

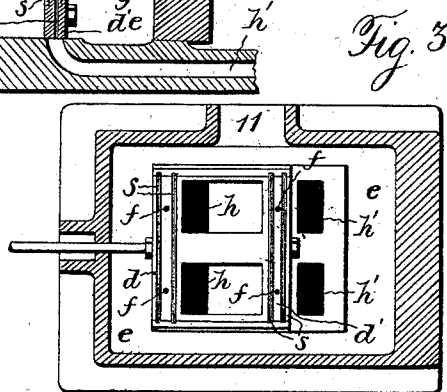
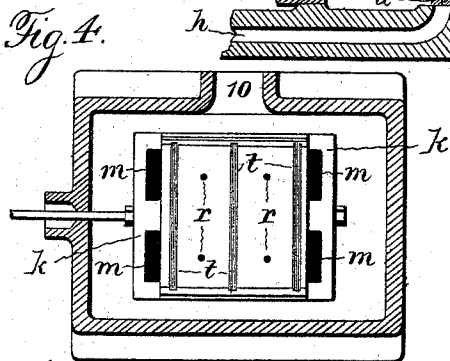
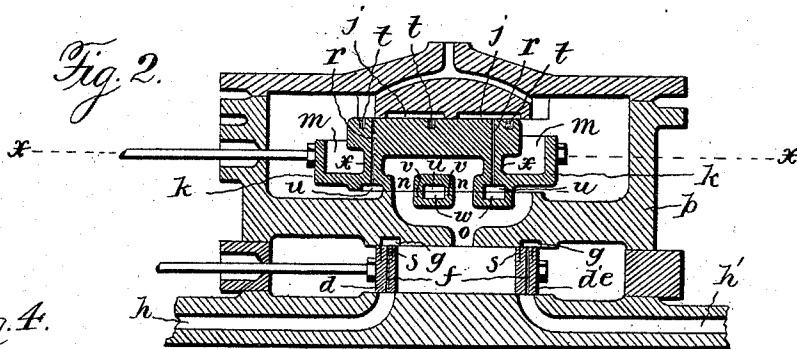
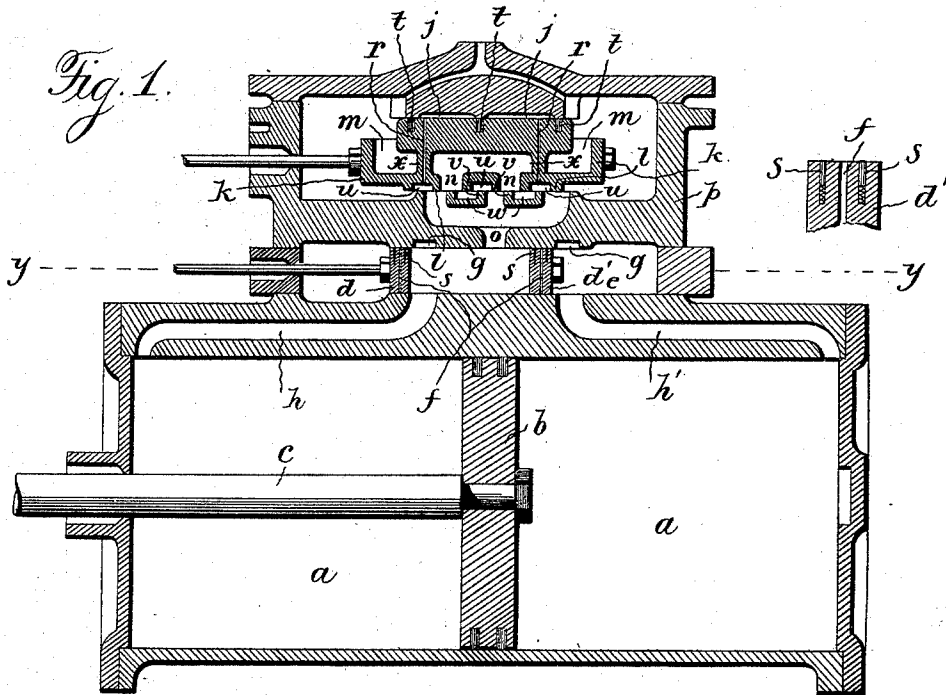
(No Model.)

2 Sheets—Sheet 1.

E. W. HARDEN.
VALVE AND STEAM CHEST FOR ENGINES.

No. 527,330.

Patented Oct. 9, 1894.



Witnesses:
Jas. Hutchinson.
Albert Everett

Inventor.
Edward W. Harden,
By Wood & Boyd Attorneys

(No Model.)

2 Sheets—Sheet 2.

E. W. HARDEN.
VALVE AND STEAM CHEST FOR ENGINES.

No. 527,330.

Patented Oct. 9, 1894.

Fig. 5.

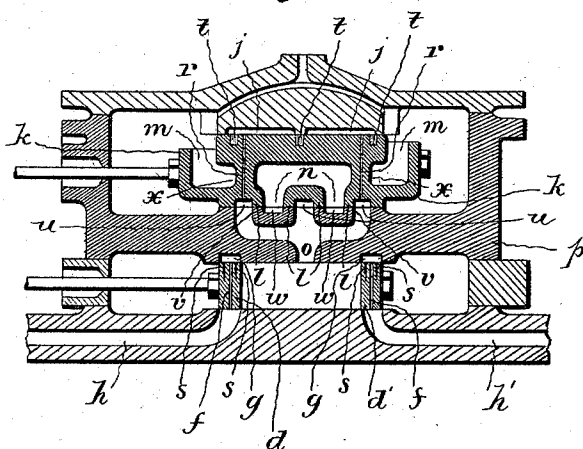
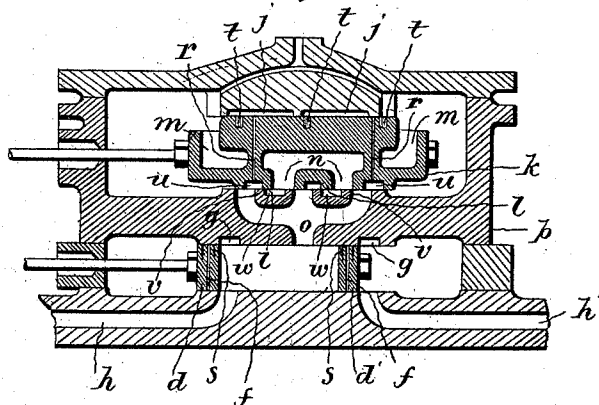


Fig. 6.



Witnesses:
Jas. Hutchinson
Robert Enright

Inventor:
Edward W. Harden,
By Woods & Boyd, attorneys.

UNITED STATES PATENT OFFICE.

EDWARD WILSON HARDEN, OF CINCINNATI, OHIO, ASSIGNOR TO FREDRIC CANDEE WEIR, OF SAME PLACE.

VALVE AND STEAM-CHEST FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 527,330, dated October 9, 1894.

Application filed May 12, 1894. Serial No. 511,047. (No model.)

To all whom it may concern:

Be it known that I, EDWARD WILSON HARDEN, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Valves and Steam-Chests for Engines, of which the following is a specification.

One of the objects of my invention is to provide a balanced main valve adapted to be used with an auxiliary valve. I accomplish this by making a skeleton main valve located in an exhaust steam chest with the auxiliary valve in the live steam chest, the main valve being constructed with a steam passage directly through it to supply steam from the auxiliary valve to the piston and exhausting outside each end of the valve directly into the exhaust chest. The upper seat for the main valve and lower seat for the cut-off valve are formed on the upper and lower face of the partition separating the live steam chest from the exhaust steam chest.

Another object of my invention is to provide a practically balanced auxiliary valve. This is accomplished by making recesses in the upper and lower seats and connecting them together by one or more separate steam passages thereby obtaining a uniform pressure from the upper and lower faces of the valves during all portions of the stroke.

The features of my invention will be more fully set forth in the description of the accompanying drawings making a part of this specification, in which—

Figure 1 is a longitudinal central vertical section of a cylinder and piston with my improvements attached, and showing the cut off valve half open. Fig. 2 is a similar section of the steam chest, showing the valves on the center, the cut off valve being full open. Fig. 3 is a section on the line $y-y$ of Fig. 1. Fig. 4 is a section on the line $x-x$ of Fig. 2. Fig. 5 is a longitudinal central vertical section showing the cut off valve closed. Fig. 6 is a similar section showing the cut off valve starting to open.

In order to illustrate my invention I have shown my improved steam chests and valves attached to a simple engine.

a represents the cylinder; b , the piston; c , the piston rod. The main valve is located in the exhaust chest e . It is of skeleton or open

form and has two cut-off sections d, d' , with a steam passage between them. Section d covers and uncovers port h of the cylinder and section d' covers and uncovers cylinder port h' . The distance between the sections d, d' , is sufficient to allow steam to be supplied freely to the cylinder ports and to cut off near the end of the stroke. The cut-off sections have the same area on their top and bottom seats.

g represents recesses in the upper seat of the main valve d, d' and f represents steam passages pierced through the valve sections d, d' , connecting recess g with the ports h, h' , when the valve cuts off so that they are practically balanced when the valve is closed as well as when the valve is moving.

s, s , represents packing strips on the upper faces of the cut-off sections to balance the valve and to prevent the escape of steam into the exhaust chamber e .

o represents a steam passage through the partition p .

k represents the auxiliary valve. It is of shell form.

m represents an opening admitting steam into the end of the shell outside of the seat face of the valve. I preferably employ such an opening at each end of the valve.

n represents a series of ports in the valve.

l represents the cut-off sections.

u represents the longitudinal recesses of the cut-off sections forming recess ports.

v represents cut-offs of the valve seat.

w represents longitudinal recesses of the two central sections for admitting steam to the recess ports each side of the cut-offs so that the valve will quickly come to a full opening from its initial movement and continue at full opening until just before it reaches the opposite end of the stroke.

In order to balance the auxiliary valve k I have shown two independent steam passages r which are preferably formed by coring cross pieces x , spanning the chamber of the valve.

j represents recesses formed in the upper seat of the valve which correspond in area with the exhaust surfaces in the lower face of the valve and as the pressure upon the upper and lower faces is maintained the same in all portions of the stroke by the independ-

ent connecting passages *r*, the valve will be practically balanced when stationary as well as when moving.

5 *t* represents packing strips upon the upper face of the valve forming a steam joint and to maintain the equilibrium of the pressure.

Packing strips *s* of the main valve and *t* of the auxiliary valve can be supported in grooves and rest on springs in the usual manner. 10 and 11, are the main steam inlet and exhaust ports, respectively. In the construction herein shown the main valve regulates the direction of the live and exhaust steam allowing a long exhaust period and thereby lessening the back pressure and permitting the auxiliary valve to cut off the steam supply at any desired part of the stroke.

I claim—

20 1. In a steam engine an auxiliary valve provided with a central receiving chamber, one or more ports on its lower seat face, one or more recesses on the upper seat and one or more independent steam passages con-

necting said recesses and ports, substantially as specified.

25 2. In a steam engine an auxiliary shell valve provided with one or more supply ports at the end of the shell, a series of ports on its lower face, a series of recesses *j*, on the upper valve seat and one or more communicating steam passages pierced through the shell, substantially as specified.

3. In a steam engine an auxiliary shell valve with a central supply chamber, one or more ports leading therefrom, one or more recessed ports on the under face, one or more recesses in the upper seat, one or more independent steam passages connecting the seat recesses with the recessed ports, substantially as specified.

40 In testimony whereof I have hereunto set my hand.

EDWARD WILSON HARDEN.

Witnesses:

W. R. WOOD,
C. W. MILES.