(No Model.) 3 Sheets—Sheet 1.

M. T. & M. C. CHAPMAN.

STEAM ENGINE.

No. 572,960. Patented Dec. 15, 1896.

Fig. 3.

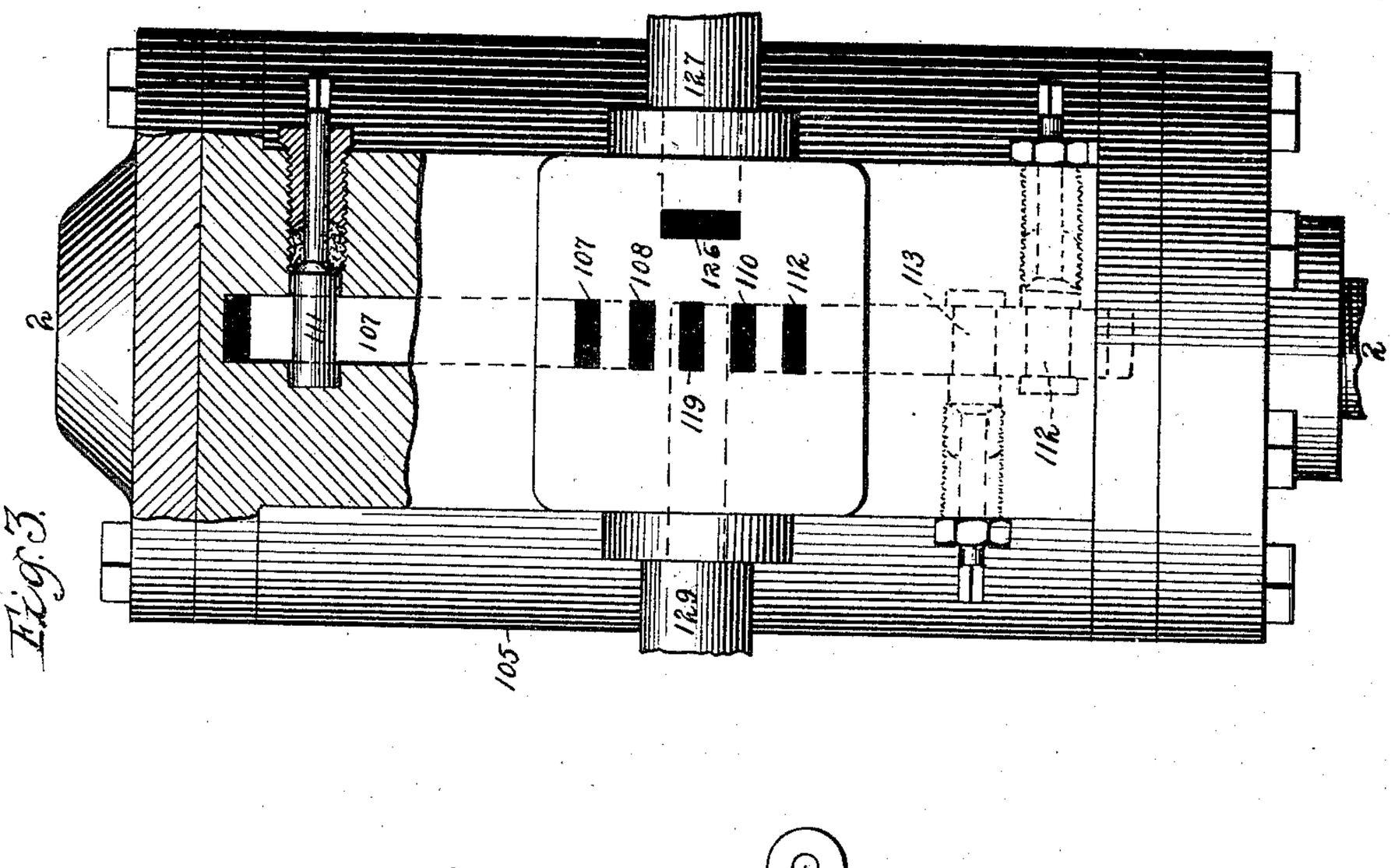
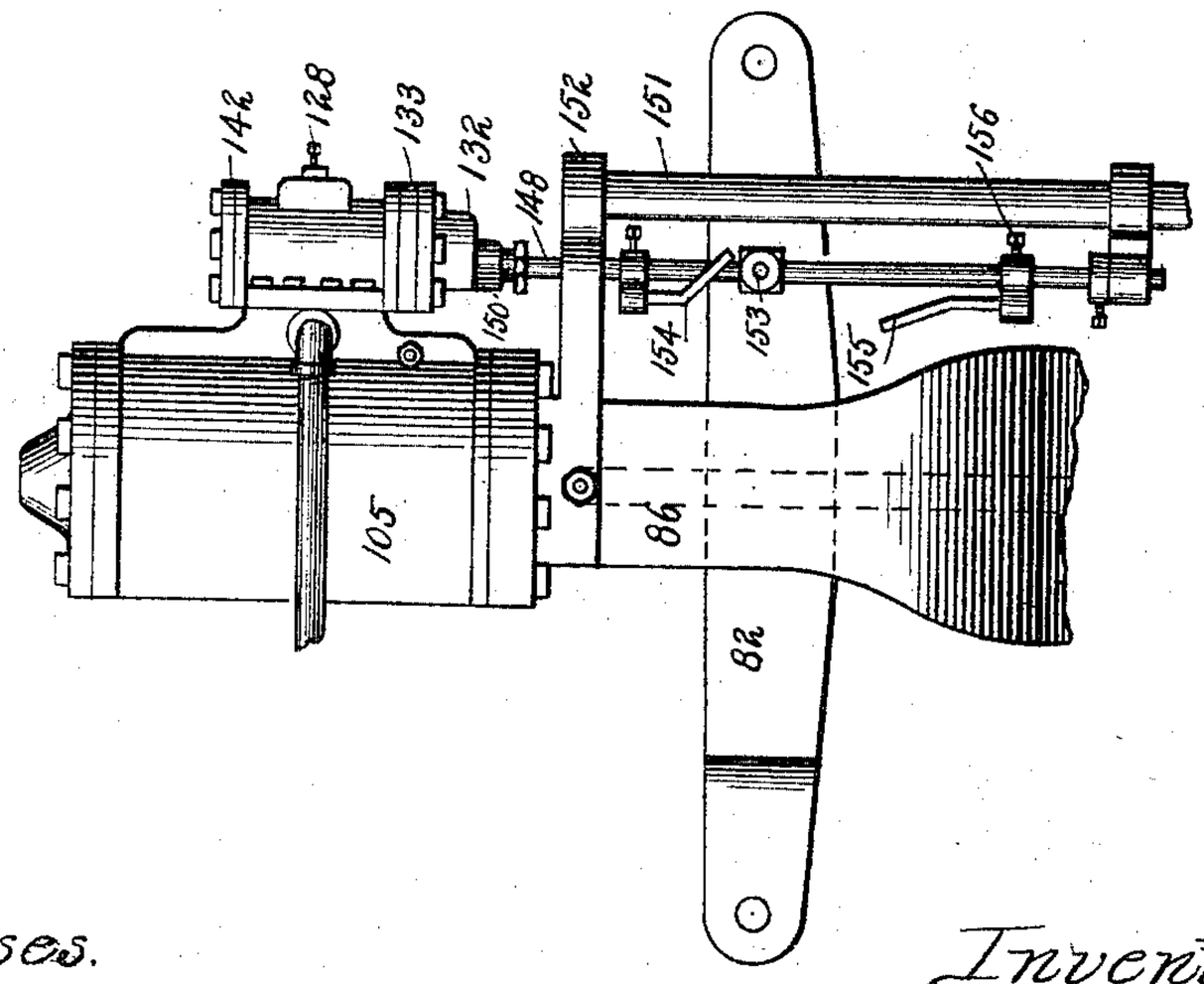


Fig. 1.



Witnesses.
Wm. N. Rheem.
Wm. F. Fleming

Inventors
Matthew J. Chapman
Mark C. Chapman
By Bond, Thurston, Pierson & Jackson, Atty's

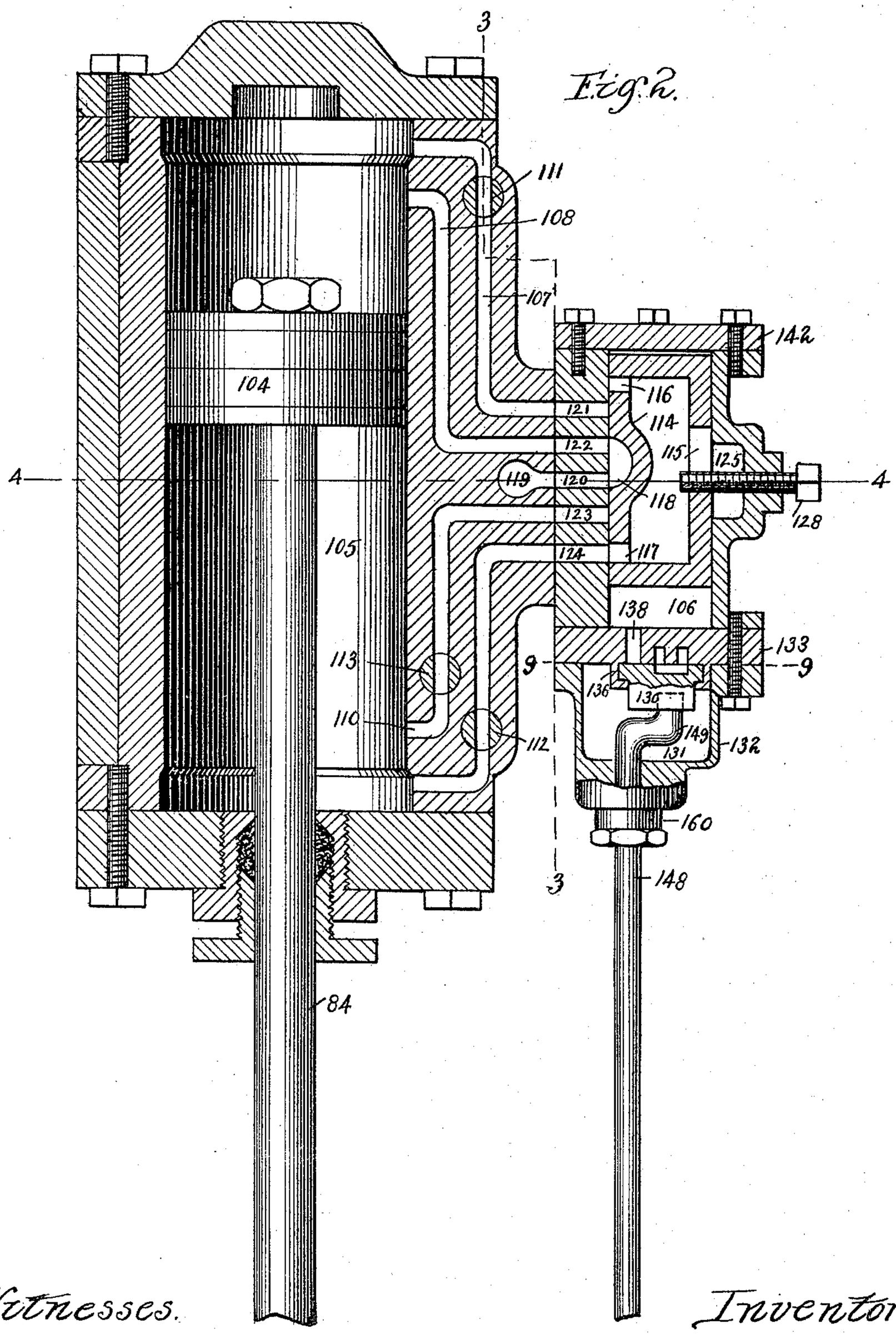
(No Model.) 3 Sheets—Sheet 2.

M. T. & M. C. CHAPMAN.

STEAM ENGINE.

No. 572,960. Patented Dec. 15, 1896.

Fig. 2.



Witnesses.
Wm. N. Rheem.
Wm. F. Fleming

Inventors
Matthew T. Chapman
Mark C. Chapman
By Bond, Adams, Pickard & Jackson Atty's.

(No Model.) 3 Sheets—Sheet 3.

M. T. & M. C. CHAPMAN.

STEAM ENGINE.

No. 572,960. Patented Dec. 15, 1896.

Fig. 4.

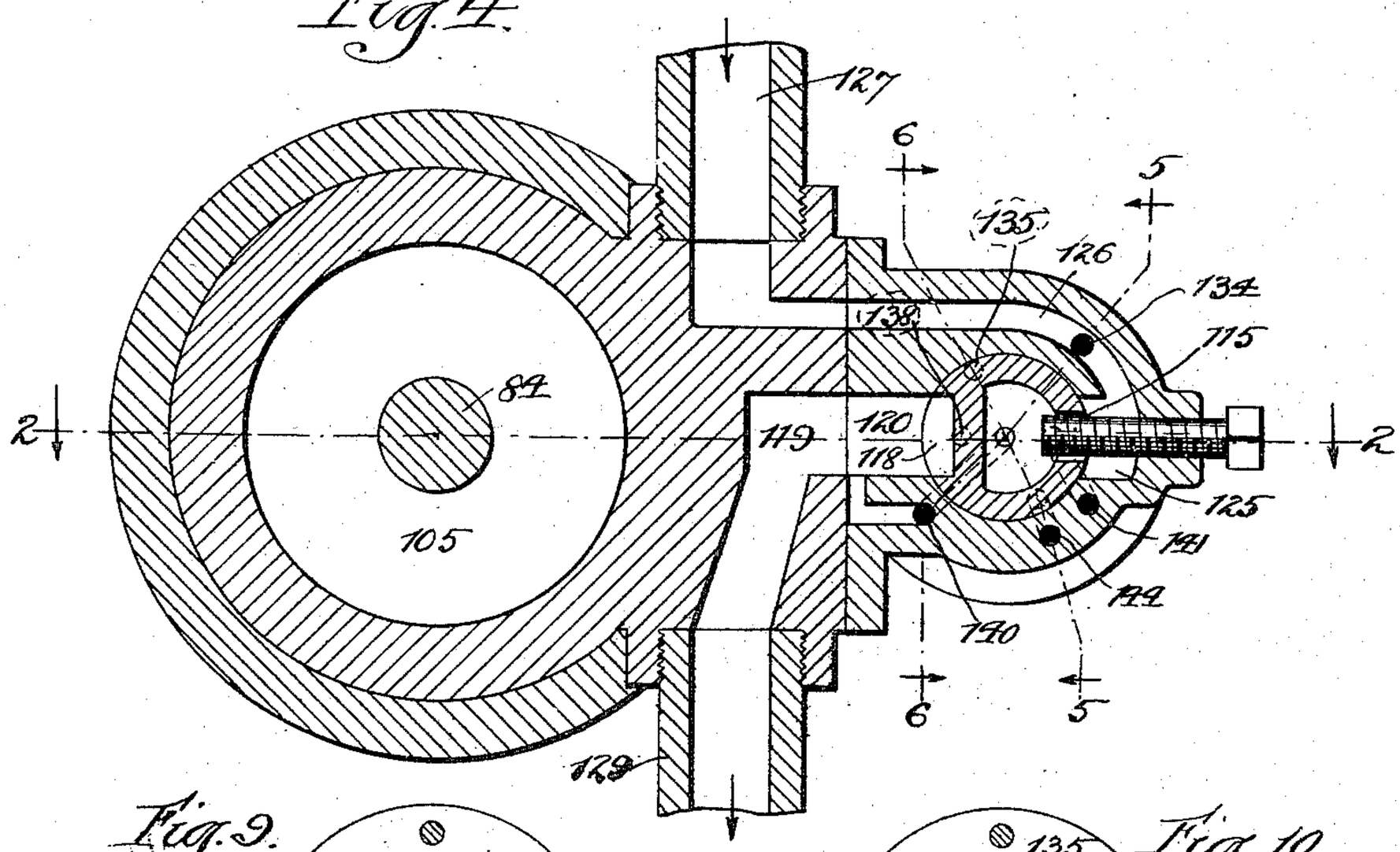


Fig. 9.

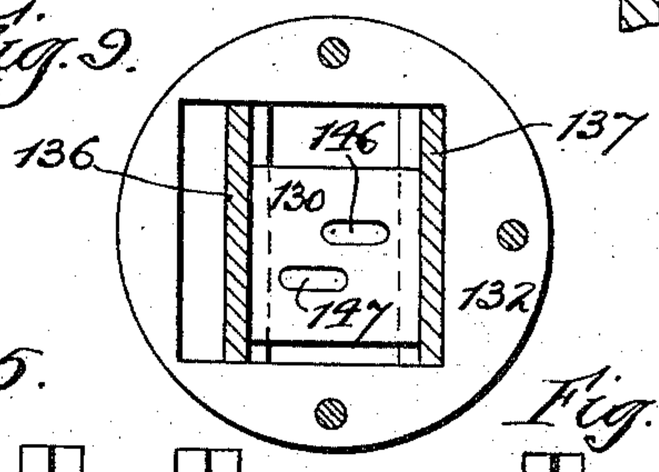


Fig. 10.

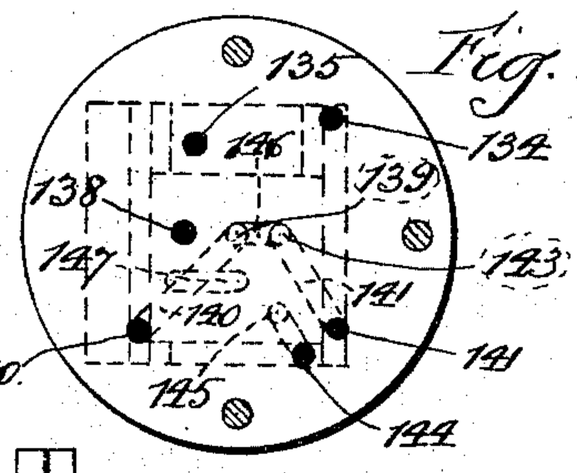


Fig. 5.

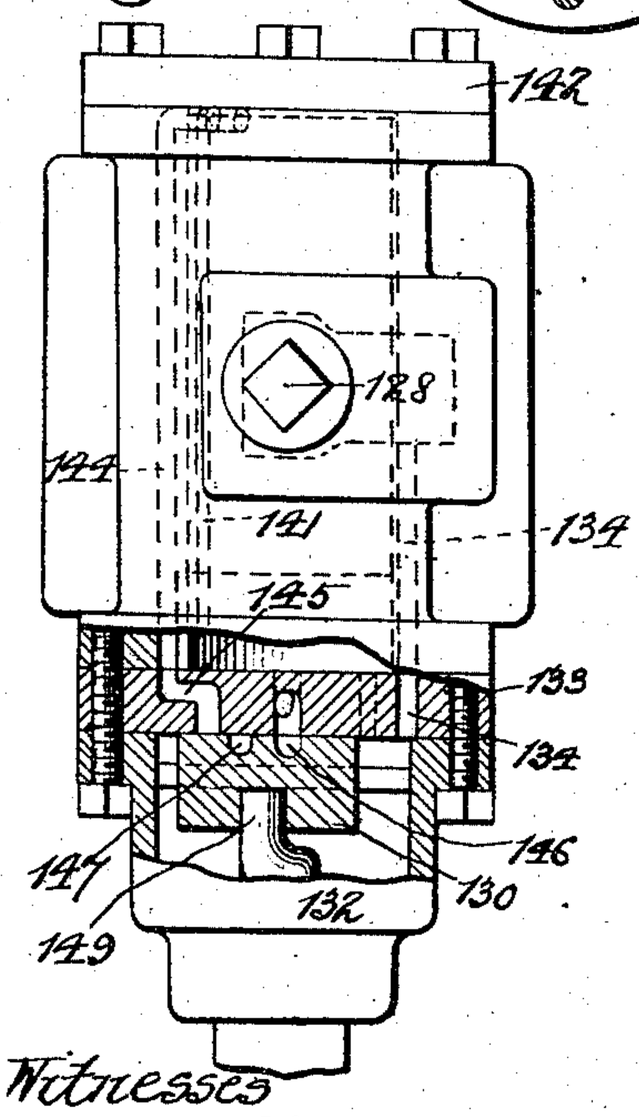


Fig. 6.

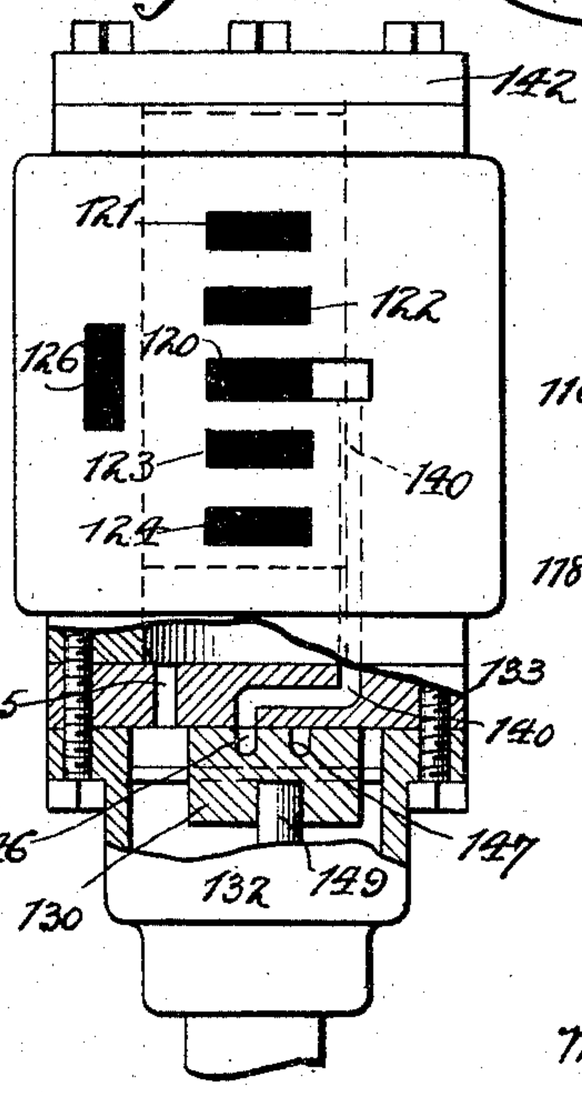


Fig. 7.

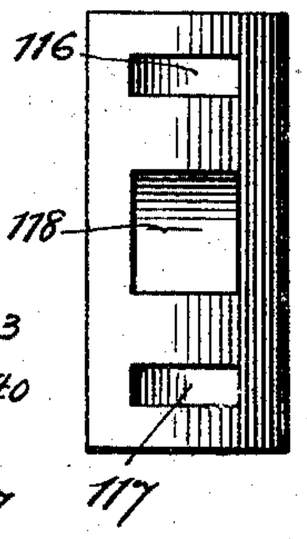
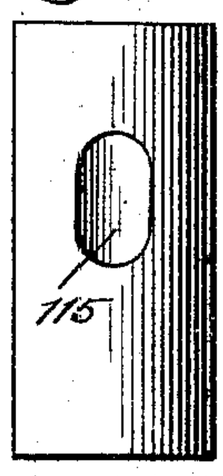


Fig. 8.



Witnesses
Wm. M. Rheem
Wm. F. Fleming

Inventors
Matthew T. Chapman
Mark C. Chapman
By Bond Adams Pickard & Jackson. Attys.

UNITED STATES PATENT OFFICE.

MATTHEW T. CHAPMAN AND MARK C. CHAPMAN, OF AURORA, ILLINOIS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 572,960, dated December 15, 1896.

Application filed July 29, 1895. Serial No. 557,465. (No model.)

To all whom it may concern:

Be it known that we, MATTHEW T. CHAPMAN and MARK C. CHAPMAN, citizens of the United States, residing at Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a partial side elevation showing our engine applied to the operation of pumping apparatus similar to that described and shown in our application filed April 6, 1894, Serial No. 506,645. Fig. 2 is a vertical section on lines 2 2 of Figs. 3 and 6, showing the cylinder of the engine and the valves for controlling the admission of steam thereto. Fig. 3 is a view of the cylinder of the engine, taken on line 3 3 of Fig. 2, part of the upper portion of the cylinder being in section. Fig. 4 is a horizontal section on line 4 4 of Fig. 2. Fig. 5 is an end view of the cylinder and valve-casing of the engine, part being in section, on line 5 5 of Fig. 4. Fig. 6 is an end view of the inner side of the valve-casing, part being in section, on line 6 6 of Fig. 4. Figs. 7 and 8 are details, being elevations of the inner and outer sides, respectively, of the slide-valve which controls the admission of steam to the engine-cylinder. Fig. 9 is a section on line 9 9 of Fig. 2, looking down, and shows the arrangement of the valve which controls the movement of the slide-valve; and Fig. 10 is a view of the lower face of the lower head of the valve-casing, showing the arrangement of the parts, the position of the valve being indicated by dotted lines.

Our invention relates to steam-engines, and has for its object principally to provide an improved steam-engine which will be particularly designed for use in operating pumping apparatus; and it consists in providing a new and improved balance-valve for regulating the admission of steam to the engine, improved means whereby the engine will be automatically controlled by the reciprocation of the piston-rod, and in certain other improvements which will be hereinafter more specifically pointed out.

In the drawings, 84 indicates the piston-rod of the engine, and 105 the cylinder thereof, which may be supported by standards 86 or in any other suitable manner.

82 indicates a cross-head which is connected to the piston-rod 84, as shown in Fig. 1.

The piston-rod 84 is connected to a piston 104, which moves in the cylinder 105 of the engine, as best shown in Fig. 2. Secured at one side of the cylinder 105 is a valve-cylinder 106, which cylinder communicates with the cylinder 105 by passages 107 108 109 110, the passages 107 108 being parallel and opening into the upper portions of the cylinders 106 105 and the passages 109 110 being also parallel and opening into the lower portions of the cylinders 106 105, as shown in Fig. 2.

111 indicates a valve located in the passage 107 and having a stem extending to the outside of the cylinder-casing, so that the valve may be readily operated for the purpose of opening or closing the passage 107. 112 113 indicate similar valves in the passages 109 110, respectively.

114 indicates a cylindrical slide-valve which is adapted to move longitudinally of the chamber 106. The valve 114 is provided at one side with an elongated opening or port 115 and in the opposite side with two openings or ports 116 117, between which is a depressed portion 118.

119 indicates an exhaust-passage in the casing of the cylinder 105, with which communicates a port 120 in the casing of the chamber 106. Ports 121 122 123 124 afford communication between the passages 107 108 110 109, respectively, and the chamber 106. The depressed portion 118 of the valve 114 is sufficient in extent to connect either the exhaust-ports 120 122 or the exhaust-ports 120 123, depending upon the position of the valve 114, and the position of the ports 116 117 is such that when the port 117 is opposite the port 124 the port 122 will be connected to the exhaust-port 120 and when the port 116 is opposite the port 121 the port 123 will be in communication with the exhaust-port 120, so that by moving the valve 114 longitudinally of the chamber 106 steam within the valve 114 may be directed into either end of the cylinder 105.

As best shown in Fig. 2, that portion of the

casing of the valve-cylinder which lies opposite the port 115 is offset to provide a chamber 125, and such chamber communicates by a passage 126 with a steam-supply pipe 127, so that steam is admitted within the valve 114 through the passage 126, chamber 125, and port 115. The valve 114 is kept in the proper position by a bolt 128, which passes through the casing of the valve-cylinder and extends into the port 115, as best shown in Figs. 2 and 4. The exhaust-passage 119 communicates with an exhaust-pipe 129, as shown in Fig. 4.

The valve 114 is moved vertically in the chamber 106 for the purpose of controlling the admission of steam to the cylinder 105 by means of steam which is admitted into the chamber 106 either above or below the valve 114, as circumstances require. The admission of steam to the chamber 106 is controlled by a slide-valve 130, which is located in a chamber 131, formed by securing a suitable casing 132 to one of the heads 133 of the valve-cylinder. A passage 134, extending from the passage 126 (see Fig. 4) to the chamber 131, serves to supply steam to said chamber. A port 135 in the head 133 serves to admit steam from the chamber 131 to the chamber 106 when said port is not closed by the slide-valve 130.

The slide-valve is secured between guides 136 137, secured to the head 133, so that the valve 130 is free to slide horizontally across the lower face of the head 133.

138 (see Fig. 10) indicates an exhaust-port in the lower portion of the chamber 106.

139 indicates an exhaust-port in the head 133, which communicates by a passage 140 with the exhaust-port 120.

141 indicates a passage which opens through the top head 142 of the valve-cylinder into the upper portion of the chamber 106 and serves to conduct exhaust-steam from said chamber to a port 143 in the lower face of the head 133 of the valve-cylinder.

144 indicates a passage which extends through the valve-cylinder casing, its upper end terminating at the upper portion of the chamber 106, its lower end opening into a port 145 in the lower face of the head 133. The relative arrangement of the different ports and passages above referred to is best shown in Fig. 10.

As best shown in Figs. 2, 5, and 9, the slide-valve 130 has in its upper face two channels 146 147, the arrangement of which is shown in Figs. 9 and 10.

When the valve 130 is in the position shown by dotted lines in Fig. 10, it will be seen that the passage which conducts exhaust-steam from the upper portion of the chamber 106 will be in communication with the channel 146, and through such channel it will communicate with the main exhaust-passage 140. Steam from above the valve 114 will therefore be permitted to escape to the main exhaust. At this time the port 135, through which steam is conducted from the chamber 131 into the chamber 106 below the valve 114, will be open, as it is uncovered by the slide-valve 130, so that the valve 114 will be forced up in the chamber 106. When the valve 130 is moved over far enough to cover the port 135, it will expose the port 145, thereby permitting steam to pass through said port and passage 144 to the chamber 106 above the valve 114. At the same time, by means of the channel 147, which will have been moved in position to connect the ports 138 139, the exhaust from below the valve 114 will be permitted to pass into the passage 140 and thence to the main exhaust, so that by sliding the valve 130 back and forth in its guides the valve 114 will be reciprocated in the chamber 106 and the admission of steam to the cylinder 105 be thereby regulated.

The slide-valve 130 is automatically moved for the purpose above stated by means of a crank-shaft 148, the upper end of which is provided with an arm 149, which engages the valve 130, as best shown in Fig. 2, the shaft 148 passing through a suitable stuffing-box 150. The shaft 148 is supported in a vertical position by an upright bar 151, which is suitably secured at its lower end, and at its upper end is secured by a bracket 152 to the standards 86 87, as best shown in Fig. 1. The bar 151 may, however, be supported in any other suitable manner. The shaft 148 is automatically rocked for the purpose of moving the valve 130 backward and forward by means of a roller 153, carried by and projecting laterally from the cross-head 82, which roller is adapted to engage cams 154 155, carried at opposite ends of the shaft 148, as shown in Fig. 1. The arrangement is such that as the cross-head 82 approaches the upper end of its stroke the roller 153 will strike the cam 154, thereby causing it to move laterally, rocking the shaft 148 in the same direction.

When the cross-head 82 approaches the lower end of its stroke, the roller 153 will strike the lower cam 155, thereby causing the shaft 148 to rock in the opposite direction, and the valve 130 will be moved accordingly. As shown, the position of the cams 154 155 upon the shaft 148 may be adjusted, as they are secured by set-screws 156, so that the lead of the engine may be regulated. The form of cross-head shown in Fig. 1 may, however, be very greatly varied, all that is necessary being that it be so arranged as to carry the roller 153, and we do not limit ourselves to the form shown. The form shown is designed especially for pumping apparatus of the form described in our application Serial No. 506,645, and for that reason is illustrated herein.

When the piston is moving down, its movement may be controlled by regulating the flow of exhaust-steam from below the piston by means of the valve 113.

Our improved engine is designed primarily for use with double-acting pumps, such as that described in our application hereinabove referred to, and in such cases it is necessary

that the piston 104 should be forced in both directions; but this engine is also adapted for use with single-acting pumps, and as in such cases it is necessary only to force the piston up, the weight of the plunger and rod being sufficient to return the piston to the lower end of the cylinder, the steam may be cut off from the upper portion of the cylinder by closing the passage 107 by means of the valve 111. The amount of steam admitted to either end of the cylinder may also be regulated by means of the valves 111 112 113.

Our improved slide-valve is perfectly balanced as the steam is admitted within it, and the surface exposed to steam-pressure is practically uniform on all sides.

We do not wish to limit ourselves to the specific form of the improvements herein described, as various modifications may be made without departing from the spirit of our invention.

Although our improved engine is designed especially for use with pumping apparatus, we do not limit ourselves to its use in connection with such apparatus, as it may be used for any other purpose to which it is adapted.

That which we claim as our invention, and desire to secure by Letters Patent, is—

1. In a steam-engine, the combination with a cylinder and piston, of a valve-chamber, passages affording communication between said valve-chamber and said cylinder, a cylindrical valve in said valve-chamber, said valve having a port for the admission of steam thereinto and ports opposite said first-mentioned port for the admission of steam to said passages, and means for controlling the movement of said valve in said valve-chamber for controlling the admission of steam to said passages, substantially as described.

2. In a steam-engine in combination with a cylinder and piston, a valve-chamber 106, passages affording communication between said valve-chamber and said cylinder, a cylindrical slide-valve 114 in said valve-chamber, said slide-valve having a port 115 at one side of the valve for admission of steam thereto, and ports 116, 117 and passage 118 in the side of the valve opposite the port 115 for the admission of steam to said passages, passages for conducting steam from said valve to said cylinder, a passage for admitting steam into said cylindrical valve, a bolt 128 projecting into said port 115 and means for controlling the movement of said valve in said valve-chamber.

3. The combination with a cylinder and piston, of a valve-chamber communicating therewith, a valve in said chamber, said chamber having longitudinal passages in its walls to operate said valve, and transversely-movable auxiliary-valve mechanism at one end of said valve-chamber for controlling the admission of steam into said valve-chamber at its ends, substantially as described.

4. The combination with a cylinder and piston, of a valve-chamber 106, passages affording communication between said valve-chamber and said cylinder, a cylindrical slide-valve 114 in said valve-chamber, said slide-valve having ports 115 116 117 and passage 118, passages for conducting steam from said valve to said cylinder, a passage for admitting steam into said cylindrical valve, means for controlling the movement of said valve in said valve-chamber, a transversely-movable slide-valve 130, valve-chamber 131, and means for moving said slide-valve 130 to control the admission of steam into said valve-chamber 106 above or below said cylindrical valve, substantially as described.

5. The combination with a cylinder and piston, of a valve-chamber, passages making communication between said valve-chamber and said cylinder, a cylindrical slide-valve in said chamber having ports 115, 116, 117 and 118, passages for conducting steam from said valve to said cylinder, a passage for admitting steam into said cylindrical valve, means for controlling the movement of said valve in said chamber, a transversely-movable slide-valve 130, and means for moving said slide-valve to admit steam to the cylindrical valve, substantially as described.

6. The combination with a cylinder and piston, of a valve-chamber 106, passages affording communication between said valve-chamber and said cylinder, a cylindrical slide-valve 114 in said valve-chamber, said slide-valve having ports 115 116 117 and passage 118, passages for conducting steam from said valve to said cylinder, a passage for admitting steam into said cylindrical valve, means for controlling the movement of said valve in said valve-chamber, a transversely-movable slide-valve 130, valve-chamber 131, crank-shaft 148 connected to said slide-valve 130, said shaft having cams 154 155, a cross-head connected to said piston, and a roller 153 carried by said cross-head, said roller being adapted to engage said cams, substantially as described.

7. The combination with a cylinder and piston, of a valve-chamber communicating therewith, a valve in said valve-chamber, passages for conducting steam into the ends of said valve-chamber, and a transversely-movable auxiliary valve arranged at one end of the valve-chamber for controlling the admission of steam into said valve-chamber at its ends, substantially as described.

MATTHEW T. CHAPMAN.
MARK C. CHAPMAN.

Witnesses:
E. W. DUNTON,
R. D. MAHOFFEY.