

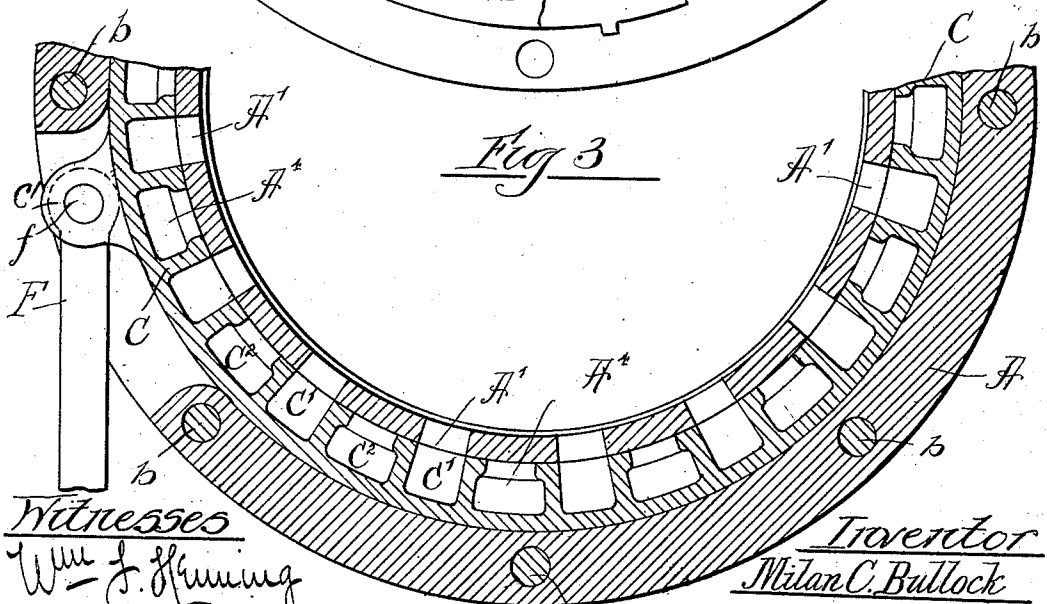
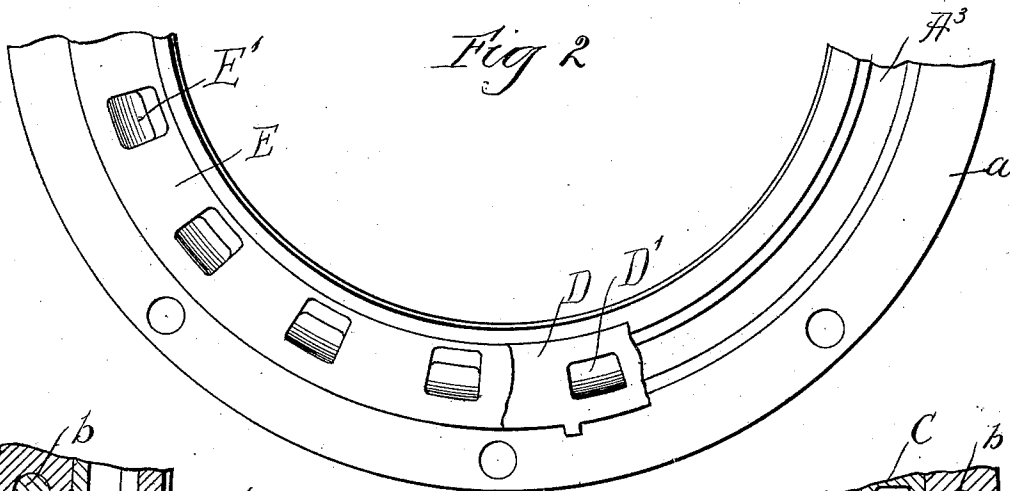
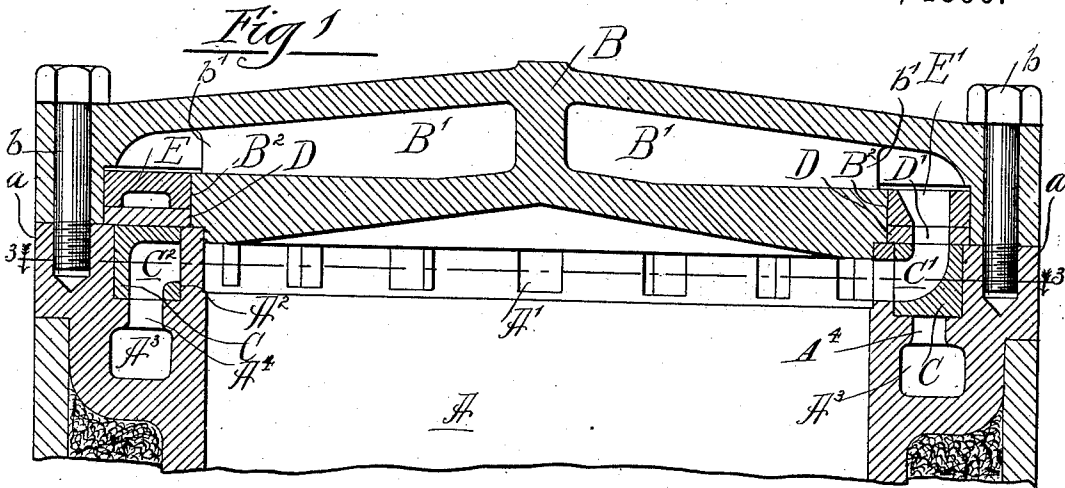
(No Model.)

4 Sheets—Sheet 1.

M. C. BULLOCK.
STEAM ENGINE VALVE.

No. 571,893.

Patented Nov. 24, 1896.



Witnesses
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Geo. M. Rheem.

Inventor
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by *Wm. Maynard, Pooler & Brown*
Attys

(No Model.)

4 Sheets—Sheet 2.

M. C. BULLOCK.
STEAM ENGINE VALVE.

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Fig 4

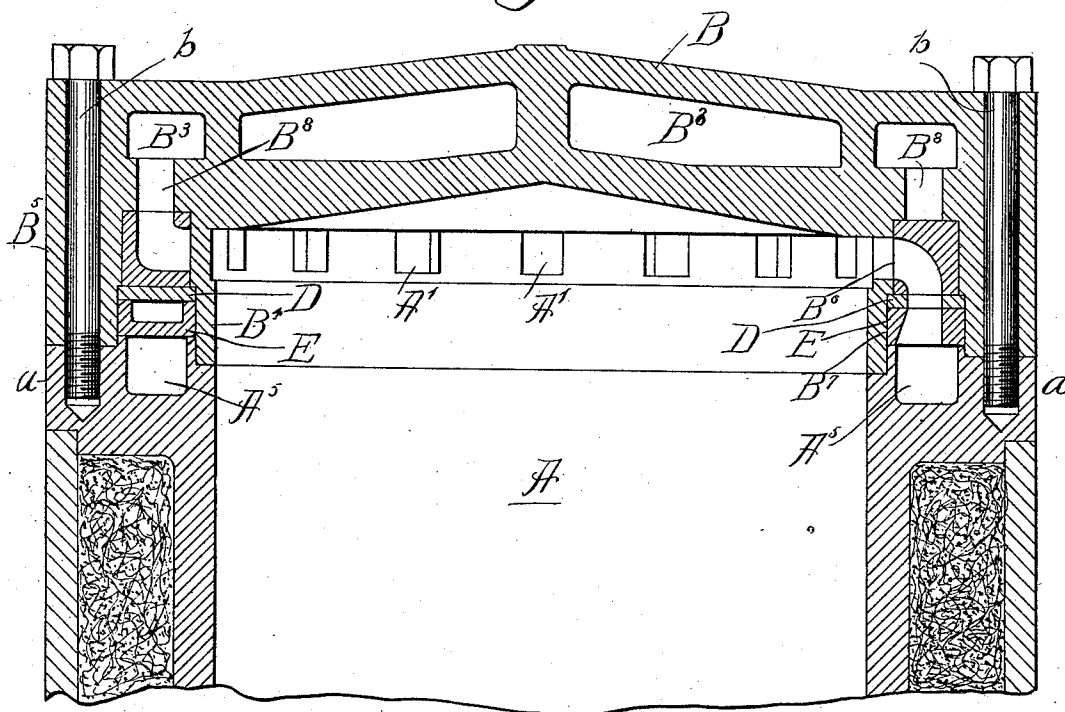
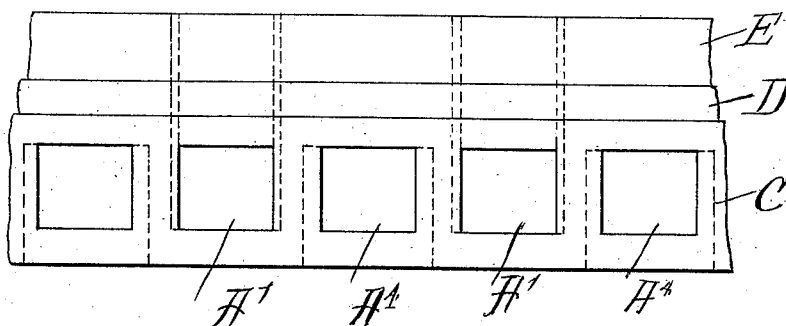


Fig 5



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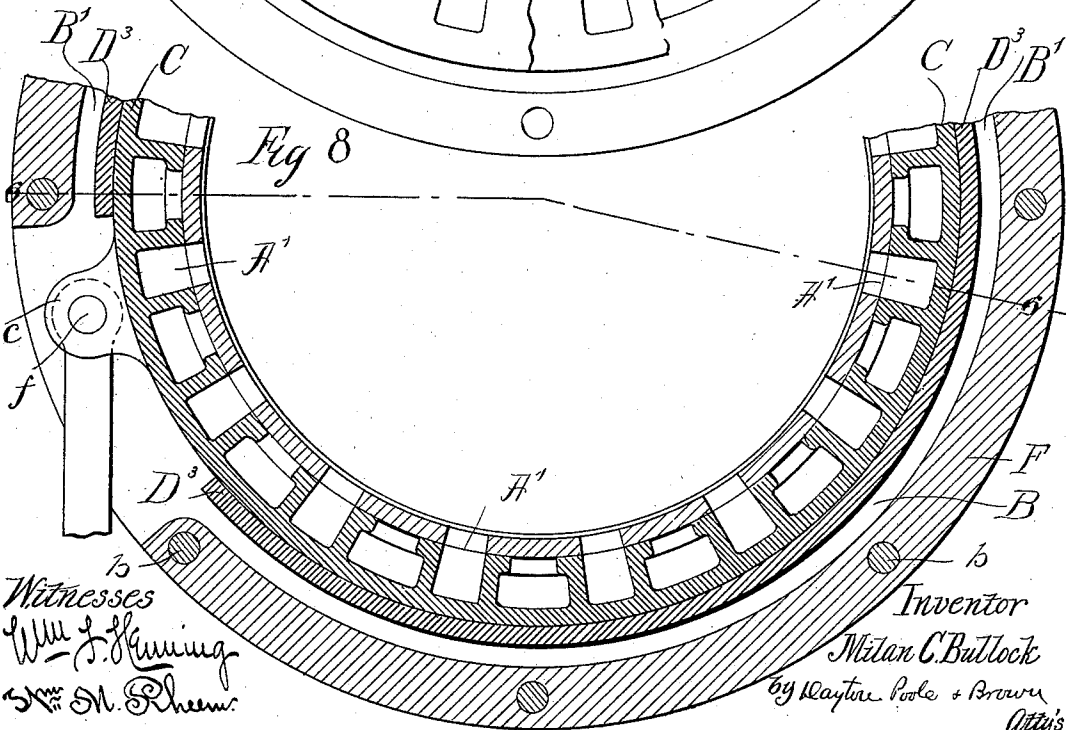
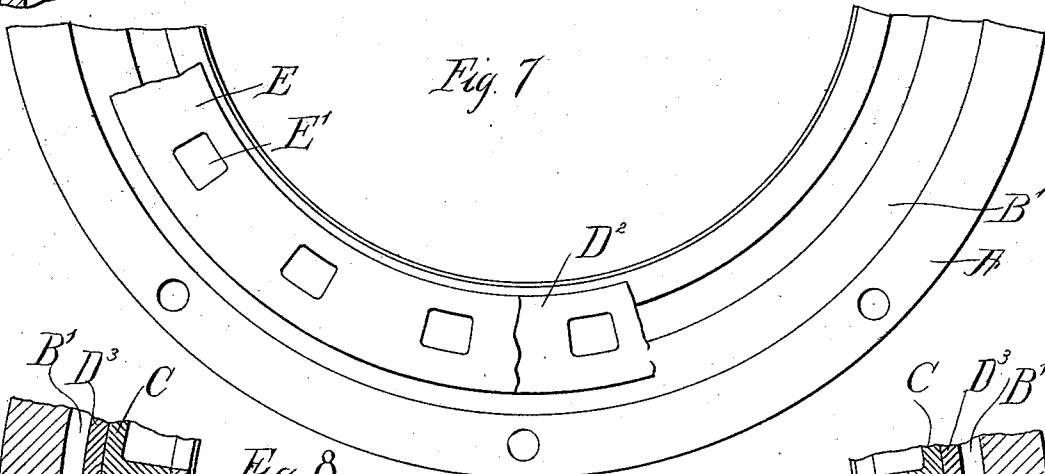
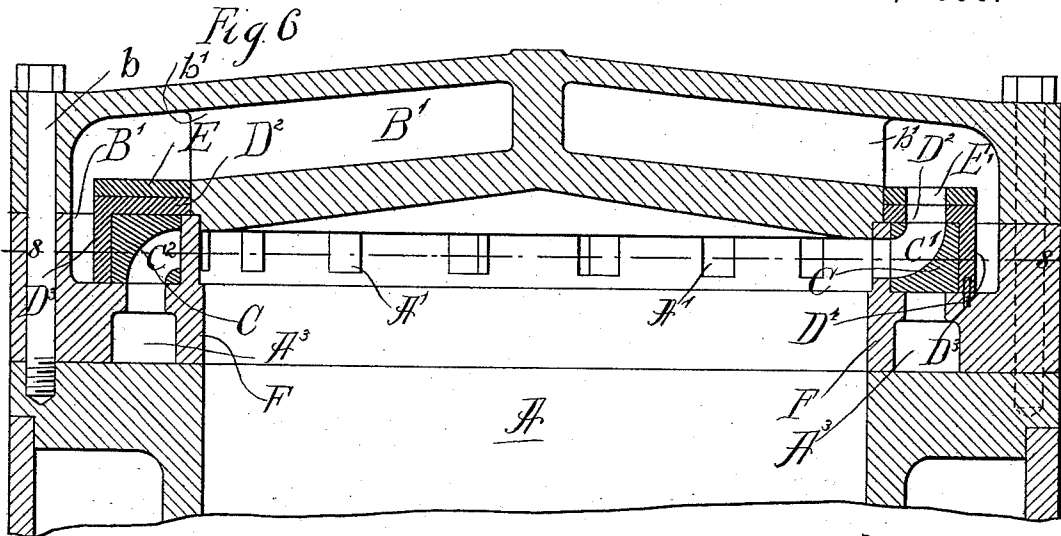
(No Model.)

4 Sheets—Sheet 3.

M. C. BULLOCK.
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Witnesses
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(No Model.)

4 Sheets—Sheet 4.

M. C. BULLOCK.
STEAM ENGINE VALVE.

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Fig 9

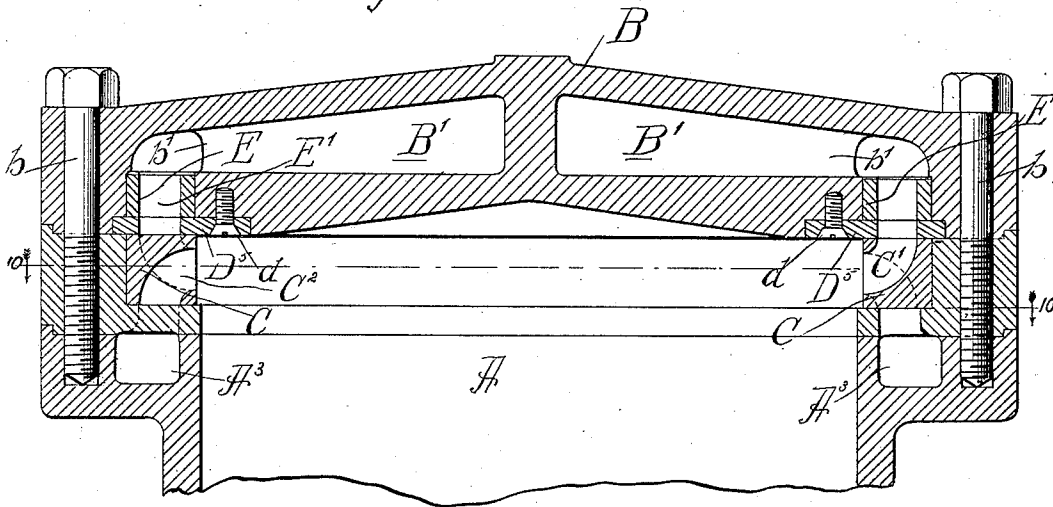
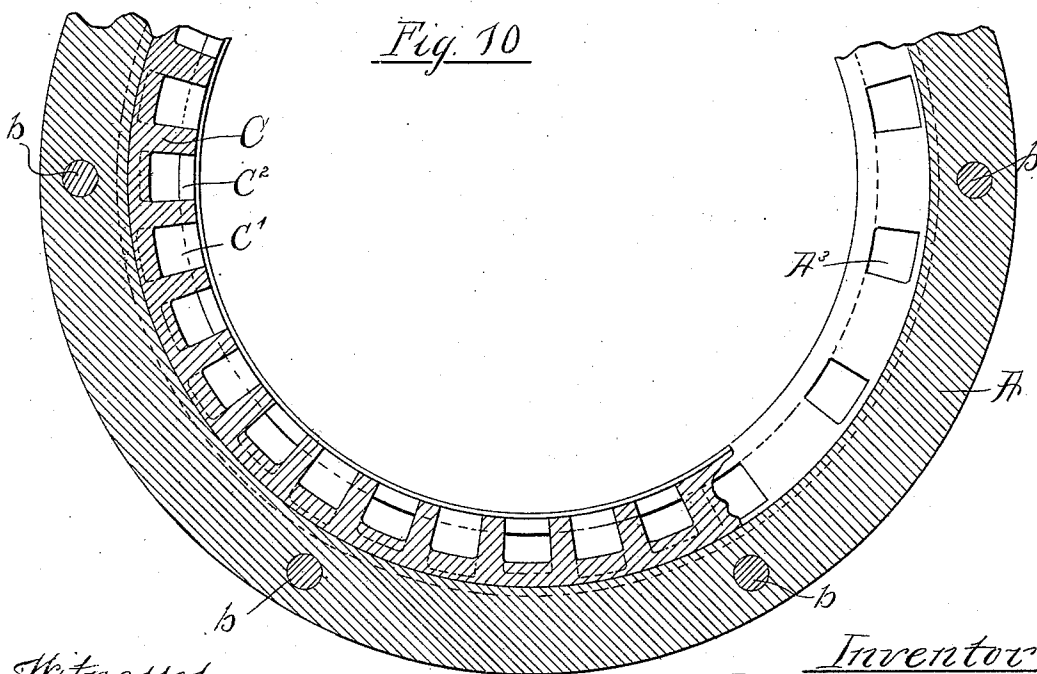


Fig. 10



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his Attorneys.

UNITED STATES PATENT OFFICE.

MILAN C. BULLOCK, OF CHICAGO, ILLINOIS.

STEAM-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 571,893, dated November 24, 1896.

Application filed August 15, 1895. Serial No. 559,355. (No model.)

To all whom it may concern:

Be it known that I, MILAN C. BULLOCK, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Engine Valves; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in steam admission and exhaust valves for engine-cylinders of that class in which the movable part of the valve is of annular form and is provided with a plurality of steam and exhaust ports which operate in connection with a plurality of ports arranged annularly about the cylinder-head and which is given oscillatory movement in such manner that the ports therein will establish communication alternately between the cylinder and steam-supply passage and exhaust-passage.

The invention consists of the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a view in central axial section of one end of the steam-engine cylinder containing a valve constructed in accordance with my invention. Fig. 2 is a fragmentary end view of the cylinder shown in Fig. 1 with the cylinder-head removed. Fig. 3 is a sectional view taken on line 3 3 of Fig. 1. Fig. 4 is a sectional view similar to Fig. 1, showing a modified form of the valve. Fig. 5 is a view of the inside edges of the main and cut-off valve rings, shown in Figs. 1, 2, and 3 as developed on a plane surface. Fig. 6 is a sectional view of still another form of valve embodying a principal feature of my invention, taken on line 6 6 of Fig. 8. Fig. 7 is a plan view of the same with the cylinder-head removed. Fig. 8 is a sectional view on line 8 8 of Fig. 6. Fig. 9 is a sectional view illustrating still another embodiment of my invention. Fig. 10 is a sectional view taken on line 10 10 of Fig. 9.

First referring to the construction shown in Figs. 1, 2, and 3, A indicates the steam-cylinder, and B the head thereof, which latter is secured to the cylinder by bolts *b* entering

marginal flanges *a* of the cylinder in a familiar manner. The head B is shown as cast hollow or provided with a chamber B', which in this instance is connected with a steam-supply passage of the cylinder and forms in effect the steam-chest.

At the end of the cylinder adjacent to the head are formed a series of ports A', which extend through the side wall of the cylinder and communicate with an annular groove or recess A², which opens at the end surface of the cylinder and contains a valve-ring C. Extending around the end of the cylinder adjacent to the recess A² is an annular exhaust-passage A³, which is connected with the recess A² by means of exhaust-ports A⁴, corresponding in arrangement and angular distance apart with the cylinder-ports A'.

In the marginal part of the head B opposite the recess A² is an annular groove or recess B², containing a valve-plate D, which rests against the end of the cylinder over the recess A² and in contact with the valve-ring C therein. Said valve-ring D is provided with ports D' equal in number to the ports A' and arranged at the same angular distance apart and in the same radial planes with said ports A'. In said recess B² is also located a valve-ring E, which forms a cut-off valve and rests in contact with the outer face of the ring D, said cut-off-valve ring E being provided with ports E' corresponding with the ports D'. Said recess B² communicates with the steam-space B' of the cylinder-head, the inner wall of the head, which is separated at its margins from the main part of the head by the recess B², being sustained or supported by means of radial webs or flanges *b'*.

The valve-ring C is provided with two sets of ports C' C², of which the ports C' are steam-admission ports and the ports C² are exhaust-ports. Both sets of ports open at the inner face of the valve-ring, and the ports constituting each set are located at a distance apart equal to the distance apart of the cylinder-ports A'. The steam-admission ports C' open at the outer flat face of the valve-ring, while the exhaust-ports C² open at the opposite or inner flat face of said valve-ring. The said steam-ports are employed to establish communication between the ports D' of the ring D and the cylinder-ports A', while the ex-

haust-ports are adapted to establish communication between the said cylinder-ports and the exhaust-passage A³ through the exhaust-ports A⁴.

- 5 In the operation of the valve-ring C it is moved or oscillated a distance sufficient to bring the ports C¹ and C² alternately opposite the cylinder-ports, the result of this movement being that the steam-space of the cylinder is brought alternately into communication with the steam-chest and with the exhaust-passage, as common in the operation of similar-acting valves. Any suitable means may be employed for giving motion to the valve-ring. The device herein shown for connecting the actuating means with the ring consists of the connecting-rod F, which is connected with an outwardly-projecting lug *c* on the valve-ring by means of a pivot-pin *f*, Fig. 3.
- 10 3. The cut-off-valve ring E is adapted to be turned on the stationary ring D by some suitable controlling or governing device, so as to increase or decrease the effective area of the ports in said stationary ring. Connection with the said cut-off-valve ring for moving the same may be afforded by any suitable device, such, for instance, as that shown in connection with the main valve in Fig. 3.

- The stationary valve-ring D and the cut-off-valve ring E are made of the same width, while the recess B², in which they rest, is made somewhat wider than the combined thickness of the two valves, thus enabling said valve-rings D and E to move outwardly in said recess away from the main-valve ring C. The object of this construction is to afford a means for relieving the cylinder from water-pressure in case water of condensation accumulates therein in such quantities as to fill the valve-ports. It is obvious that in the construction described the said valve-plate D will be held against the main valve by pressure of the live steam in the steam-supply passages, and that in case of an excess of back pressure produced by the undue accumulation of water therein said valve-plate will be lifted from its seat against the steam-pressure thereon, and the water will thus be allowed to escape backward into the steam-chest.

- The construction described possesses great advantages, as will appear from the following: The pressure of live steam acting on the cut-off-valve ring E (which will be directly upon the valve-plate D in case the cut-off valve be not employed) tends to press or force the said plate D against the main-valve ring and at the same time to press said main-valve ring sidewise against its seat at the bottom of the recess A². Steam-tight joints are thus maintained between the valve-plate D and the main-valve ring and also between said main-valve ring and the annular valve-seat of the cylinder which contains the exhaust-ports A⁴. The liability of the escape of steam from the live-steam passage to the exhaust-passage past the main-valve ring is

thus avoided without regard to the closeness of fit between the inner and outer cylindric surfaces of the main-valve ring and the cylinder. As is well understood by those acquainted with the art, one of the principal difficulties arising in the use of annular valves is due to the unequal expansion or contraction of the ring relatively to the cylindric bearing-surfaces between which it fits, so that if the ring be made sufficiently tight to prevent leakage it is liable to stick or bind in its seat. Furthermore, a difficulty has been found in keeping the valve tight after it has been subjected to any considerable wear, from the fact that the valve-ring can be neither expanded nor contracted to compensate for such wear and thereby bring it in close contact with the bearing surface or surfaces at its inner and outer edge.

In the construction illustrated the main-valve ring may be made to fit between the cylindric side walls to the groove or recess in which it is placed to such a degree of looseness as to provide for necessary expansion or contraction of the ring relatively to the cylinder, while wearing away of the cylindric surfaces of the cylinder and valve, which are in rubbing contact with each other, will have no effect on the tightness of the valve, because the valve-ring will be at all times in intimate contact at its opposite flat sides with the opposite and bearing surface of the cylinder and the annular valve-plate D. Moreover, the flat contact-surfaces may be easily and quickly refinished by scraping or otherwise in case of wear, while this is not true of the cylindric surfaces. The recess B² of the cylinder-head is shown as made somewhat wider than the recess A² of the cylinder, so that the edges of the annular valve-plate D overlap the sides of the said recess of the cylinder, this construction being conveniently employed to give greater width to the said plate and to the cut-off valve. It is not essential, however, and when used the main-valve ring will be made somewhat thicker than the depth of the recess A², so that the annular valve-plate will at all times bear upon the valve-ring instead of against the cylinder, thereby providing not only for maintaining the parts in contact under the steam-pressure on the valve-plate, but providing also for a slight diminution of the thickness of the valve-ring by reason of wear. The same result, however, may be produced by reducing the thickness of the valve-plate D at its parts which rest against the end of the cylinder. Suitable fastening or securing devices, as, for instance, a pin *d*, inserted in the recess of the head and engaging a notch in the outer edge of the valve-plate, will be employed to hold said plate from turning with the valves and maintain the ports therein accurately opposite the cylinder-ports.

In Figs. 4 and 5 I have shown a construction embracing the same features which are above described, excepting that in this in-

stance the arrangement of the steam supply and exhaust passages is reversed, an annular steam-supply passage A⁵ being provided in the end portion of the cylinder, while the cylinder-head contains an annular exhaust-passage B³. As shown in said Fig. 4, the cylinder-head B is provided with inner and outer flanges B⁴ B⁵, which extend inwardly to meet the end of the shortened cylinder, and which, in fact, form the end portion of said cylinder. The inner flange B⁴ in this instance contains the cylinder-ports A', and annular recesses B⁶ contain the main-valve ring C, the annular valve-plate D and the cut-off-valve ring E being located in a recess B⁷, formed by and between said inner and outer flanges. The innermost recess B⁶ is arranged opposite the cylinder-ports A' and contains the valve-ring C. Said recess is connected with the exhaust-passage B³ of the head by means of exhaust-ports B⁸. The exterior recess B⁷ is made somewhat wider than the recess B⁶ and the valve-plate D is located in the bottom thereof in contact with the main-valve ring C. In the outer part of said recess B⁷ and adjacent to the steam-passage A⁵, which is formed in the cylinder-flange opposite the recess B⁷, is located the cut-off-valve ring E. Like the recess B⁶, the recess B⁷ is made of a depth greater than the combined thickness of the plate and ring E, so as to give freedom of movement of said rings toward and from the main-valve ring, thereby enabling the valve-plate to be forced away from the valve-ring to relieve water-pressure in the cylinder.

The operation of the parts shown in Figs. 4 and 5 is the same as that of those illustrated in the hereinbefore-mentioned figures of the drawings, and the same advantages are obtained thereby.

In Figs. 6, 7, and 8 I have shown a construction generally similar to that shown in Figs. 1 and 2, the cylinder in this case being provided with a valve-ring C, an annular exhaust-passage A³, and a live-steam space or passage B' in the cylinder-head. In this instance, however, the live-steam passage extends around the outer surface or periphery of the valve-ring, and in place of an annular valve-plate D of flat form I employ a similar plate D², having at its outer edge a cylindric flange D³, which extends downwardly over the outer surface of the ring C and bears at its lower edge against a bearing-surface of the cylinder, which bearing-surface is herein shown as made flush with the bearing-surface against which the ring C rests. In this instance the ring D may be conveniently held from rotation by means of a dowel-pin D⁴, Fig. 6, inserted in the edge of the flange D³ and in a hole in the cylinder, in the manner illustrated. A cut-off-valve ring E is shown in this instance as placed over the ring D², the same being made, however, thinner than that illustrated in Figs. 1 and 2.

To facilitate the construction of the parts, the end portion of the cylinder, containing

the exhaust-passage A³, the steam-ports A', and the bearing-surfaces for the valve-ring C, is made in a separate annular casting F, which is secured between the cylinder-head and the body of the cylinder by means of the holding-bolts which pass through the head and annular casting into the cylinder-flange, as clearly shown in the drawings.

The feature of construction embracing such ring F is of great advantage in connection with a valve of the character herein shown and may be applied to the other form of valves illustrated as well as the particular one shown in said Figs. 6 and 7. This construction has the advantage that the cylinder is perfectly plain, having end flanges only, while the parts which require finishing and the principal part of the work in constructing the valve are located in the said ring F. In other words, it will be seen from the construction described that the cylinder-head in Fig. 6 needs no lathework excepting on its face which comes in contact with the ring F, and similarly the body of the cylinder requires merely to be finished on its inner surface and the faces of its flanges which come in contact with said ring F, all other lathe-work required being on the said ring F.

In Figs. 9 and 10 is illustrated a construction in which the part of the cylinder containing the cylinder-ports A' is omitted and the valve-ring C is exposed at the inner surface of the cylinder, it being obvious that in the construction described the presence of a part or wall of the cylinder inside of the valve-ring is not necessary for securing a steam-tight joint between the valve-ring and cylinder, since this result is obtained by contact of the flat sides of the ring with the bearing-surface at opposite sides of the same. In said Figs. 9 and 10 the live-steam passage B' and exhaust-passage A³ are arranged as shown in Fig. 1, while the valve-ring C is located in an annular recess which opens directly into the cylinder, the live-steam and exhaust ports C' and C² being arranged in the same manner as in Fig. 1, except that said ports open directly into the cylinder. In this instance a valve-plate D³ is employed, which performs the same function as the plate D of Fig. 1, but which in this instance is extended inwardly past the valve-ring and is secured to the cylinder-head by means of screws or bolts $\bar{a}$, as shown. The said plate D³ rests against the adjacent flat surface of the valve-ring C and forms therewith a steam-tight joint. A cut-off-valve ring E, provided with ports E', rests against the outer surface of the plate D³, as before described. In this instance the parts of the cylinder containing the bearing-surfaces for the valve-ring are formed in a separate ring F', resembling the ring F of Fig. 6, but which differs therefrom in not containing the exhaust-passage A³, which is formed in the cylinder itself. Like the ring F the ring F' has formed upon it the annular bearing-surfaces for the valve-ring, which re-

quire to be accurately formed and finished and which may be more easily and conveniently formed on said ring than on the cylinder itself.

- 5 The construction shown in Figs. 9 and 10 has the advantages possessed by that shown in the other figures of the drawings in respect to the bearing-surfaces of the valve-ring, namely, that said surfaces being flat they
10 may be easily finished and fitted and refinished when rendered imperfect by wear.

I claim as my invention—

1. The combination, with a steam-cylinder provided with an annular valve-recess having
15 at one side thereof, a flat valve-seat provided with steam-ports and steam supply and exhaust passages at opposite sides of said recess, of a valve-ring located in said recess and provided with steam-admission ports extend-
20 ing from one side face of the ring to the inner face of the ring, and with steam-exhaust ports which extend from the opposite side of the ring to said inner face of the ring, and a valve-plate resting against the valve-ring and
25 located between the same and the steam-supply passage, said plate being provided with steam-ports and forming a flat valve-seat opposite to that of said recess, substantially as described.

- 30 2. The combination, with a steam-cylinder provided with an annular valve-recess having at one side thereof a flat valve-seat provided with steam-ports and steam supply and exhaust passages at opposite sides of said recess, of a valve-ring located in said recess and provided with steam-admission ports extend-
35 ing from one side face of the ring to the inner face of the ring, and with steam-exhaust

ports which extend from the opposite side face of the ring to said inner face of the ring, a
40 valve-plate resting against the valve-ring and located between the same and the steam-supply passage, said plate being provided with steam-ports, and forming a flat valve-seat opposite to that of the said recess, and a cut-off-
45 valve ring resting against the outer surface of said valve-plate, substantially as described.

3. The combination, with a steam-cylinder provided with an annular valve-recess having
50 at one side thereof a flat valve-seat provided with steam-ports and steam supply and exhaust passages at opposite sides of said recess, of a valve-ring located in said recess and provided with steam-admission ports extend-
55 ing from one side face of the ring to the inner face of the ring, and with steam-exhaust ports which extend from the opposite side face of the ring to said inner face of the ring, a valve-plate resting against the valve-ring and located between the same and the steam-sup-
60 ply passage, said plate being provided with steam-ports and forming a flat valve-seat opposite to that of the said recess, the end portion of the cylinder adjacent to the cylinder-head being formed by a separate ring inter-
65 posed between the body of the cylinder and the head, and containing the annular valve-recess, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature, in pres-
70 ence of two witnesses, this 19th day of June, A. D. 1895.

MILAN C. BULLOCK.

Witnesses:

C. CLARENCE POOLE,
ALBERT H. GRAVES.