

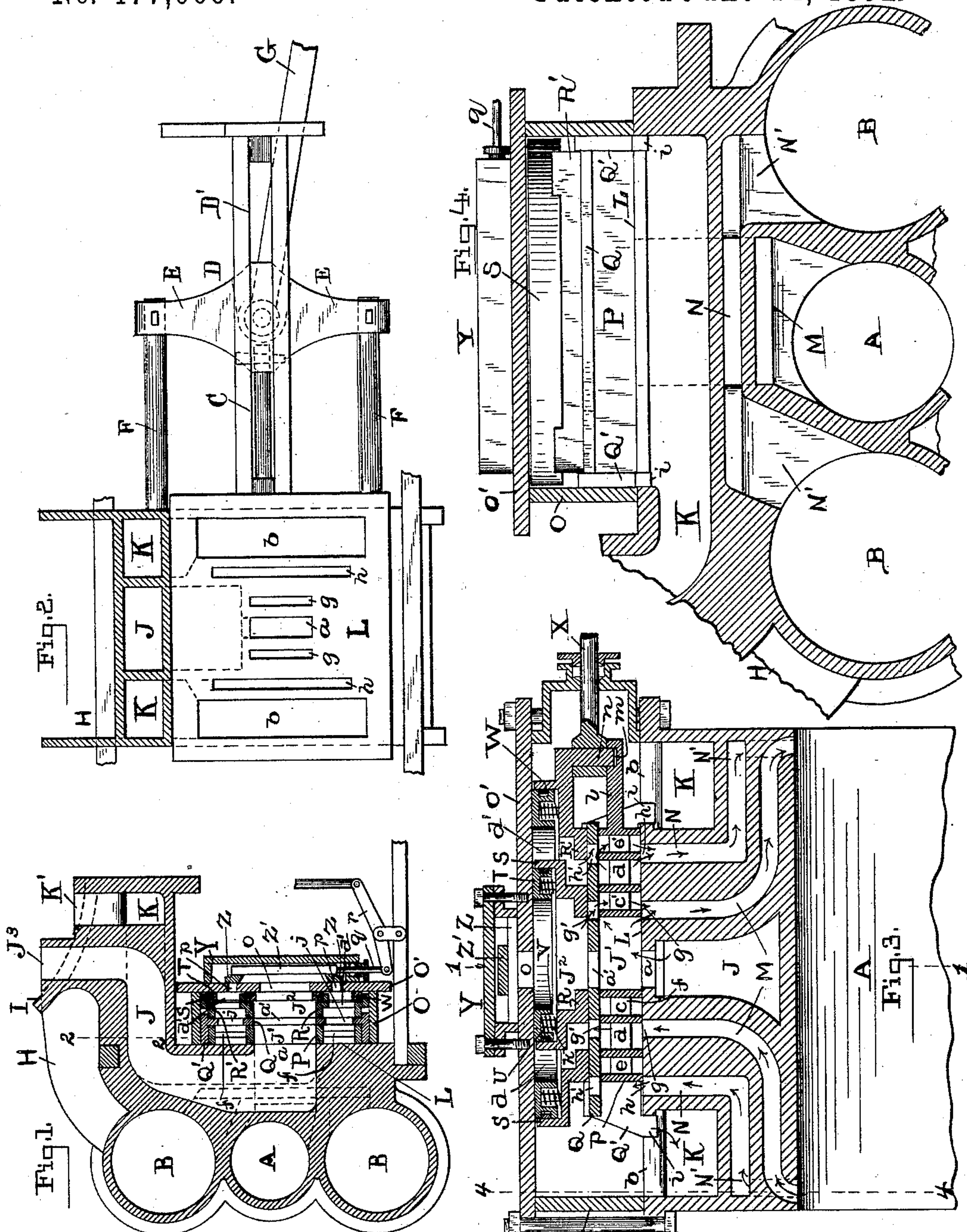
(No Model.)

2 Sheets—Sheet 1.

J. HUNT.
COMPOUND STEAM ENGINE.

No. 477,006.

Patented June 14, 1892.



WITNESSES:
A. O. Babendreier,
J. Parker Davis.

INVENTOR:
Jesse Hunt,
BY Chas B. Mann
ATTORNEY.

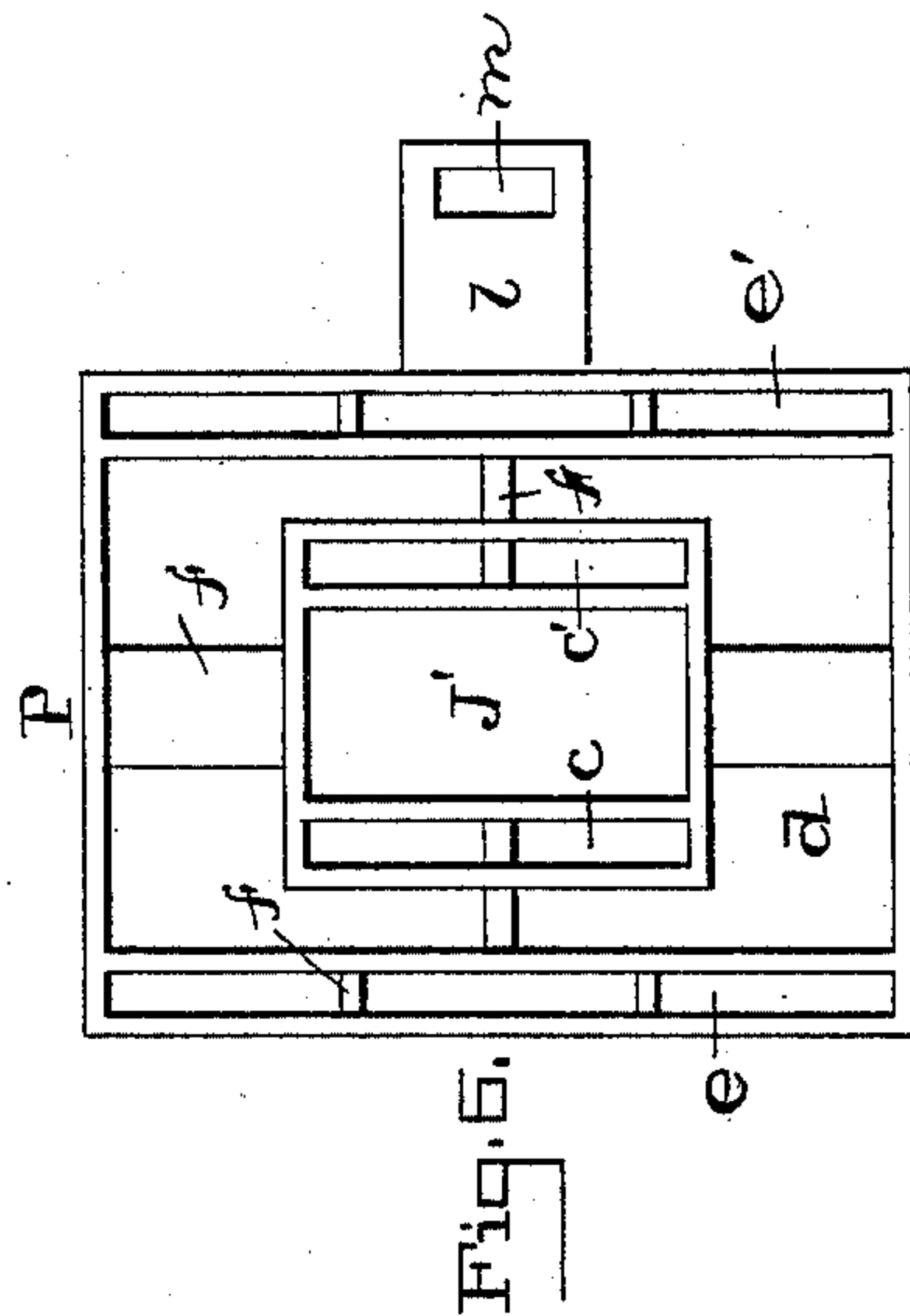
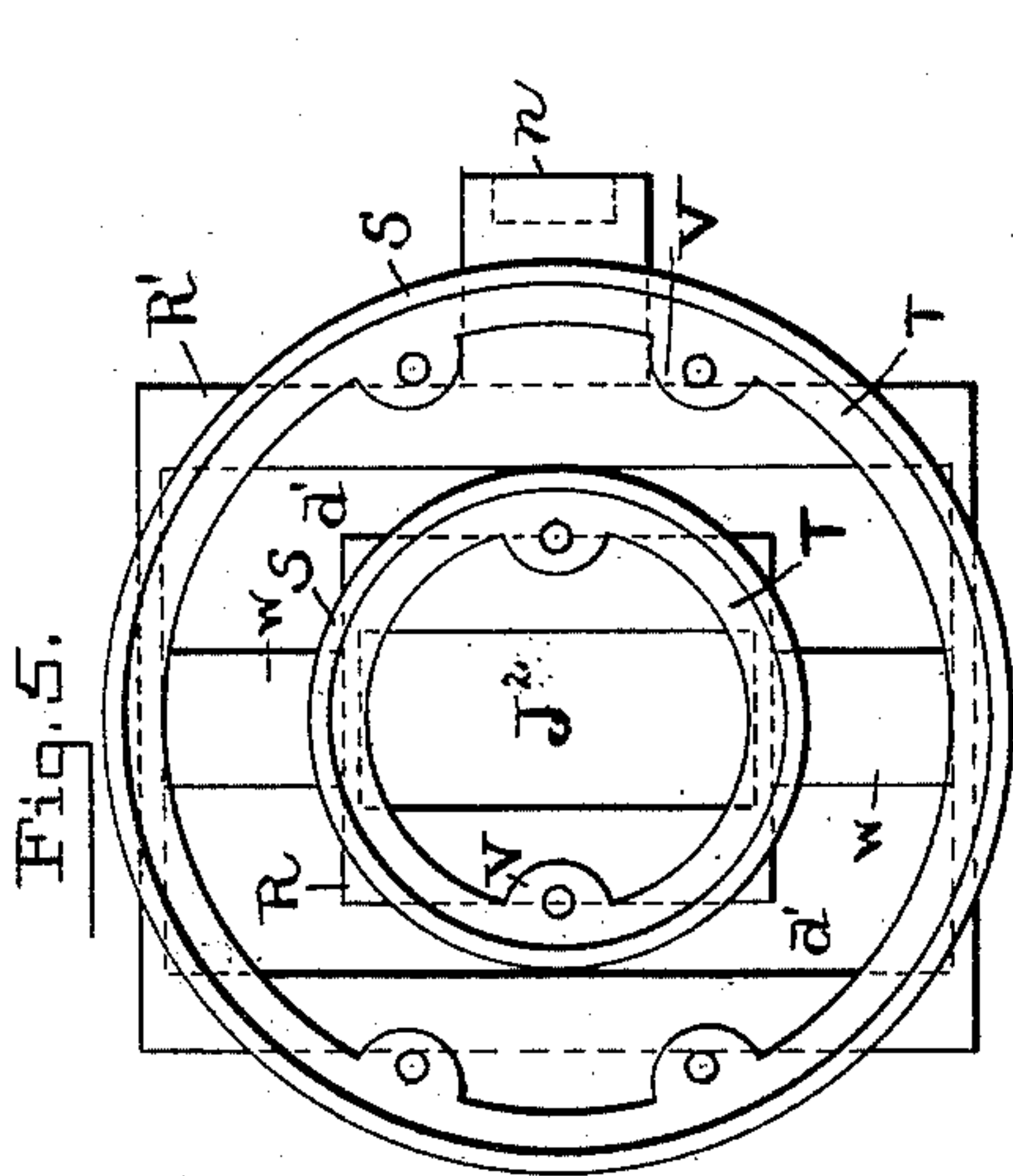
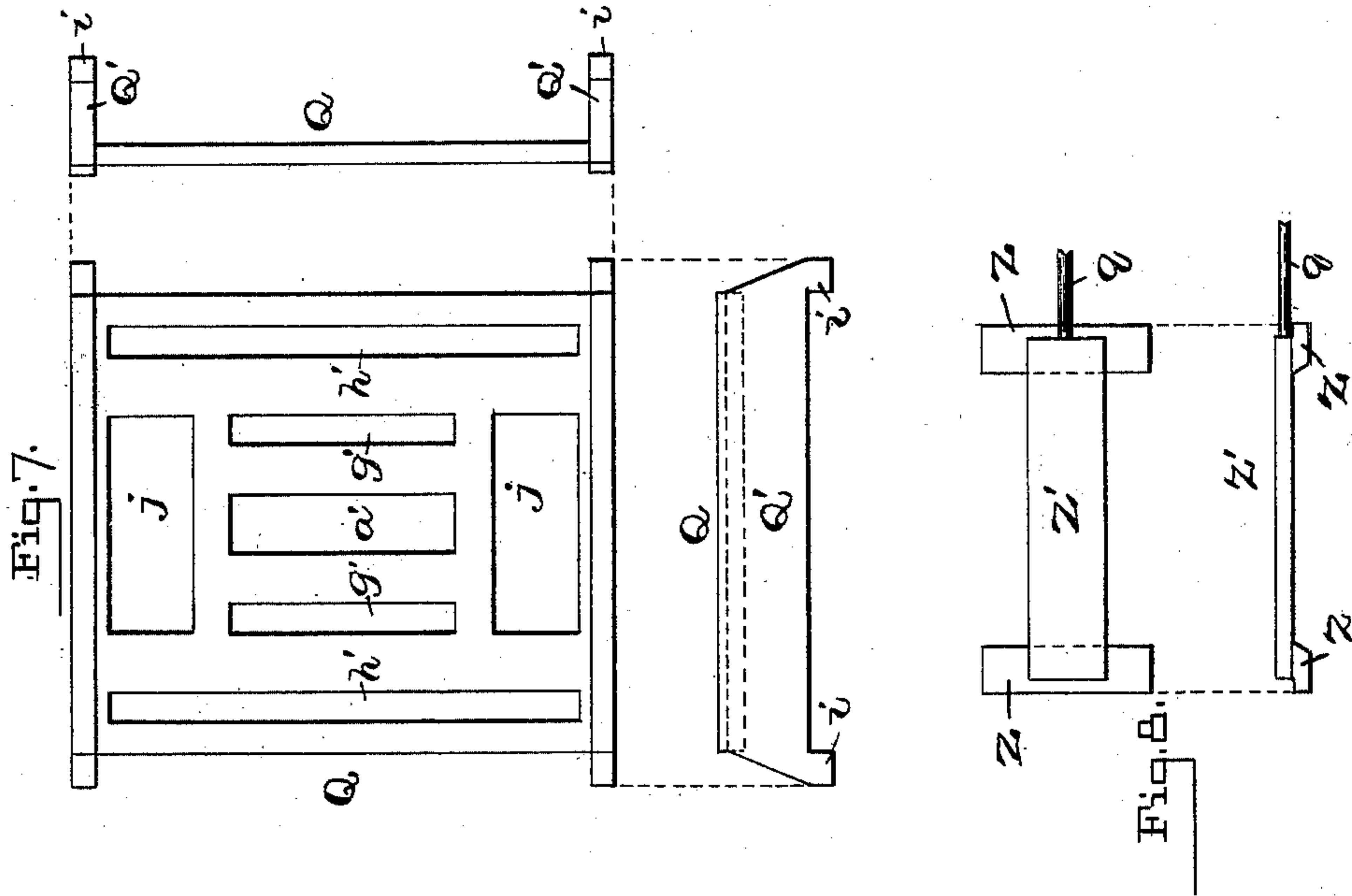
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UNITED STATES PATENT OFFICE.

JESSE HUNT, OF BALTIMORE, MARYLAND.

COMPOUND STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 477,006, dated June 14, 1892.

Application filed February 23, 1892. Serial No. 422,344. (No model.)

To all whom it may concern:

Be it known that I, JESSE HUNT, a citizen of the United States, residing at Baltimore city, in the State of Maryland, have invented certain new and useful Improvements in Compound Steam-Engines, of which the following is a specification.

This invention relates to certain improvements in compound steam-engines; and the objects are to concentrate power at the cross-head, to provide improved valve mechanism which will give a more rapid cut-off and release with ample port-opening for admission and exhaust, and to provide for the admission of live steam from the boiler directly to both the high and low pressure cylinders at the time of starting.

With these ends in view the invention may be said to consist in the novel features of construction, arrangement, and combinations of parts hereinafter described and claimed.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 shows a cross-section of the cylinders, valve, and admission and exhaust passages leading from the boiler, the section being taken on the line 1 1 of Fig. 3. Fig. 2 shows an inside elevation with the valve-chest and valve removed to disclose the construction of the valve-seat. The upper portion of this view is a section taken on the line 2 2 of Fig. 1. Fig. 3 shows a longitudinal central section of the valve and seat. Fig. 4 is a vertical section taken on the line 4 4 of Fig. 3 and shows the cylinders in section and the passages leading thereto. Fig. 5 shows a plan view of the balance-valve. Fig. 6 shows a plan view of the main valve. Fig. 7 shows a plan view, end view, and side view of any auxiliary-valve seat. Fig. 8 shows a plan and side view of a supplemental valve.

The arrangement here shown is specially designed for locomotive-engines; but the principles of the invention may also be embodied in stationary engines.

I locate a high-pressure cylinder A between two low-pressure cylinders B, one being above and the other below said high-pressure cylinder and both the same size.

C designates the piston-rod of the high-pressure cylinder, and D the cross-head, to the center of which it is attached and which fits

a slideway D'. This cross-head has a projecting arm E on its upper and its lower side, and these arms, which are of the same length, have joined to their outer ends the piston-rods F of the low-pressure cylinders. The driver-rod G is jointed to the center of the cross-head, and it will be observed that the power from the three cylinders is concentrated at this point to drive the said rod. The cylinders are supported in a suitable casting H, which also forms a yoke or saddle I for the boiler to rest in. Within this casting are formed passages J K, the former for the live steam from the boiler, which steam enters at the port J³, and the passage K for the final exhaust, whose exit is at K'.

The letter L designates the valve-seat, which is a finished inner vertical face of the casting H. The steam-passage J extends directly to the valve-seat and has a port *a* at the middle of the same, while the exhaust-passage K divides and extends on each side of said passage J, as seen in Fig. 2, the two branches of said exhaust-passage having ports *b* at opposite ends of the valve-seat.

Passages M extend on each side of the central inlet-passage J from ports *g* at the valve-seat to the opposite ends of the high-pressure cylinder and are for admission of steam to and exhaust of steam from said cylinder. Outside of these passages M are passages N for admission to and exhaust from the low-pressure cylinder. Each of said passages extends first straight back from the valve-seat port *h* and then at right angles, diverging into two branches N', one of which extends to each low-pressure cylinder, as seen in Fig. 4.

A chest O and lid O' for the same are bolted to the valve-seat through suitable flanges, and a slide-valve P is contained in the chest and works over the seat L. This slide-valve has a central chamber J' extending through it and communicating with the admission-port *a* in the valve-seat, passages *c c'* through it on two opposite sides of said central chamber and adapted to communicate with the passages M, leading from the valve-seat to the high-pressure cylinder, an exhaust chamber *d*, extending entirely around the central chamber J² and side passages *c c'* and separated therefrom, as best seen in Fig. 6. This chamber is open through the valve and is adapted to

communicate with the passages M and N, leading from the valve-seat to the high and low pressure cylinders, and passages *e e'* at opposite ends outside the said exhaust-chamber to also communicate with said passages N and extending, like the other passages, through the valve. Suitable webs *f* between the valve-passages serve to brace and strengthen the valve between the chambers and passages.

On the outer side of the slide-valve P is an auxiliary-valve seat in the form of a partition Q, bearing against said valve and having ports *a' g' h'* exactly corresponding with the ports in the main-valve seat. This partition Q has legs or standards *Q'* at opposite sides, which rest against the said valve-seat, and have lugs *i* at each end taking past said seat to hold the partition from shifting, but not preventing a movement away from the valve-seat, said lugs serving as guides in such movement.

The auxiliary-valve seat or partition has, in addition to the ports above-named as corresponding with those in the main-valve seat, two ports *j* on opposite sides of the central ports, the office of which side ports will be explained hereinafter.

A balance-valve works over the outer face of the partition Q and comprises two rectangular ribs *R R'*, one included in the other and suitably joined by webs *w*. The inside rib incloses a chamber *J²*, communicating through the port *a'* with the chamber *J'* of the main valve, and between the two ribs is an annular chamber *d'*, which is in alignment with the exhaust-chamber *d* of the main slide-valve and may communicate therewith through the ports *g'* in the auxiliary-valve seat. Each rib has rising from its outer surface a circular flange *S*, in which fit concentric balance-rings *T*, the outer faces of which bear against the lid of the valve-chest and are held against the same by coiled springs *U*, fitting in pockets *V* in the rings, and over studs *k*, projecting from the valve. Packing-rings *W* fit in annular grooves around the outside of the balance-rings, said packing-rings bearing against the inside surfaces of the raised flanges *S*.

The two valves P and R are connected together as follows: An arm *l*, projecting from the valve P, has a socket *m* in its outer side, and a lug *n* on the valve R fits said socket and also receives the valve-rod X. The valves thus joined will move as one. The lid *O'* has a port *o* through the middle and a smaller port *p* on two opposite sides, and a supplemental valve-chest Y is fastened on the lid of the main chest and contains a slide-valve, which comprises a slide-block Z for each of the ports *p* and a bar *Z'*, connecting their upper sides. The rod *q* of this valve is connected with a lever *r*, which in turn has a rod connection extending to the engineer's cab.

The operation is as follows: With a comparatively slight uncovering of the right-hand port *g* of the main-valve seat, as illustrated

in Fig. 3, steam entering through the passage J and filling the chambers *J'* and *J²* passes through the port *g*, and at the same time through the upper and under side of the port *g'* into the passage *c'*, and thence into the passage M to the high-pressure cylinder. At the same time the exhaust-steam from the high-pressure cylinder passes out through the passage M at the opposite end of the valve into the chamber *d* in the valve and around the said chamber to the other side, where it enters the passage N at the port *h*, and also through the under side of the port *h'* in the auxiliary-valve seat into the passage *e'*, and thence into the passage N. The exhaust-steam from the high-pressure cylinder also passes through the left-hand port *g'* into the annular chamber *d'* in the balance-valve around the same and through the port *h'* in the auxiliary-valve seat into the passage *e'*, and thence into the passage N. The said passage N conducts this exhaust-steam from the high-pressure cylinder to the two low-pressure cylinders through its branches *N'*. The exhaust from the low-pressure cylinder is taking place through the passages *N N'* at the opposite end of the valve-seat into the valve-chest and passage K. This is the final exhaust.

It will be observed that by my construction of valve I obtain a double admission at the port of the high-pressure-cylinder passage M from the chamber *J'* and valve-passage *c'* and a double admission to said valve-passage through the upper and under sides of the port *g'*, and a similar admission is obtained for high-pressure exhaust at the port of the low-pressure-cylinder passage. Thus a slight movement of the valve gives ample port-opening, and I am enabled to handle the steam more quickly, which in compound engines is the important thing. The valve is perfectly balanced and allowed a slight movement away from the valve seat by the compression of the springs *U*.

In starting the engine, which is the time when most work is required, I make provision for admitting live steam from the boiler directly to all the cylinders. This is accomplished by shifting the supplemental valve *Z Z'* to uncover the ports *p* in the chest-lid *O'*, whereby the live steam, which has free access at all times to the supplemental valve-chest, may pass through said ports into the passage or chamber *d'*, thence through the ports *j* in the partition Q, and to the low-pressure cylinders through the main valve. When the engine is under way, the supplemental valve is shifted to close the ports *p* in the valve-chest, and the valve then handles the steam, as before explained, the steam exhausting from the high into the low pressure cylinders. By this arrangement the engines may be given great power at the time of starting when it is most needed and does not have to labor so heavily.

It is evident that variations may be made

in the construction and arrangement of parts here shown and described, and I do not limit myself in the claims to such construction and arrangement.

5 Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a compound steam-engine, the combination, with the valve-seat having ports and passages communicating with the high and low pressure cylinders, respectively, of a slide-valve working over said seat and provided with a chamber open to the live-steam supply, passages for communicating with the high-pressure-cylinder ports in the valve-seat, an exhaust-chamber, also to communicate with said high-pressure ports, and passages for communicating with the low-pressure ports, and an auxiliary-valve seat fitting against the outer side of said valve and having ports corresponding with those on the main-valve seat and arranged to communicate with the chambers and passages in the valve, in the manner substantially as described.

2. In a compound steam-engine, the combination, with the valve-seat having ports and passages communicating with the high and low pressure cylinders, respectively, of a slide-valve working over said seat and provided with a chamber open to the live-steam supply, passages for communicating with the high-pressure-cylinder ports in the valve-seat, an exhaust-chamber, also to communicate with said high-pressure ports, and passages for communicating with the low-pressure ports, an auxiliary-valve seat, in the form of a partition, fitting against the outer side of said slide-valve and having ports through it corresponding with those in the main-valve seat and arranged to communicate with the chambers and passages in the valve, and a valve working over the outer face of said partition and having a chamber for live steam and a chamber for exhaust-steam from the high-pressure cylinder, said latter chamber to have communication with chambers and passages in the main valve, substantially as described.

3. In a compound steam-engine, the combination, with the valve-seat having ports and passages communicating with the high and low pressure cylinders, respectively, of a slide-valve working over said seat and provided with a chamber open to the live-steam supply, passages for communicating with the high-pressure-cylinder ports in the valve-seat, an exhaust-chamber, also to communicate with said high-pressure ports, and passages for communicating with the low-pressure ports, an auxiliary-valve seat, in the form of a partition, fitting against the outer side of said slide-valve and having ports through it corresponding with those in the main-valve seat and arranged to communicate with the chambers and passages in the valve, a valve working over the outer face of said partition and having a chamber for live steam and a chamber for exhaust-steam from the high-pressure

cylinder, said latter chamber to have communication with chambers and passages in the main valve, and balance-rings in the outer valve held by spring-pressure against the valve-chest lid.

4. In a compound steam-engine, the combination, with the valve-seat having ports and passages communicating with the high and low pressure cylinders, respectively, of a slide-valve working over said seat and provided with a chamber open to the live-steam supply, passages for communicating with the high-pressure-cylinder ports in the valve-seat, an exhaust-chamber, also to communicate with said high-pressure ports, an auxiliary-valve seat, in the form of a partition, fitting against the outer face of said slide-valve and having ports through it corresponding with those in the main-valve seat and arranged to communicate with the chambers and passages in the valve, said partition having side standards fitting against the main-valve seat and provided with lugs taking past said seat, a valve working over the outer face of said partition and having a chamber for live steam and a chamber for exhaust-steam from the high-pressure cylinder, said latter chamber to have communication with chambers and passages in the main valve, and balance-rings in the outer valve held by spring-pressure against the valve-chest lid.

5. In a compound steam-engine, the combination, with the valve-seat having ports and passages communicating with the high and low pressure cylinders, respectively, of a slide-valve working over said seat and provided with a chamber open to the live-steam supply, passages for communicating with the high-pressure-cylinder ports in the valve-seat, an exhaust-chamber, also to communicate with said high-pressure ports, and passages for communicating with the low-pressure ports, an auxiliary-valve seat fitting against the outer side of said valve and having ports corresponding with those of the main-valve seat and arranged to communicate with the chambers and passages in the valve, and also provided with a central port open to the live-steam supply and side ports communicating with the exhaust-chamber of the slide-valve, a supplemental valve-chest in communication with the said central port of the auxiliary-valve seat, and a supplemental valve in said chest, controlling communication between the valve-chest and the side ports of the auxiliary valve-seat.

6. In a compound steam-engine, the combination, with the valve-seat having ports and passages communicating with the high and low pressure cylinders, respectively, of a valve-chest having a lid with a central port through it and side ports, a slide-valve working over said seat and provided with a chamber open to the live-steam supply, passages for communicating with the high-pressure-cylinder ports in the valve-seat, an exhaust-chamber, also to communicate with said high-pressure

ports, and passages for communicating with the low-pressure ports, an auxiliary-valve seat in the form of a partition, fitting against the outer side of said slide-valve and having ports 5 through it corresponding with those in the main-valve seat and arranged to communicate with the chambers and passages in the valve, and also provided with a central port open to the live-steam supply and side ports 10 communicating with the exhaust-chamber of the slide-valve, a valve working over the outer face of said partition and having a chamber for live steam and a chamber for exhaust-steam from the high-pressure cylinder, said 15 latter chamber to have communication with chambers and passages in the main valve, a

supplemental valve-chest on the lid of the main valve-chest and having communication through the central port in said lid with the live-steam chamber of the outer valve, and 20 also having communication through the side ports in the lid with the exhaust-chamber of said outer valve, and a supplemental slide-valve in said chest, controlling communication with the said exhaust-chamber. 25

In testimony whereof I affix my signature in the presence of two witnesses.

JESSE HUNT.

Witnesses.

CHAS. B. MANN,
F. PARKER DAVIS.