(No Model.) 2 Sheets—Sheet 1.

H. W. FORSLUND.

STEAM ENGINE.

No. 567,188. Patented Sept. 8, 1896.

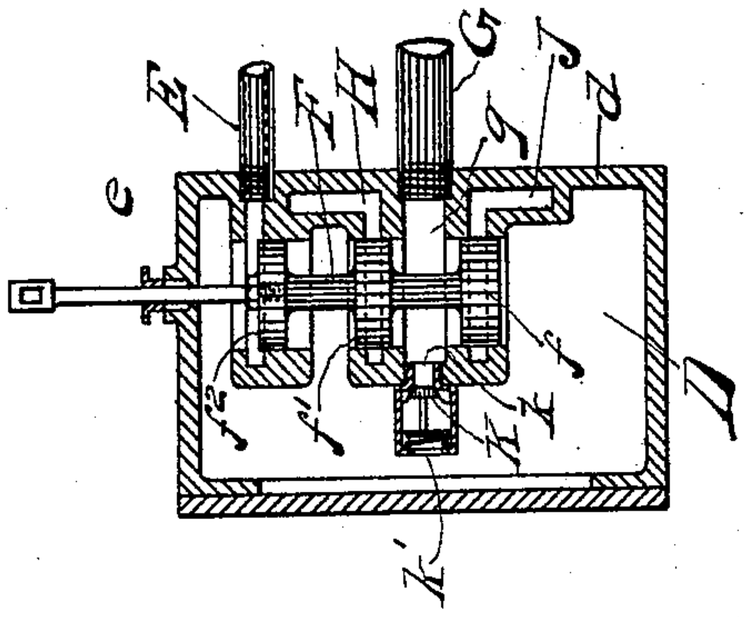

FIG. 2.

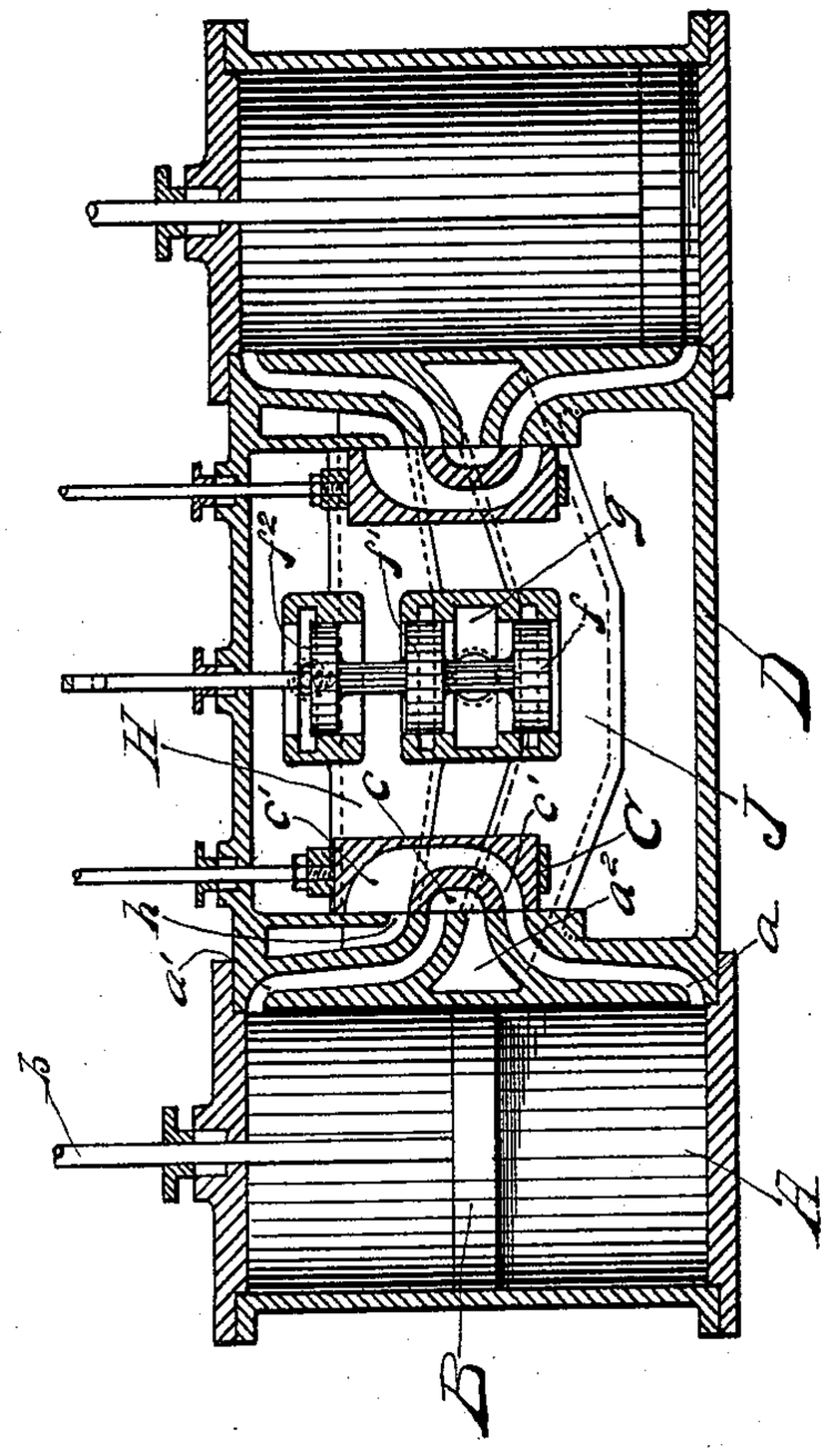

FIG. 1.

Witnesses
E. E. Bartholomew
Spencer Ward

Inventor
Hugo W. Forslund
By his Attorney
Louis C. Wilson

(No Model.) 2 Sheets—Sheet 2.

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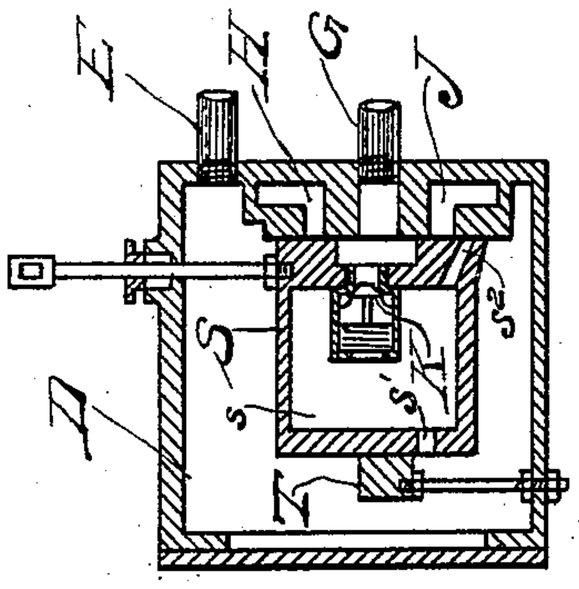

Fig. 5.

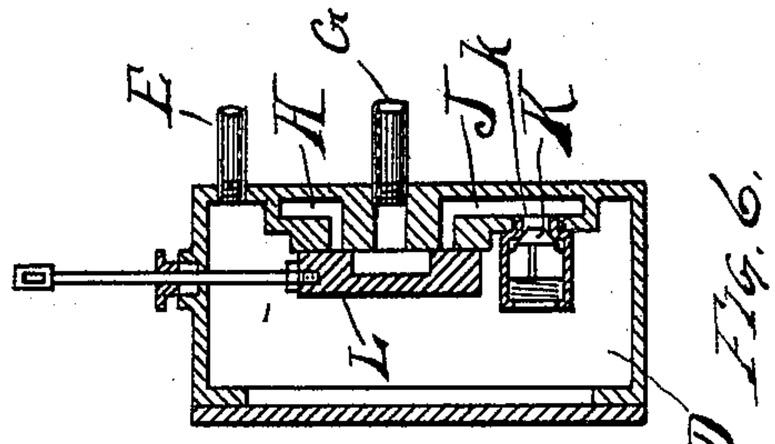

Fig. 6.

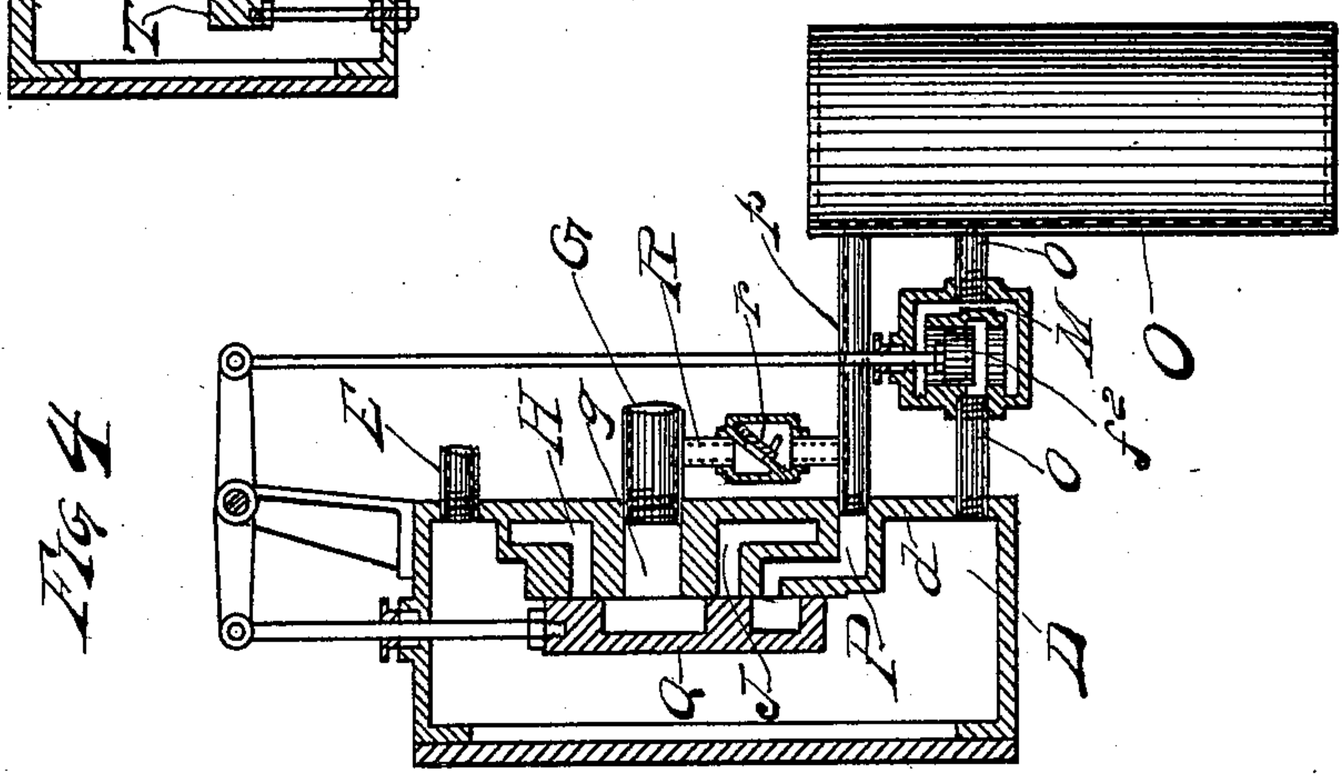

Fig. 4.

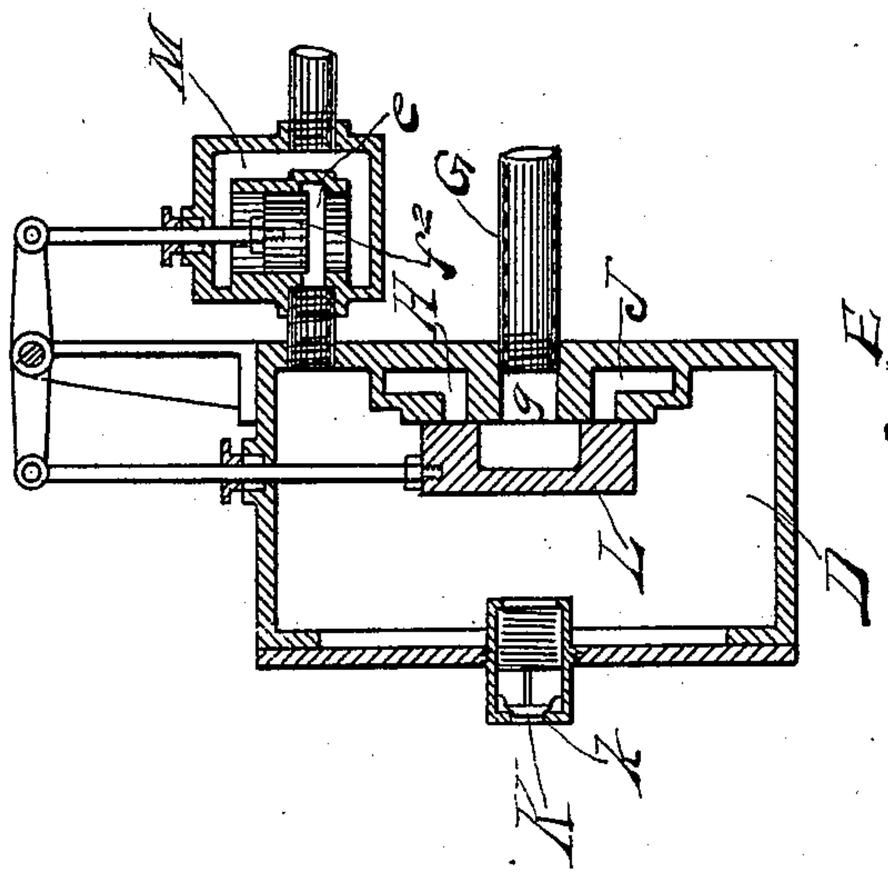

Fig. 3.

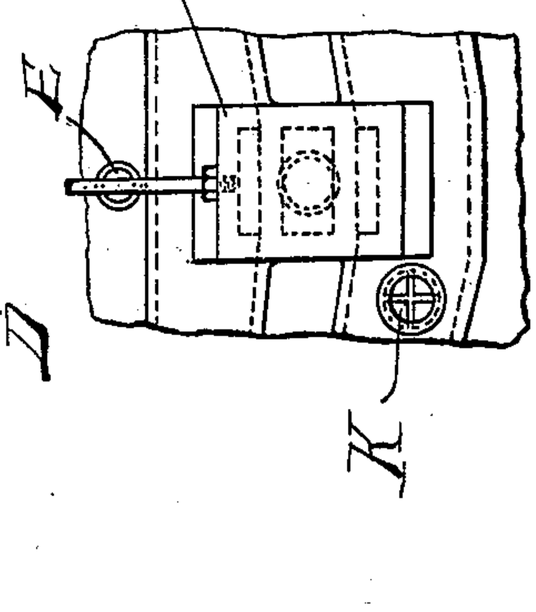

Fig. 7.

Witnesses
E. E. Bartholomew
Jno. Ellen Ward

Inventor
Hugo W. Forslund
By his Attorney
Louis Gibson

UNITED STATES PATENT OFFICE.

HUGO W. FORSLUND, OF CHICAGO, ILLINOIS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 567,188, dated September 8, 1896.

Application filed March 28, 1895. Renewed July 29, 1896. Serial No. 600,990. (No model.)

To all whom it may concern:

Be it known that I, HUGO W. FORSLUND, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to engines capable of being reversed and designed for use in connection with hoisting machinery. Its object is to provide for the operation of the engine under the influence of a descending load without requiring the use of steam to prevent a partial vacuum within the cylinder, but more particularly to provide for the starting of the machinery when the load is not sufficient to readily overcome the inertia and the friction.

The invention consists in such a construction and arrangement of valves that the service of steam may be cut off from the steam-chest while opening the chest to the engine, thereby utilizing the steam already within the chest for starting the engine, but limiting the consumption of steam during the reverse movement of the engine to that quantity.

It consists in a further arrangement of valves whereby the circulation of fluid within the cylinder is provided for after the steam-chest has been emptied of its contents.

The objects in view may be accomplished in a variety of ways, and I therefore show several forms of construction in the drawings, in which—

Figure 1 is a longitudinal section through a pair of cylinders and the steam-chest common to both. Fig. 2 is a transverse section of the steam-chest through the seat of the reversing-valve. Figs. 3, 4, 5, and 6 are views similar to Fig. 2, showing modified forms of construction. Fig. 7 is a plan view of the change-valve shown in Fig. 6.

As the cylinders shown in Fig. 1 are exactly alike I will describe but one of them.

The cylinder is represented at A and its piston at B, the piston-rod at b, the steam-passages leading to opposite ends of the cylinder at $a\,a'$, and an exhaust-chamber located between these passages at a^2. The passages $a\,a'$ and chamber a^2 open through the seat of a D-valve C of common construction and automatically operated, having an exhaust-cavity C and a duct C′ leading around this cavity and opening through the valve-face. The valve C is located within the steam-chest D, within one of whose walls d are cored-out passages H J, leading from the seat of the change-valve F respectively to the port h, opening through the seat of the valve C and to the exhaust-chamber a^2. The change-valve F is of the piston variety, and its seat is formed within a mass of metal upon the inner surface of the side d of the steam-chest. This valve comprises the disk f, controlling the port of the passage J, and the disk f', mounted upon the same stem, controlling the port of the passage H. The main exhaust-port g of the engine is located between the disks $f\,f'$ and leads to a discharge-pipe G. The service-pipe leading from the steam-generator to the steam-chest D is shown at E and is controlled within the chest by a piston-valve f^2, mounted upon the same stem with the disks $f\,f'$ and seated in a mass of metal cast upon the wall d of the chest, the steam being admitted through a port e, which may be entirely closed by the disk f^2.

In the drawings the change-valve is shown as centered, the steam-induction passage of the chest as open, steam is shut off from the cylinders, and the exhaust-port g is cut off from them. To operate the engine so as to carry the load, the change-valve is thrust in, opening the passage H to the steam-chest and the passage J to the exhaust-port g. Steam enters the cylinder through the port h, duct c', and passage a to start the engine. To allow the engine to be operated by the load, the change-valve is drawn out so that the disk f^2 covers the port e, the passage H is opened to the exhaust g, and the passage J to the steam-chest. The steam within the chest expands and enters the cylinder through the chamber a^2 and passage a' to start the engine. The contents of the opposite end of the cylinder are expelled through the passage a, duct c', and passage H. The operation of the cyl-

inder-valve after the first stroke, with the change-valve shifted to either position, will be readily understood. It will be seen that when the engine is operated with the steam-service port *e* closed a vacuum will be quickly occasioned within the steam-chest unless means are provided for relieving it. This obstacle to the operation of the engine is provided against in the construction described by a passage *k* from the exhaust-port *g* to the steam-chest and closed by means of check or puppet valve K, openable by pressure within the port *g*, but closed by pressure within the chest. The valve K may be normally held to its seat by a light spring *k'*, though this is hardly necessary. As soon as there is a partial vacuum in the steam-chest it is relieved by the opening of this valve K, so that in practice the steam exhausted through the passage H will be drawn back into the chest through the passage, the result being the constant transfer of the fluid contents of the cylinder A from one of its ends to the other through the passage H, port *g*, passage *k*, steam-chest D, and passage J.

In Fig. 3 a modification is shown in which the change-valve L is of the D-valve pattern. The steam enters the chest D through a chamber M, and the piston-valve f^2 is located within this chamber, the stems of the two valves L f^2 being connected with crank-arms radiating from a rock-shaft common to both. The initial operation in reversing the engine is the same as in the construction shown in Figs. 1 and 2, but the vacuum is prevented by locating the passage *k* in one of the walls of the chest D, so that air is drawn into the chest, circulated in the engine, and driven out through the exhaust G.

In Fig. 4 is shown a construction in which a supplemental chamber Q is used as an adjunct to the steam-chest D, and is in communication therewith through the pipe *o*, which is controlled by the valve f^2, seated within the chamber M, which is incorporated into and forms a part of the passage from the steam-chest D to the chamber O. In this construction the wall *d* of the steam-chest, in addition to the passages H J, is provided with a duct P, which is passed through the wall and opens through the seat of the change-valve Q adjacent to the port of the passage J. A pipe *p* leads from the outer end of the duct P to the interior of the chamber O. The valve Q is so ported as to bring the duct into communication with the port of the passage J when the port of the passage H is opened to the exhaust-port *g*, so that the engine is served with steam from the chamber O. The valve f^2 is operated by the same shaft as the valve Q, and is so disposed as to close the passage from the steam-chest to the chamber Q when the latter is brought into communication with the passage J, as already described. In this form of construction provision is made for preventing the vacuum by connecting the exhaust-pipe G with the pipe *o* by means of the pipe R, within which is located the flap check-valve *r*, openable by suction in the pipe *p*.

In Fig. 5 is shown a construction in which a supplemental chamber is used for providing the necessary steam-pressure for starting the engine in the reverse direction, and is formed directly within the body of the change-valve, which in this instance is marked S, the chamber being shown at *s*. This chamber has an induction-port *s'*, by means of which it receives steam from the steam-chest D. It has an eduction-port s^2, leading through the face of the valve and adapted to register with the port of the passage J when the valve is shifted to open the passage H to the exhaust G. When the valve is in this position, the port *s'* is closed by the block T, fixed within the steam-chest D and in sliding contact with the back of the valve S. In this construction the check-valve K, for preventing the vacuum, is located within the chamber *s* and closes a passage leading from the cavity of the valve S to this chamber.

The results secured from these several forms of construction are the same, with the exception that in those forms in which the steam-service pipe is not shut off from the steam-chest the slide-valves are held to their seat by continuous pressure.

In Figs. 6 and 7 a modification is shown in which the relief-passage *k* leads from the steam-chest D to the passage J, the valve K being openable by pressure within the passage J. This construction contemplates a disposition of the eccentric the reverse of that used in the several forms shown in other figures, that is to say, the pressure for raising the elevator is applied through the passage J instead of through the passage H. As this change involves no invention and is one which is common in the art I have not deemed it necessary to show the other parts of the engine. Having shown the valve f^2 in other modifications as applied to the steam-service pipe, I do not deem it necessary to repeat it in illustration of this modification. In the form of construction now under consideration the change-valve L is of the same form as is shown in Fig. 3. When thrust forward to uncover the port of the passage H to the steam-chest D, it brings the passage J into communication with the exhaust G, and as the steam-chest D is emptied of its contents the valve K is lifted and the steam driven out of the cylinder by the advance of the piston into the passage J is drawn back into the steam-chest to again enter the cylinder through the passage H. In this construction the valve K is located at one side of the seat of the valve L, in order that it may obstruct the free movement of the valve.

I believe I am the first to provide a reversing-engine with a temporary supply of steam for starting, reliance being had upon the load to operate the engine after it is under headway. Any form of reversing-gear which will

turn the live steam into the cylinder as it is being shifted to reverse the movement will come within the scope of my invention, and while I have shown as means for accomplishing this purpose a construction in which reliance is placed upon the expansibility of a chest full of steam cut off from the source of power as it is opened to the engine I do not desire to be limited thereto.

I claim as my invention—

1. The combination with a reversible hoisting-engine and with its steam and exhaust passages, of a reverse-valve system for controlling such passages and adapted when shifted to reverse the engine to provide it with a temporary supply of steam for starting.

2. The combination with a reversible hoisting-engine having a steam-chest and service and exhaust passages and a steam-induction passage for the chest, of a reverse-valve system for controlling such passages and adapted when shifted to reverse the engine to open the steam-chest to the cylinder and cut it off from the source of power.

3. In a reversible hoisting-engine the combination with reverse mechanism of a throttle-valve for closing the induction-passage of the steam-chest, and operative connection between the reversing mechanism and the throttle-valve, whereby the throttle-valve is opened as the reversing mechanism is shifted to run the engine in one of its directions of movement and is closed when such mechanism is shifted to permit the engine to run in the opposite direction.

4. In a reversible hoisting-engine the combination with a change-valve for reversing the movement of the engine, of a throttling-valve for cutting off the power from the steam-chest and mechanical connection between the change and throttling valves whereby they may be actuated together.

5. The combination with a reversible hoisting-engine adapted to be driven in one direction by its load, of a change-valve system adapted to provide the engine with steam-pressure for starting it in such direction.

6. The combination with a reversible hoisting-engine capable of being driven by its load, and having a steam-chamber for service when so driven, and a valve system for cutting such chamber off from the source of power and opening it to the engine-cylinder, whereby the engine may be started to be so driven by the expansion of the steam within the chamber.

7. The combination with a reversible hoisting-engine of a steam-chamber for supplying pressure when driven by its load, and a valve system whereby the chamber may be brought into communication with the source of power when the engine is not so driven and may be cut off therefrom when so driven.

8. The combination with a reversible hoisting-engine having a steam-chest, of change or reversing valves constructed and arranged to simultaneously close the induction-passage of the steam-chest and open such chest to the cylinder, and a relief-valve automatically openable to the interior of the engine by pressure from without.

9. The combination with a reversible hoisting-engine having a steam-chest, of change or reversing valves constructed and arranged to close the induction-passage of the steam-chest and to open such chest to the cylinder, and a relief-valve automatically openable to the interior of the engine by pressure from without.

10. A hoisting-engine, capable of being driven in the reverse direction by its load, and having a steam-chamber for service during the reverse movement of the engine and a valve system for cutting such chamber off from the source of power, and opening it to the engine-cylinder, whereby the engine may be started in its reverse movement by the expansion of the steam within the chamber.

11. The combination with a hoisting-engine, of a steam-chamber for supplying pressure for reversing the engine, and a valve system whereby the chamber may be brought into communication with the source of power when the engine is not reversed, and may be cut off therefrom when opened to reverse the engine.

12. The combination with a hoisting-engine, having a steam-chest, of change or reversing valves constructed and arranged to simultaneously close the induction-passage of the steam-chest, and open such chest to the cylinder.

13. The combination with a hoisting-engine, having a steam-chest, of change or reversing valves constructed and arranged to simultaneously close the induction-passage of the steam-chest, and open such chest to the cylinder, and a relief-valve automatically openable to the chest by pressure from without the same.

14. The combination with the cylinder A, having a reciprocating piston, service and exhaust ports, and a valve for controlling such ports, and a steam-chest D, having an induction-port *e*, and an eduction-port *g*, and passages H, J, leading to the seat of the cylinder-valve, of valves *f*, *f'*, *f*², adapted to move together and to control respectively the passages J, and H, and port *e*, said valves being so disposed that they will simultaneously open the passage J, to the steam-chest and the passage H, to the exhaust-port *g*, and close the port *e*, substantially as described and for the purpose set forth.

15. The combination with the cylinder A, having a reciprocating piston, service and exhaust ports and a valve for controlling such ports, and a steam-chest D, having an induction-port *e*, and an eduction-port *g*, and passages H, J, leading to the seat of the cylinder-valve, of valves *f*, *f'*, *f*², adapted to move together and to control respectively the passages J, and H, and port *e*, said valves being so disposed that they will simultaneously open the passage J, to the steam-chest and the passage H, to the exhaust-port *g*, and

close the port *e*, and a pressure-actuated relief-valve adapted to automatically open communication between the port *g*, and the interior of the steam-chest, substantially as described and for the purpose set forth.

16. The combination with a reversible engine, of a throttle-valve for controlling the induction-passage of the steam-chest and reversing mechanism operatively connected and so related that the chest is cut off from the source of pressure when the reversing mechanism is shifted to start the engine in one of its directions of movement, whereby a measured quantity of steam is provided for starting the engine by its expansion.

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

HUGO W. FORSLUND.

Witnesses:
LOUIS K. GILLSON,
E. E. BARTHOLOMEW.