No. 636,180. Patented Oct. 31, 1899.

F. M. RITES.

FLUID COMPRESSOR.

(Application filed Aug. 29, 1896.)

(No Model.) 4 Sheets—Sheet 1.

FIG. 1.

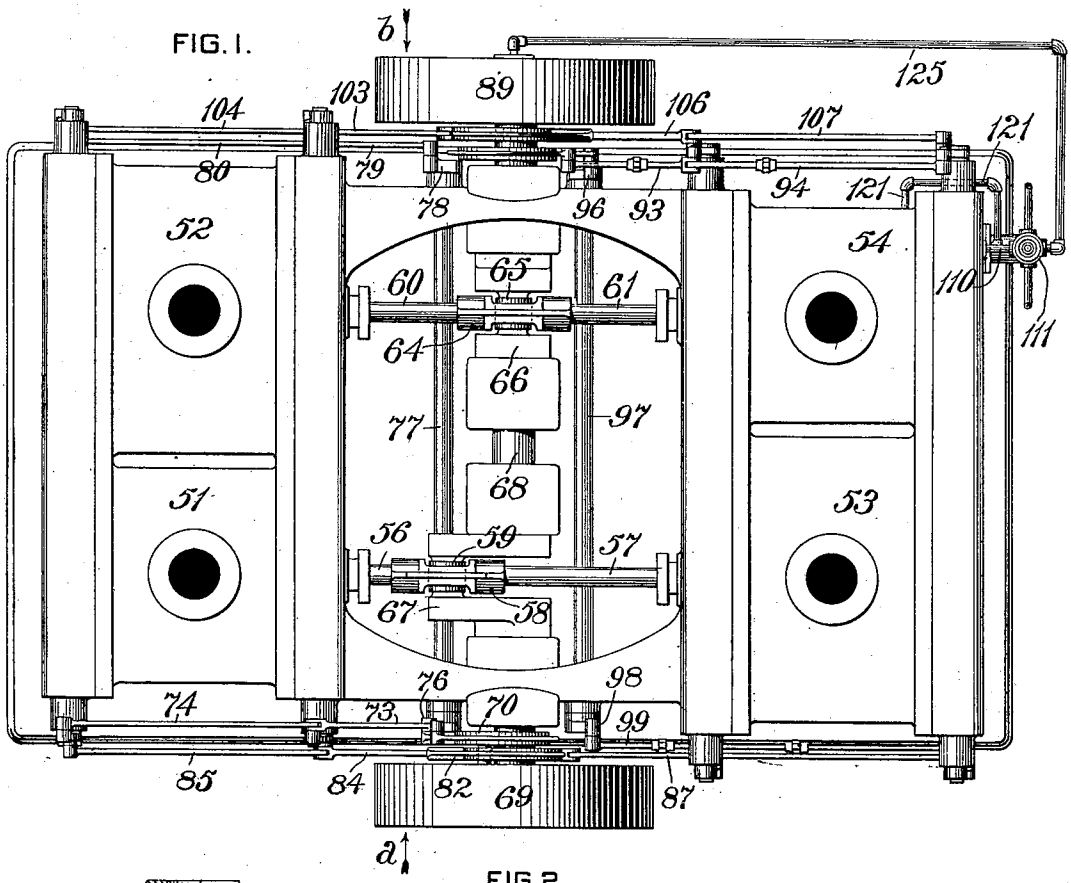

FIG. 2.

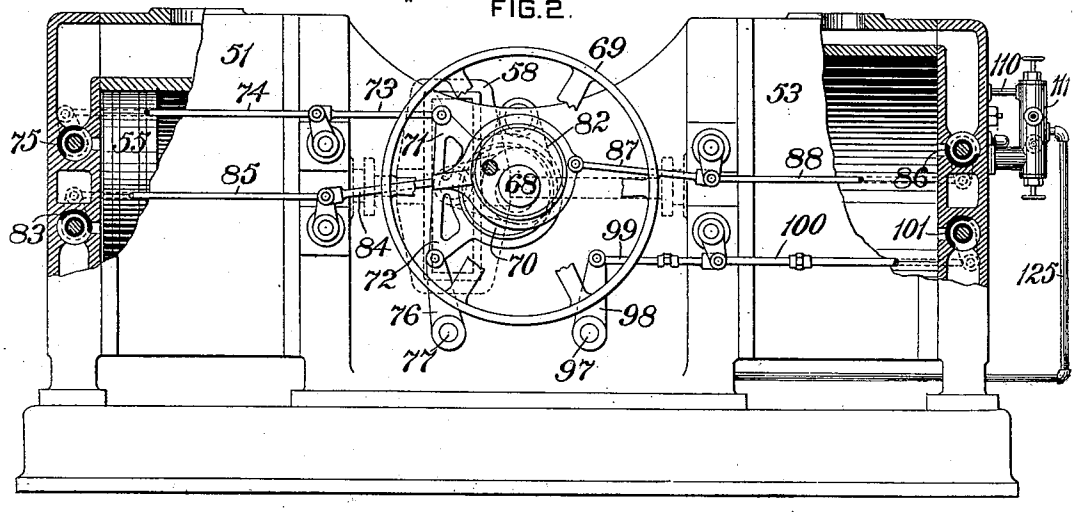

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FIG. 3.

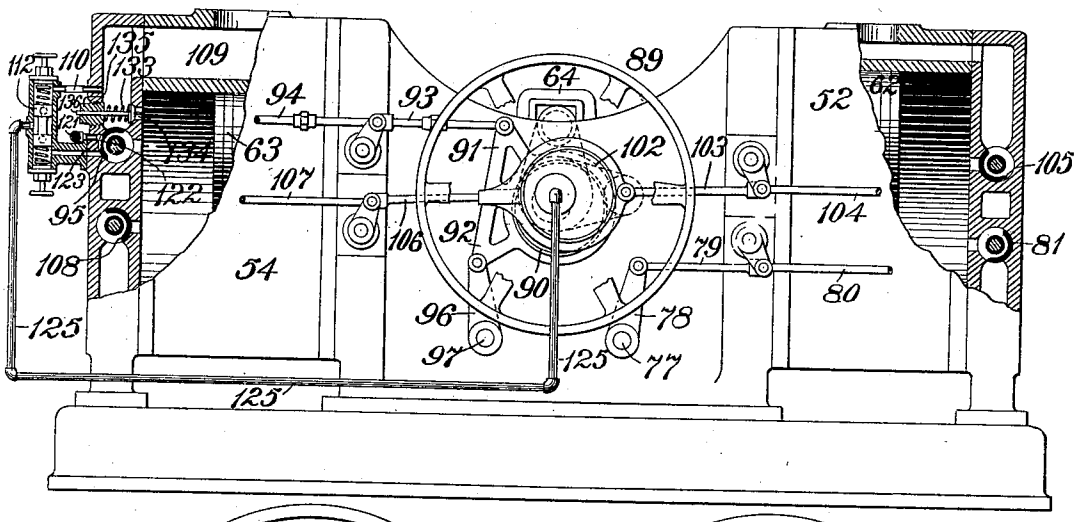


FIG. 4.

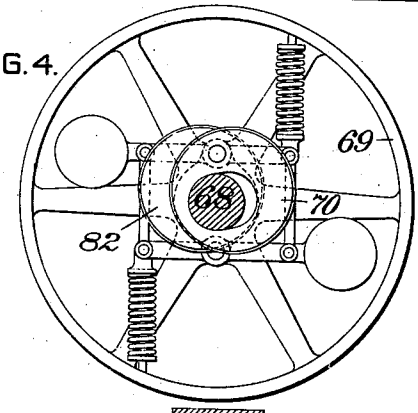


FIG. 6.

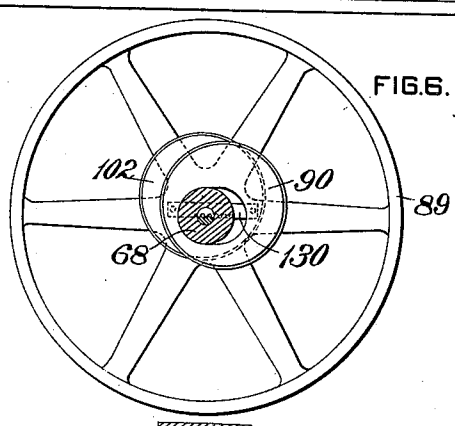


FIG. 5.

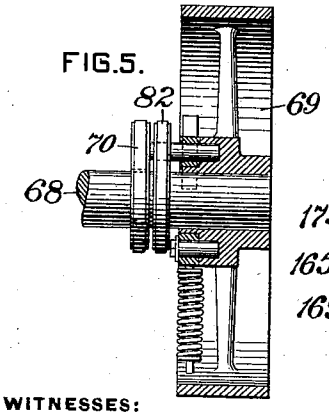


FIG. 10.

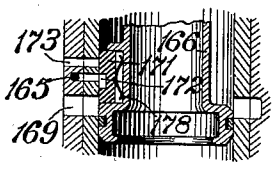
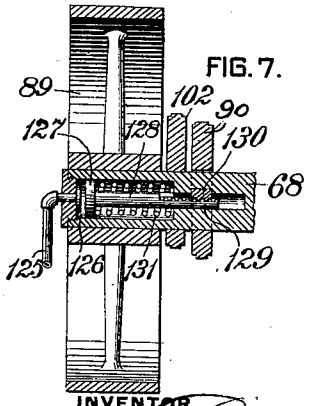


FIG. 7.



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(No Model.) 4 Sheets—Sheet 3.

FIG. 11.

FIG. 7b

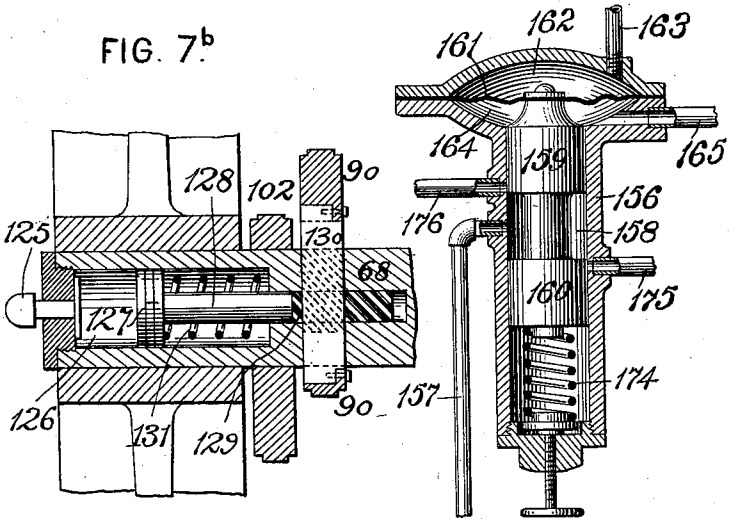


FIG. 7a

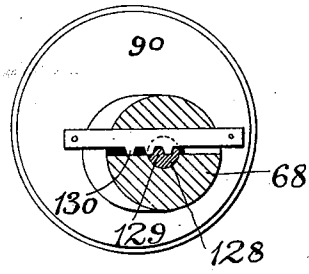


FIG. 12.

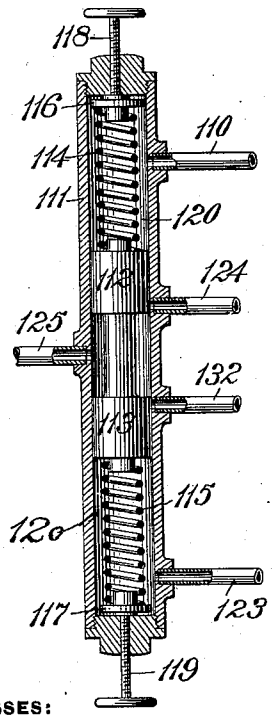
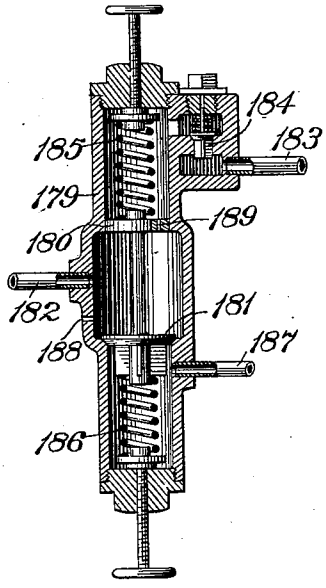


FIG. 13.



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FLUID COMPRESSOR.

(Application filed Aug. 29, 1898.)

(No Model.) 4 Sheets—Sheet 4.

FIG. 9.

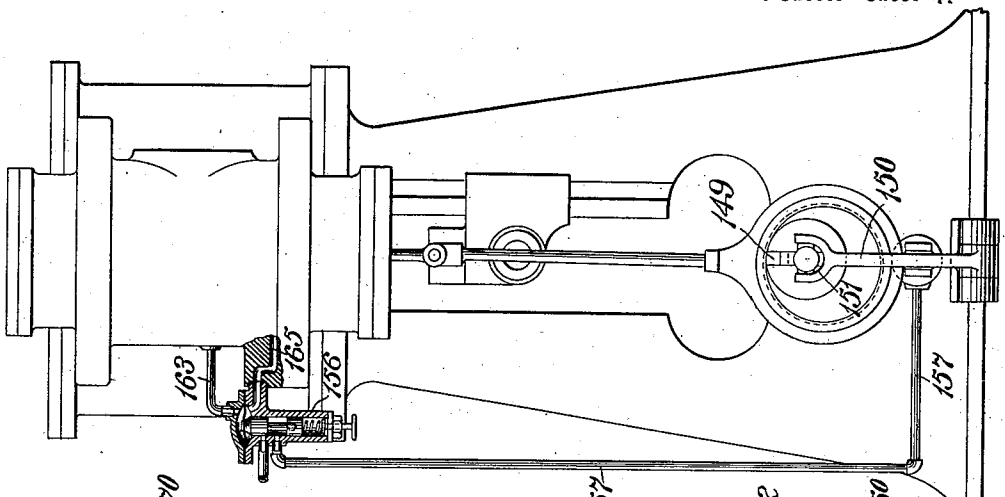
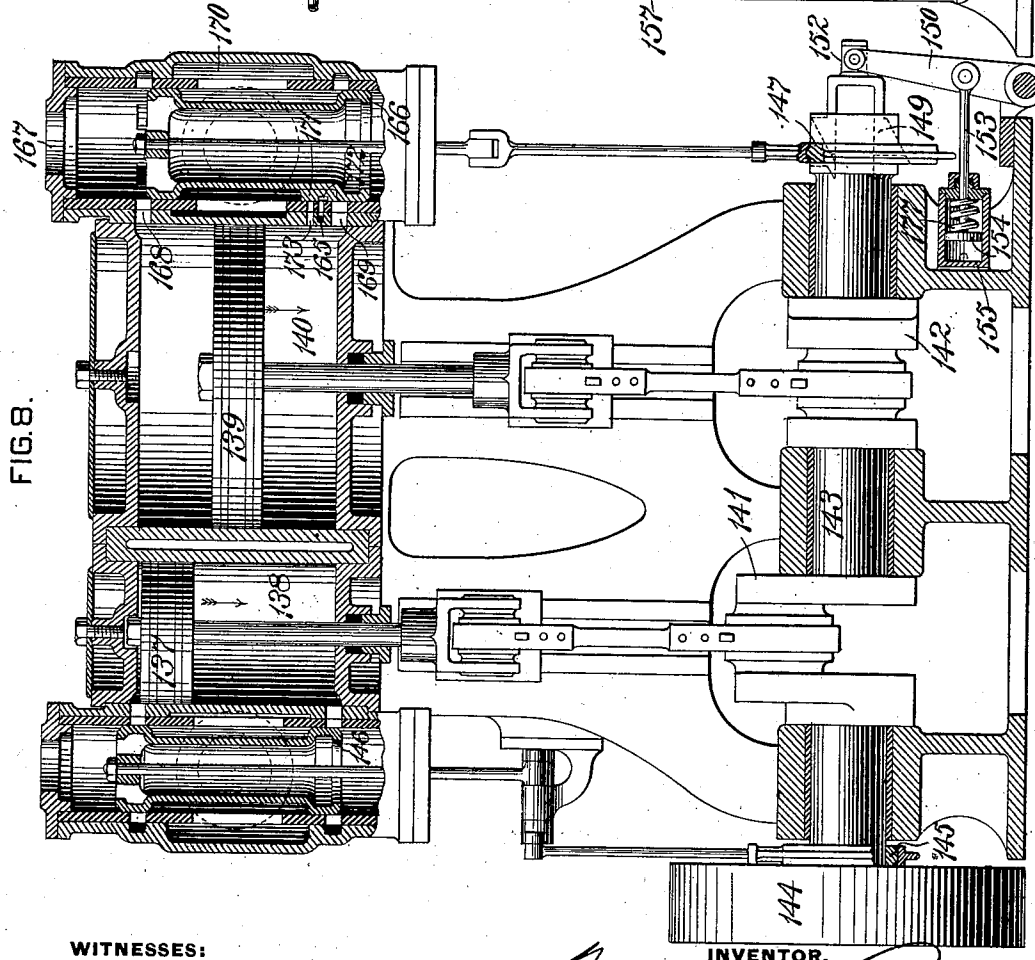


FIG. 8.



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UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF ITHACA, NEW YORK.

FLUID-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 636,180, dated October 31, 1899.

Application filed August 29, 1896. Serial No. 604,327. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. RITES, a citizen of the United States, residing at Ithaca, in the county of Tompkins and State of New York, have invented or discovered a certain new and useful Improvement in Fluid-Compressors, (for which I have obtained British Patent No. 22,182 of 1896,) of which improvement the following is a specification.

The object of my invention is to provide new and improved means for varying and controlling the operation of the valves of fluid-compressors; and to this end my invention, generally stated, consists in the combination, with a shifting eccentric for operating the valve mechanism, of a governing mechanism subject to the opposing fluid-pressures in the reservoir and cylinder of the compressor and which is adapted to effect adjustment of the shifting eccentric for the purpose of varying the operation of the compressor-valve mechanism and a valve device for admitting fluid under pressure from the compressing-cylinder to the governing device; and my invention further consists in certain combinations and features of construction, all as hereinafter fully set forth.

In the accompanying drawings, which illustrate applications of my invention, Figure 1 is a plan view of a compound fluid-compressor embodying my invention; Fig. 2, a side elevation and partial section of the compressor shown in Fig. 1 looking in the direction of the arrow marked *a;* Fig. 3, a similar side elevation and partial section of the construction shown in Fig. 1 looking in the direction indicated by the arrow marked *b;* Fig. 4, an elevation of the shifting eccentric mechanism for controlling the cut-off in the steam-cylinders; Fig. 5, a section at right angles to Fig. 4; Fig. 6, an elevation of the fly-wheel and eccentric mechanism on the opposite side of the compressor; Fig. 7, a section at right angles to Fig. 6; Fig. 7^a, a section on the line $x\,x$ of Fig. 7; Fig. 7^b, a section on the line $y\,y$ of Fig. 7; Fig. 8, a central section through a compressor provided with a modification of my improvement; Fig. 9, an end elevation of the compressor shown in Fig. 8; Fig. 10, a modification of a portion of the governing mechanism shown in Fig. 8; Fig. 11, a central section, on an enlarged scale, through the governing-valve device shown in Fig. 9; Fig. 12, a section, on an enlarged scale, through the governing-valve device shown in Figs. 1, 2, and 3; and Fig. 13, a section through a modification of the governing-valve device.

In the practice of my invention, referring first to the embodiment thereof shown in Figs. 1, 2, and 3, I employ a high-pressure steam-cylinder 51, a low-pressure steam-cylinder 52, a low-pressure fluid-compressing cylinder 53, and a high-pressure fluid-compressing cylinder 54. The piston 55 in the high-pressure steam-cylinder and the piston in the low-pressure compressing-cylinder have their rods 56 and 57 connected by means of a yoke 58, within which the crank-pin 59 works. The piston-rods 60 and 61 of the low-pressure steam-piston 62 and the high-pressure compressing-piston 63 are connected together by means of the yoke 64, within which the crank-pin 65 works. The cranks 66 and 67 are placed at right angles to one another.

On one end of the shaft 68 is a fly-wheel or rotary carrier 69, on which is mounted a shifting eccentric 70. (Shown in Figs. 1, 2, 4, and 5.) This eccentric is provided with a strap having the angularly-disposed arms 71 and 72, the arm 71 being connected by the rods 73 and 74 with the admission-valves 75 of the high-pressure steam-cylinder, and the arm 72 being connected with an arm 76 on a rock-shaft 77, which extends across the frame of the engine to the opposite side and carries on its opposite end an arm 78, which is connected by the rods 79 and 80 with the admission-valves 81 of the low-pressure steam-cylinder 52. By means of these connections the shifting eccentric 70 is connected with and adapted to vary the adjustment of the admission-valves of both the high and low pressure steam-cylinders.

On the same side of the engine with the shifting eccentric 70 is located a fixed eccentric 82, the strap of which is connected with the high-pressure steam-exhaust valves 83 by means of the rods 84 and 85 and with the inlet-valves 86 of the low-pressure compressing-cylinder by means of the rods 87 and 88.

A fly-wheel or rotary carrier 89 is mounted on the main shaft 68 on the side of the engine opposite to the fly-wheel 69 and carries a shifting eccentric 90, which is provided with a

strap having angularly-disposed arms 91 and 92, the arm 91 being connected by rods 93 and 94 with the outlet-valves 95 of the high-pressure compressing-cylinder and the arm 92 being connected with an arm 96 on one end of a rock-shaft 97, which extends across the frame of the engine to the opposite side, where it is provided with an arm 98, which is connected by means of the rods 99 and 100 with the outlet-valves 101 of the low-pressure compressing-cylinder 53. By means of these connections the shifting eccentric 90 operates the outlet-valves of both the high and low pressure compressing-cylinders.

Mounted on the main shaft 68, outside of the shifting eccentric 90, is a fixed eccentric 102, the strap of which is connected by rods 103 and 104 with the exhaust-valves 105 of the low-pressure steam-cylinder 52 and by means of rods 106 and 107 with the inlet-valves 108 of the high-pressure compressing-cylinder 54.

The shifting eccentric 70, which operates the admission-valves of the high and low pressure steam-cylinders, may form part of and be adjusted by any preferred form of governor, such as that shown in Fig. 4; but the shifting eccentric 90, which operates the outlet-valves of the high and low pressure compressing-cylinders, is adjusted by mechanism whose operation is dependent on the relative pressures in the high-pressure compressing-cylinder and in the reservoir or outlet-passage leading from the high-pressure compressing-cylinder.

The governing mechanism controlling the adjustment of the shifting eccentric 90 is shown in Figs. 1, 2, and 3 in position on the compressor, in Fig. 12 on a larger scale and detached from the compressor, and in Figs. 11 and 13 modifications of the governing device are shown.

As shown in the drawings, the reservoir-space or outlet-passage 109, into which the fluid is discharged from the high-pressure compressing-cylinder 54, is connected by means of a pipe 110 with one end of the governing-valve device 111, within which are fitted the connected pistons 112 and 113. Springs 114 and 115 are located in the piston-chamber 120 of the cylindrical casing 111 in position to bear on the opposite ends of the pistons 112 and 113, and these springs tend to hold the pistons in a central position. The outer ends of the springs bear against plates 116 and 117, which are adjustable in position by means of the screws 118 and 119, as shown in Fig. 12.

The outer end of the piston 112 is at all times exposed to the pressure in the reservoir, which is admitted through the pipe 110, and the opposite end of the piston-chamber 120 is at intervals put in communication with the interior of the high-pressure compressing-cylinder by the action of the outlet-valve 95. (Shown on the left of Fig. 3.) A cavity 122 is so formed and located in the face of the outlet-valve 95 that when the outlet-valve is about to open the cavity connects the pipe or passage 123 leading to the lower end of chamber 120 with a pipe or passage 121 leading to the interior of the high-pressure compressing-cylinder, and thereby exposes the outer end of the piston-valve 113 to the pressure within the high-pressure compressing-cylinder.

If the pressures acting on the outer ends of the pistons 112 and 113 are equal, there will be no movement of those pistons; but if the pressure in the compressing-cylinder, which acts on the outer end of the piston 113, is in excess of that in the reservoir, and which acts on the piston 112, the pistons will be moved upward and the piston 112 will uncover the pipe or passage 124 leading from a supply of fluid under pressure and admit fluid under pressure to the pipe 125, which leads to a chamber 126, formed in the main shaft 68. Within the chamber 126 is fitted a piston 127, and on its stem 128 is formed or secured an inclined rack 129, which engages with a rack 130, passing through the shaft and secured to the shifting eccentric 90. Surrounding the stem of the piston 127 is a spring 131, which tends to hold the piston in the outer end of the chamber 126, as shown in Figs. 7 and 7b.

When fluid under pressure is admitted through the pipe 125 to the chamber 126, the piston 127 will be moved, so as to adjust the eccentric 90 to a position in which an earlier opening of the outlet-valves of the compressor-cylinders will be effected.

When the outlet-valve 95 puts the compressor-cylinder in communication with the chamber 120 below the piston 113, if the pressure in the compressing-cylinder is less than the reservoir-pressure acting on the piston 112 the pistons 112 and 113 will be moved down, so as to close the passage 124 and to open the pipe or passage 132. The fluid-pressure acting on the small piston 127 will then be released through the pipe 132, which opens to the atmosphere, and the spring 131 will move the piston 127 and the rack 129, so as to shift the eccentric 90 into position to effect a later opening of the outlet-valves of the compressor-cylinders.

It will be seen that by means of my improvement the shifting eccentric, operating and controlling the time of opening of the outlet-valves of the compressing-cylinders, will be automatically adjusted in accordance with the variations of fluid-pressure in the reservoir and compressing-cylinder, and this governing action by varying the time of opening of the outlet-valves of the compressor will also affect the resistance required to be overcome by the motor and cause a corresponding variation in the cut off of the motor fluid by means of the shifting eccentric 70.

The pipe 124, through which fluid-pressure is admitted between the pistons 112 and 113 and to the pipe 125 for moving the piston 127 in the chamber 126, may be connected with a

water-main or a steam-boiler or with any other suitable supply of fluid under pressure; but it is preferred that this pressure should be independent of the compressor or its condition as to operation—that is, it should be available at all stages of operation of the compressor.

A small valve 133 controls a passage 134 in the head of the high-pressure compressing-cylinder and is normally held to its seat by the pressure in the reservoir or outlet-passage 109 and by a spring. The stem 136 of this valve passes out through a plug 135 into position to be visible on the outside of the cylinder-head or to be felt by the hand, so that its outward movement by unusual differences of pressure will indicate the condition of pressure in the compressing-cylinder. The sound caused by the closing movement of this valve may also indicate that the valve has been opened.

In Figs. 8 and 9 I have shown my improvement applied to a vertical compressor in which the piston 137 of the steam-cylinder 138 and the piston 139 of the compressing-cylinder 140 are connected to the cranks 141 and 142, placed at right angles to one another on the main shaft 143. On one end of the main shaft are a fly-wheel 144, carrying a governor, (not shown,) and a shifting eccentric 145, which is connected to and operates the steam-distribution valve 146. On the opposite end of the main shaft is a shifting eccentric 147, which is connected to and operates the distribution-valve 148 of the compressing-cylinder 140. The shifting eccentric 147 is adapted to be adjusted by means of a sliding wedge-block 149, which in itself is a common device for this purpose and is employed merely to show an application of my improvement. Sliding motion is given to the wedge-block by means of a pivoted arm 150, which is provided with a forked upper end 151, connected to a loose collar 152 on an extension of the wedge-block. The arm 150 is pivoted at its lower end and between its ends is connected to the rod 153 of a small piston 154, which is fitted in a cylinder 155. Inside of the cylinder 155 the piston-rod is surrounded by a spring 177, which tends to move the piston and the wedge-block toward the left, as shown in Fig. 8, and to shift the eccentric, so as to cause an early opening of the outlet-valve of the compressor. The interior of the small cylinder 155 is in communication, through the pipe 157, with the valve-chamber 158 of a governing-valve device 156. (Shown in Figs. 9 and 11.) The pipe 157 opens into the valve-chamber 158 between the two pistons 159 and 160, which are connected to and operated by the movement of a movable abutment or diaphragm 161. The diaphragm 161 is exposed on one side to the pressure in the reservoir or outlet-passage of the compressor, which is admitted to the chamber 162 of the governing-valve through the pipe 163. The other side of the diaphragm 161 is exposed to the pressure in the cylinder 140 of the compressor, which is admitted to the chamber 164 through the passage 165, which is at intervals connected with the interior of the cylinder 140 by means of a valve device connected to or operated by the main valve 166 of the compressor. Fluid is admitted to the ports 168 and 169 in the opposite ends of the compressing-cylinder 140 through the passage 167 and through the body of the main valve 166 and after being compressed is discharged into the passage 170, which communicates with the reservoir. Formed on or connected to the main valve 166 of the compressor is a small valve 171, having a cavity 172 formed in its face, which controls communication between the passages 165 and 173 in the wall of the cylinder 140. The passage 173 is at all times in communication with the interior of the compressor-cylinder 140, and the passage 165 is in communication with the chamber 164 of the governing-valve device 156, and about the same time that the port 169 is opened to the reservoir-space 170 by the valve 166 the cavity 172 connects the passage 173 with the passage 165 and admits fluid under pressure to the chamber 164 of the governing-valve device on one side of the diaphragm 161. Except when the small cavity 172 connects the passages 165 and 173 the chamber 164 of the governing device is cut off from the main cylinder 140, and the diaphragm 161 is therefore not exposed to the great variations of pressure that occur in the main cylinder. When the pressure in the compressor-cylinder 140 at or near the time of opening the port 169 to the reservoir is substantially the same as the pressure in the reservoir, the diaphragm 161 of the governing device will be substantially balanced by the reservoir-pressure on one side acting against the cylinder-pressure and the pressure of the spring 174 on the other side, and the pistons 159 and 160 of the governing device will be held in the position shown in Fig. 11. There will then be no change in the adjustment of the shifting eccentric 147 or of the valve 166. When, however, the pressure in the compressing-cylinder at the time of discharge through the port 169 is greater or less than the pressure in the reservoir, the diaphragm 161 and the piston-valves 159 and 160 will be moved in direction to effect a proper adjustment of the eccentric 147 and valve 166, and thereby to vary the time of opening the discharge from the cylinder 140 into the reservoir-space 170. If at the time of discharging from the compressor-cylinder the cylinder-pressure is considerably in excess of the reservoir-pressure, it will be because the discharge from the cylinder to the reservoir is not early enough, and the cylinder-pressure, acting below the diaphragm 161, will move the diaphragm and the piston-valves upward, so as to close the exhaust-passage 175 and to connect the pipe 157 with the

pipe or passage 176, which may be connected with any reservoir or supply of pressure, preferably a permanent supply from which pressure may be obtained at any time. When the pipe 157 is put in communication with the pipe or passage 176, the pressure, acting on the piston 154, will move the piston, and with it the lever 150 and the wedge-block 149, to the right, and the shifting eccentric 147 and valve 166 will be adjusted to effect an earlier discharge of fluid from the compressor-cylinder 140. If the discharge from the compressor-cylinder occurs too early—that is, at a time when the pressure in the cylinder is relatively low as compared with that in the reservoir—the pressure admitted through the passages 173, 172, and 165 to the chamber 164 of the governing-valve device will be less than that above the diaphragm, and the diaphragm and pistons 159 and 160 will be moved down, closing the passage 176 and opening the passage 175, which communicates with the atmosphere. Pressure will then be released from the cylinder 154 through the pipe 157 and pipe 175, and the spring 177 will move the arm or lever 150 and the wedge-block 149, so as to adjust the eccentric 147 and valve 166 to effect a later opening of the discharge from the cylinder 140.

As shown in Fig. 8, the passage 173 is so located that it may be opened to the reservoir-space 170 at one end by the movement of the small valve 171; but its inner end will then be closed by the piston 139.

In Fig. 10 of the drawings I have shown a modification in which the arrangement of the passages 173 and 165, through which fluid from the compressor-cylinder is admitted to one side of the diaphragm 161, is the same as in Fig. 8; but the valve 171, instead of being formed integral with the main valve 166, is formed of a separate piece fitted between two shoulders on the main valve and held to its seat by a spring 178.

In Fig. 13 I have shown a modification of the governing-valve device, in which a piston 180, fitted in a casing 179, is connected to a valve 181, controlling the admission of pressure from the reservoir of the compressor to a pipe 182, through which fluid is supplied to act on a piston for operating the shifting eccentric. Fluid under pressure from the cylinder of the compressor lifts the check-valve 184 and acts on the upper side of the piston 180, tending to move that piston so as to seat the valve 181. The piston 180 and valve 181 are acted on by the springs 185 and 186, tending to balance them when in the position shown in the drawings. The check-valve 184 is opened only when the pressure in the compressor-cylinder is in excess of that above the piston 180, and the closing of the check-valve prevents any return of fluid from the upper side of the piston 180 to the cylinder. When the pressure in the reservoir is in excess of that above the piston 180, the fluid under pressure admitted from the reservoir through the pipe 187 to the under side of the valve 181 will lift the valve 181 and pass through the pipe 182 to act on the piston for shifting the eccentric. When the pressure in the reservoir is not sufficient to overcome the pressure closing the valve 181, pressure may be released from the pipe 182 through the small passage 188 in the casing 179, so as to permit an adjustment of the shifting eccentric the reverse of that effected by admitting reservoir-pressure to the pipe 182. A comparatively slow release of pressure from above the piston 180 is permitted through the small passage 189 in the piston 180; but no pressure in the pipe 182 is caused thereby, as the fluid may escape more quickly through the opening 188 in the casing than it can pass through the passage 189 in the piston 180. The object of the leakage-passage 189 is to permit variations of pressure above the piston 180 corresponding with the changes of pressure in the compressor-cylinder.

I claim as my invention and desire to secure by Letters Patent—

1. In a fluid-compressor, the combination, with a valve device controlling the port, or ports of the compressing-cylinder, of a shifting eccentric for operating the valve device, a governing device operated by variations in the relative pressures in the compressing-cylinder and in the reservoir, or outlet-passage, of the compressor, for controlling the adjustment of the shifting eccentric, and a passage controlled by a continuously-operated valve connected with the main valve of the compressor for admitting fluid under pressure from the compressor-cylinder to the governing device.

2. In a fluid-compressor, the combination, with a valve device controlling the release of fluid from the compressing-cylinder of a shifting eccentric for operating the valve device and varying its time of opening, a governing device controlling the adjustment of the eccentric, and a valve for admitting fluid under pressure from the compressing-cylinder to the governing device.

3. In a fluid-compressor, the combination, with the main valve, or valves, of the compressing-cylinder, of an auxiliary valve device mounted in the head, or wall, of the cylinder in position to be acted on by the pressures in the reservoir and cylinder, and which is adapted to be moved by the pressure within the cylinder only when that pressure is abnormally greater than the pressure in the reservoir or outlet-passage, substantially as set forth.

4. In a fluid-compressor, the combination, with a compressing-cylinder having a positively-operated main valve, of an auxiliary valve device exposed to the pressures in the cylinder and in the reservoir, or outlet-passage, and adapted to be operated by excess of pressure in the cylinder, and a stem ex-

tending outside of the cylinder in position to indicate movement of the auxiliary valve device, substantially as set forth.

5. In a fluid-compressor, an indicating device, which is independent of the usual compressor-valves, and exposed to the pressures in the cylinder and in the outlet-passage, or reservoir, of the compressor, and a stem extending outside of the valve-casing, in position to act as an indicator of the relative pressures of the cylinder, and reservoir, substantially as set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS M. RITES.

Witnesses:
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C. E. BAXTER.