(No Model.) 3 Sheets—Sheet 1.

C. SCHMID.

SLIDE VALVE MECHANISM.

No. 423,492. Patented Mar. 18, 1890.

Fig. 1.

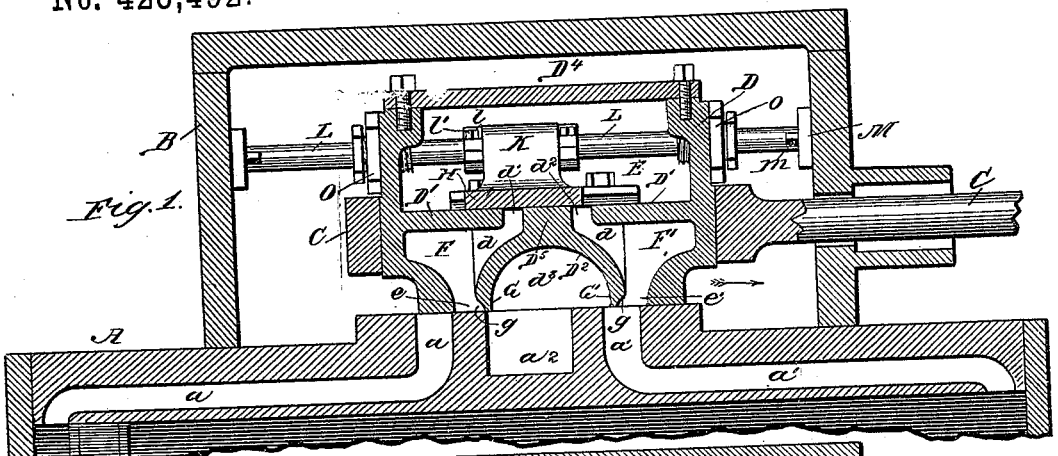


Fig. 2.

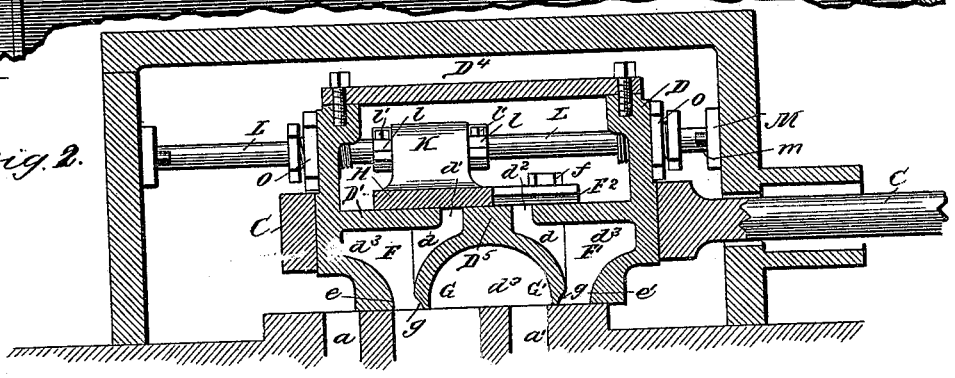


Fig. 3.

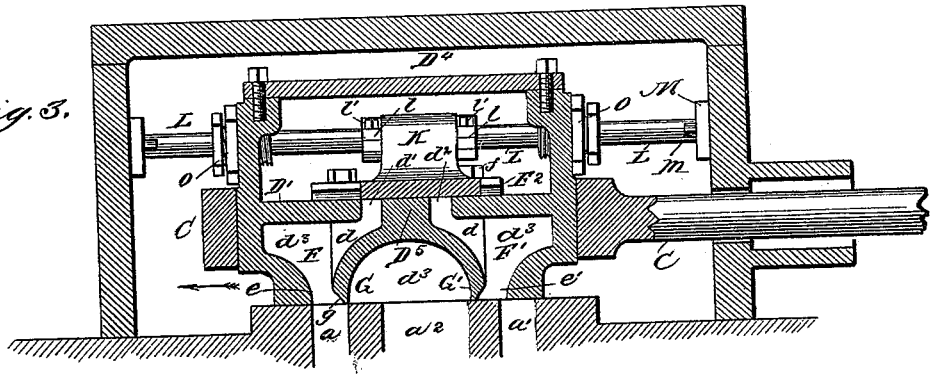
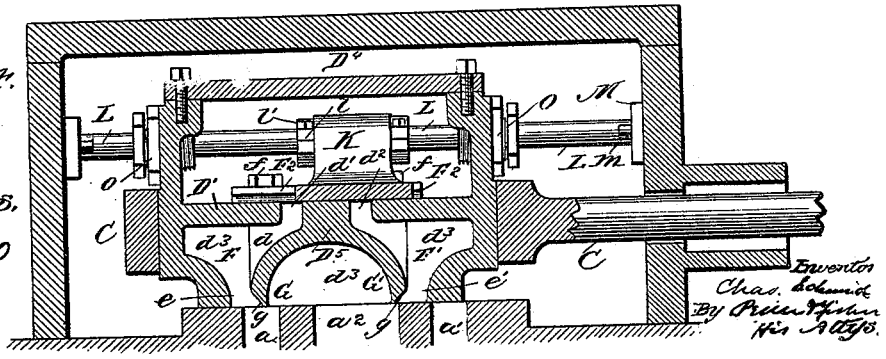


Fig. 4.



Witnesses.

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(No Model.) 3 Sheets—Sheet 2.

C. SCHMID.

SLIDE VALVE MECHANISM.

No. 423,492. Patented Mar. 18, 1890.

Fig. 5.

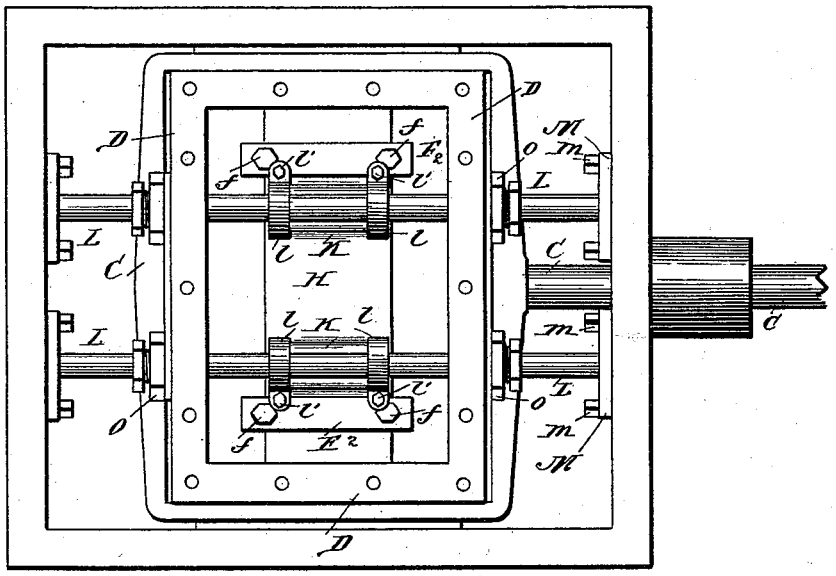
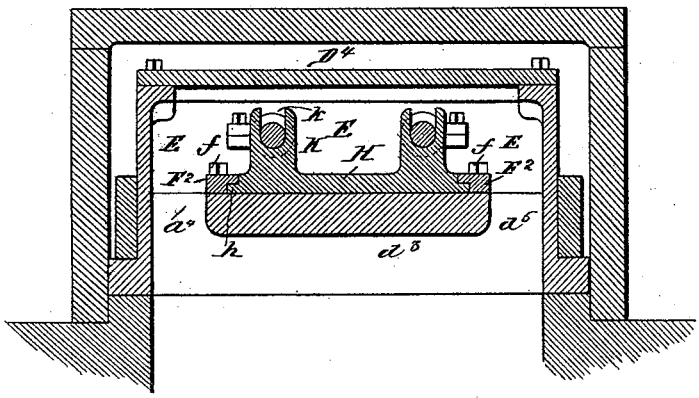


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

C. SCHMID.

SLIDE VALVE MECHANISM.

No. 423,492. Patented Mar. 18, 1890.

Fig. 7.

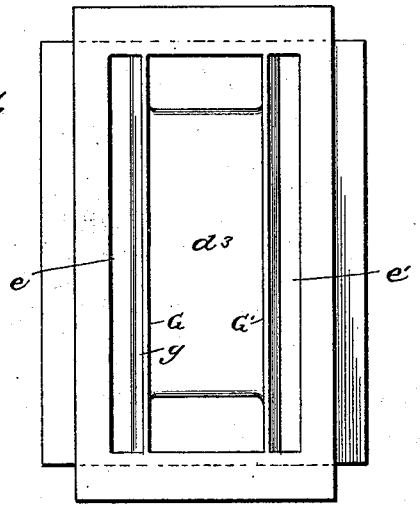


Fig. 8.

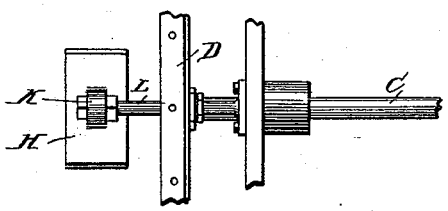
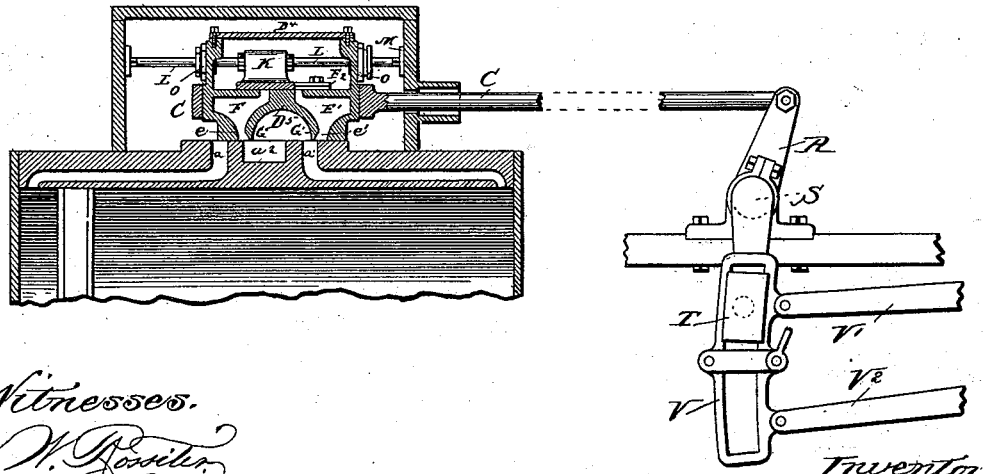


Fig. 9.



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UNITED STATES PATENT OFFICE.

CHARLES SCHMID, OF CHICAGO, ILLINOIS.

SLIDE-VALVE MECHANISM.

SPECIFICATION forming part of Letters Patent No. 423,492, dated March 18, 1890.

Application filed June 2, 1887. Serial No. 240,024. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SCHMID, 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 Slide-Valve Mechanism for Steam-Engines, of which I do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My present invention has relation to that class of slide-valve mechanism for steam-engines set out in the Letters Patent of the United States Nos. 337,441 and 347,012, granted to myself and George Farnsworth on March 9, 1886, and August 10, 1886, respectively. In the construction of valve mechanism set forth in said patents the main slide-valve was provided with escape or exhaust ports adapted to be brought coincident with the usual steamways of the main cylinder, the passage of the steam through these ports being controlled by means of a supplemental valve placed within a chamber of the main slide-valve, which chamber communicated with the usual exhaust-cavity of the cylinder, and the position of the supplemental valve with respect to the escape and exhaust ports of the main valve was determined by a connection between said supplemental valve and its steam-chest, so that the position of the supplemental valve with respect to the ports of the main valve was shifted at each movement of the main valve. The object of the inventions defined in said patents was to lessen the back-pressure or resistance in the cylinder upon the exhaust side of the piston, so that the loss of energy and consequent increase of working cost incident to such resistance would be avoided. In my present construction of valve mechanism the main slide-valve is also provided with escape or exhaust ports, the passage of steam through which is controlled by a supplemental valve, the position of this valve with respect to the ports of the main valve being shifted or changed at each movement of the latter; but in this construction I have modified the mechanism whereby the shift or change of the position of the supplemental valve with respect to the main valve is effected, and have modified, also, in various respects, hereinafter noted, the relative arrangement of the main and supplemental valves.

My present invention consists in the various novel features of construction hereinafter described, illustrated in the accompanying drawings, and particularly defined in the claims at the end of this specification.

Figure 1 is a view in central longitudinal section on line $x\ x$ of Fig. 5. Figs. 2, 3, and 4 are views similar to Fig. 1, but showing the parts in different positions during the action of the valve. Fig. 5 is a plan view of my improved valve mechanism, the cover of the slide-valve being omitted. Fig. 6 is a view in vertical cross-section on line $y\ y$ of Fig. 5. Fig. 7 is an inverted plan view of the main valve. Fig. 8 is a fractional plan view (reduced scale) of a modified form of connection for the supplemental valve. Fig. 9 is a view, partly in section and partly in side elevation, showing the combination of the valve with variable "cut-off."

A designates the main cylinder of the engine, provided with the usual steamways a and a' and exhaust-port a^2, and B denotes the steam-chest, within which, upon its appropriate seat, is placed the main slide-valve, that is operated in the usual manner by the valve-rod C, the yoke c of which embraces the valve. The body of the main slide-valve (like that in Patent No. 347,012) is preferably cast in such manner as to form the outer walls or sides D in single piece with the port-plate D′ and the cavity plate or roof D^2, these plates being connected together by the end plates or ribs d, which extend between them at the ends of the long valve-chamber ports d' and d^2. The main slide-valve is provided with the usual exhaust-cavity d^3, that extends from side to side of the valve, as seen in Fig. 6, and at its ends this cavity communicates by the ports d^4 and d^5 with the exhaust-chamber E, formed in the upper portion of the main valve by the walls D, the cover D^4, that is suitably bolted to said walls, and by the port-plate D′. Beneath the port-plate D′, and on opposite sides of the central rib D^5 and cavity plate or roof D^2, are preferably formed the expanded steam-spaces F and F′, that are connected at their top with the valve-chamber E by means of the valve-ports d' and d^2

and at their bottoms terminate in the long escape or exhaust ports *e* and *e'*. It will be observed that portions of the inside lap-plates G and G' are cut away, as shown at *g*, the purpose of this being to give increased area to the exhaust-ports *e* and *e'*, as will hereinafter more fully appear. Upon the upper face of the port-plate D', and at the edge of the exhaust-ports d^4 and d^5, are preferably placed the guide strips or ribs F^2, that are fixed by bolts *f* to the port-plate, and the flanges of these strips overlap the reduced ends *h* of the supplemental valve H and serve to hold this valve in proper bearing upon the port-plate as the main slide-valve is moved. Upon the upper face of the supplemental valve H are preferably formed the lugs or standards K, having sockets or seats *k* formed therein to receive the rods L, which are held in fixed position with respect to the supplemental valve by means of the split collars *l*, that encircle the rods adjacent the lugs or standards K, and are firmly clamped therein by the screws *l'*, passing through their ends. The rods L, as shown in Fig. 5, pass through the end walls of the main slide-valve, and in this specific construction are conveniently attached to the steam-chest by means of the plates M, bolted thereto, as seen at *m*. If desired, stuffing-boxes O, of usual or suitable construction, may be fitted in the perforations of the slide-valve that receives the rods L, and by this means all danger of the leakage of steam from the steam-chest into the chamber of the main valve will be avoided.

From the foregoing description the operation of the mechanism will be seen to be as follows: Assume the parts to be in the relative position shown in Fig. 1, with the main slide-valve traveling in the direction of the arrow. At this instant live steam is being admitted from the steam-chest through the steamway *a* into the cylinder behind the piston W and the exhaust-steam is passing from the exhaust end of the cylinder through the steamway *a'*, and thence in part through the exhaust-cavity d^3 and exhaust-port a^2 of the cylinder and in part through the escape-port *d'*, the steam-space F', and the escape-port d^2 into the chamber E of the valve, and thence through the ports d^4 and d^5 into the exhaust-cavity d^3. As the valve continues to be moved in the direction of the arrow, Fig. 1, live steam will continue to pass through the steamway *a* into the cylinder, and will exhaust in the manner above specified until the lap-plate G' has passed beyond the port of the steamway *a'*, as seen in Fig. 2, at which time the entire exhaust will occur directly from the steamway *a'* into the exhaust-cavity d^3. From the position of the parts in Fig. 1 it will be seen that if the valve were of ordinary construction—that is to say, without exhaust or escape ports formed therein—the entire exhaust at the beginning of the stroke would occur through the narrow space between the steamway *a'* and the exhaust-cavity d^3; but by providing the main slide-valve with the exhaust-ports formed through the same it is obvious that I double the area of the exhaust, since it is plain that in addition to the direct exhaust from the steamway *a'* into the cavity d^3, I obtain a passage of equal area for the exhaust-steam through the exhaust or escape ports *e'*, steam-space F', and port d^2. By reference to Fig. 3 it will be seen that the port *d'* in the port-plate D' does not pass from beneath the supplemental valve until the lap-plate G passes off the bridge adjacent the steamway *a*, and hence the release of the steam through the port *d'* and exhaust or escape port *e* does not occur any sooner than the direct release through the port of the steamway *a'* and exhaust-cavity d^3. When the main valve, after being moved to open the steamway *a*, returns to a point slightly beyond the position shown in Fig. 1, the communication between the steam-chest and the steamway *a* will be cut off and the steam will be allowed to act expansively in the cylinder until the valve reaches the position shown in Fig. 3, when the release of the steam will occur. From Fig. 1 it will be seen that at the moment that the steam is thus cut off a free escape of the exhaust-steam from the cylinder will be had from the steamway *a'* in part directly through the exhaust-cavity d^3 and in part through the escape-port *e'* of the main valve, and hence it is obvious that during a great part of the stroke of the main valve a large portion of the exhaust-steam will be permitted to escape through the exhaust or escape ports of the main valve. In other words, while obtaining the advantage of the inside lap-plates G and G', I avoid the disadvantage incident to the employment of inside lap in ordinary valves, and it is well known that in the ordinary construction of slide-valves the use of "inside lap" so shortens the period of exhaust, by obstructing the steamways of the cylinder, that for this reason no inside lap (or a trifling amount only) is usually given to valves for engines—such, for example, as locomotives—which run at high rates of speed, and in which the valves consequently work with very short stroke. With my above-described form of valve, however, it is obvious that no matter how short may be the stroke of the valve an ample exhaust of the steam will be attained, as the stroke will always be sufficient to uncover the exhaust-ports *d'* and d^2, and, while there will be a period (shortly after the steam has been cut off and before the "release") during which there will be no exhaust from the cylinder, still it will be found that the full exhaust already permitted will have allowed so much of the steam to escape that the exhaust-steam remaining in the cylinder will cause no material loss of energy.

In Fig. 4 the parts are shown in the position the reverse of that illustrated in Fig. 1—that is to say, at the beginning of the admission of steam through the steamway *a'* and its exhaust through the steamway *a*. It is obvious that when the steam is thus admitted

to the cylinder through the steamway a' the exhaust-steam passing through the steamway a will escape in part directly through the exhaust-cavity d^3 and in part through the escape or exhaust ports e, the ports d', the chamber E, and thence through the exhaust-ports d^4 and d^5 to the exhaust-cavity d^3. It will be seen that during this back-and-forth movement of the main valve the supplemental valve H will be held in fixed position by the rods L, and the shift or change of the relative position of the main and supplemental valves will occur at such time that when the live steam is being admitted through the steamway a to the main slide-valve the exhaust-port d' of the port-plate D will be closed, and when live steam is being admitted through the steamway a' (see Fig. 4) the exhaust-port d^2 in the port-plate D′ will be closed, and hence at such time no escape of live steam can occur through these ports. By forming the supplemental valve H of such size that it will cover the ports d' and d^2, I am enabled to hold the supplemental valve stationary during the movement of the main valve, and at the same time to delay the release of the steam through these ports until such release occurs directly through the steamways and the exhaust-cavity d^3, and by forming the supplemental valve of such width that it will overlap (that is to say, will have "lap") the ports d' and d^2. The delay in the release of the steam through these escape-ports e and e' will be correspondingly prolonged, and in the construction shown the supplemental valve is provided with a lap equal to the inside lap of the main valve, and hence, as seen by Fig. 3, the release of the steam will occur simultaneously directly through the exhaust-cavity d^3 and through the escape-ports d'.

By reference to Fig. 7 of the drawings it will be seen that the escape or exhaust ports e and e' extend from end to end of the main valve, with the exception of the thickness of the end walls, and hence extend opposite the ports d^4 and d^5, which lead from the valve-chamber E into the usual exhaust-cavity d^3. My purpose in giving to these ports e and e' this increased length is to correspondingly increase the area of the exhaust-ports e and e', so that when the valve is working with a short stroke a freer exhaust will be had through these ports. A further advantage, which I believe to be incident to forming the exhaust-ports e and e' of considerable area, and as well, also, to forming the valve with the steam-spaces F and F′, is that the compression from the exhaust side of the cylinder, after the port d^2 has been closed, exerting pressure upon the port-plate D′, will tend to slightly lift or "balance" the main valve, and hence relieve in a measure its friction upon the valve-seat. Moreover, when the rods L are extended through the walls D of the main valve and fastened to the steam-chest these rods will also serve to relieve the pressure of the main valve upon its seat, and will hence operate in a measure to balance the main valve.

In the modified construction illustrated in Fig. 7 of the drawings I have shown a single rod L, connecting the supplemental valve H with the steam-chest, and in this construction this rod L is also shown as connected with the steam-chest at one end only. This modification is evidently within the scope of my present invention, although I do not regard it as so desirable an embodiment thereof as the form previously described.

My present construction of valve mechanism, as well as that set forth in my prior patents above referred to, I have found most applicable for use in connection with variable cut-off mechanism—such, for example, as a link-motion, commonly employed on locomotives—or a valve-gear governor—such, for example, as the well-known slotted eccentric-governor—and in Fig. 8 of the drawings I have illustrated my invention as applied to the well-known form of link-motion commonly used upon locomotives.

Referring to Fig. 8, the valve-rod C is shown as connected to the upper end of the rocker R, that is pivoted in the usual manner to the rocker-shaft S, the lower arm of this rocker being connected in the usual manner with the block T, that slides within the slotted link V, to which movement is imparted by the eccentric-rods V′ and V^2 from the usual eccentrics. The position of the link V will be shifted in well-known manner, either automatically, if a governor be employed, or by hand, if a reverse-rod be employed, as in a locomotive. It will be found that when the position of the link is shifted, in order to vary the stroke of the main slide-valve, the position of the supplemental valve with respect to the escape-ports of the main valve will be so determined by the connection of the supplemental valve to the steam-chest that even when a very short stroke is given to the main valve the escape or exhaust ports of the main valve will be uncovered in such manner as to permit a free escape of the exhaust-steam through these ports.

In Fig. 8 of the drawings, where the main valve is shown as making a very short stroke, it will be seen that escape or exhaust port d^2 is wide open, thus permitting a free escape of steam through this port into the chamber of the main valve. While I have shown but one form of variable "cut-off," (by which term I mean any suitable mechanism for varying the stroke of the main valve,) it is obvious that it will be within the scope of my invention to employ other forms of variable cut-offs—such as a governor—without departing from the scope of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In slide-valve mechanism, the combination, with the main slide-valve having escape or exhaust ports therein and a supplemental

valve for said ports, of suitable mechanism extending between said supplemental valve and some relatively fixed part of the engine, said mechanism serving to hold the supplemental valve during the movement of the main slide-valve, substantially as described.

2. In slide-valve mechanism, the combination, with the main slide-valve having escape-ports therein, of a supplemental valve for said ports and a rod or rods connected with the supplemental valve and with the steam-chest for holding the supplemental valve during the movement of the main slide-valve, substantially as described.

3. In slide-valve mechanism, the combination, with the chambered slide-valve having escape-ports therein, of a supplemental valve and a fixed connection extending between said supplemental valve and the steam-chest, said connection serving to hold the supplemental valve during the movement of the main valve, substantially as described.

4. In slide-valve mechanism, the combination, with the main chambered slide-valve having escape-ports therein, of a supplemental valve and a rod or rods extending through the main slide-valve, said rod or rods being connected with the supplemental valve and to some relatively fixed part of the engine structure, substantially as described.

5. In slide-valve mechanism, the combination, with the main slide-valve having escape-ports therein, of a supplemental valve for said escape-ports, said supplemental valve being of sufficient width to cover the escape-ports immediately beneath it, and suitable mechanism controlling the position of said supplemental valve during the movement of the main slide-valve, substantially as described.

6. In slide-valve mechanism, the combination, with the main chambered slide-valve having escape-ports therein, of a fixed supplemental valve for said escape-ports, said supplemental valve being of sufficient width to overlap the escape-ports immediately beneath it an extent equal to the inside lap of the main slide-valve, substantially as described.

7. In slide-valve mechanism, the combination, with the main chambered slide-valve having escape-ports therein, of a supplemental valve for said escape-ports and rods extending through the walls of the main slide-valve and connected at their ends to the steam-chest, and connected also with the supplemental valve, substantially as described.

8. In slide-valve mechanism, the combination, with the cylinder having suitable steamways, of a main slide-valve having exhaust or escape ports therein adapted to be brought coincident with the steamways, and having lap-plates the lower edges of which are reduced or cut away on the sides adjacent the exhaust-ports, substantially as described.

9. In slide-valve mechanism, the combination, with a main chambered slide-valve having exhaust or escape ports therein, of a supplemental valve located within said main slide-valve, suitable mechanism extending between said supplemental valve and some relatively fixed part of the structure and adapted to control the position of said supplemental valve as the main slide-valve is operated, and a variable cut-off for controlling the stroke of the main slide-valve, substantially as described.

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