(No Model.) 2 Sheets—Sheet 1.

J. F. MURPHY.
COMPOUND ENGINE.

No. 474,643. Patented May 10, 1892.

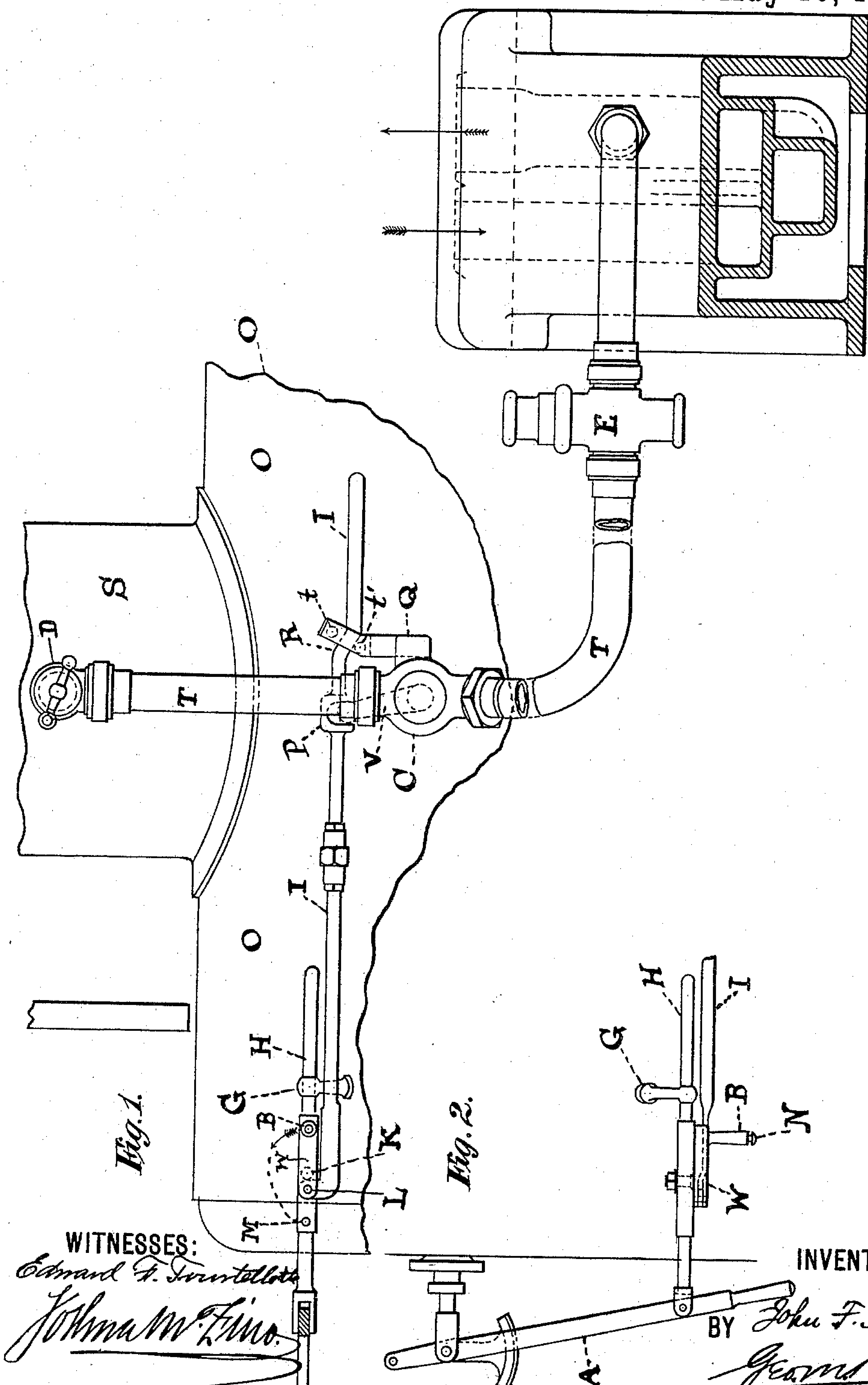


Fig. 1.

Fig. 2.

WITNESSES:
Edward F. Trowtellotte
John McFinn

INVENTOR
BY John F. Murphy
Geo. M. Baker
ATTORNEY

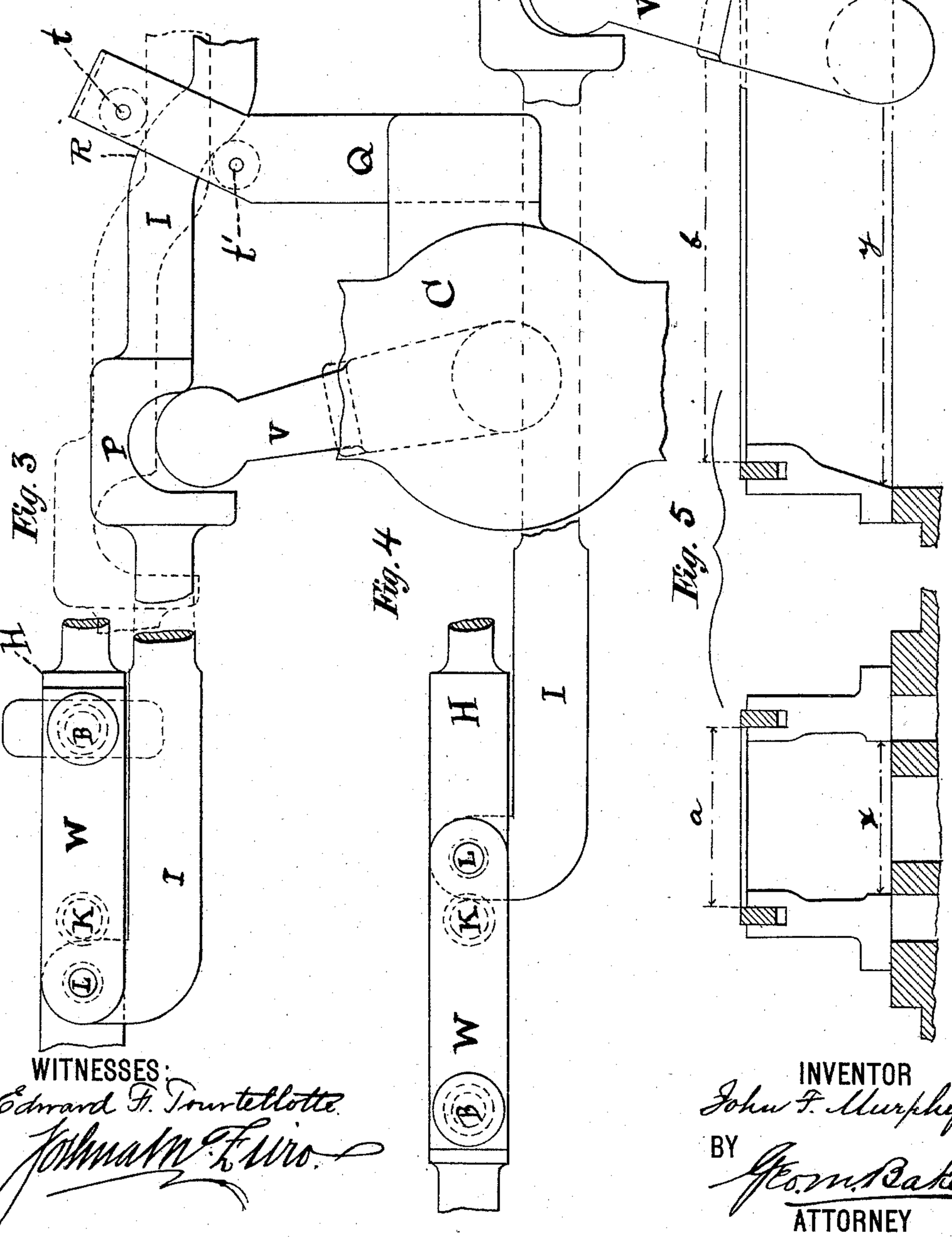
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

J. F. MURPHY.

COMPOUND ENGINE.

No. 474,643. Patented May 10, 1892.



WITNESSES:
Edward F. Tourtellotte.
Johnathan F. Wiro.

INVENTOR
John F. Murphy
BY
Geo. W. Baker
ATTORNEY

UNITED STATES PATENT OFFICE.

JOHN F. MURPHY, OF PATERSON, NEW JERSEY.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 474,643, dated May 10, 1892.

Application filed November 9, 1891. Serial No. 411,270. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. MURPHY, a citizen of the United States, residing at Paterson, in the county of Passaic and State of New Jersey, have made certain new and useful Improvements in Compound Engines, of which the following is a specification.

My invention relates to that class of compound engines in which in starting steam may be admitted directly to the low-pressure cylinder without first passing it into the high-pressure cylinder.

The objects of my invention are, first, to provide means for admitting into the receiver just before starting live steam at a pressure equal to that of the exhaust-steam from the high-pressure cylinder when the engine is working at maximum cut-off, and, secondly, to regulate the passage of the live steam into the receiver when the throttle-valve is closed and also in connection with the movements of the throttle-lever. These objects I accomplish by means of the devices shown in the accompanying drawings, in which—

Figure 1 is an elevation of a portion of the boiler of a locomotive-engine and its steam-dome with my improvements attached thereto. Fig. 2 is a plan view of the starting-handle, the throttle-lever, and parts connecting the same. Figs. 3 and 4 are views of the lever-arm of the starting-valve and a portion of the operating-rod I, showing the position of the lever-arm V when the starting-valve is open, Fig. 4, and shut, Fig. 3. Fig. 5 is a view of the slide-valve of the high-pressure cylinder which it is desirable to use in my improved compound engine.

O is the boiler. S is the steam-dome.

T is a pipe connecting the steam-dome with the exhaust-passage from the high-pressure cylinder.

D is a valve, through which the steam passes from the steam-dome S into the pipe T.

C is the starting-valve, which regulates the supply of live steam to the receiver.

E is a reducing-valve, placed in the pipe T, intermediate the starting-valve C and the exhaust-passage from the high-pressure cylinder.

V is the lever-arm of the starting-valve C, which is operated by the rod I, one end of the latter being pivoted to the arm W, which in turn is pivoted to the rod H, which last is secured to the throttle-lever A and supported in the guide-bracket G.

The boiler, steam-dome, and the valves C, D, and E may be of any of the usual forms of construction, as I claim nothing new in these as such, but in the novel arrangement of some of them and in the manner of operating the starting-valve. The valve D is not absolutely essential to the working of my improvements; but for obvious and practical reasons—such as repairing the starting-valve, &c.—it always will be well to employ it. It may be of any usual construction—such as a "globe-valve"—and is always left open when the engine is running.

The operation of my improved engine is as follows, reference being had to Fig. 1, in which the starting-valve C is shown as closed: Just before starting the engine and before opening the throttle-valve turn the starting-handle B in the direction of the arrow. This will force the rod I in the opposite direction. The rod I is provided with a notch P, which fits loosely over the end of the lever-arm V of the starting-valve C. When, therefore, the rod I is forced forward, as above stated, it engages with the lever-arm V, throwing it into the position shown in Fig. 4, thereby opening the starting-valve C. This at once admits steam from the steam-dome S into the pipe T, and through the reducing-valve E into the receiver. The object of passing the steam through the reducing-valve is to have it, after it reaches the receiver, of a pressure equal to that of the exhaust-steam from the high-pressure cylinder when the engine is working at maximum cut-off. The throttle-valve is then opened, and as the throttle-lever is pulled backward, carrying with it the rod I, the lever-arm V will be actuated to close the starting-valve C, and thus shut off further live-steam from the receiver. It is evident, however, that a comparatively slight movement of the throttle-lever will be sufficient to close the starting-valve C, and, therefore, as the throttle-lever is drawn back still farther and the rod I follows, it is necessary that it shall

cease to act upon the lever-arm of the starting-valve. This I secure by bending the rod I near its free end and causing it to pass between the two rollers $t\,t'$ on the bracket Q, which is supported on the valve C, as shown in Figs. 1 and 3. As the rod I continues to move in the direction of the arrow, Fig. 1, it will impinge on the roller t' and be lifted up until the notch P clears the lever-arm V and rides over it without interfering therewith, as shown by the dotted lines in Fig. 3. When it is desired to stop the engine, if the stop is to be for only a short time, the throttle-valve is closed by pushing forward the throttle-lever, which in turn thrusts forward the rod I, opening the starting-valve C, thereby again filling the receiver with live steam, and when the throttle is again opened the starting-valve will be closed, as above described. If, on the other hand, the stop is to be for a long time, the starting-valve should be left closed. To accomplish this, before closing the throttle turn the starting-handle B in the direction opposite to that indicated by the arrow in Fig. 1. This has the effect of shortening the rod I, and when the throttle-lever is pushed forward the rod I and its connections will assume the position shown in Fig. 1 and will not act upon the lever-arm V. When it is desired to start the engine again, the same operation is repeated as above described, first opening the starting-valve by means of the starting-handle B. In practice it is desirable in all cases, after the throttle has been opened and the starting-valve closed, to turn forward the starting-handle B, so that the starting-valve will not be opened by the closing of the throttle. Especially should the handle be so turned if the engine is to be stopped suddenly, as in that case if the starting-valve be open the steam may pass into the wrong end of the cylinder and act as a brake. The starting-valve C may be opened and closed by means of the starting-handle B, independently of the movement of the throttle-lever, when the throttle-valve is closed, or it may be operated entirely by the throttle-lever, being opened by the closing of the throttle and closed by the opening of the throttle, as above described. The distance between the pivotal points L and K on the lever-arm W must be such that when the latter is turned in either direction it will move the rod I through a distance sufficient to open or close the valve C. The relative positions of the notch P and the bend R of the rod I and the rollers $t\,t'$ must be such that the moment the lever-arm V has been pulled backward until the valve C is closed the rod I will impinge upon the roller t' and be lifted, as above described. The notch P should be so constructed that it will readily slip over the end of the lever-arm V when the rod I is lifted, as shown in Fig. 3. The starting-handle B may be of any usual form. I have shown it with a spring catch N to hold it in place when it has been turned.

When the valve C has been opened just before starting, as I have described, the receiver will be filled with reduced live steam, so that when the throttle-valve is opened the engine will at once start up either under high pressure or low pressure. Should the slide-valve of the low-pressure cylinder be favorably placed, the reduced steam in the receiver will act upon the piston of that cylinder in exactly the same manner as the exhaust-steam from the high-pressure cylinder would act upon it were the engine under full headway. Should the slide-valve of the high-pressure cylinder be in favorable position, then the live steam will enter that cylinder direct from the boiler and when exhausted will mingle with that already admitted into the receiver through the starting-valve C, to operate upon the piston of the low-pressure cylinder in the usual manner. The pressure of the steam in the high-pressure cylinder will be so great as to lift the slide-valve from its seat, and so fill the steam-chest and passages with steam. This is obviated by making the high-pressure slide-valve with an open top, so as to admit steam above the valve. Any balanced slide-valve, as the "Richardson" valve, may be used. The pressure of the steam on the top of the valve must be greater than that below, and the area of the top $a\,b$ must exceed that of the opening $x\,y$, as shown in Fig. 5.

While I have shown my improvements as applied to a locomotive-engine, they may also be used in connection with a stationary engine.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a compound engine, the combination of the starting-valve, throttle-lever, connections between said valve and lever, and means for lengthening and shortening said connections to the end that said starting-valve may or may not be operated by said lever, substantially as shown and described.

2. In a compound engine, the combination of the starting-valve, throttle-lever, connections between said valve and lever adapted to operate said valve according to the movements of said lever, and means for automatically disengaging said connections from the valve after the latter has been opened, substantially as shown and described.

3. The combination of the valve C, its lever-arm V, the throttle-lever A, a rod connecting said lever-arm V with the said throttle-lever, said rod being provided with a notch P and having its end bent downward, the bracket Q, and the rollers $t\,t'$, substantially as shown and described.

4. The combination of the valve C, its lever-arm V, rod I, provided with the notch P, the lever W, and the starting-handle B, adapted to open and close said starting-valve independently of the movement of the throttle-lever, substantially as shown and described.

5. The combination of valve C, its lever-

arm V, throttle-lever A, connecting-rods H and I, the lever W, the bracket Q, and the rollers *t t'*, substantially as shown and described.

6. The combination of the receiver, valves C and E, the pipe T, lever-arm V, bracket Q, rollers *t t'*, throttle-lever A, and the connecting-rods and lever I, H, and W, substantially as shown and described.

JOHN F. MURPHY.

Witnesses:
JOHN S. COOKE,
CHAS. D. COOKE.