b that can be seated in one direction upon the seat i and in the other direction upon the seat g , and there is a valve H that can be seated in one direction upon the seat h or in the other direction upon the seat f , and this valve H is provided with a valve rod c , and the respective valve rods b and c pass through stuffing boxes upon the walls of the respective ports as shown in Fig. 2. It will now be understood that when the valves G and H are closed on the respective seats g and f , as shown in Fig. 2, and the valves k and j are also closed, the engines will work expansively, the steam passing from the valve chests $s s'$ by the ordinary engine valve and ports into the respective cylinders $a a'$ and thence by the exhaust ports $E E'$ through the valve seats i and h and the respective ports D

into the valve chests S S' and from there by the ordinary valves and ports into the respective cylinders A A' to act therein expansively and then escape by the exhaust passages F F' and pipe *e*, and with the valves closed as stated, the engines will work economically in consequence of the expansion of the steam. If however greater power is required, such for instance as when a fire may occur and the pumps require to be driven at their full capacity, the valves *k* and *j* are opened so that the live steam will pass from the valve chests *s s'* into the valve chests S S' and the live steam will act directly in the cylinders A A' as well as in the cylinders *a a'*, and in this arrangement the valve G is to be moved from the seat *g* to the seat *i*, and the valve H is to be moved from the seat *f* to the seat *h*, as shown in Fig. 3, and thereby the ports D will be closed and the exhaust steam from the cylinders *a a'* will pass by the ports E E' through the valve seats *f* and *g* into the cross pipe N and by the branch N' thereof to the main exhaust pipe *e* and thence to the atmosphere or to a condenser. This arrangement enables me to run the engines either economically or with their highest power by simply changing the positions of the valves as aforesaid.

I claim as my invention—

1. The combination with the two pairs of

large and small engine cylinders and their respective steam ports, of valve chests having partitions, a port, valve seat and valve between the two parts of each valve chest, the exhaust ports E. E'. of the smaller cylinders and connections therefrom to the main exhaust pipe, and the valves G. and H. and their respective seats at opposite sides of the valves, for directing the exhaust from the smaller cylinders to the larger cylinders or to the main exhaust pipe, substantially as specified.

2. The combination with the two pairs of large and small cylinders and their respective valve chests and exhaust ports for the larger cylinders, of the ports E. E'. and a cross pipe N. between them, valve seats *f. g. h. i.* in pairs facing each other and valves G. and H. adapted to close either the seats *f.* or *h.* or *g.* or *i.* and the ports K. K'. leading from the respective valve chests and the valves *j.* and *k.* arranged substantially as specified, whereby the duplex engines are adapted to being worked expansively or by the pressure of the live steam in all the cylinders, substantially as set forth.

Signed by me this 28th day of October, 1892.

GEORGE DE LAVAL.

Witnesses:

GEORGE P. ABORN,

C. F. STAPLES.