(No Model.)

3 Sheets—Sheet 1.

B. W. GRIST.

STEAM ENGINE.

No. 305,811. Patented Sept. 30, 1884.

Fig. 1.

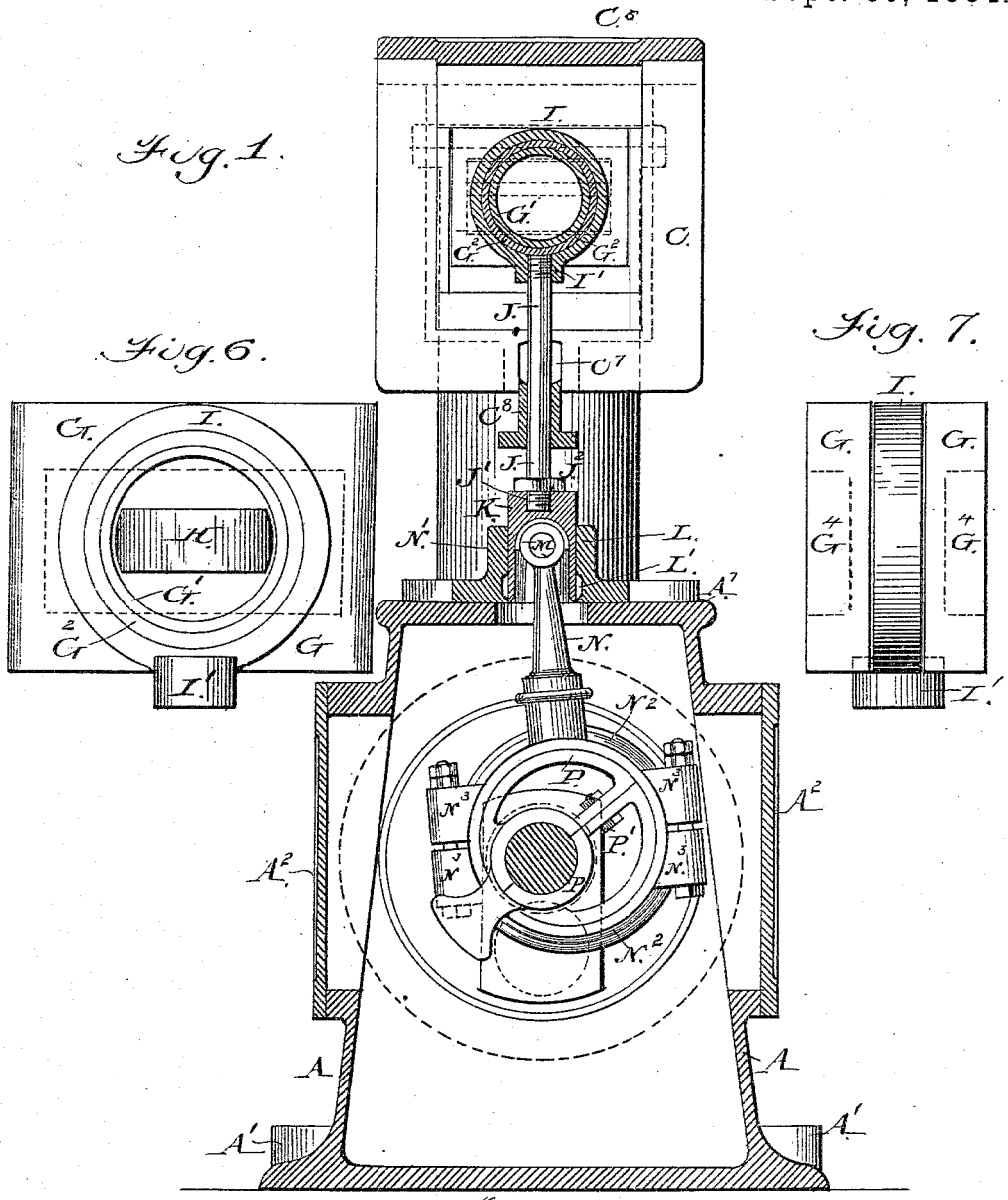
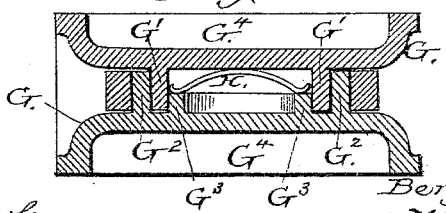


Fig. 6.

Fig. 7.

Fig. 5.



Attest;

J. Walter Fowler.
H. B. Applewhaite,

Inventor;

Benjamin W. Grist,
Thomas P. Kinsey
atty.

(No Model.)

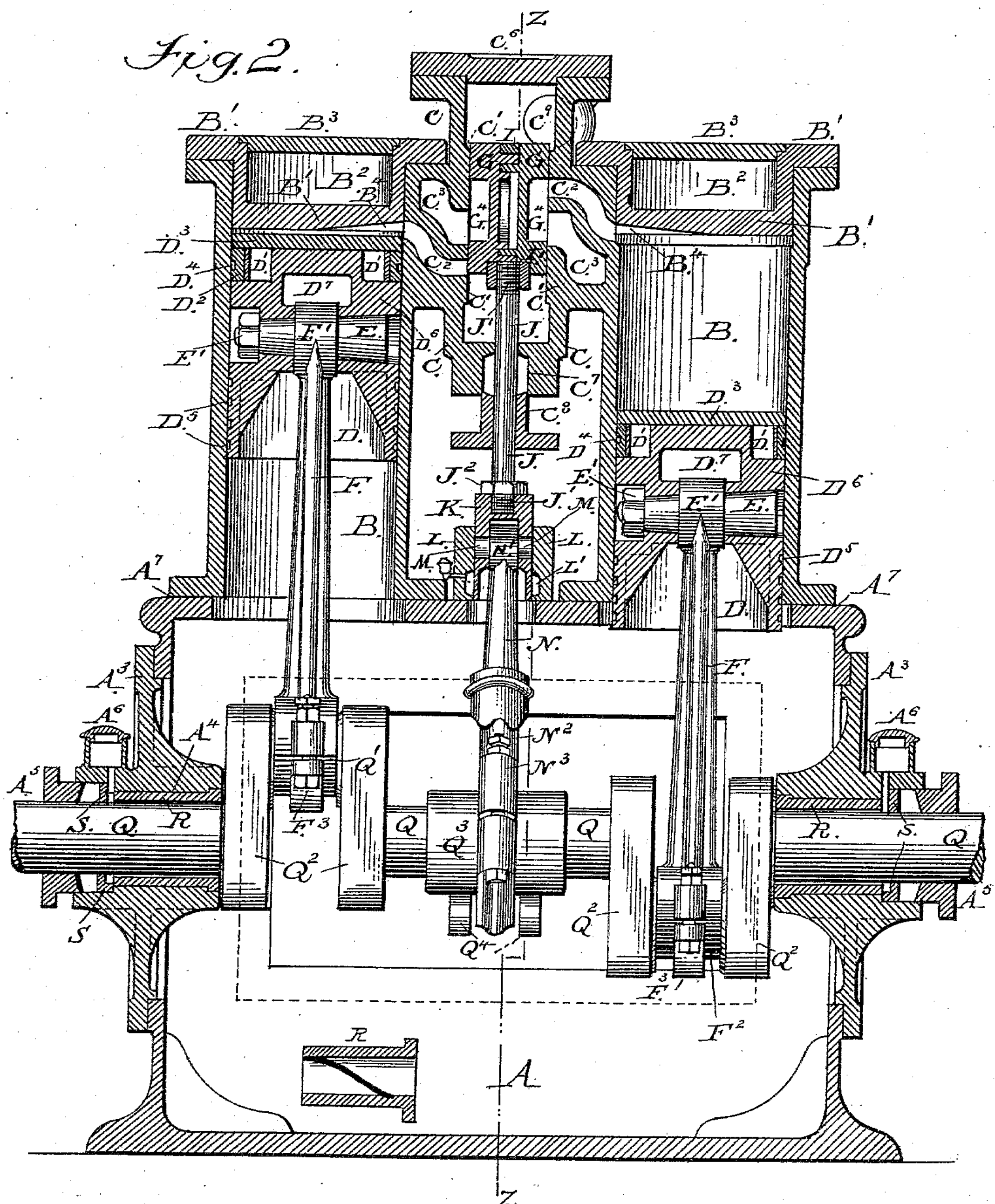
3 Sheets—Sheet 2.

B. W. GRIST.

STEAM ENGINE.

No. 305,811. Patented Sept. 30, 1884.

Fig. 2.



Attest:
J. Walter Fowler,
H. B. Applewhaite,

Inventor:
Benjamin W. Grist
by Thomas P. Kinsey
atty.

(No Model.)

3 Sheets—Sheet 3.

B. W. GRIST.

STEAM ENGINE.

No. 305,811. Patented Sept. 30, 1884.

Fig. 3.

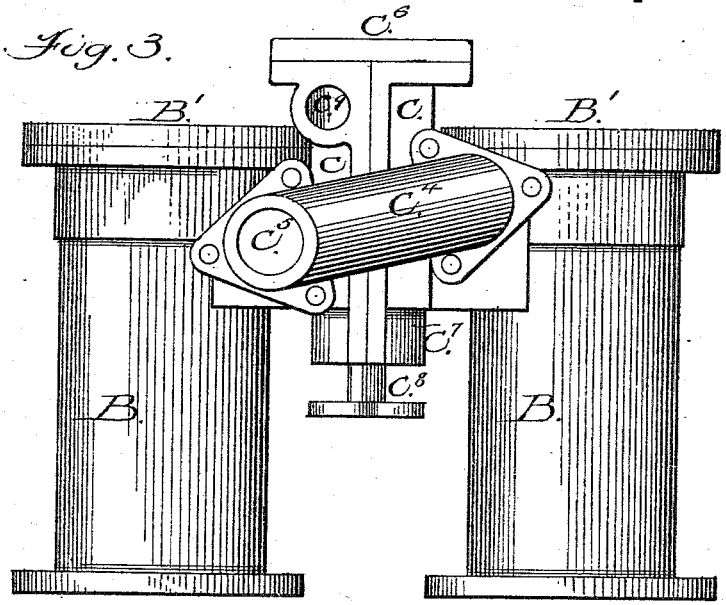
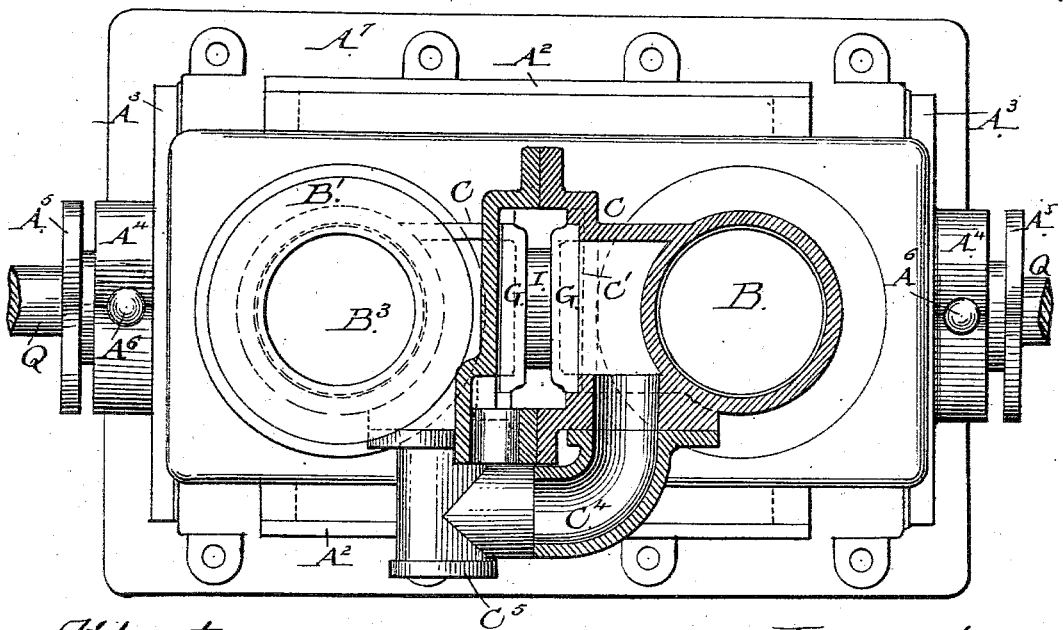


Fig. 4.



Attest;

S. Walter Fowler

H. B. Applewhaite,

Inventor

Benjamin W. Grist.

by Thomas P. Kinsey

atty.

UNITED STATES PATENT OFFICE.

BENJAMIN W. GRIST, OF READING, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO WILLIAM HARRY ORR, OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 305,811, dated September 30, 1884.

Application filed February 11, 1884. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN W. GRIST, a citizen of the United States, residing at the city of Reading, county of Berks, State of Pennsylvania, have invented a new and useful Improvement in Steam-Engines, of which the following is a specification.

My invention relates to improvements in the construction and arrangement of twin trunk-engines taking steam upon one face only of the piston.

The object of the improvement is to obtain a free and practically instantaneous admission of steam upon the completion of an upward piston-stroke and simultaneously an equal and instantaneous release. A decided advantage is also secured by the arrangement of the steam-chest and valve-chamber between the upright cylinders in such a compact form as to make the induction and release ports leading therefrom into the cylinders so short as virtually to make the admission and release of the steam to and from the cylinders instantaneous, thus simplifying the construction and rendering the operation more effectual.

The above objects are attained in the use of the machinery shown in the accompanying drawings, in which similar letters in all cases indicate similar parts.

Figure 1, Sheet 1, is a sectional elevation looking to the left in the plane of the line *z z* of Fig. 2. Fig. 2, Sheet 2, is a vertical longitudinal sectional view showing clearly the arrangement of the cylinders, steam-chest, valves, &c. Fig. 3, Sheet 3, is a rear vertical elevation of the cylinders, showing steam-inlet and exhaust-outlet. Fig. 4, Sheet 3, is a plan partly in section, the section being through the upper portion of the steam-chest. Fig. 5, Sheet 1, is a horizontal cross-section through the D-valves, showing the construction of the same. Fig. 6, Sheet 1, is a plan of the valve, showing the yoke for the same. Fig. 7, Sheet 1, is an end elevation of the D-valves, in all of which—

A represents a hollow base, forming an oil or lubricating reservoir; A′, bolting-lugs; A^2, front and rear caps to base; A^3, end caps; A^4, stuffing-box seats provided therein; A^5, stuffing-box glands; A^6, oil-cups integral with stuffing-box; A^7, top of base and seat for cylinders; B B, steam-cylinders; B′, cylinder-caps; B^2, depression of cap to form non-conducting space; B^3, sub-cap to inclose air-space; B^4, recess in face of cap forming a port to the cylinder; C, portion (one-half) of a steam-chest cast integral with each cylinder; C′, valve-seat within the same; C^2, steam-induction ports leading from the cylinder into the steam-chest; C^3, exhaust-ports leading from the valve-seat into the exhaust-pipe; C^4, exhaust-pipe; C^5, exhaust-outlet; C^6, cap common to the separate halves of the steam-chest; C^7, stuffing-box for valve-rod; C^8, stuffing-box gland for the same; C^9, steam-inlet to the steam-chest; D D, trunk-pistons; D′, inner packing-ring; D^2, outer packing-ring; D^3, junk-ring or follower; D^4, steam-grooves in face of packing-ring; D^5, steam-grooves in the periphery of pistons at their lower ends; D^6, taper-bore through the piston to receive the connecting-rod pin; D^7, chamber cored in the piston to give head-room for the connecting-rod; E, taper-pin for upper end of connecting-rod; E′, thread and nut at one end of same; F, connecting-rod; F′, solid end bored to fit pin E of piston; F^2, crank end of rod of box form; F^3, bolts and nuts for securing the same; G, slide-valves of the ordinary D form; G′, male annular ring on the back of the right-hand valve; G^2 and G^3, combined, forming a female annular ring on the back of the left-hand valve; G^4, exhaust-port in the valves; H, a flat steel spring placed between the valves on seats provided therefor, the function of the spring being to press the valves lightly to the valve-seats and to give way by compression in case water should be discharged from either cylinder; I, a valve-yoke bored to fit the turned exterior annular ring of the left-hand slide-valve, as shown in Fig. 2; I′, a threaded boss for the reception of the valve-rod; J, the valve-rod threaded at each end; J′, the thread; J^2, a jamb-nut at the lower end of the rod; K, valve-rod guide-block; L, guide for valve-rod block bolted to top of base; L′, annular oil-chamber within the guide; M, guide-block pin; N, extension-arm of the eccentric yoke connected to the guide-block by the pin M fitted to the head N′ of the eccentric yoke; N^2, eccentric yoke; N^3, eccentric-yoke lugs and bolts; P, the eccentric cast in halves and secured to

the shaft by bolts P′, as shown; Q, the main or crank shaft; Q′, crank-pins; Q^2, crank-disks; Q^3, counterbalance-bosses; Q^4, counter-balances; R, lantern-bearings for the main shaft fitted from the inside of the bearing-box A^4 in the end caps; S, annular disks with an exterior ledge abutting against the lantern-bearings, and thereby forming an annular oil or lubricating reservoir within the stuffing-box, the outer ledge being cut through below the opening from the oil-cup A^6, from whence the reservoir is supplied.

The construction of the engine is as follows: The base of the form shown has a front and rear opening cast therein of a rectangular form and two end openings of circular form, also on the top circular openings for the cylinders and guide of valve-rod. The front, rear, and end openings are provided with caps, which are fitted oil-tight and secured by bolts to the base. The end caps are bored to receive the lantern-bearings for the main shaft, the bearings being provided with a collar on the inside recessed within the cap flush with its inside face beyond the bearing in each cap. The bore is enlarged to form a stuffing-box, and a gland is provided for the same between the packing and bearing, and abutting against the latter is a gun-metal disk bored to slip over the shaft. It is provided with an annular ledge next to the bearing, and is turned to fit snug in the counterbore stuffing-box. When in place, the stuffing-box packed, and the gland in position, the disk forms an annular oil-reservoir around the shaft. Oil is supplied to the same by an oil-cup cast integral with the cap, a portion of the ledge being cut away to admit the oil. The shaft-bearing or lantern-brass has spiral grooves formed in its face, which admits the oil from the reservoir and transmits it over the face of the bearing. The top of the base is planed or faced off for the reception of the cylinders and valve-rod guides, which are bolted thereto. The cylinders are each cast with one-half of the steam-chest or valve-chamber attached to each. Valve-seats are provided within each half-chest, in which are cast steam-ports C^2 and exhaust-ports C^3, the steam-port for the right-hand cylinder in Fig. 2 being above the exhaust-port on that side, while for the left-hand cylinder the steam-port is below the exhaust-port, and at equal distances from the center of the same. The ports, both steam and exhaust, are of a rectangular parallelogrammic form upon the valve-seat, and are generally of a length equal, or nearly so, to the diameter of the cylinder, thus admitting the steam at once over almost the entire area of the piston. The steam-chest is made of sufficient length inside to give the proper travel to the valve with a small amount of clearance. It is also of a rectangular parallelogrammic form with flanges integral therewith. The valve-seats and flanges are planed to true and parallel surfaces. The flanges are then bolted together and the cap C^6 fitted and bolted to the upper end of the chest. The cylinders are then bored, and the steam-chest is also bored for the valve-rod and stuffing-box. The cylinders may then be secured to the base. The caps or heads of the cylinders are extended within the cylinders far enough to intercept one-half of the depth of the steam-ports within the same. A recess, B^4, is cut of a wedge or tapered form across the face of the head corresponding in depth with the port in the cylinder and terminating at the center flush with the face of the head. A sub-cap, B^3, closes the head, and thus incloses a dead-air or non-conducting space, B^2, between the same. The pistons are of the trunk form, and are constructed of a length sufficient to insure a steady and easy motion for the highest speed at which the engine may be run. Spring-packings D′ D^2 of the usual form are provided at the top edge of the pistons and are retained in place by a junk-ring or follower, D^3, which is bolted to the main body of the piston. The rings are made to fit the cylinder, are cut diagonally across their faces, and having the usual springs within the rings will expand diametrically and automatically as wear takes place. In the face of the outer rings I turn one or more shallow grooves, D^4, and at the lower edge of the body of the piston similar grooves, D^5, as a precaution against steam passing the piston into the base. Each piston is connected to its connecting-rod F by a tapered wrist-pin, E, the wrist-pin being provided with a threaded end and nut, E′. The connecting-rods may be of cast-iron, as the stress is of compression only; or they may be of any suitable metal. I prefer making them, as shown, with a solid end where connected with the piston, said end bored to fit the taper-pin E, and the crank-bearing end of the usual clamp-box form having lugs and bolts to secure the same to the crank-bearing.

The slide-valves are constructed of the ordinary D form, with the following additions: On the back of one of the valves a single annular ring or ledge is raised, G′, forming a male annular ring. On the back of the other valve two annular ledges are raised, G^2 G^3, the latter of one-half the height of the former, the two combined forming a female recess for the reception of the male annular ring of the valve first described. These several rings are turned and bored to make sliding steam-joints, and the exterior of ring G^2 is turned to fit the yoke I. The inner ring, G^3, forms a seat for the reception of a flat curved steel spring, H, the crown of the spring resting against the back of the opposite valve in a recess provided therein of the width of the spring, thus preventing lateral motion of the same while in operation, the object of the spring being to insure a positive connection with the valve-seats, and yet permit either valve to rise off of its seat in case of an accumulation of water in the cylinders, and thus give clearance and prevent breakage.

The yoke I is made of sufficient depth to ad-

mit of the above-described movement of the valve, and yet retain sufficient contact-surface to prevent entrance of steam between the valves.

It will be evident from the above that the valves are virtually balanced and will absorb but a small amount of power to operate the same.

The valve-rod J is a plain round rod of steel or iron threaded at each end J′, the upper end secured in the boss I′ of the yoke I, and the lower end in the guide-block K, a jam-nut, J^2, giving additional security to the connection. The guide-block K is a plain cylindrical plug with its lower end recessed or truncated and its length so arranged that its maximum movement upward shall not uncover the oil-reservoir in the guide. The block is connected with the eccentric yoke by a pin, M, passing through the block and the head N′ of the arm N. The guide L is a cylindrical casting having flanges or ears by which it is secured to the top of the base, and is bored to permit the guide-block sliding snugly within the same. It is provided with an annular recess, L′, which is in communication with the exterior by a perforation and oil-cup. A groove in the pin M, (not shown,) as the block passes the reservoir, picks up the oil and lubricates the pin and connection N′, the block itself being always fully lubricated. The eccentric P is cast in halves and secured upon the main shaft by bolt P′ and a key, and is so adjusted relative to the slide-valves that when at either terminus of its stroke (which occurs when the piston is moving at nearly its maximum velocity) the exhaust-port shall be fully open during this period, and the piston thus rendered free from compression. This instantaneous exhaust is secured by means of valve travel and lap. The steam is also admitted at exactly the right point of time to perform its proper function to the most economical advantage, and having performed its duty is also instantaneously released without wire-drawing, thus giving a maximum amount of power with a minimum amount of steam. The crank-shaft is a double one, with the cranks set so that the separate pistons will each move in directly opposite directions in the same instant of time.

I do not limit myself to the particular form of engine shown in the drawings, claiming the liberty to vary therefrom to suit the varied requirements of the engines for the positions in which they may be placed as long as I retain the special features of my invention, the half-chests cast integral with the cylinders and forming when combined a valve-chamber common to both cylinders.

Having described the construction, operation, and advantages of my invention, I desire to secure by Letters Patent the following claims thereon:

1. The cylinders of a twin engine, each having half of a steam-chest formed integral therewith and adapted when combined to form a valve or steam-chest for the two cylinders, substantially as described.

2. The cylinders of a twin engine, each having half of a steam-chest cast integral therewith, forming a valve or steam-chest common to both cylinders, in combination with a double valve, substantially as shown.

3. The cylinders of a twin engine provided with a steam-chest common to both and having ports to supply and exhaust steam, in combination with a balanced double D-valve controlling said parts, the surrounding yoke, guide-block, main shaft, and intermediate connections, substantially as described.

4. An engine-cylinder provided with inlet and exhaust ports, in combination with the cap or head projecting into the cylinder and cut away, as shown, to form an extension of the inlet-port to conduct steam to the diametrical center of the cylinder, substantially as set forth.

5. An engine-cylinder provided with a removable head cut away to form an extension of the inlet-port and having a non-conducting chamber formed therein, substantially as shown and described.

6. In combination with the cylinders of a twin engine having a valve or steam-chest common to both, a double D-valve, one of which valves is provided with an annular ring upon its back adapted to fit within an annulus upon the back of the opposite valve, a spring for holding each valve to its seat, and a surrounding yoke, substantially as described.

7. The combination of the twin cylinders, their valve-chest provided with ports C^2 C^3, alternating as described, a balanced double D-valve and yoke, the valve-rod detachably connected thereto, and to a guide-block, the eccentric connected to the guide-block, and the driving-shaft, substantially as shown.

8. The combination of the valve, the guide-block, and the guide having an oil-chamber, substantially as shown, and for the purpose described.

9. The combination, with the base of the engine, of the removable heads having bearings formed therein for the main shaft, the annular disk cut away, as described, and the grooved lantern-bearing, substantially as and for the purpose set forth.

10. In combination with a pair of vertical trunk-cylinders provided with a joint valve-chamber and double D-valve and the valve-rod for the same, a guide-block, K, threaded at its upper end for the valve-rod J, its lower end, truncated and having a pin, M, connecting the same with the eccentric-arm N N′, a guide, L, having an annular recess, L′, provided as an oil-reservoir, bolted to the top of the base A and bored to a sliding fit of the guide-block K, substantially as and for the purpose hereinbefore specified.

11. In combination with the bearing of the main shaft of trunk or other engines, the an-

nular disk S, provided with an outer ledge, said ledge cut through beneath the exterior oil-cup and adapted to rest against the end of the lantern-bearing within the stuffing-box, whereby an oil-reservoir is formed around the shaft, the shaft-bearing provided with oil-grooves, whereby the oil from the reservoir is distributed over the same, substantially as and for the purpose declared.

12. A double-cylinder vertical trunk-engine composed of the following elements: two upright cylinders, each having one-half depth of steam-chest cast integral therewith and combined forming a valve-chamber common to both cylinders, a double balanced D-valve, a valve-rod, guide, and block, a single eccentric, and double crank-shaft, arranged to give alternate, simultaneous, and directly opposite movement to the trunk-pistons of the cylinders by rods F, a base upon which the cylinders and valve-rod guide are bolted having front and rear openings closed with plain caps and end openings closed with caps provided with bearings for the crank-shaft, the whole arranged and adapted for service substantially as shown, and for the purpose described.

BENJAMIN W. GRIST.

Witnesses:
EDWIN A. MOORE,
THOMAS P. KINSEY.