April 13, 1926. 1,580,434

F. D. HOLDSWORTH

UNLOADING MECHANISM FOR COMPRESSORS

Filed March 14, 1917

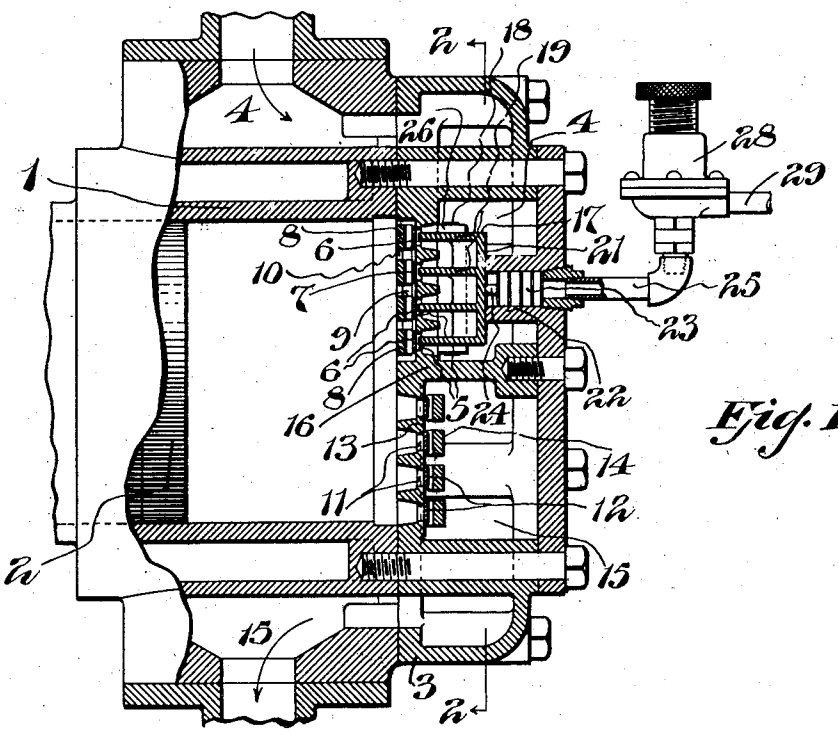


Fig. 1.

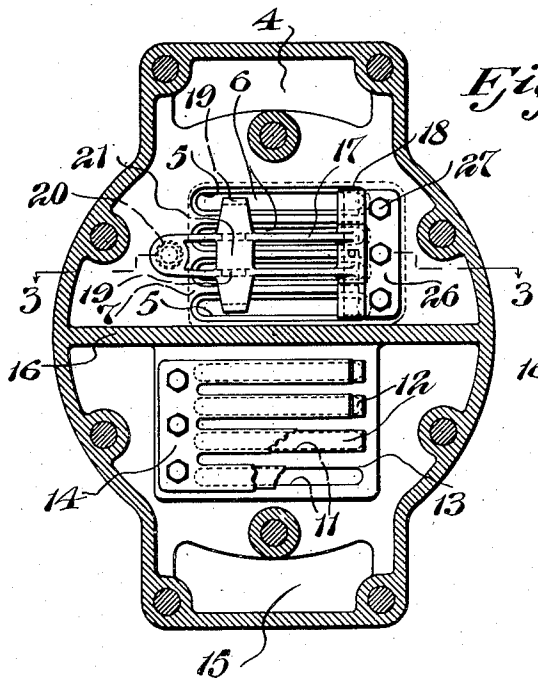


Fig. 2.

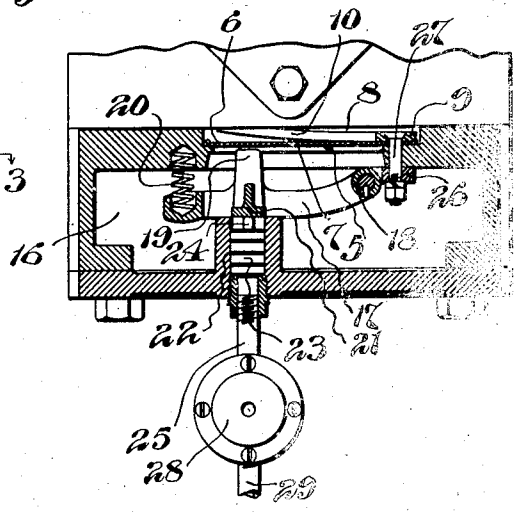


Fig. 3.

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UNITED STATES PATENT OFFICE.

FRED D. HOLDSWORTH, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS.

UNLOADING MECHANISM FOR COMPRESSORS.

Application filed March 14, 1917. Serial No. 154,811.

To all whom it may concern:

Be it known that I, FRED D. HOLDSWORTH, a citizen of the United States, residing at Claremont, in the county of Sullivan and State of New Hampshire, have invented certain new and useful Improvements in Unloading Mechanism for Compressors, of which the following is a full, clear, and exact specification.

My invention relates to compressors.

It has for its object to load or unload a compressor of the plate valve type in an improved manner. A further object of my invention is to provide improved means whereby such a compressor may be loaded or unloaded through control of its inlet valve or valves. A still further object of my invention is to provide improved means controlling the loading and unloading of such a compressor, especially adapted to use with an automatic control system wherein the loading or unloading means is automatically operated.

In the accompanying drawings, I have shown for purposes of illustration one embodiment which my invention may assume in practice.

In these drawings,—

Fig. 1 is a partial longitudinal sectional view through one end of a compressor cylinder equipped with my improvement.

Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a detail sectional view of the complete mechanism taken on line 3—3 of Fig. 2.

In this illustrative construction, it will be noted that a compressor having a cylinder 1 and a piston 2 movable therein, is provided with a cylinder head 3. As in a well known construction, the air is admitted to the cylinder 1 through communicating inlet passages 4 in the cylinder and head and a series of valve ports 5 opening into the cylinder and controlled by a plate valve, herein shown to comprise a plurality of resilient or fingered, normally closed, plate valve members 6 moving between the ported valve seat 7 and curved guards 8 preferably formed on a single plate 9 having slots 10 therein leading into the cylinder. The air is also discharged from this cylinder 1 through a series of ports 11 controlled by a similar series of plate valve members 12 operating between the valve seat 13 and a slotted guard plate 14, the air passing out through these ports into discharge passages 15, separated from the passages 4 by a wall 16 in the head. As the specific construction or type of the discharge valves, however, does not enter into my present invention, the same need not here be more specifically described.

In my improvement, it will be noted that disposed adjacent the inlet valves 6, is a valve operating means adapted to engage one or more, and preferably each, of the resilient fingers of the valve members, and raise the same from their normal engagement with their seats in such a manner as to open communication from the inlet passages 4 to the cylinder 1 and thus unload the compressor. This means in the form shown herein, comprises a member 17 pivoted at 18 at a point within the head and having a series or gang of projections, lugs or fingers 19 thereon adapted to engage with the several inlet valve members 6 at a point adjacent their ends and lift the same from their seats and force the same against the curved guards 8 therefor, which are provided on the guard plate 9. As shown, this member 17 presents a narrow surface to the flow of fluid, guides the fingers so that the latter do not strike the valve seats or other elements of the valve or compressor and is normally held inoperative by a resilient means of any suitable form, herein shown to comprise a single coiled spring 20 disposed at the free end of the member 17 and outside the path of the air. This spring 20 acts between the member 17 and the cylinder head 3 so that this member 17 is normally held in inoperative position and is automatically returned thereto as the valve members return to their seats. It will also be noted that I have provided a surface 21 on the member 17 disposed over a small cylinder 22, preferably formed in the head 3, and that in this cylinder I have provided a piston 23, preferably having a boss 24 on its upper end, so that when the cylinder 22 is supplied with pressure fluid from a suitable source, such as a pressure fluid connection 25, this boss 24 may engage the surface 21 on the member 17 and force that member upward against its spring 20 to raise the valve members 6 from their seats and thereby unload the compressor.

In the use of my improvement, it will be noted that the member 17 may, as shown in Fig. 3, be pivoted to a bracket or plate 26

which may be clamped to the cylinder head by one of the bolts 27 which are used to clamp the guard plate 9 upon the valve members 6 and clamp both of the same to the cylinder head, thus producing an exceedingly simple and cheap construction. It will also be noted that the supply of air to the piston 23 may be controlled by any means adapting the device to use in an automatic system, as for instance a pilot or unloader valve 28, which is in turn connected to the receiver (not shown) through a pipe connection 29, and is adapted to admit pressure to the pipe 25 and thereby unload the compressor when the pressure rises above a predetermined amount in the receiver, and to exhaust the pressure in this pipe 25 when the receiver pressure falls below a predetermined amount. As this pilot valve is, however, of a well known construction, known in the art as the Judson pilot valve, a detailed description of the same is believed to be unnecessary.

It will be noted that as a result of my improved construction, a compressor having one or more inlet valves of the plate type may be unloaded whenever desired and without injury to the valves, by simply causing the elevation of one or more of the members 17, and that as soon as the force elevating the latter is removed, the compressor will be loaded. By applying the force adapted to open the valves adjacent the free ends thereof a much wider opening is effected, as they are caused to bend around their curved guard members and conform to the shape of the latter much more closely than were the contact at a lower point; and thereby a clear opening of much greater size is provided. It will be seen that the free end of the valve, beyond the contact of the fingers, is tangent to the curve of the guard, so that the nearer to the end of the valve that contact occurs, the greater the clear opening. It will also be evident that the mechanism by which the unloading of the compressor is brought about may be very cheaply produced and readily inserted within a cylinder head and applied to a standard compressor, and that, if desired, the same may be automatically operated in such a manner as to adapt it to use in connection with an automatically controlled system of any suitable type. Obviously, however, the member 17 may, in certain forms of the invention, be operated by any desired means. These and other advantages of my improved construction will, however, be apparent to those skilled in the art.

While I have in this application specifically described one embodiment which my invention may assume in practice, it is of course to be understood that the invention is not limited thereto but may be modified and embodied in various other forms without departing from its spirit, it being my intention to include all such modifications within the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. The combination with a compressor having a cylinder having a port communicating therewith and a valve controlling said port and flexing about a transverse line in opening, of an element adapted to engage said valve at a point remote from said transverse line and to flex it into open position.

2. The combination with a compressor which has a cylinder having a port communicating therewith and a valve controlling said port and flexing about a transverse line in opening, of an arcuately movable element adapted to engage said valve at a point remote from said transverse line and to flex it into open position.

3. The combination with a compressor which has a cylinder having a port communicating therewith and a valve having a fixed end and a freely movable end controlling said port, of unloading means adjacent said free end for moving said free end.

4. The combination with a compressor which has a cylinder having a port communicating therewith and a valve member having a fixed end and a freely movable end and controlling said port, of unloading means comprising a finger adapted to contact with said free end and a finger actuating member mounted on said cylinder adjacent the free end of said valve member.

5. The combination with a compressor which has a cylinder and a port communicating therewith and a valve member having a fixed end and a freely movable end and controlling said port, of unloading means comprising a finger adapted to contact with said free end and a finger actuating plunger mounted on said cylinder adjacent the free end of said valve member.

6. The combination with a compressor which has a cylinder having a port communicating therewith and a valve member having a fixed end and a freely movable end and controlling said port, of unloading means comprising a member adapted to raise the free end of said valve member from its seat, guiding means for said second named member, and actuating means for said second named member.

7. The combination with a compressor which has a cylinder having a port communicating therewith and a valve member having a fixed end and a freely movable end and controlling said port, of unloading means comprising a member adapted to raise the free end of said valve member from its seat, guiding means for said second named member, and actuating means for said second named member, said guiding means extending longitudinally of said valve member.

8. The combination with a compressor which has a cylinder having a port communicating therewith and a valve member having a fixed end and a freely movable end and controlling said port, of unloading means comprising a member adapted to raise the free end of said valve member from its seat, pivoted guiding means for said second named member, and actuating means for said second named member.

9. The combination with a compressor which has a cylinder having a port communicating therewith and a valve member having a fixed end and a freely movable end and controlling said port, of unloading means comprising a member adapted to raise the free end of said valve member from its seat, guiding means for said second named member, and actuating means for said second named member, said guiding means comprising a member of greater width than thickness and presenting a narrow surface in the path of the fluid flow.

10. The combination with a compressor which has a cylinder having a plurality of ports communicating therewith and valve means controlling said ports comprising a plurality of elastic valve members each having a fixed end and a freely movable end, of a gang of fingers adapted to contact with said valve members adjacent their freely movable ends to hold the valve members inoperative, and guiding means for said gang.

11. The combination with a compressor which has a cylinder having a plurality of ports communicating therewith and valve means controlling said ports comprising a plurality of elastic valve members each having a fixed end and a freely movable end, of a simultaneously movable gang of fingers adapted to contact with said valve members adjacent their freely movable ends to hold the valve members inoperative, guiding means for said gang, and means for normally holding said gang in an inoperative position.

12. The combination with a compressor which comprises a cylinder having a cylinder head, a ported valve seat formed in said cylinder head, a ported guard plate having a curved guard thereon, and a plurality of plate valves fixed to said head at one end and having their opposite ends normally engageable with said seat and flexible into engagement with said curved guards, of normally inoperative means carried in said head for flexing said valve members against said curved guards.

13. As an article of manufacture, in combination, a cylinder head having a ported valve seat formed therein, a curved guard disposed over a port in said seat, a plate valve member attached at one end to said seat and between the latter and said guard, unloading mechanism including a pivoted member carried in said head engageable with the free end of said valve member to raise the latter from its seat, and a single means for attaching said guard, said valve and said member to said head.

14. As an article of manufacture, in combination, a cylinder head having a ported valve seat formed therein, a curved guard disposed over a port in said seat, a plate valve member attached at one end to said seat and between the latter and said guard, a pivoted member carried in said head engageable with the free end of said valve member to raise the latter from its seat, a cover plate for said cylinder head, a cylinder formed in said cover plate, and a piston reciprocable in said cylinder and operative to actuate said pivoted member to effect opening of said valve.

15. The combination with a compressor which has a cylinder, a cylinder head, a ported valve seat communicating with said cylinder and arranged in said head, a ported guard plate opening into said cylinder and a plurality of flexible valve members clamped at one end between said guard plate and seat and having their opposite ends normally resting on said seat, of means carried in said head and engageable with the free ends of said valve members and lifting the same from their seats, and cooperating means normally rendering said last mentioned means inoperative.

16. The combination with a compressor which has a cylinder, a cylinder head, a ported valve seat communicating with said cylinder and arranged in said head, a ported guard plate opening into said cylinder, and a plurality of flexible valve members clamped at one end between said guard plate and seat and having their opposite ends normally resting on said seat, of means carried in said head and engageable with the free ends of said valve members for lifting the same from their seats, cooperating means normally rendering said last mentioned means inoperative, and fluid pressure means for operating said first mentioned means.

17. The combination with a compressor comprising a cylinder having a head, a ported valve seat communicating with said cylinder and arranged in said head, a ported guard plate opening into said cylinder, and a plurality of flexible valve members clamped at one end between said guard plate and seat and having their opposite ends normally resting on said seat. of a member pivotally mounted in said head having a plurality of fingers thereon engageable with certain of said valve members to lift the same from their seats, resilient means normally rendering said member inoperative, a cooperating cylinder, a piston movable in said cylinder and engageable with said member, and automatic controlling mechanism controlled by

the receiver pressure for supplying and exhausting pressure fluid beneath said piston.

18. The combination with a compressor which comprises a cylinder having an inlet valve comprising an elastic valve member having a fixed end and a freely movable end, of a member pivoted at one end and having means for engaging and moving the free end of said valve.

19. The combination with a compressor which comprises a cylinder having an inlet valve comprising an elastic valve member having a fixed end and a freely movable end, of a member pivoted at one end and having means for engaging and moving the free end of said valve, and a spring engaging the free end of said unloading member for normally holding the same inoperative.

20. The combination with a compressor which comprises a cylinder having an inlet valve comprising an elastic valve member having a fixed end and a freely movable end, of a member pivoted at one end and having means for engaging and moving the free end of said valve, a second cylinder, and a piston in said last named cylinder loosely engaging said unloading member for operating the same.

21. The combination with a compressor which comprises a cylinder having an inlet valve comprising an elastic valve member having a fixed end and a freely movable end, of a member pivoted at one end and having means for engaging and moving the free end of said valve, a spring engaging the free end of said unloading member for normally holding the same inoperative, a second cylinder, and a piston in said last named cylinder loosely engaging said unloading member for operating the same.

22. The combination with a compressor which comprises a cylinder and an inlet valve therein comprising an elastic valve member having a fixed end and a freely movable end, of a member pivoted at its end adjacent the fixed end of said valve and having means for engaging and moving the free end of said valve.

23. The combination with a compressor which comprises a cylinder, a ported valve seat, an elastic valve cooperating with said seat, and a curved guard cooperating with said valve, of a member having means for engaging and operating said valve, a support upon which said member is pivoted at one end, and means for clamping said support, one end of said valve, and one end of said guard to said valve seat.

24. The combination with a compressor which comprises a cylinder, a valve seat having a plurality of ports and a valve member fixed at one end and having a plurality of elastic fingers each cooperating with one of said ports in said valve seat, of a member pivoted at one end and having a plurality of finger portions extending through the several ports and engaging said valve fingers respectively.

25. The combination with a compressor which comprises a cylinder and a valve therein comprising an elastic valve member having a fixed end and a freely movable end, of means operable from the exterior of the cylinder for engaging the free end of said valve and controlling the operation thereof.

26. The combination with a compressor which comprises a cylinder and a valve therein comprising an elastic valve member having a fixed end and a freely movable end, of means operable from the exterior of the cylinder for engaging the free end of said valve and lifting the same from its seat.

27. As an article of manufacture, in combination, a cylinder head comprising an open ended chamber and a cover therefor, ports traversing a wall of said chamber, valve means cooperating with said ports, means for unseating said valve means, and means for actuating said unseating means comprising fluid operated means carried by said cover and disposed wholly within the exterior limits of said cylinder head.

28. As an article of manufacture, a cylinder head comprising, in combination, an open ended chamber and a cover therefor, one wall of said open ended chamber being traversed by at least one port, a valve fixed at one end and overlying said port and flexible to permit flow through said port, means for opening said valve including a pivoted member overlying said valve, and operating means for said pivoted member including a cylinder carried by said cover and projecting into said chamber, and a piston reciprocable in a path lying wholly within the limits of said head.

29. The combination with a compressor which comprises a cylinder having a port communicating therewith, a valve controlling said port and flexing upon opening about a line extending transversely thereof, and a guard disposed at the side of said valve opposite said port and limiting the opening of said valve, the side of said guard adjacent said valve being curved and being tangent to said valve at said transverse line whereby said valve on opening progressively flexes into contact with said guard, of an element adapted to engage said valve at a point remote from the transverse line and flex it into open position.

30. The combination with a compressor which comprises a cylinder having an elongated port communicating therewith, an elongated valve overlying said port and having free and fixed ends and flexible to open said port, of an elongated member pivoted adjacent the fixed end of said valve for arcuate movement in a plane perpendicular to the plane of said valve when the

latter is closed, and means for actuating said pivoted member to open said valve.

31. The combination with a compressor which has a cylinder having a port communicating therewith and a flexible valve controlling said port and flexing to open the latter said valve having an end freely movable in substantially the same direction as the flow of fluid through said port, of an element adapted to engage said valve and flex the same into open position.

In testimony whereof I affix my signature.

FRED D. HOLDSWORTH.