

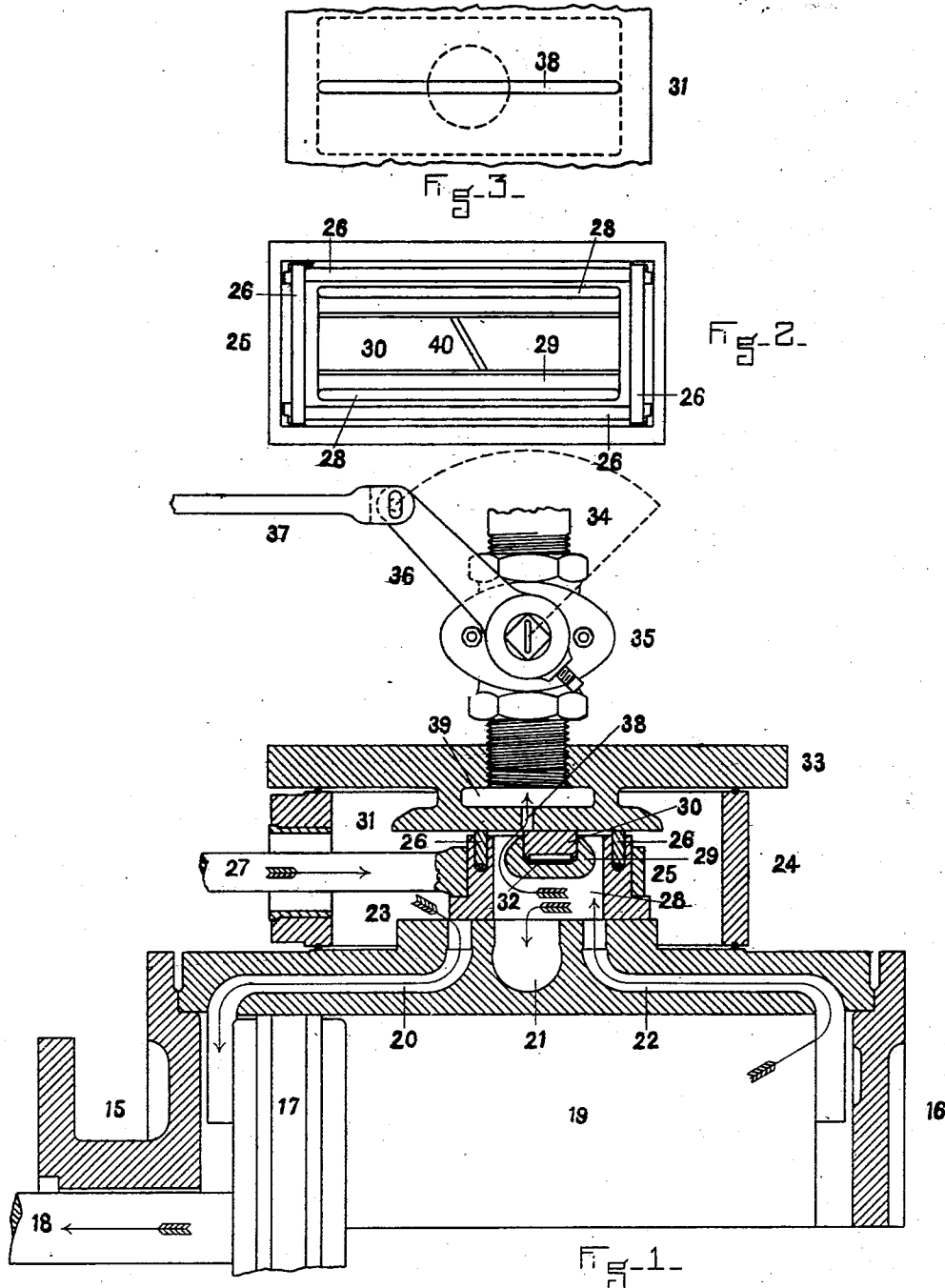
(No Model.)

3 Sheets—Sheet 1.

H. R. FAY.
ENGINE VALVE.

No. 564,917.

Patented July 28, 1896.



WITNESSES:

George L. Dolbear.
Carl Vaughan

BY

INVENTOR.

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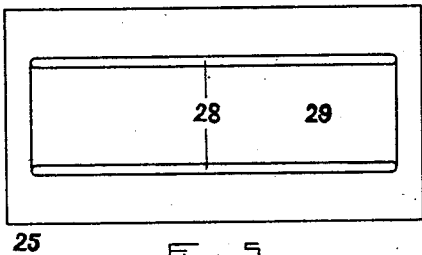
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Fig. 5.

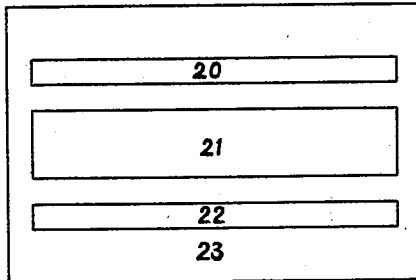


Fig-4-

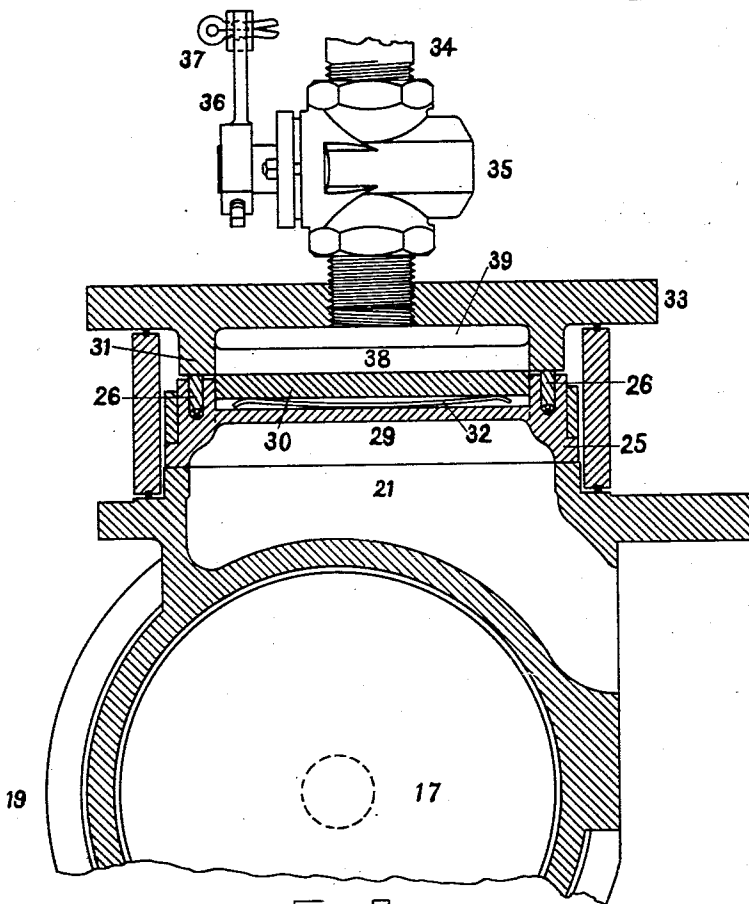


Fig. 6.

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(No Model.)

3 Sheets—Sheet 3.

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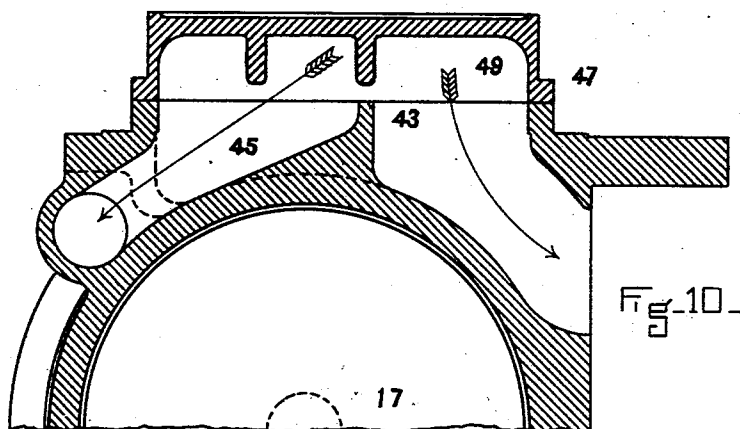


Fig. 10.

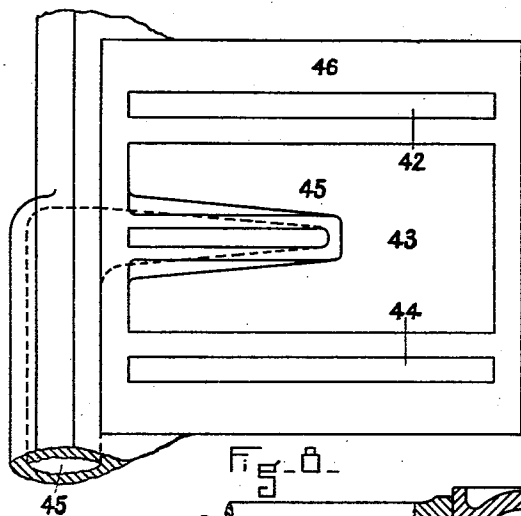


Fig. 8.

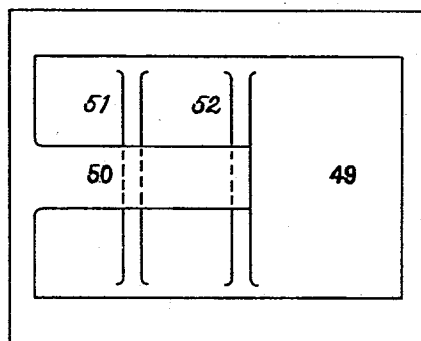


Fig. 9.

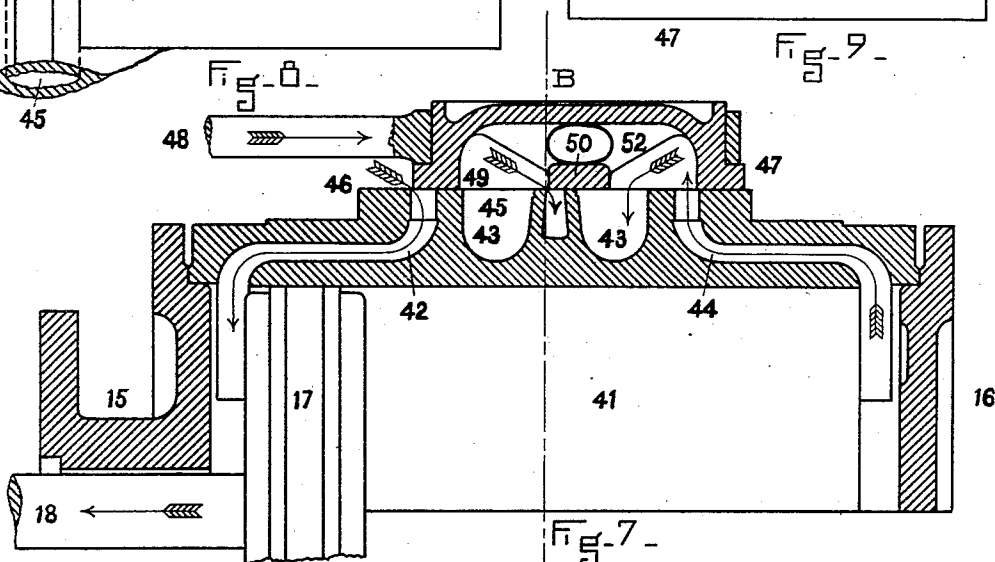


Fig. 7.

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UNITED STATES PATENT OFFICE.

HENRY ROLAND FAY, OF BOSTON, MASSACHUSETTS.

ENGINE-VALVE.

SPECIFICATION forming part of Letters Patent No. 564,917, dated July 28, 1896.

Application filed May 4, 1896. Serial No. 590,217. (No model.)

To all whom it may concern:

Be it known that I, HENRY ROLAND FAY, a citizen of the United States, residing at Boston, in the county of Suffolk and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Engine-Valves, of which the following is a specification.

My invention relates to engine-valves for engines, pumps, and the like, and it is especially adapted for use upon locomotives.

It has for its object the relieving of back-pressure within the cylinder of an engine particularly when, as in a locomotive, the back-pressure is (usually) considerable, for the reason that the exhaust is used as a means of producing the necessary draft in the fire-box.

The invention consists principally in a steam-engine cylinder provided with main and auxiliary exhaust-ports and a valve for directing the exhaust to the main port and for controlling the auxiliary exhaust-port without interference with the regular exhaust.

In the scale drawings my invention is shown as applied to an eighteen by twenty-two locomotive-cylinder, the valve of which is provided with an outside lap of seven-eighths of an inch, line and line inside, and in this construction and arrangement of the cylinder and valve my device is designed to operate in the following manner: When steam admission takes place on the back end of the cylinder, the auxiliary exhaust opens from exhaust-cavities to atmosphere through auxiliary exhaust-pipe, the admission-port on the front end of the cylinder operating as an exhaust-port (the valve being line and line inside) having opened to an extent equal to the outside lap of the valve at the time the auxiliary exhaust commenced to open—that is to say, the outside lap of the valve being in this case seven-eighths of an inch, the front end admission-port operating as an exhaust-port will be opened seven-eighths of an inch at the time of the commencing of the opening of the auxiliary exhaust-port. On the front end of the cylinder, on the return stroke of the piston, the auxiliary exhaust closes when steam-admission cut-off takes place on the back end of the cylinder, at which time the admission-port

on the front end of the cylinder operating as an exhaust-port is open seven-eighths of an inch and the valve is traveling in the direction of exhaust-closure. Therefore the auxiliary exhaust-port opens after the commencing of the regular or main exhaust and closes before the closing of the regular exhaust.

When the auxiliary exhaust-port is in the shield or balance-plate, the width of the auxiliary-exhaust-port packing-strip will be twice the outside lap of the valve plus the width of the auxiliary exhaust-port in shield, or seven-eighths of an inch times two equals one and three-fourths inches, plus one-half inch, equals two and one-fourth inches, which is the width of the auxiliary-exhaust-port valve or strip.

The amount of exhaust-steam passing from the exhaust-cavities into the atmosphere may be made (if desired) variable at the pleasure of the engineer by the placing of a valve or cock in the auxiliary-exhaust-port pipe which is designed to be operated by the engineer.

Figures 1, 2, 3, 4, 5, and 6 illustrate the adaptation of my invention to a locomotive-cylinder provided with a balanced D-valve of the Richardson type. Fig. 1 is a vertical central sectional view of the upper half of a locomotive-cylinder. In this view the piston and valve are shown in their approximately correct relative position directly after the admission of steam, as indicated by an arrow, into the back end of the cylinder, the direction of travel of both piston and valve being indicated by means of arrows. The path of the exhaust from the front end of the cylinder into the exhaust-cavity of the valve and from thence, in two directions, into the regular exhaust port and cavity and into the auxiliary exhaust-port, is shown by means of arrows. Fig. 2 is a full plan of the valve. Fig. 3 is an inverted plan of a portion of the shield or balance-plate, showing the extra exhaust-port. Fig. 4 is a plan of the valve-seat on the cylinder. Fig. 5 is an inverted plan of the valve. Fig. 6 is a cross central sectional view of the cylinder shown in Fig. 1, the valve being placed in its central position upon the valve-seat.

Figs. 7, 8, 9, and 10 illustrate the application of my device to a locomotive-cylinder

provided with a plain unbalanced **D**-valve. Fig. 7 is a vertical central sectional view of the upper half of a locomotive-cylinder. In this view the piston and valve are shown in their approximately correct relative position directly after the admission of steam, as indicated by an arrow, into the back end of the cylinder, the direction of travel of both piston and valve being indicated by means of arrows. The path of the exhaust from the front end of the cylinder into the exhaust-cavity of the valve and from thence, in two directions, into the regular exhaust port and cavity and into the auxiliary exhaust-port, is shown by means of arrows. Fig. 8 is a plan of the valve-seat on the cylinder, showing the construction of the auxiliary exhaust-port in valve-seat and cylinder. Fig. 9 is an inverted plan of the valve, and Fig. 10 is a cross-sectional view of Fig. 7 on section-line A B.

The locomotive-cylinder is provided with the following, all of which are of ordinary construction and arrangement: back head 15, front head 16, piston 17, and piston-rod 18.

The following is a description of my invention as applied to a locomotive-cylinder provided with a balanced valve, as illustrated by Figs. 1 to 6, inclusive:

The cylinder 19 is provided with the following, which are all of the ordinary construction and arrangement: back admission-port 20, main or regular exhaust-port 21, front admission-port 22, valve-seat 23, and steam-chest 24. The **D**-valve 25, of the Richardson open-top type, is provided with the usual balance-strips 26 and the valve-rod 27. The valve is provided with the usual amount of outside and inside lap and with the exhaust-cavity 28, within which is the auxiliary-exhaust-port trough or bridge 29, which is an integral part of the valve, and it is designed to receive the auxiliary-exhaust-port valve or strip 30, which is kept in its position in contact with the shield 31 by means of the spring 32.

The steam-chest cover 33 of the cylinder is provided with the shield or balance-plate 31 and the auxiliary-exhaust-port pipe 34 and the auxiliary-exhaust-regulating cock 35. This cock is provided with a lever 36 and the rod 37 and it is designed to be operated by the engineer in a manner similar to the operating of the usual cylinder-cocks. The shield is provided with the auxiliary exhaust-port 38, through which the auxiliary exhaust may pass into the auxiliary exhaust-cavity 39, which is steam-tight as far as direct steam-pressure is concerned and then into the atmosphere, through the auxiliary-exhaust-port pipe 34, which is designed to be run outside or inside the smoke-stack as a matter of convenience. The auxiliary-exhaust-port valve is provided with the shallow groove 40, which is designed to permit the escape of the water of steam condensation within the auxiliary-exhaust-port pipe.

The operation of my invention, referring particularly to Fig. 1, is as follows: When steam admission takes place into the back end of the cylinder, and when, as shown in the drawings, this admission of steam takes place before the piston has completed its stroke, in which case this admission is usually called preadmission of steam, then the auxiliary exhaust-port commences to open and at this point in the travel of the valve it will be observed that the front admission-port is nearly opened and is doing nearly its full-capacity duty in permitting the passage of the exhaust-steam from the front end of the cylinder into the regular exhaust port and cavity. When the back admission-port is about half open, then the auxiliary exhaust-port will be wide open, at which time the actual area of opening of the auxiliary exhaust-port will be about equal to the area of the regular exhaust-pipe tip as usually constructed at its top, thereby giving an exhaust efficiency of about double as compared with the common type of engines. The auxiliary exhaust-port will not close until steam-admission cut-off from the back end of the cylinder takes place. This valve operates in all particulars in a like manner for each end of the cylinder, or for the complete cycle of preadmission, admission, cut-off, exhaust-opening, and closure.

It is obvious that if the exhaust-opening is doubled in area the back-pressure will be greatly lowered or reduced.

One very important feature of my invention is that the auxiliary exhaust-port does not open until after the initial regular exhaust has substantially taken place. The result of this is that the initial regular exhaust, which is practically sufficient for draft purposes, is not interfered with, while the back-pressure, which in most locomotives under certain running conditions is extremely excessive, is greatly reduced.

The following is a description of my device as applied to a locomotive-cylinder provided with a plain unbalanced (or balanced, if desired) closed-top **D**-valve, as illustrated by Figs. 7 to 10, inclusive.

The cylinder 41 is provided with the back admission-port 42, main or regular exhaust-port 43, front admission-port 44, auxiliary exhaust-port 45, and valve-seat 46. The **D**-valve 47 is provided with the same amount of outside and inside lap as valve 25, the valve-rod 48, and the exhaust-cavity 49, within which is located, as an integral part of the valve, the auxiliary-exhaust-port valve 50, which is designed to operate the auxiliary exhaust-port. The auxiliary-exhaust-port valve 50 is strongly held to the valve 47 by means of the ribs 51 and 52.

The auxiliary exhaust-port 45 is designed as shown in order that the exhaust-steam may be piped off to the atmosphere in a manner similar to that shown in Figs. 1 to 6. The auxiliary-exhaust-port pipe, which is not

shown, connects with the auxiliary exhaust-port at any convenient point and extends into the atmosphere.

The operation of the device, referring particularly to Fig. 7, is as follows: When steam admission takes place into the back end of the cylinder through back admission-port 42, as indicated by an arrow, then the auxiliary exhaust-port 45 commences to open, and at this point in the travel of the valve it will be observed that the front admission-port 44 is nearly opened and is doing nearly its full-capacity duty in permitting the passage of the exhaust from the front end of the cylinder into the exhaust-cavity 49 and the regular exhaust-port 43. When the back admission-port 42 is about half open, then the auxiliary exhaust-port 45 will be wide open, at which time the actual area of the full opening of the auxiliary exhaust-port will be about equal to the area of the regular exhaust-pipe tip, as commonly constructed, at its top, thereby giving a total exhaust efficiency of about double as compared with the common type of express passenger engines. The auxiliary exhaust-port will not close until steam-admission cut-off through the back admission-port 42 takes place. The valve operates in all respects the same for each end of the cylinder.

One important feature of the device is that the auxiliary exhaust-port is not opened until that portion of the regular exhaust, which is requisite for draft purposes, has taken place.

In order to be more explicit relative to the double exhaust efficiency previously mentioned, I make the following statement: The drawings are scale reproductions of an eighteen by twenty-two inch cylinder (as previously stated) of a standard express passenger-engine of a well-known type in use upon a well and favorably known railroad. This locomotive is provided with a double-tip exhaust, one tip for each cylinder. The inside diameter of each tip at the top is three inches, the area for regular exhaust purposes being therefore about seven square inches. The area of the auxiliary exhaust-port, as shown in the drawings, is about seven square inches, which, added to the seven-square-inch area of the regular exhaust, gives a total port or outlet area for exhaust of about fourteen square inches, which area is about double the area of the exhaust-tip, thereby giving an approximately double exhaust opening and efficiency.

In locomotives having defective or deficient draft or steaming qualities, by the use of my invention a smaller tip could be used, thereby acquiring draft and steaming qualities and at the same time reducing to quite an extent the back-pressure.

The auxiliary-exhaust-port valve may be provided with whatever outside lap may be thought desirable to best adapt my invention to any style of engine-cylinder, and this auxiliary exhaust-port may be contained within

the regular exhaust-port whenever the regular exhaust-port is sufficiently widened, as shown in Figs. 7, 8, and 10, to receive the auxiliary exhaust-port without materially contracting the regular exhaust-port.

My invention can be readily applied to almost any style of valve of the flat or piston, balanced or unbalanced type by making such adaptations as may be needful.

It is obvious that a great many modifications of my invention will necessarily have to be made in order to make the best adaptation to produce the results sought to be obtained, as hereinbefore fully set forth.

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

1. In a steam-engine the combination of a steam-cylinder provided with main and auxiliary exhaust-ports, and a valve for directing the exhaust to the main port and for controlling the auxiliary port without interference with the regular exhaust.

2. In a steam-engine, the combination of a steam-cylinder provided with main and auxiliary exhaust-ports, and a valve directing the exhaust-steam to the main exhaust and intermittently opening and closing the auxiliary exhaust-port while the main exhaust-port is open.

3. In a steam-engine, the combination of a steam-cylinder provided with main and auxiliary exhaust-ports, and a main valve for directing the exhaust to the main exhaust-port said main valve carrying an auxiliary valve carried and operated by the main valve for controlling the auxiliary port without interference with the regular exhaust.

4. In a steam-engine, the combination of a steam-cylinder provided with main and auxiliary exhaust-ports, a valve for directing the exhaust to the main port and for controlling the auxiliary port without interference with the regular exhaust, and an auxiliary exhaust-pipe connected with the auxiliary exhaust-port.

5. In a steam-engine, the combination of a steam-cylinder provided with main and auxiliary exhaust-ports, a valve for directing the exhaust to the main port and for controlling the auxiliary port without interference with the regular exhaust, and an auxiliary exhaust-pipe connected with the exhaust-port, and provided with an auxiliary regulating-cock.

6. In a steam-engine, the combination of a steam-cylinder, provided with a valve-seat, and admission and main exhaust ports connecting said valve-seat with the interior of the cylinder, a steam-chest mounted on said cylinder and surrounding said valve-seat, the cover of said steam-chest being provided with a balance-plate having an auxiliary exhaust-port and a slide-valve operating between said valve-seat and balance-plate for directing the exhaust to the main exhaust-port and for controlling the auxiliary port without interference with the regular exhaust.

7. In a steam-engine, the combination of a

cylinder having main and auxiliary exhaust-ports, a valve for directing the exhaust to the main port and for controlling the auxiliary port, an auxiliary exhaust-pipe connected
5 with the auxiliary exhaust-port, and a regulating-cock for said auxiliary exhaust-pipe.

In testimony whereof I have signed my

name to this specification in the presence of two subscribing witnesses.

HENRY ROLAND FAY.

Witnesses:

E. FRANK WOODBURY,
GEORGE L. DOLBEARE.