(No Model.) 2 Sheets—Sheet 1.

C. SCHMID.

SLIDE VALVE FOR ENGINES.

No. 347,012. Patented Aug. 10, 1886.

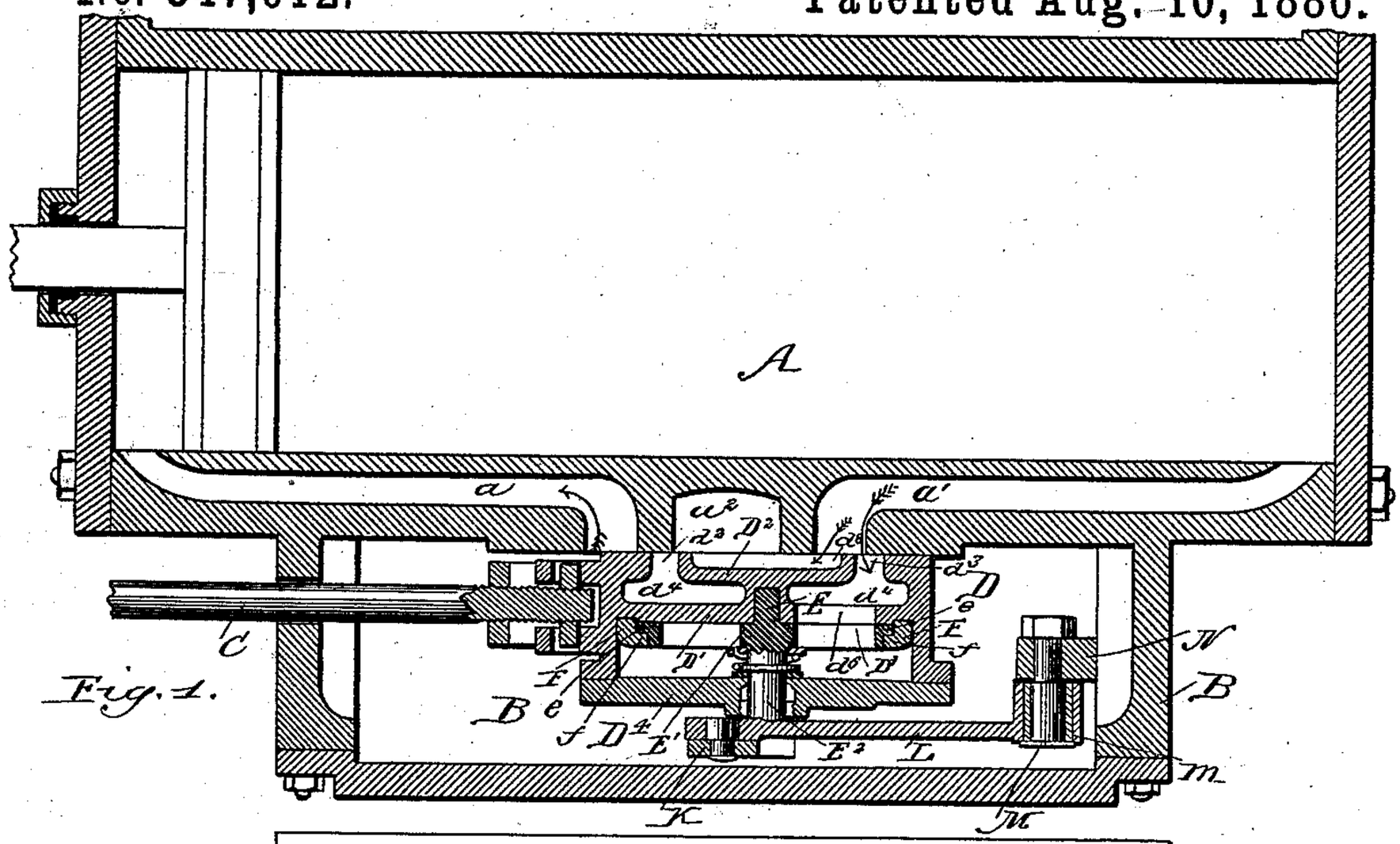

Fig. 1.

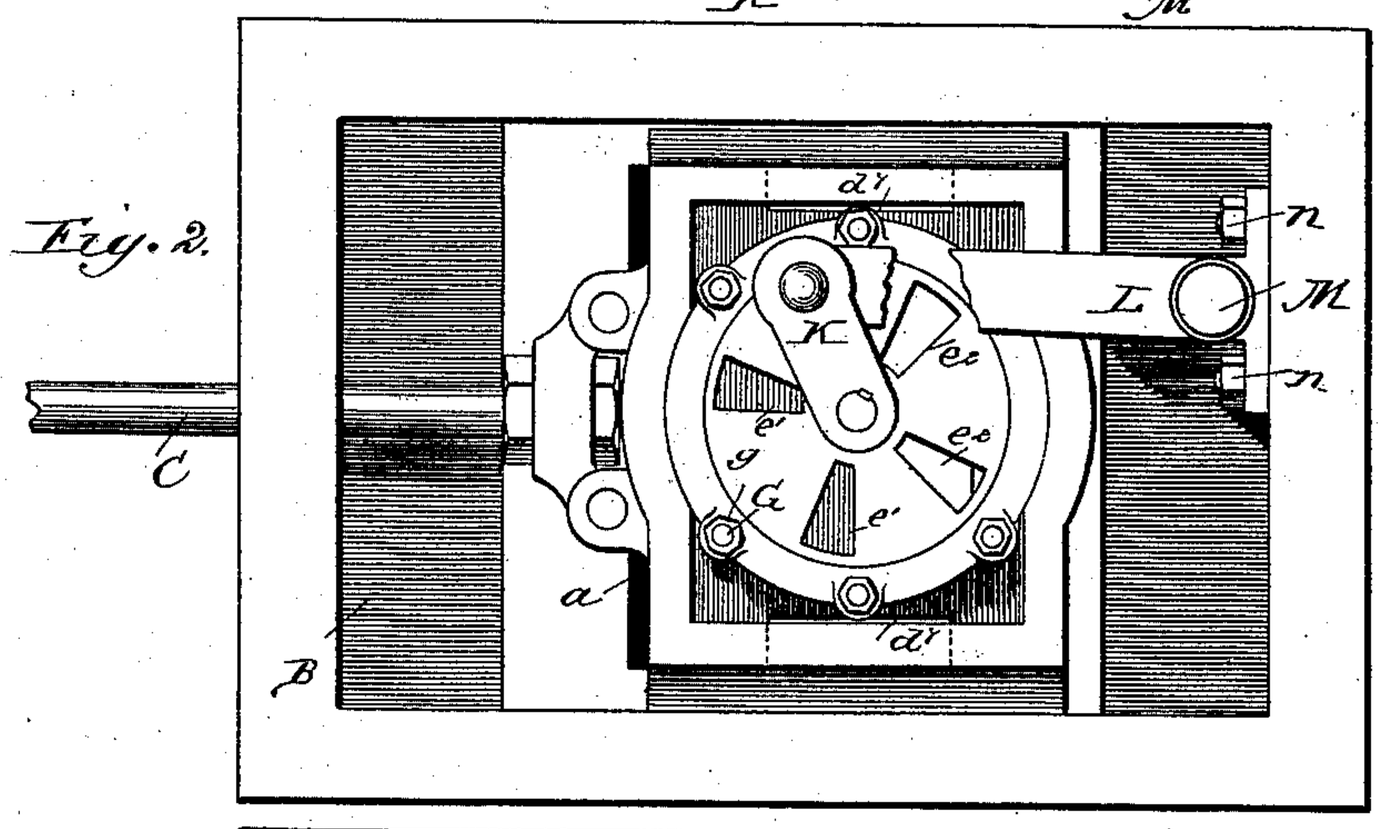

Fig. 2.

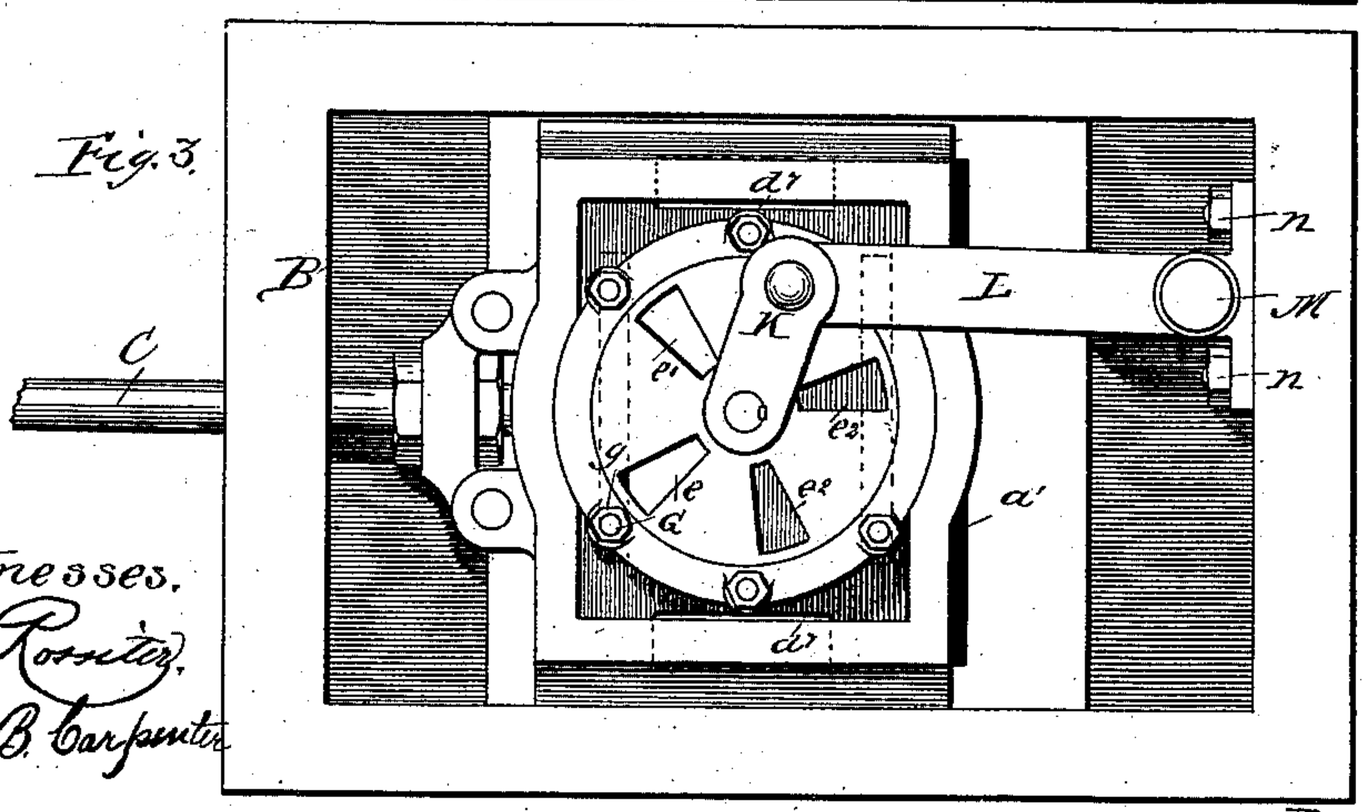

Fig. 3.

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(No Model.) 2 Sheets—Sheet 2.

C. SCHMID.

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Fig. 4.

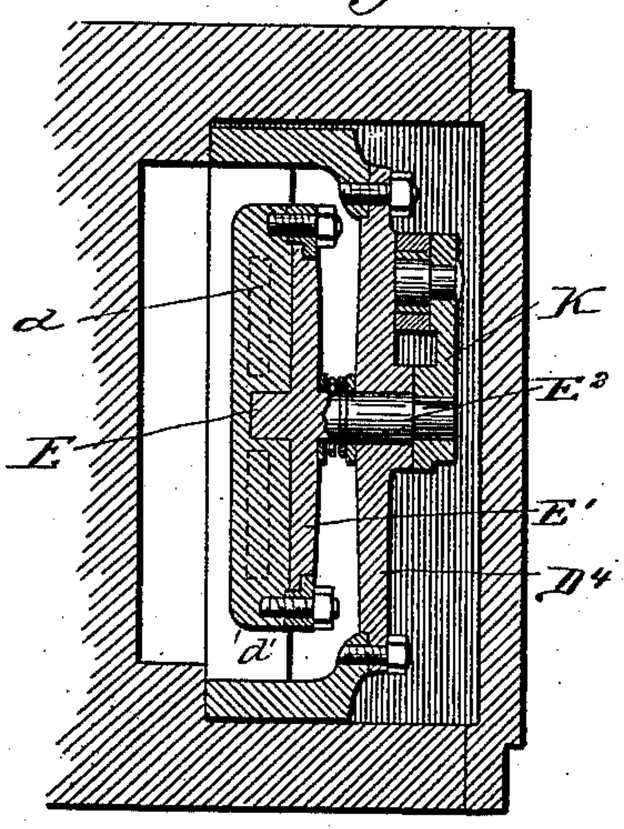


Fig. 5.

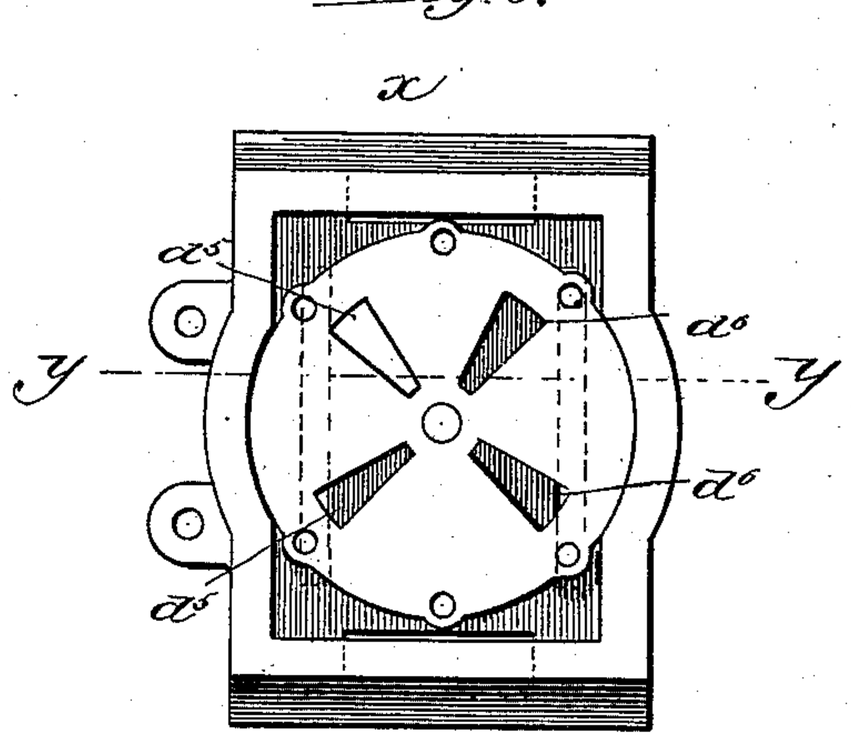


Fig. 6.

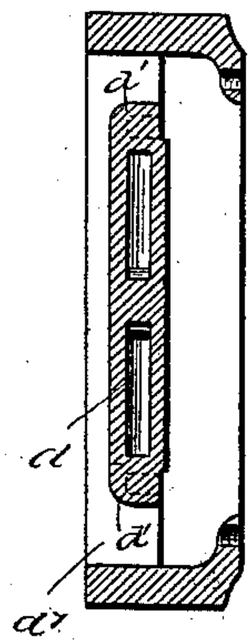


Fig. 7.

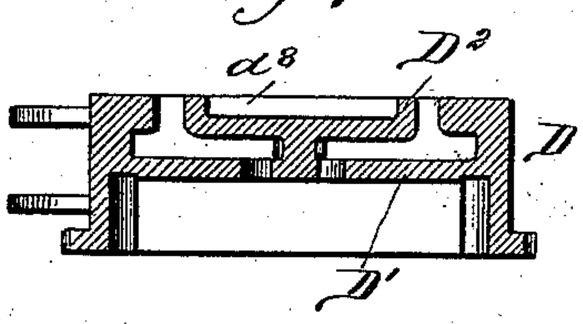


Fig. 8.

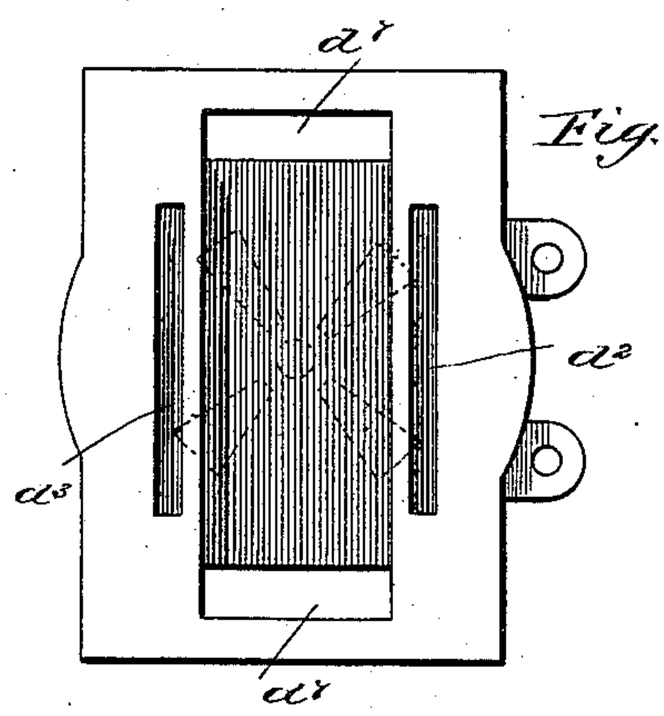
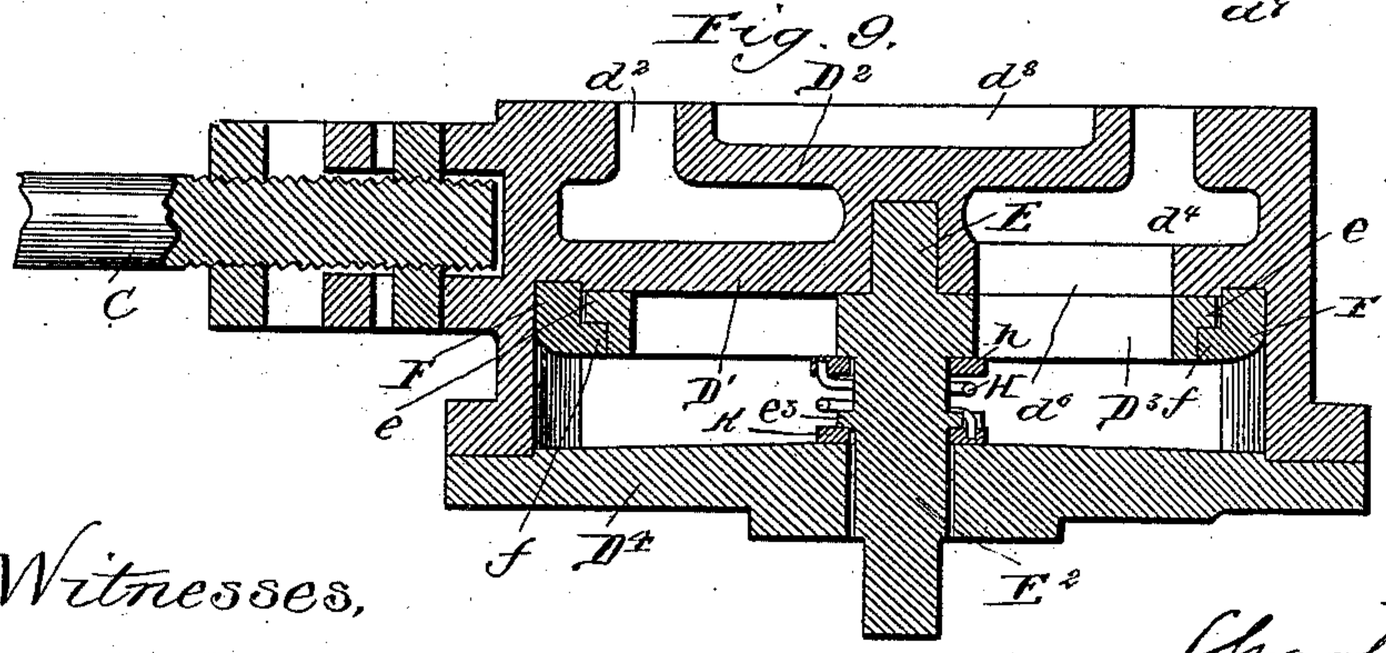


Fig. 9.



Witnesses,
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J. B. Carpenter.

Inventor.
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UNITED STATES PATENT OFFICE.

CHARLES SCHMID, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO GEORGE FARNSWORTH, OF SAME PLACE.

SLIDE-VALVE FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 347,012, dated August 10, 1886.

Application filed April 8, 1886. Serial No. 198,236. (No model.)

To all whom it may concern:

Be it known I, CHARLES SCHMID, a citizen of the United States, residing at Chicago, county of Cook, 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 the improvement of that class of slide-valve mechanism for steam-engines wherein provision is made for relieving the back-pressure or resistance of the steam on the exhaust side of the main piston, so that the loss of energy and consequent increase of working cost incident to such resistance may be avoided; and particularly does my invention relate to the improvement of the slide-valve mechanism set forth in Letters Patent of the United States, No. 337,441, granted to me and to George Farnsworth, as my assignee, on the 9th day of March, 1886. In the mechanism described in said patent the main slide-valve was provided with escape-ports therein, through which the steam might freely pass from the exhaust side of the piston, so as to avoid back-pressure thereon, and a reciprocating supplemental valve was employed to alternately open and close such escape-ports as the main slide-valve was shifted, said supplemental valve being in suitable connection with some relatively fixed part of the engine structure. In my present improved construction I also provide the main slide-valve with escape-ports, escape or exhaust ports, (these two terms being hereinafter employed synonymously,) and with a supplemental valve for alternately opening and closing said ports; but I have simplified and improved the construction there shown.

My present invention therefore consists in the several 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 longitudinal transverse section through the steam-chest, the slide-valve, and the main cylinder. Fig. 2 is a view in side elevation, the cover of the steam-chest and of the main slide-valve being removed. Fig. 3 is a view similar to Fig. 2, with the slide-valve in different position. Fig. 4 is a view in central vertical section through the steam-chest and the slide-valve. Fig. 5 is a detail view of the slide-valve with its cover and the supplemental valve removed therefrom. Fig. 6 is a view in vertical section on line *x x* of Fig. 5. Fig. 7 is a view in longitudinal section on line *y y* of Fig. 5. Fig. 8 is a view in side elevation of the main slide-valve from the rear side. Fig. 9 is an enlarged detail view in longitudinal section of the main slide-valve.

A designates the main cylinder of the engine, provided with the usual steamways, *a* and *a'*, and exhaust-ports a^2; and B denotes the steam-chest, within which, upon its appropriate seat, is placed the main slide-valve, that is operated by the valve-rod C in the usual manner. The body of the main slide-valve 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 central plate, D^2, these plates being connected together at the corners and by the central web, *d*, and webs *d'*. Between the sides of the central plate, D^2, and the walls D of the valve are formed the long escape-ports d^2 and d^3, which communicate with the spaces d^4 beneath the central plate, D', and in this central plate are formed the escape-ports d^5 and d^6, which communicate with the chamber D^3, that is formed by the walls D of the main valve and the cover D^4, that is suitably bolted thereto. At the ends of the central plate and port-plate, and between the webs *d'* and the walls D of the valve, are formed the transverse escape-ports d^7, which are in constant communication with the exhaust-port a^2 of the main cylinder and the exhaust-cavity d^8 of the slide-valve. Within the central web, *d*, is formed a seat adapted to receive one end of the arbor E of the supplemental valve E', this arbor being preferably cast in one piece with such valve, and the upper face of the port-plate D' will be suitably ground to form a seat whereon the valve may turn. Within a recess formed in the port-plate D' fits the

edge of the guard-ring F, the flange *f* of which overlaps the flanged portion *e* of the supplemental valve E′, and serves to hold this valve in position upon its seat. The guard-ring F is connected to the port-plate by means of suitable bolts, G, entering threaded seats in the plate, these bolts being provided, preferably upon their outer ends, with set-nuts *g*, which enable the ring to be drawn more or less tightly against the flange of the supplemental valve, to secure an accurate working of the parts and compensate for wear. Within the supplemental valve E′ is formed the radial apertures e' and e^2, corresponding in shape and location with the ports d^5 and d^6 in the port-plate D′, although it will be understood that the size, arrangement, and number of such apertures may be varied as desired. From the outer face of the supplemental valve E′ extends the arbor E^2, that passes through the cover D^4 of the slide-valve, and is provided with the annular shoulder e^3, between which and the inner face of the cover D^4 is fitted the washer *h*, and on the arbor E^2, and bearing against the supplemental valve E′, is placed the washer *h*′. Encircling the arbor, between the washers *h* and *h*′, is the coiled spring H, the ends of which are fixed in the washers, so that the spring bears constantly upon the supplemental valve and the inner face of the cover D^4. I have found in practice that if the supplemental valve be drawn firmly to its seat by the guard-ring F when the parts are cold, the unequal expansion of the parts is apt to cause the supplemental valve to bind upon its seat when the parts become heated in the working of the engine. My purpose therefore, in providing the coiled spring H is to hold the supplemental valve at all times snugly against its seat. Within the opening formed in the cover D^4 of the main valve is fitted the threaded steel journal-ring *i*, upon which the arbor E^2 will bear, and upon the reduced outer end of this arbor is keyed the crank-arm K, which serves to determine the movement of the supplemental valve as the main valve is reciprocated. At the outer end of this crank-arm is pivotally connected one end of the rod L, the opposite end of this rod being held upon the journal-pin M of the bracket-plate N, that is bolted, as shown at *n*, to the end of the steam-chest. A steel sleeve, *m*, is preferably fitted upon the journal-pin M to avoid wear, and it will be understood that like provision for a similar purpose may be made where desired.

From the foregoing construction, the operation of my improved mechanism will be seen to be as follows: Assuming the parts to be in the relative position shown in Fig. 1 of the drawings, at this instant live steam is being admitted from the steam-chest B through the steam way *a* into the main cylinder behind the piston, and is being exhausted through the steam way *a*′ and through the exhaust-cavity d^8, and the exhaust-port a^2 in the usual manner of ordinary slide-valve mechanism, and as well also through the escape-port d^5, the space d^4, the ports d^6 of the port-plate, the ports e^2 of the supplemental valve, the chamber D^3 of the main valve, the end ports, d^7, and the exhaust-port a^2 of the main cylinder. The exhaust thus continues until the main slide-valve has completed its movement and has been so reversed as to cut off the steam and cause it to work expansively. When the steam has been thus cut off by closing the steamway *a*′, the direct communication is also broken between the steamway *a*′ and the exhaust-cavity d^8; but there is a free outlet for the exhaust-steam through the long ports a^3, the ports d^6 e^2, chamber D^3, end ports, d^7, and main exhaust-port a^2, so that as the steam is acting expansively to move the piston the exhaust-steam can escape freely from the main cylinder by reason of this coincidence of the apertures d^2 of the supplemental valve with the ports d^6 of the main valve. As the main slide-valve continues to move backward after having cut off the steam, the rod L and crank K, by reason of their connection with the arbor of the supplemental valve, cause this valve to partially rotate until the apertures e^2 of the supplemental valve no longer coincide with the ports d^6 of the main valve, and these ports are closed. The complete closing of the ports d^6 by the partial rotation of the supplemental valve occurs when the main valve is about mid-stroke and just before the main piston has completed its stroke, my purpose in cutting off the escape-steam at this point being to retain sufficient air and steam upon the exhaust side of the piston to afford a proper cushion for the piston. As the main slide-valve now continues to move backward from its mid-stroke position, the rod L and crank K cause the further rotation of the supplemental valve until the apertures e' of this valve are brought coincident with the ports d^5 of the main valve, this coincidence occurring by the time the main slide-valve has moved backward far enough to permit live steam to enter from the steam-chest through the steamway *a*′ behind the main piston. As live steam is thus admitted through the steamway *a*′ the exhaust-steam will escape through the steamway *a* directly into the exhaust-cavity d^8, and main exhaust-port a^2 and indirectly through the long escape-ports d^2 of the main valve, the ports d^5 and apertures e' of the supplemental valve, the chamber D^3, the end ports, d^7, and the maine xhaust-ports a^2 of the cylinder. This direct and indirect escape of the exhaust-steam thus continues until shortly after the main valve is reversed and the live steam cut off from the port *a*′, after which the entire escape of exhaust-steam occurs through the long escape-ports d^2 of the main valve, the ports d^5, the apertures e' of the supplemental valve, the chamber D^3, the ports d^7, and the main exhaust-ports e^2.

It will be observed that as long as live steam is

passing through the steamway *a* the ports d^5 of the main valve are closed by the supplemental valve, and these ports remain so closed while the steam thus admitted is acting expansively and until the main piston has about completed its stroke. So, also, when live steam is being admitted through the steamway *a'*, the ports d^6 of the main valve are closed by the supplemental valve and remain closed while the steam on their end of the cylinder is acting expansively and until about the completion of the return-stroke of the piston. It will thus be seen that the ports d^5 and d^6 of the main slide-valve are alternately opened and closed by the supplemental valve, so that there can be no escape of live steam through the ports d^5 while the exhaust-steam is passing through the ports d^6, and vice versa.

It will be observed that the ports d^5 and d^6 of the main slide-valve and the apertures e' and e^2 of the supplemental valve are so arranged with respect to each other that in the moving of the main slide-valve the complete coincidence of the ports d^5 with the apertures e' occurs, while the complete closing of the ports d^6 by the supplemental valve will be effected, and vice versa, this operation being preferably accomplished by forming the upper port d^5 and the upper port d^6 of the main valve at a greater distance from the horizontal bisecting line than the lower port d^5 and the lower port d^6, the apertures of the supplemental valve being reversely arranged with respect to such ports.

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 chambered slide-valve having escape-ports therein, of a supplemental valve for said ports, having apertures therein adapted to be brought coincident with the ports of the main slide-valve, and suitable mechanism for controlling the movement of said supplemental valve, substantially as described.

2. In slide-valve mechanism, the combination, with the main slide-valve having escape-ports therein, of a supplemental disk-valve for said ports and suitable mechanism for controlling the movement of said supplemental valve, substantially as described.

3. In slide-valve mechanism, the combination, with the main slide-valve having escape-ports therein, of a supplemental rotating valve within said main valve, an arbor leading from said supplemental valve, a crank connected to said arbor, and a rod connecting said crank to the steam-chest, substantially as described.

4. In slide-valve mechanism, the combination, with the main slide-valve having escape-ports therein, of a supplemental rotating or disk valve, a guard-ring for said valve, and a suitable arbor and controlling mechanism for said valve, substantially as described.

5. In slide-valve mechanism, the combination, with the main slide-valve having escape-ports therein, of a supplemental rotating or disk valve for said ports, having its arbor formed integral therewith, and suitable mechanism for turning said arbor, substantially as described.

6. In slide-valve mechanism, the combination of the main chambered slide-valve having suitable escape-ports therein, of a supplemental disk-valve located within said main slide-valve and adapted to control the escape-ports thereof, the escape-ports of said main valve and the apertures of said disk-valve being relatively arranged, substantially as described.

7. In slide-valve mechanism, the combination, with the main slide-valve having suitable escape-ports therein, of a supplemental rotating or disk valve journaled within said main valve, and a coiled spring on the arbor of said supplemental valve for pressing it against its seat, substantially as described.

8. In slide-valve mechanism, the combination of the chambered slide-valve having the cover D^4, the central portion, D^2, and port-plate D', and having the ports d^2 d^3 d^5 d^6, spaces d^4, and end ports, d^7, the supplemental valve E', having apertures e' and e^2 therein, the arbor E^2, the crank K, and rod L, substantially as described.

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Witnesses:
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JAMES H. PEIRCE.