

No. 846,041.

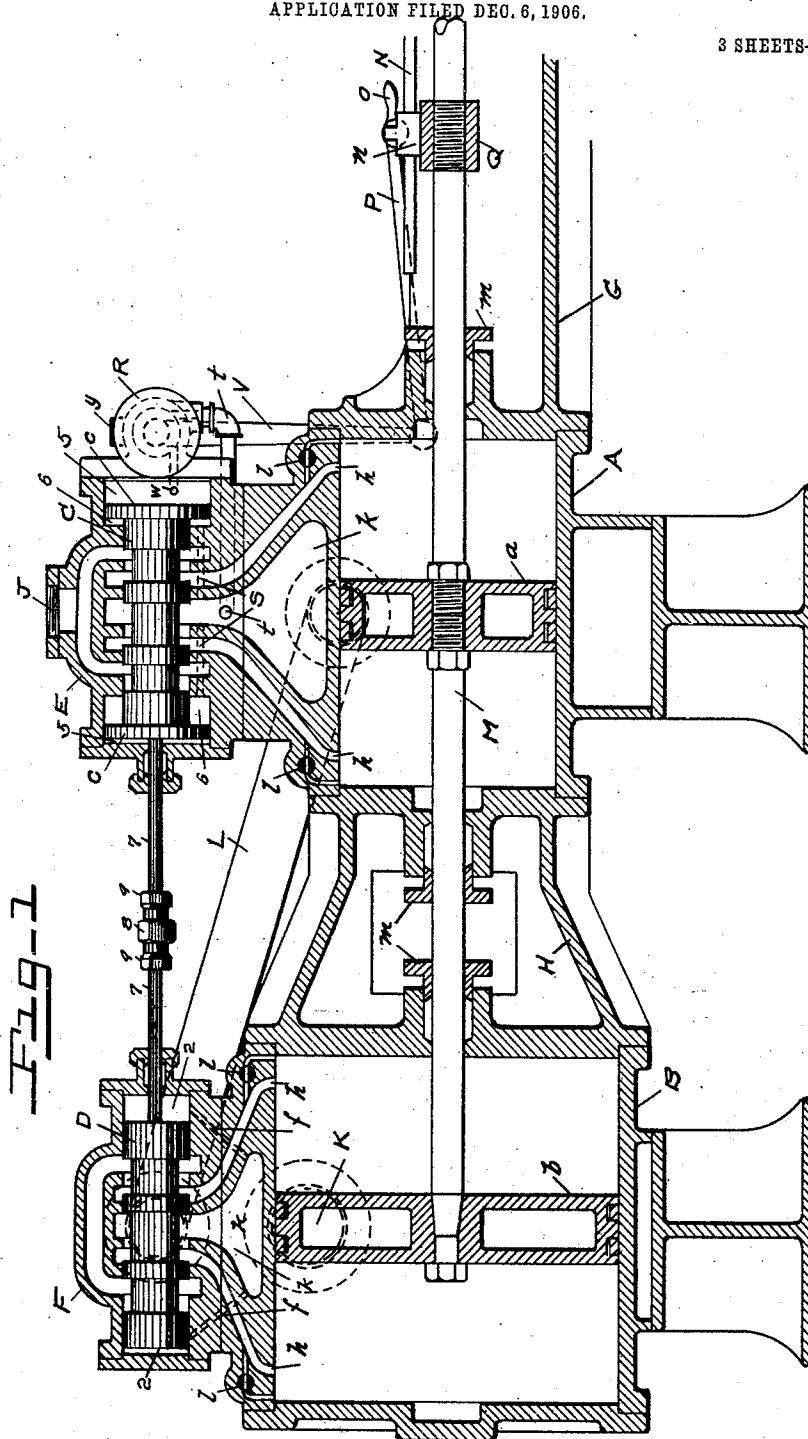
PATENTED MAR. 5, 1907.

F. M. METCALF.

STEAM VALVE.

APPLICATION FILED DEC. 6, 1906.

3 SHEETS—SHEET 1.



WITNESSES.

John Henry Rosberry
Chas. Wakefield Wheeler

INVENTOR.

Foster M. Metcalf

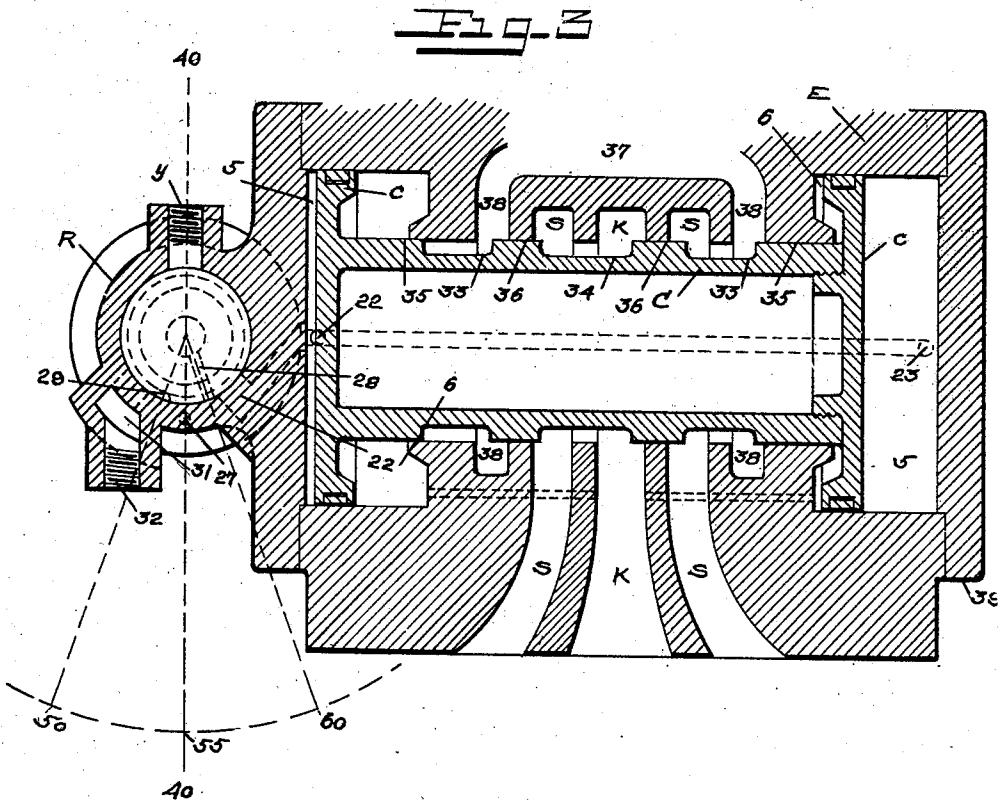
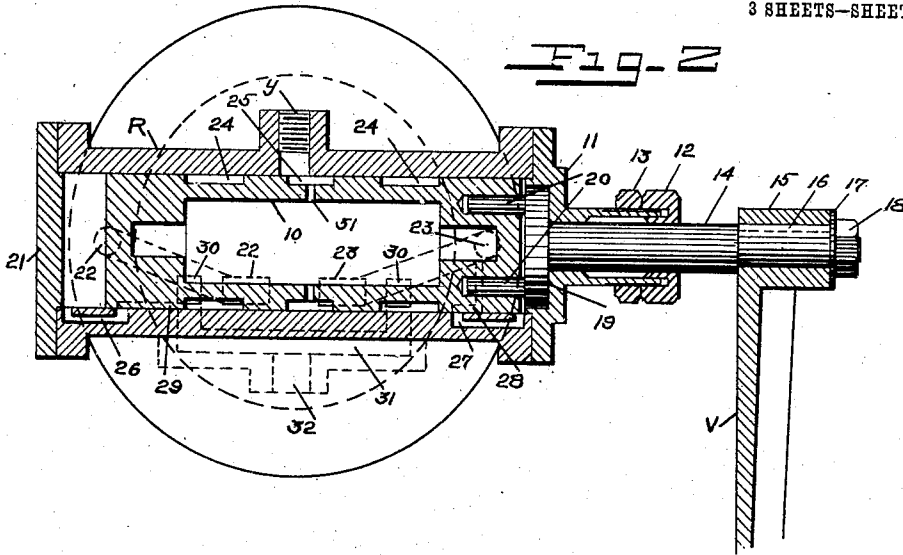
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3 SHEETS—SHEET 2.



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Fig-4

3 SHEETS—SHEET 3.

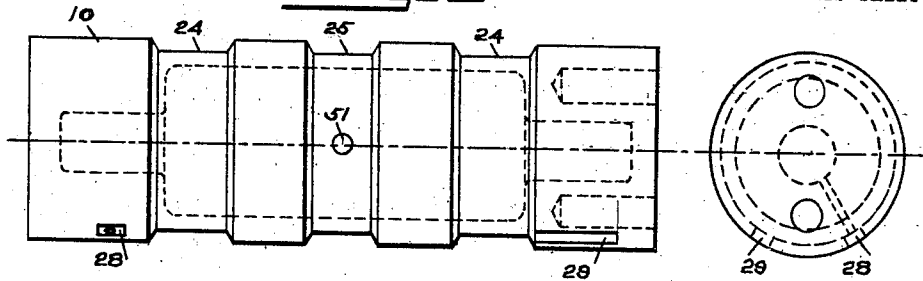


Fig-5

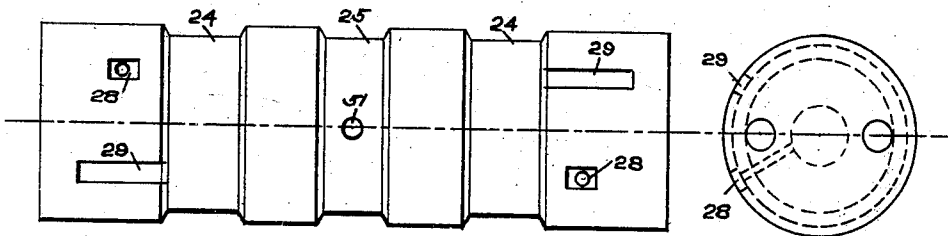
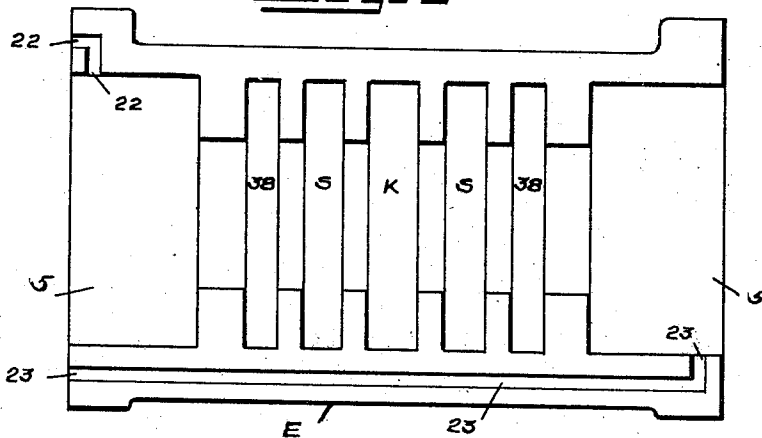


Fig-6



WITNESSES.

John Henry Rosebury
Lehas Wakefield Wheeler

INVENTOR.

Foster M. Metcalf

UNITED STATES PATENT OFFICE.

FOSTER M. METCALF, OF BATTLE CREEK, MICHIGAN, ASSIGNOR TO
AMERICAN STEAM PUMP COMPANY, OF BATTLE CREEK, MICHIGAN.

STEAM-VALVE.

No. 846,041.

Specification of Letters Patent.

Patented March 5, 1907.

Application filed December 6, 1906. Serial No. 346,883.

To all whom it may concern:

Be it known that I, FOSTER M. METCALF, a citizen of the United States, residing at Battle Creek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Steam-Valves, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to that class of steam or other fluid engines in which the main steam-valve is actuated by an auxiliary valve operated by link-and-lever connection to a cross-head carried by the piston-rod, and has for its object the prompt and certain action of the engine under all conditions, and more particularly the prompt and rapid actuation of the main valve. In the usual type of engines of this class heretofore made actuation of the main valve is accomplished by direct portings from the auxiliary, controlled by the lever connection from the cross-head alone.

My improvement consists in a peculiar and novel arrangement whereby the lever movement from the cross-head does not control direct portage to the main valve, but only subports to the auxiliary-chest heads, which in turn produce a transverse movement of the auxiliary valve, thereby porting the main valve.

As is well known to those versed in the art to which this invention applies with constructions heretofore used, should the piston movement be exceedingly slow or quite stop just on the line of port-opening from the auxiliary the portings to the main valve would be corresponding slight and the movement of the main valve in reversal sluggish. When engines of this type are employed to operate steam-pumps controlled by automatic pressure-governors, both of these conditions are not only likely but certain to occur, and should the piston entirely stop when the auxiliary portage was on a hair-line the valve might slowly creep to a central position and stay there, thus "hanging up the pump." In practice this is exactly what does and has repeatedly occurred, and one of the prime objects of this invention is to provide means whereby the main valve will in any event quickly complete its travel in reversal when started.

My auxiliary valve is cylindrical in form and derives a rocking motion with an arc of approximately forty-five degrees from the lever connection to cross-head and a longitudinal movement from the subports thus exposed to actuate the main valve, as will hereinafter appear.

In the drawings, in which like figures and letters of reference denote similar parts in the various views, Figure 1 is a sectional elevation of the steam end of a compound pumping-engine, showing the main steam-valves, cylinders, pistons, &c., of the type patented by me March 13, 1906, No. 814,793, with my present improvement and its connecting lever, rod, cross-head, and guide. Fig. 2 is a sectional view of my new auxiliary valve and chest with valve-stem and lever. Fig. 3 is a sectional view of the main steam valve and chest with my improved auxiliary attached, showing the relation of parts and ports. Figs. 4 and 5 are side and bottom views of my auxiliary valve, respectively, showing the position and relation of port-passages. Fig. 6 is shown to illustrate the trip-passages from the auxiliary leading to the enlarged end chambers of the main steam-chest, of which this figure is a horizontal section.

The parts indicated by figures and letters of reference are as follows:

A is the high-pressure steam-cylinder.
B is the low-pressure steam-cylinder.
a is the high-pressure steam-piston.
b is the low-pressure steam-piston.
C is the high-pressure steam-valve.
D is the low-pressure steam-valve.
E is the high-pressure steam-chest.
F is the low-pressure steam-chest.
H is the steam-cylinder yoke.
G is the water-cylinder yoke.
c c are the high-pressure valve-heads or actuating-pistons.

J is the steam-pipe connection.

K is the exhaust-pipe connection.

L is the receiver-pipe connecting exhaust from high-pressure cylinder to steam-chest of low-pressure cylinder.

7 7 are the steam-valve stems with coupling 8 and lock-nuts 9 9.

22 23 are the steam-valve trip-ports.

h h h h are the main-cylinder ports.

k k are the exhaust-ports.

l l l l are cushion-ports, valved, connecting cylinder ends with the main-cylinder ports.

M is the piston-rod.

m m are the piston-rod glands.

5 N is the cross-head guide.

n is the cross-head arm.

Q is the cross-head.

P is the auxiliary-valve rod, with detaching-handle O.

10 V is the auxiliary-valve lever, secured by key 16 to stem 14.

20 represents projecting pins from head 19 of auxiliary-valve stem 14, which are loosely fitted to the engaging holes in the auxiliary valve, permitting a rocking motion to be thereby communicated to the auxiliary by the lever-and-rod connection from cross-head, but at the same time allowing a longitudinal movement of the valve freely within its chest-bore.

37 is a live-steam chamber in the main steam-chest, branching to ports 38 38 toward the outer end chambers of the chest.

25 S S S S are main-chest ports, and K K is exhaust-port.

5 5 are the enlarged end chest-chambers within which the valve-moving pistons are operatively embraced, the portion of these chambers 6 6 inclosed by the heads being 30 symmetrically connected to main exhaust by passages (shown in dotted lines) to balance the inside head-pressure and by restriction prevent too violent action of the valve in reversal.

35 The auxiliary-valve chest is provided with an induction steam connection *y*, which is to be coupled, preferably, above the governor on steam-pipe when such governor is used; exhaust-ports 30 30, terminating in common 40 at 32, which may be led to chest-exhaust or elsewhere, as desired; trip-ports 22 23, leading to either end chamber of the main steam-chest, and subports 26 27, leading to either end of the auxiliary for the purpose of tripping or moving the auxiliary valve longitudinally to control the main-chest trip-ports 22 and 23.

My auxiliary valve is cylindrical in form with a central depression 25 and two outer 30 depressions 24 24. The interior is hollow and is provided with a port or ports 51 in the central depression, which is under uninterrupted live-steam pressure from *y*; also, ports 28 28 near each end of the auxiliary for the 55 purpose of supplying pressure to each end of the auxiliary valve alternately in conjunction with exhaust-grooves 29 29, both sets acting through the auxiliary subports 26 and 27 to shift the position of the auxiliary valve 60 within its chest.

The operation is as follows: With main steam valves and pistons in position shown in Fig. 1 the direction of motion is toward the left, as an inspection of the relation of ports

and passages will make clear to those familiar with engines of this class. The auxiliary valve will be in the opposite end of its chest from position shown in Fig. 2, the lever vertical, as in Fig. 1, moving toward the left in that view and toward the right in Fig. 3 on the arc 55 60 with port 29 in the auxiliary approaching support 27 on right-hand end of Fig. 2 and port 28 approaching subport 26 on left-hand end of same view. When the piston movement has continued toward the left sufficiently to move the valve-lever to 60 on Fig. 3, it is obvious that port 29 will register with subport 27, placing the right-hand end chamber of auxiliary in exhaust by way of valve depression 24 and exhaust port and passage 30, 31, and 32. On the opposite end of the auxiliary port 28 will register with subport 26, placing the left-hand end chamber of the auxiliary under live-steam pressure from *y*, central depression 25, and port 51. It is then obvious that the auxiliary valve must move toward the right and assume the position shown in Fig. 2. This will place the right-hand end chamber of the main high-pressure chest in exhaust by way of trip-port 22, auxiliary-valve depression 24, and auxiliary-chest ports and passages 30, 31, and 32. The left-hand end chamber of main chest will be under the influence of direct live-steam pressure from *y*, central depression 25 of auxiliary, and trip-port 23. It is obvious that the main valve must then travel toward the right, reverse the portage and direction of travel of steam and exhaust currents, and consequently the steam-pistons.

It will be observed that my device is equally applicable to compound engines, as shown in Fig. 1, or the simple single-cylinder type for which the chest shown in Fig. 3 is designed.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

An auxiliary steam-chest arranged to mount on the end of a main steam-chest, and provided with suitable ports and passages, a hollow cylindrical auxiliary valve fitted to operate within the same having a central depression and two outer end depressions, a live-steam port leading from the central depression to the interior, live-steam ports leading from the interior near each end of the valve, exhaust-grooves to act in conjunction with the same, and end recesses to loosely receive projecting pins on the enlarged end of the valve-stem, and a rock-lever keyed pend- ent to the outer extremity of same.

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

FOSTER M. METCALF.

Witnesses:

ALBERT C. PERKINS,
RICHARD R. HICKS.