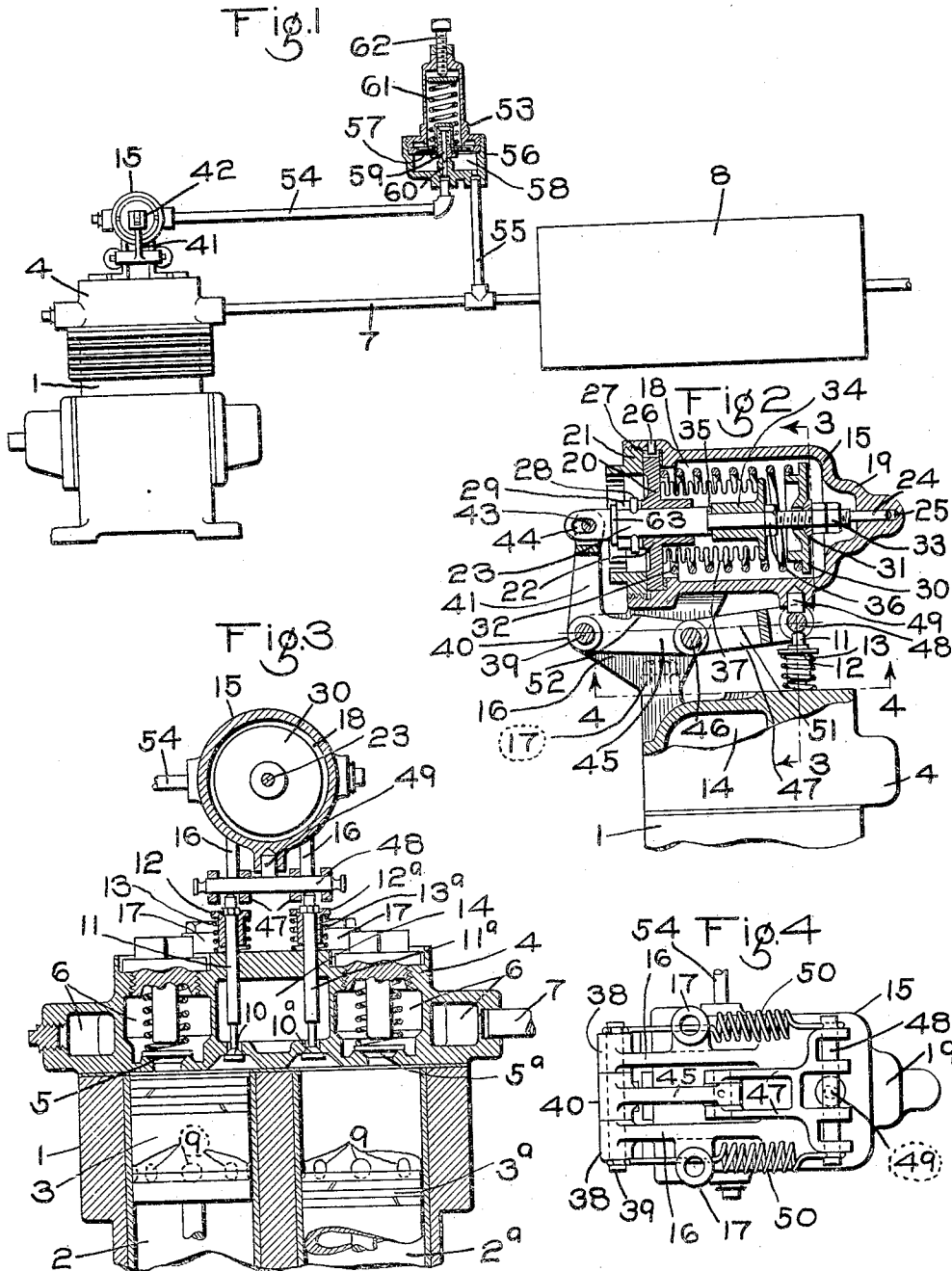


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COMPRESSOR UNLOADER
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COMPRESSOR UNLOADER

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This invention relates to compressor unloaders and it has particular relation to unloaders of the quick action type employed with continuously operated compressors and which vent the compressors when the pressure of the fluid compressed reaches a predetermined value.

One object of my invention is to provide an improved compressor unloading device which has a positive and snap action in operation.

Other objects of the invention will appear from the following description and appended claims.

In the accompanying drawing; Fig. 1 is a diagrammatic view, partly in elevation and partly in section, of a fluid compressing apparatus embodying my invention; Fig. 2 is an enlarged vertical sectional view of the unloading device shown in Fig. 1; Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 2; and Fig. 4 is an inverted plan view of the structure shown in Fig. 2.

Referring to the drawing, my invention is shown as being applied to a compressor which operates continuously, as distinguished from the type in which the operation of the compressor is interrupted when the pressure of the fluid compressed reaches a predetermined value, and is resumed when the pressure becomes reduced to a predetermined degree below such value. According to the present invention, the compressor is shown as comprising a cylinder block 1 formed with a pair of cylinders 2—2^a in which a pair of pistons 3—3^a are respectively mounted and which are reciprocated in the usual manner.

The upper ends of the cylinders 2—2^a are closed by a cylinder head 4 provided with outlet valves 5—5^a for controlling the flow of fluid under pressure from the cylinders 2—2^a to an outlet chamber 6 which communicates through a pipe 7 with a fluid pressure reservoir 8. Fluid is admitted to the cylinders 2 and 2^a through ports 9 in the side walls of the cylinders which are uncovered when the pistons 3—3^a move downwardly but which are closed by the pistons during the first portion of their upward or compression stroke.

The cylinders 2—2^a are also provided with unloading valves 10—10^a respectively, which are carried by vertically extending valve stems 11—11^a. These stems are slidably mounted in the cylinder head 4 and carry collars 12—12^a for limiting the downward or opening movement of the valves. The valves 10—10^a are normally maintained closed by springs 13—13^a surrounding the valve stems 11—11^a between the collars 12—12^a and the cylinder head 4. When the valves 10—10^a are opened, communication is established between the cylinders 2—2^a and a chamber 14 so that the fluid displaced by one piston during its compression stroke will flow into the chamber 14 and thence into the other cylinder as its associated piston descends. The fluid is thus forced back and forth between the cylinder 2—2^a as long as the valves 10—10^a remain open, without unseating the valves 5—5^a.

The unloading device comprises a casing 15 provided with a pair of spaced brackets 16 which are provided with lugs 17 adapted to be bolted on the cylinder head 4. The casing 15 is provided with a chamber 18 which is closed at one end by an end portion 19 (Fig. 2) and at the other end by a disk 20 which is maintained against displacement by a ring 21 having a threaded engagement with the casing 15. The disk 20 is provided with a centrally located hub or bearing portion 22 in which a rod 23 is mounted for axial sliding movement. One end of the rod 23 is provided with a reduced portion 24 for sliding engagement with an axial bore 25 formed in the end portion 19 of the casing 15. The disk 20 is prevented from rotating by means of a pin 26 carried by the casing 15 for engagement with a slot 27 formed in the disk 20 and the rod 23 is prevented from rotating in the bearing 22 by means of a pin 28 which is carried by the rod and which projects into a slot 29 formed in the bearing 22. A collar 30 is mounted on the rod 23 by means of a universal connection 31 and a spring 32 is interposed between the collar 30 and the disk 20. The collar 30 may be adjusted longitudinally of the rod in order to regulate the tension exerted by the spring 32, by means

of nuts 33 threaded onto the rod 23. Also mounted on the rod 23 is a collar 34 which is clamped between a shoulder 35 formed on the rod 23 and a nut 36 threaded onto the rod. Interposed between the collar 34 and the disk 20 is a compressible corrugated metallic diaphragm 37, the ends of which are soldered or otherwise hermetically secured to the disk 20 and to the collar 34.

The brackets 16 are provided with bearings 38 (Fig. 4) which support a pivot pin 39 upon which a bell crank lever 40 is pivotally mounted. One arm 41 of the bell crank lever 40 extends upwardly and is formed with a yoke portion 42 which carries a pin 43 for engagement in a slot 44 formed in the outer end of the rod 23. The other arm 45 of the bell crank lever 40 extends beneath the casing 15 and is pivotally connected by a pin 46 to one end of a floating yoke lever 47. The other end of the yoke lever 47 carries a pin 48 which is disposed between a stop pin 49 carried by the casing 15 and the upper ends of both of the valve stems 11—11^a of the unloading valves 10—10^a. Springs 50 connect the outer ends of the pin 48 with the outer ends of the pin 39 and tend to bias the pivot pin 46 connecting the arm 45 of the bell crank lever 40 with the yoke lever 47, toward one side or the other of a center line connecting the pins 39 and 48 and indicated at 51 in Fig. 2. This provides an "over the center" or snap action of the parts, as will hereinafter be described. The arm 45 of the bell crank lever 40 is formed with a shoulder 52 for engagement with the lower portion of the casing 15 in order to limit the swinging movement of the lever 40 in a counter-clockwise direction, as viewed in Fig. 2.

Fluid under pressure is supplied to the chamber 18 of the unloading device from the compressor, by means of a pressure controlling valve device 53 interposed between a pipe 54 leading to the chamber 18 and a pipe 55 connecting with the pipe 7. The valve device 53 comprises a casing 56 having a diaphragm 57 therein forming a chamber 58 on one side thereof which communicates directly with the pipe 55. The diaphragm 57 carries a valve member 59 for controlling communication between the chamber 58 and a passage 60 with which the pipe 54 communicates. The diaphragm 57 is flexed downwardly by a spring 61 in order to maintain the valve 59 closed under normal conditions and the force exerted by this spring may be regulated by an adjusting screw 62.

In operation the compressor will force fluid through the outlet valves 5—5^a, chamber 6 and pipe 7 into the storage reservoir 8 and chamber 58 of the regulating valve 54 until the pressure of the fluid therein reaches a predetermined value sufficient to overcome the pressure of spring 61, when the diaphragm 57 is flexed upwardly to open the valve 59 of

the regulating valve device. Fluid under pressure will then flow through the pipe 54 to the chamber 18 of the unloading device and compress the diaphragm 37 against the action of the spring 32. During the compressing of the diaphragm 37, the fluid therein will leak out around the rod 23. The movement of the diaphragm 37 is transmitted to the rod 23 and causes it to move to the left, as viewed in the drawing, and to swing the bell crank lever 40 about its pivot pin 39 in a counter-clockwise direction. This movement of the bell crank lever 40 causes the arm 45 thereof to swing upwardly against the action of the springs 50 until the pivot pin 46 passes the center line 51, at which point the action of the springs 50 causes the bell crank lever to continue its counter-clockwise movement with a snap action until its movement is arrested by the stop 52 engaging the lower side of the casing 15. During this snap movement of the bell crank lever 40, the pin 43 carried by the arm 41 thereof moves in the slot 44 in the rod 23 without transmitting any additional movement to the rod or any shock or jar to the diaphragm 37. The upward movement of the arm 45 first causes the yoke lever 47 to also swing upward about the pin 48 as a pivot but as soon as the arm 45 carries its pivot 46 past the center line 51, the springs 50 cause the lever 47 to move downwardly about the pin 46 as a pivot and depress the valve stems 11—11^a until its movement is arrested by the collars 12—12^a engaging the cylinder head 4. The downward movement of the stems 11—11^a open the unloading valves 10—10^a and establish communication between the cylinders 2—2^a through the chamber 14, so that the fluid displaced from one of the cylinders 2—2^a by the upward movement of its associated piston will flow into the other cylinder during the downward movement of its associated piston, instead of being forced into the storage reservoir 8 through the valves 5—5^a.

As soon, however, as the pressure in the reservoir 8 and chamber 58 becomes reduced to a predetermined value determined by the force exerted by the spring 61, the valve 60 closes and interrupts the flow of fluid under pressure to the chamber 18 of the unloading device. The pressure in this chamber being thus reduced, the spring 30 forces the rod 23 to the right, as viewed in the drawing, and elongates the diaphragm 37 into which fluid leaks around the rod 23. The movement of the rod 23 swings the bell crank lever 40 about its pivot pin 39 in a clockwise direction. This movement of the lever 40 swings the arm 45 thereof downwardly against the action of the springs 50 until the pin 46 carried thereby passes the center line 51, at which point the springs 50 cause the bell crank lever 40 to continue its clockwise movement at an accelerated rate until its movement is arrested by a stop 63 carried by the rod 23 engaging the

outer end of the bearing 22. During this movement of the lever 40, the pin 43 carried by the arm 41 thereof moves to the right in the slot 44 provided in the rod 23 without transmitting motion or jar to the rod or its associated parts. The downward movement of the arm 45 of the bell crank lever 40 first causes the yoke lever 47 to swing downwardly about the pin 48 as a pivot, but as soon as the pivot 46 passes the center line 51, the springs 50 cause the lever 47 to move upwardly about the pin 46 as a pivot until its movement is arrested by the engagement of the pin 48 with the stop pin 49. This upward swinging movement of the yoke lever 47 permits the valve stems 11—11^a to rise under the action of the springs 13—13^a and close the unloading valves 10—10^a. The compressor is now in a condition in which it will deliver fluid under pressure to the storage reservoir 8 as hereinbefore described.

While only one illustrative embodiment of the invention has been described in detail, it is not my intention to limit its scope to this embodiment or otherwise than by the terms of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The combination with a fluid compressor having an unloading valve, of a device responsive to pressure of fluid compressed by the compressor, a bell crank lever operated by said device, and a floating lever operated by said bell crank lever and movable successively about two pivotal points for operating said unloading valve.

2. The combination with a fluid compressor having an unloading valve, of a floating lever, a device responsive to the pressure of fluid compressed by the compressor for moving said lever about one pivotal point a predetermined degree, and spring means for moving said lever about another pivotal point to operate said unloading valve.

3. The combination with a fluid compressor having an unloading valve, of a floating lever, a device responsive to the pressure of fluid compressed by the compressor for swinging said lever a predetermined distance about a pivotal point adjacent to one end thereof, and other means for swinging said lever a predetermined distance about a pivotal point adjacent to the other end thereof to operate said unloading valve.

4. The combination with a fluid compressor having an unloading valve, of a first lever having a fixed pivot, a second lever pivotally connected to said first lever and having a shiftable pivot, fluid pressure responsive means for operating said first lever to move the second lever about its shiftable pivot from a predetermined point on one side of a line connecting said fixed pivot and said shiftable pivot to a predetermined point on

the other side of said line, and additional means for swinging said second lever about said pivotal connection between said first and second levers a predetermined distance at an accelerated rate to operate said unloading valve.

5. The combination with a fluid compressor having an unloading valve, of a first lever having a fixed pivot, a second lever pivotally connected to said first lever and having a shiftable pivot, fluid pressure responsive means for operating said first lever to move the second lever about its shiftable pivot from a predetermined point on one side of a line connecting said fixed pivot and said shiftable pivot to a predetermined point on the other side of said line, and a spring connecting said fixed pivot and said shiftable pivot for swinging said second lever about said pivotal connection between said first and second levers a predetermined distance at an accelerated rate to operate said unloading valve.

6. The combination with a fluid compressor having an unloading valve, of a lever mounted for movement between a first position and a second position to operate said unloading valve, a fluid pressure responsive device for swinging said lever a portion of the distance from its first position toward its second position, quick acting means for swinging said lever the remainder of the distance toward said second position, and a lost motion connection between said lever and said fluid pressure responsive device for preventing said lever from transmitting motion to said device during its movement to its second position under the influence of said quick acting means.

7. The combination with a fluid compressor having an unloading valve, of a lever, a member pivotally connected to said lever for operating said valve, a spring for actuating said member to operate said valve upon a predetermined movement of the pivotal connection by said lever, and a movable abutment operated upon a predetermined increase in the pressure of fluid compressed by the compressor for actuating said lever.

In testimony whereof I have hereunto set my hand, this 23rd day of February, 1931.

JOSEPH C. McCUNE.