

No. 679,949.

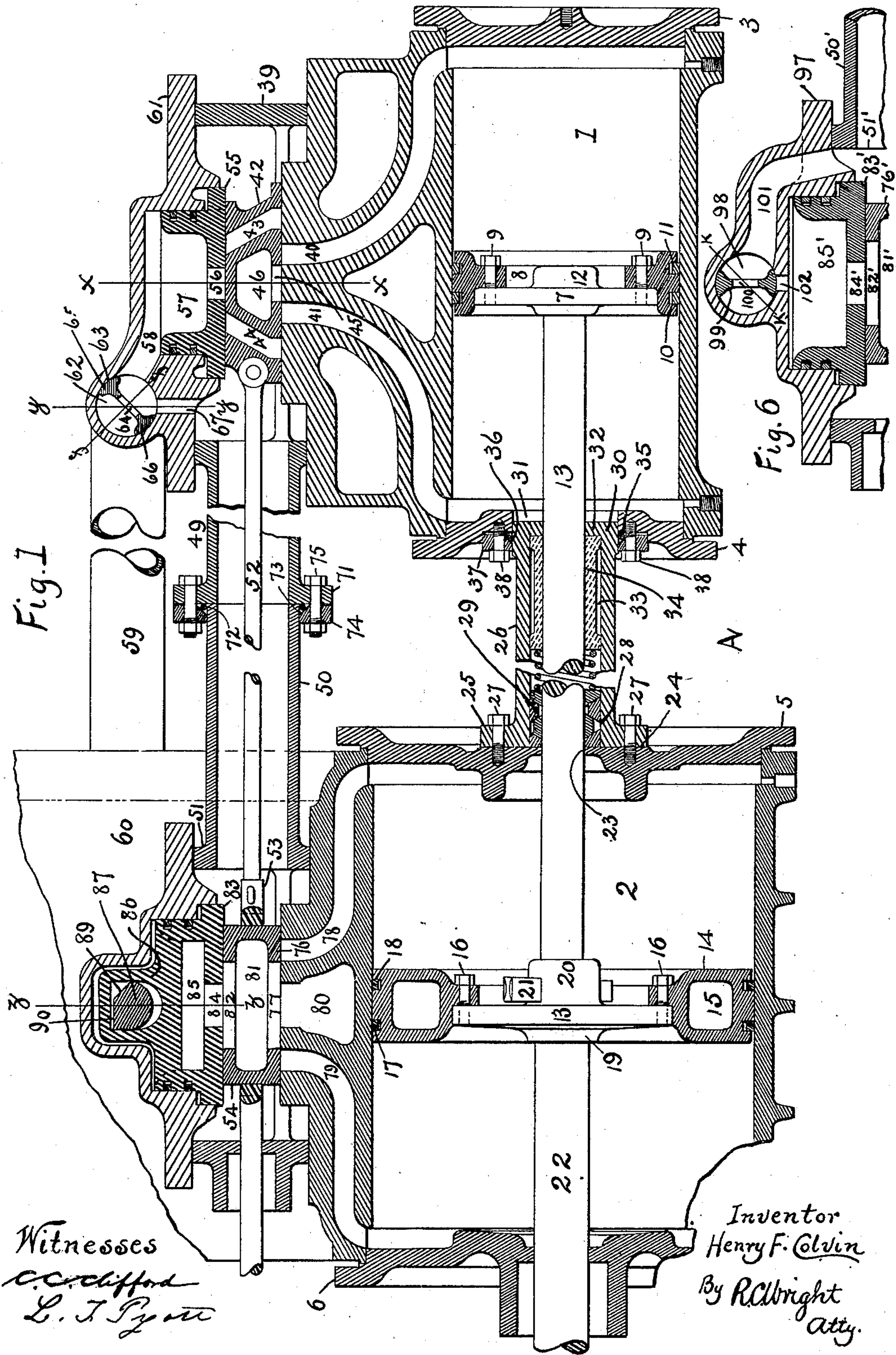
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STEAM ENGINE.

(Application filed Dec. 24, 1900.)

(No Model.)

2 Sheets—Sheet 1.



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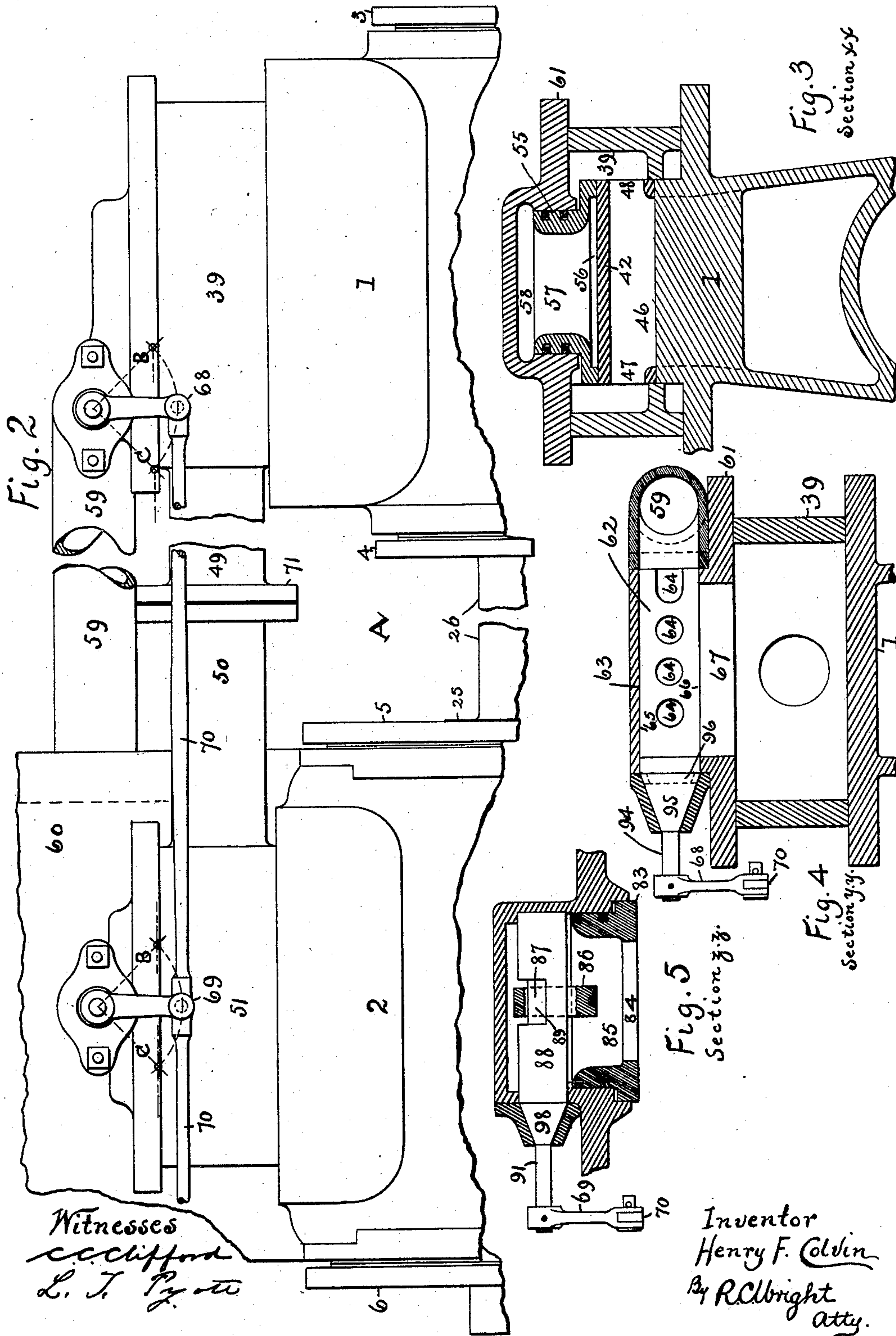
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UNITED STATES PATENT OFFICE.

HENRY F. COLVIN, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 679,949, dated August 6, 1901.

Application filed December 24, 1900. Serial No. 40,992. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. COLVIN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

The objects of my invention are to construct a multiple-cylinder engine in a manner to afford easy access to the pistons and their packing-rings; to provide for the easy introduction and removal of the pistons; to reduce the number of stuffing-boxes heretofore necessary for tandem engines and reduce them to nearly the minimum, as heretofore only necessary on simple engines; to form a direct exhaust-passage from the high-pressure to the low-pressure steam-chests; to provide a simple by-pass valve of sufficient capacity to enable a free and unobstructed flow of high-pressure steam to low-pressure cylinders by the simple movement of a lever—a by-pass valve of sufficient capacity to relieve the cylinder from producing a vacuum, as is liable by a locomotive-engine when running without using steam, and thereby obviate the necessity of using vacuum-valves and other features pointed out in the specification.

My invention is illustrated in the accompanying drawings, shown as a tandem multiple-cylinder locomotive, wherein many of the features are equally as effective and as well adapted to stationary and other engines and also to simple or single expansion engines, and wherein—

Figure 1 is a central vertical section as to most parts of the engine. Fig. 2 is an elevation of such parts as are necessary to show the connection of the by-pass valve and slide-valve balance-plate operative mechanism. Fig. 3 is a transverse section on line X X, Fig. 1. Fig. 4 is a transverse section on line Y Y, Fig. 1. Fig. 5 is a transverse section on line Z Z, Fig. 1. Fig. 6 is a modification used in connection with low-pressure cylinder 2.

Similar figures of reference indicate similar parts throughout the various views.

The high-pressure cylinder 1 is placed in line with the low-pressure cylinder 2, the cylinder 1 having a front head 3 and a back head 4 and the cylinder 2 having a front

head 5 and a back head 6. Cylinder 1 has a piston comprising a central disk 7, secured to an outer annular ring 8 by bolts 9 and carrying packing-rings 10 11, the disk 7 having a central hub 12, wherein is secured piston-rod 13 in any desired or suitable way. Cylinder 2 has a piston composed of a central disk 13, of less diameter than the bore of cylinder 1, secured to an annular ring 14, cored at 15 to lighten it, and secured to disk 13 by bolts 16 and carries packing-rings 17 18. The disk 13 has a central hub, part 19 projecting at the back side and part 20 at the front side. Piston-rod 13 from cylinder 1 is secured to hub 20 by key 21, and piston-rod 22 is secured to hub 19 and thereafter passes through the back head 6 and is secured to the cross-head. (Not shown.) Thus it will be seen the pistons must act in unison. The manner of securing the rods 13 22 to the low-pressure piston may be of any of the approved forms heretofore or now in use. The front head 5 of cylinder 2 has a central opening 23 for the free passing of piston-rod 13, and upon its front side a seat 24 is formed, whereon is secured flange 25 of connecting-sleeve 26 by bolts 27. The sleeve 26 is open at its back end 28 and, if desired, may be provided with any suitable packing 29 to surround piston-rod 13, which passes through it. The connecting-sleeve 26 is slightly enlarged at its front end 30, where it enters central opening 31 in back head 4 of cylinder 1. It also has an internal flange 32 at this end, which passes inward to just clear piston-rod 13, and within its central space 33 and abutting the inner wall of flange 32 it may, if desired, be provided with a bushing 34 to form a bearing or support for piston-rod 13. In order to allow for the expansion of the sleeve 26 through opening 30 and at the same time prevent any leakage of steam around it, its high-pressure end is provided with a soft metallic ring 35, (preferably copper wire,) and against it is forced the beveled edge 36 of annular ring 37, and all secured in place for a tight joint by bolts 38. The object of the sleeve 26 and the mechanism just described is to cover the piston-rod, connect the cylinders, and gain room to inspect the piston of cylinder 2 between the two cylinders, and therefore the stuffing-boxes usually heretofore employed on heads 4 5 are superseded

by my mechanism, as when heads 3 5 are unbolted from their cylinders the high and low pressure pistons can be moved forward until heads 4 and 5 abut, as the connecting-sleeve 26 will telescope into cylinder 1, and the low-pressure piston can be moved into space A, where it will all be visible and accessible for inspection or adjustment, as with the usual longitudinal centers of cylinders there will be ample room, whereas heretofore the room was cramped and limited by the separate stuffing-boxes projecting from heads 4 5 into space A.

Mounted on cylinder 1 is an exhaust-steam chest 39 over ports 40 41, and within chest 39 is a slide-valve 42, having live-steam ports 43 44 therethrough to the cylinder-ports, they being wider apart at the bottom than at the top or angling inwardly toward the top. An exhaust-port 45 is central between ports 43 44 and opens upward into a cavity 46, which has openings 47 48 (see Fig. 3) through each side directly into chest 39, the chest having a neck 49, joined to a neck 50 of low-pressure steam-chest 51, so that the exhaust from cylinder 1 has a free and direct passage through valve 42 directly into chest 39 and through necks 49 50 to steam-chest 51 for admission to cylinder 2. This construction eliminates the usual steam-chest stuffing-boxes, as the valve-stem 52, attached to and moving valve 42 at one end and attached to valve-yoke 53 of valve 54, passes within necks 49 50. Above valve 42 is a balance-plate 55, having a port 56 through its lower face into its interior space 57, which is open at its top and communicates with live-steam passage 58, connected to steam-pipe 59, reaching from cylinder-saddle 60, communicating with the branch pipes within the smoke-box and controlled by the engine's throttle-valve. Extending outward from the end of steam-pipe 59, where it is attached to steam-chest cover 61, is a chamber 62, forming a connection between port 58 and steam-pipe 59, and within chamber 62 is a by-pass valve 63, pierced by openings 64 to permit free fluid flowing and broadened at the top 65 and bottom 66, and a port 67 permits live steam to pass from chamber 62 into exhaust-steam chest 39 and around slide-valve 42 when valve 63 is moved to open port 67, as shown in Fig. 1, and with the arms 68 69 and rod 70, as shown in full lines in Fig. 2, and as when live steam is admitted to all the cylinders. Steam-chest neck 49 has a flange 71, and around steam-chest neck 50, which abuts it, is a soft metallic ring 72, (preferably of copper wire,) against which is forced the beveled edge 73 of ring 74, held by bolts 75, passing through flange 71 and ring 74, to make a steam-tight joint. Low-pressure cylinder 2 has a slide-valve 76 made of hollow box form for the convenience of passing yoke 53 over it, and through its bottom wall is exhaust-port 77, affording means of communication between the steam-ports 78 79 and the exhaust-port 80. The cavity

81 of the valve also communicates with a port 82 through the valve's upper wall, and the balance-plate 83 also has a port 84, through which exhaust steam enters the cavity 85 of balance-plate 83. In order to permit valve 76 to lift when the engine is running with steam shut off, and thereby prevent producing a vacuum in cylinder 2, a yoke 86 is formed on the balance-plate 83 above its top, (see Figs. 1 and 5,) and inserted therein is a cam 87, formed on shaft 88, as seen in Figs. 1 and 5, where the cam is in one of its inoperative positions, as when the engine is working with live steam in all cylinders, and by-pass valve 63 and cam 87 are in the positions shown in Fig. 1, with their arms 68 69 and rod 70 as seen in full lines in Fig. 2. When it is desired to shut off live steam from cylinder 2 and work the engine compound, the rod 70 will be moved forward, forcing arms 68 69 to the positions B, as seen in dotted lines in Fig. 2, which movement will cause by-pass valve 63 to move into a vertical position, as line *y y*, and cover port 67, when only the exhaust steam from cylinder 1 will pass to cylinder 2. The above movement will have no effect to change the relations or movements of the valve 76, balance-plate 83, or its yoke 86 of cylinder 2, as the part 89 of cam 87 will still be clear of and not lift yoke 86, and balance-plate 83 will operate as heretofore. When the engine is running with the steam shut off, the rod 70 will be moved back, carrying arms 68 69 to position C, moving by-pass valve 63 into a position at right angles to that shown in Fig. 1 or line *f f*, and by means of the openings 64 therethrough free by-pass passage will be had from cylinder 1 through valve 42, balance-plate 55, port 58, chamber 62 to port 67 and thereafter through valve 76 to the exhaust-port 80 of cylinder 2 to the atmosphere, while the relief of the cylinder 1 is at the same time effected, as by the movement of arm 68 to position C the part 90 of cam 87 is swung up, bearing under and lifting yoke 86 and carrying the balance-plate 83 clear of valve 76, relieving cylinder 2. Arm 69 (see Fig. 5) operates shaft 91, coned at 92 and enlarged at 88. Arm 68 (see Fig. 4) operates shaft 94, having a cone 95 and a tongued projection 96, fitting in cone 95 of by-pass valve 63. The by-pass valve 63, with its connected and operative mechanism, by itself, and distinct from cam 87 and its mechanism, is equally effective for the relief of simple or single expansion-cylinders, as for multiple expansion-cylinders, and valve 76, its balance-plate 83, with its yoke 86, cam 87, and their connected and operative mechanisms are, independent of by-pass valve 63 and its mechanism, equally effective by themselves, for a by-pass or relief from vacuum creating in simple or single expansion-engines, as in multiple expansion-engines. Therefore I do not wish to be considered as limiting my claims thereto to any special type of engines.

In Fig. 6 I show a modification for use over cylinder 2 wherein steam-chest cover 97 has a chamber 98, in which is placed a by-pass valve 99, having openings 100 therethrough, similar to openings 64 in Fig. 4, and a passage 101, leading from the steam-chest 51' to chamber 98, and a port 102, leading from chamber 98 to cavity 85' of balance-plate 83' and therethrough to valve 76' and its cylinder. When the engine is working under steam, the by-pass valve 99 will be closed, as seen in Fig. 6, and when the engine is running with the steam shut off the by-pass 99 will be moved to line *k* K, giving free passage from the steam-chest 51' to the valve 83' and therethrough to the engine's exhaust and the atmosphere and prevent creating a vacuum in the cylinder and applicable to any locomotive or other steam engines, simple or compound.

I claim—

1. In an engine, cylinders arranged tandem, pistons and piston-rods within the cylinders, exhaust-steam chests mounted on the cylinders, and a slide-valve having live-steam ports therethrough, a balance-plate above the valve, an exhaust-port in the valve open to the exhaust-port of the cylinder, and having means of communication from the cylinder-ports directly through the valve to the interior of the exhaust-steam chest, and means to operate the valve.

2. In an engine, cylinders arranged tandem, pistons and piston-rods within the cylinders, steam-chests on the cylinders, a steam-valve having vertical steam-ports therethrough, an exhaust-port at the bottom and at each side, communicating with a central cavity and therethrough to the interior of the steam-chest, a balance-plate mounted above the valve, having a central port put in alternate communication with the valve's steam-ports, and also in constant communication with an interior open space in the balance-plate, a cover over the balance-plate, a chamber in the cover in communication with the engine's steam-pipe, and a port leading from the chamber to the balance-plate's open space.

3. In an engine, high and low pressure cylinders, pistons and their rods within the cylinders, steam-chests on the cylinders, valves in the steam-chests, covers on the steam-chests and in the high-pressure cover a chamber connected to the engine's steam-pipe and having a port communicating with the high-pressure valve and therethrough to the cylinder's steam-ports, a by-pass valve in the cham-

ber, a port from the chamber communicating with the interior of the steam-chest, and means to operate the by-pass valve to open or close the port aforesaid to admit or shut off live steam leading to the interior of the exhaust-steam chest, and exterior to the exhaust-steam-chest's valve.

4. In an engine, a cylinder, a piston in the cylinder, a steam-chest mounted on the cylinder, a steam-valve in the steam-chest, a balance-plate on the steam-valve, a cover on the steam-chest and over the balance-plate, means inclosed therein and upon the relief-plate by which to lift the relief-plate from the valve and means exterior to the cover for the operation of the lifting means.

5. In an engine, multiple cylinders, pistons and rods within the cylinders, steam-chests mounted upon the cylinders, valves within the steam-chests, relief-plates on the valves, a by-pass valve for one of the cylinders, a relief-plate-lifting means for the valve of the other cylinder, means to connect the by-pass valve and the lifting means for cooperative action, and means for their coacting movement.

6. In a steam-engine, cylinders therefor, a piston for each cylinder, a steam-chest for each cylinder, a steam admission and exhaust valve for each cylinder, a balance-plate for each valve, a by-pass valve for each steam-chest, a chamber wherein the by-pass valve is located, a steam-passage from the steam-chest to the by-pass chamber, a steam-passage from the by-pass chamber to the balance-plate and therethrough to the engine's valve and cylinder, and means to operate the by-pass valve to close or open the passage from its chamber to the balance-plate.

7. In an engine, multiple cylinders arranged tandem and spaced longitudinally apart, pistons within the cylinders and connected by a common piston-rod, heads for the cylinders, a connecting-sleeve surrounding the piston-rod, removably secured to one cylinder-head and freely passing into and telescoping through the adjacent cylinder-head, and into the high-pressure cylinder when the low-pressure piston is to be removed into the space between the cylinders, for inspection or the adjustment of its parts.

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

HENRY F. COLVIN.

Witnesses:

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R. C. WRIGHT.