

(No Model.)

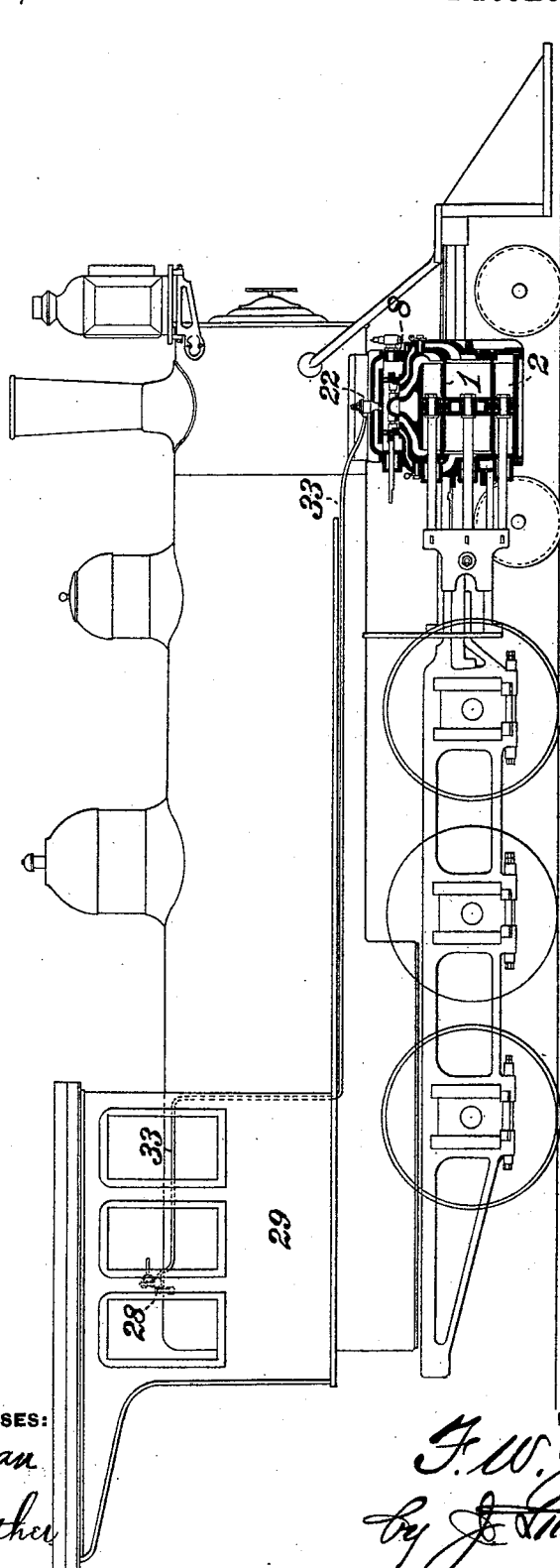
2 Sheets—Sheet 1.

F. W. JOHNSTONE.
STARTING VALVE FOR COMPOUND ENGINES.

No. 460,581.

Patented Oct. 6, 1891.

FIG. 1.



WITNESSES:

T. J. Hogan
F. C. Gaither

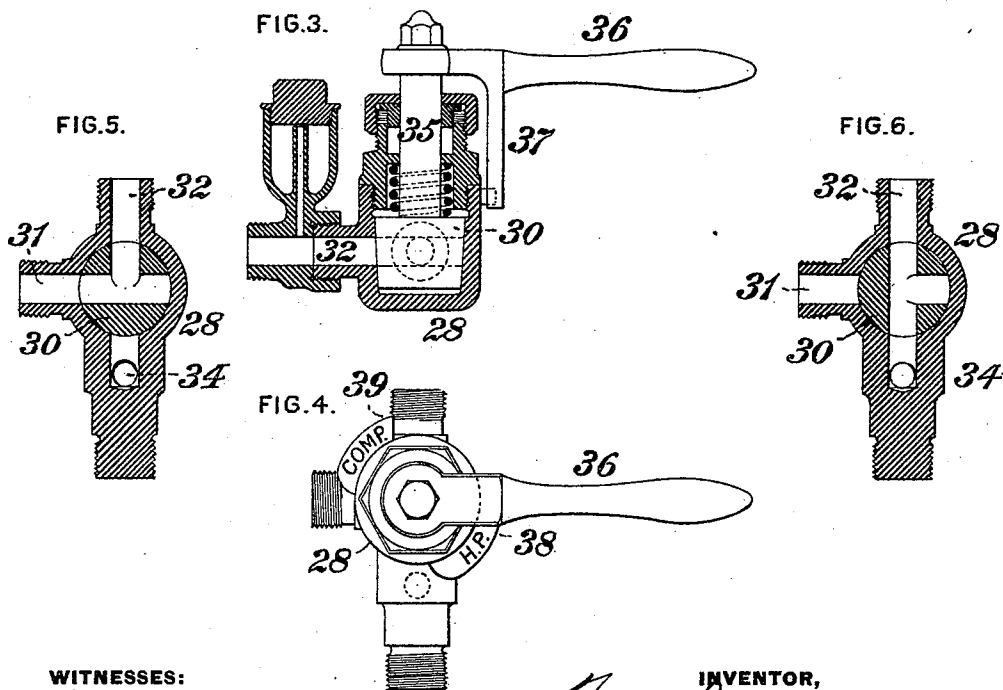
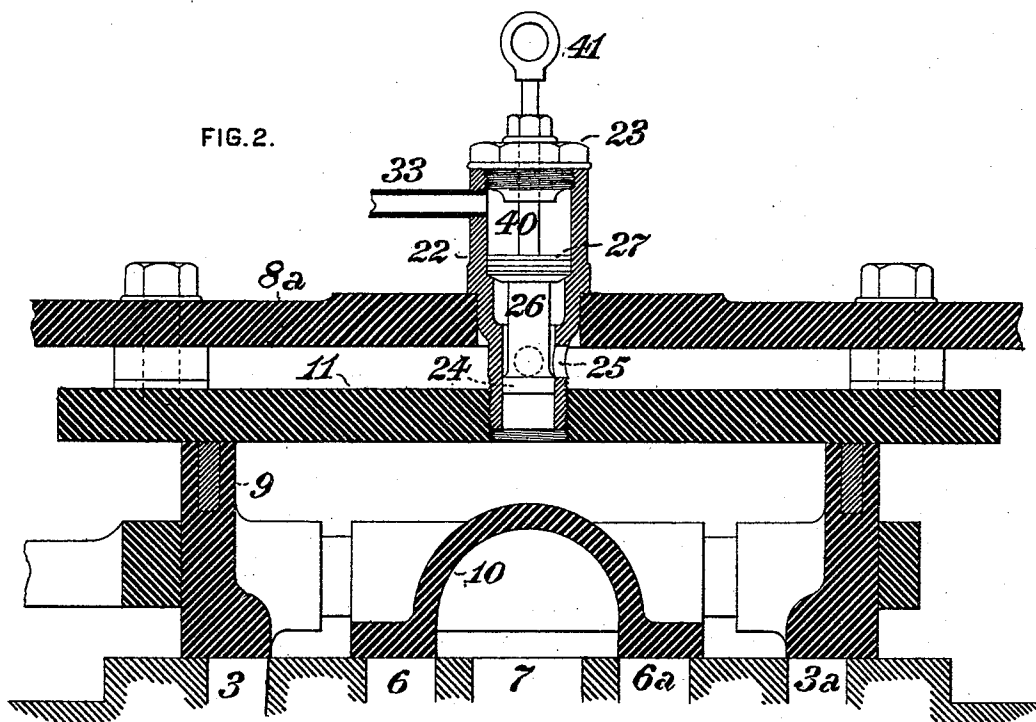
INVENTOR,

F. W. Johnstone,
by J. Snowden Bell.
Att'y.

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UNITED STATES PATENT OFFICE.

FRANCIS W. JOHNSTONE, OF MEXICO, MEXICO.

STARTING-VALVE FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 460,581, dated October 6, 1891.

Application filed July 20, 1891. Serial No. 400,078. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. JOHNSTONE, a citizen of the United States, residing at the city of Mexico, in the Republic of Mexico, have invented a certain new and useful Improvement in Starting-Valves for Compound Engines, of which improvement the following is a specification.

The object of my invention is to provide a simple and effective appliance for the admission of live steam to the low-pressure cylinder of a compound engine under circumstances—as in starting the engine, &c.—in which it may be necessary or desirable to temporarily exert a higher pressure upon the low-pressure piston than is imparted thereto in the normal operation of the engine.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a diagrammatic side view of a compound locomotive-engine illustrating an application of my invention; Fig. 2, a vertical central section, on an enlarged scale, through the cylinders, valve-chest, distribution-valve, and starting-valve case; Fig. 3, a vertical central section through the regulating-valve case; Fig. 4, a plan or top view of the same; and Figs. 5 and 6, horizontal sections through the same, showing the valve in position for the operation of the engine as compound and simple high-pressure, respectively.

My invention is herein illustrated as applied in connection with a compound locomotive-engine having each of its high-pressure cylinders 1 inclosed within an annular low-pressure cylinder 2, and having a slide distribution-valve composed of an outer section 9 and an inner section 10, and reciprocated in a valve-chest 8. The outer section of the valve controls the admission and exhaust of steam to and from the high-pressure cylinder, and the inner section controls the admission of steam from the high-pressure cylinder to the low-pressure and its exhaust from the low-pressure cylinder.

The above construction, which forms the subject-matter of an application filed by me November 4, 1890, Serial No. 370,321, and does not in and of itself form part of my present invention, is here shown as exemplifying a type of compound engine to which the same

is desirably adaptable, but to which it is not necessarily limited.

In the practice of my invention I provide a cylindrical case or chest 22, closed at top by a removable cap or cover 23, and having its lower end, which is open, screwed into an opening in the balance-plate 11, which fits against the top of the outer valve-section 10. The case 22 fits in and forms a steam-tight joint with the cover 8^a of the valve-chest 8. A starting-valve 24 is fitted steam-tight in the lower portion of the case and controls communication between one or more ports 25, formed in the case between the balance-plate 11 and valve-chest cover 8^a and open to the live steam in the valve-chest and the open lower end of the valve, which is in communication with the space between the inner and outer valve-sections 9 and 10. The starting-valve 24 is fixed upon the lower end of a stem 26, upon the upper end of which is fixed an actuating-piston 27, which is of greater diameter than the starting-valve and is fitted to work steam-tight in the case 22 and to be normally seated on an annular face or shoulder therein.

A valve case or chest 28 is supported at a point within easy reach of the engineer, preferably inside the cab 29 of the engine, and a regulating-valve, which, in this instance, is in the form of a plug-cock 30, is fitted in said case. The cock 30 is of the three-way type and controls a passage 31, connected with the steam-space of the boiler, a passage 32, connected by a pipe 33 with the case 22 of the starting-valve adjacent to the upper end thereof, and an exhaust-passage 34, leading to the atmosphere. The cock 30 is fixed upon a stem 35, having an operating-handle 36, provided with a downwardly-projecting arm 37, which is adapted to abut against one or the other of two stops 38 and 39 at the extremities of the range of movement of the cock about its axis. When the cock is turned into position in which the arm 37 abuts against the stop 38, as in Fig. 5, communication is thereby opened between the case 22, above the piston 27, and the boiler, in which position the engine will work normally as a compound engine, and when turned into position in which the arm 37 abuts against the stop 39, as in Fig. 6, communication is opened between the case 22, above the piston 27, and the at-

mosphere, whereupon, and as the result of the upward movement of the piston and starting-valve, which is thereby effected, live steam will be admitted to the low-pressure cylinder and the engine will work as a simple high-pressure engine.

It will be seen that when the starting-valve and actuating-piston are in the positions shown in Fig. 2 and the regulating-valve in the position shown in Fig. 5 the preponderance of pressure of steam from the boiler on the upper side of the actuating-piston 27 above that on the smaller effective area on its lower side admitted from the valve-chest through the ports 25 will maintain the parts in the positions shown and prevent the admission of live steam to the inner valve-section or the space between the valve-sections. The engine will consequently be normally operated as a compound engine. When it is desired to admit live steam to the low-pressure cylinder, as in starting or when a temporary increase of power is desired, the engineer moves the regulating-valve into the position shown in Fig. 6, thereby exhausting steam from the case 22, above the piston 27, and releasing the downward pressure theretofore acting on said piston. The preponderance of upward pressure of steam from the valve-chest admitted through the ports 25 to the lower side of the piston 27 above that on the smaller area of the upper side of the starting-valve thereupon raises the piston and starting-valve until arrested by the cap 23, thereby opening communication between the ports 25 and the inner valve-section 9. Steam from the valve-chest will thereupon be admitted directly to the low-pressure cylinder 2 through the ports 25 and open end of the case 22 and will act with full valve-chest pressure alternately upon opposite sides of the low-pressure piston, thereby causing the engine to operate as a simple high-pressure engine having a piston area largely in excess of that of the normal initial or high-pressure cylinder, in which, under the above conditions, an equilibrium of pressure is maintained on opposite sides of its piston through the direct admission of steam thereto by the outer and inner sections of the valve.

A central stem 40, having an eye 41 at its outer end, is secured to and projects from the upper side of the piston 27 through the cap 23 and serves to facilitate the insertion and removal of the actuating-piston and starting-valve. It will be seen that, if preferred, the closure of the starting-valve may be effected by the application of manual power, through suitable connections, to the stem 40 in lieu of employing a regulating-valve and pressure-conducting pipe, as described and shown, the opening of the valve being effected by the upward pressure from the valve-chest, as before described.

I claim as my invention and desire to secure by Letters Patent—

1. In a compound engine, the combination

of a low-pressure distribution-valve or valve-section, a starting-valve controlling communication between a live-steam receptacle and said distribution-valve, an actuating-piston connected to said starting-valve and subject continuously in operation to steam-pressure on one of its sides in direction to impart opening movement to the starting-valve, and a regulating-valve controlling the supply and exhaust of steam to and from a larger area on the opposite side of said piston, and thereby instituting and releasing, respectively, a preponderance of steam-pressure thereon in direction to impart closing movement to the starting-valve, substantially as set forth.

2. In a compound engine, the combination of a valve-chest, a valve working therein and having a section-controlling low-pressure-cylinder distribution, a case or chest connected to the valve-chest and open at different points to said chest and to the low-pressure distribution-valve section, respectively, a starting-valve fitting in said chest and controlling communication between the valve-chest and low-pressure distribution-valve section, a piston fitting in said case and connected to the starting-valve, said piston being continuously open on one side to the pressure in the valve-chest, a regulating-valve case connected with the boiler and with the piston-case on the side of the piston opposite that which is open to valve-chest pressure, and a regulating-valve which in one position opens communication between the piston-case and the boiler and in another between the piston-case and an exhaust-passage, substantially as set forth.

3. In a compound engine, the combination of a high-pressure cylinder, a low-pressure cylinder, steam-passages leading from opposite ends of said cylinders to a valve-face, an exhaust-passage leading from said valve-face, a valve-chest covering said valve-face and the ends or ports of said passages, a distribution-valve composed of an outer section and an independent inner section and controlling the valve-face ports, said valve providing a passage for steam between the sections from the high-pressure to the low-pressure cylinder, a balance-plate closing the top of the outer valve-section, a starting-valve case opening into the space between the valve-sections through the balance-plate and having ports opening into the valve-chest, a starting-valve fitting said case and controlling communication between said ports and the space between the valve-sections, an actuating-piston connected to the starting-valve and fitting in the case above the ports thereof, a pipe leading from the starting-valve case above the piston to a regulating-valve case, and a regulating-valve controlling communication between said pipe and the boiler and between said pipe and an exhaust-pipe, respectively, substantially as set forth.

4. The combination of a case or chest having an open lower end adapted to be secured to a valve balance-plate and a lateral port or

ports, a starting-valve fitting in said case, a
piston fitting in said case above its ports and
connected to the starting-valve, and a stem
connected to the piston on the side opposite
5 the starting-valve and projecting outwardly
from the case, substantially as set forth.

5. The combination of a case or chest hav-
ing an open lower end adapted to be secured
to a valve balance-plate and a lateral port or
10 ports, a starting-valve fitting in said case, a
piston fitting in said case above its ports and

connected to the starting-valve, said piston
having a greater effective area on its side
farthest from the starting-valve, and a pas-
sage in said case above the piston, adapted for 15
connection with a pipe leading to a regulat-
ing-valve, substantially as set forth.

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Witnesses:

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