

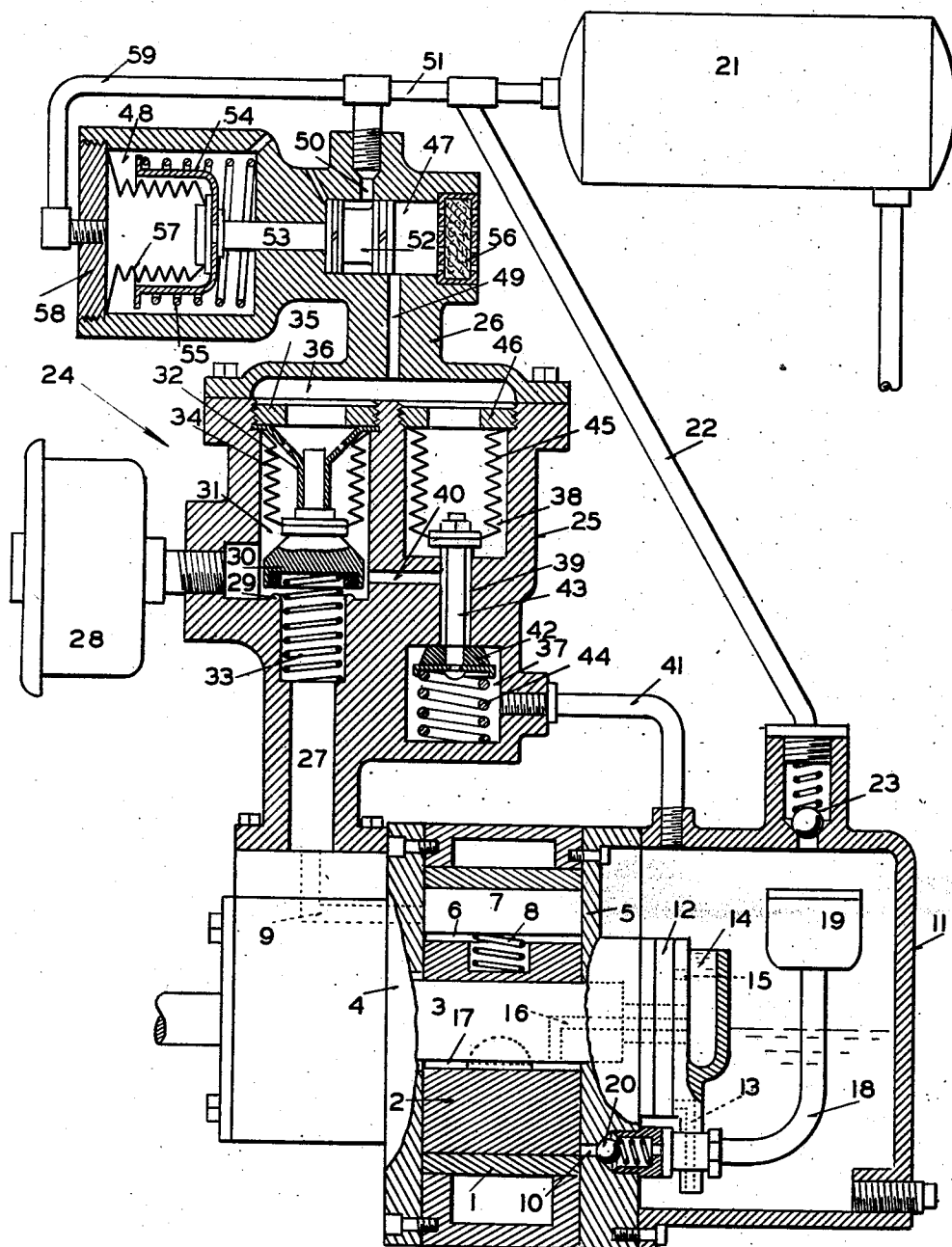
March 11, 1941.

B. DICK

2,234,470

VALVE MECHANISM FOR UNLOADING COMPRESSORS

Filed Nov. 8, 1939



INVENTOR
BURNS DICK

BY

E. C. Huffman

ATTORNEY.

UNITED STATES PATENT OFFICE

2,234,470

VALVE MECHANISM FOR UNLOADING
COMPRESSORSBurns Dick, Ferguson, Mo., assignor to Wagner
Electric Corporation, St. Louis, Mo., a corpora-
tion of Delaware

Application November 8, 1939, Serial No. 303,380

4 Claims. (Cl. 230—31)

My invention relates to compressors and more particularly to a valve mechanism for causing the compressor to be unloaded.

One of the objects of my invention is to provide an improved valve mechanism which is automatically operable to unload a compressor when the pressure in the receiver of the compressor is a predetermined value.

Another object of my invention is to produce an unloading valve mechanism which will be quick acting to unload the compressor when the pressure in the receiver is a predetermined value and also quick acting to place the compressor again in operation when the pressure in the receiver drops to a value below said predetermined value.

Other objects of my invention will become apparent from the following description taken in connection with the accompanying drawing in which the single figure is a view, partly in section, showing a compressor having associated therewith an unloading valve mechanism embodying my invention.

Referring to the drawing in detail, the rotary compressor is of known construction and comprises a stator 1 having eccentrically mounted therein a rotor 2 secured to a drive shaft 3 journaled in the end plates 4 and 5. The rotor 2 is provided with a plurality of spaced slots 6 extending in an axial direction in which are mounted reciprocable blades 7 (one only being shown) biased outwardly into engagement with the inner surface of the stator by springs 8. The end plate 4 is provided with an intake passage 9 and the end plate 5 with an outlet passage 10. Secured to the end plate 5 is an oil reservoir or dome 11 which contains oil for the purpose of lubricating the compressor. In the construction shown the shaft 3 of the compressor drives an oil pump 12 to pump oil from the body of oil through passage 13 and discharge it into a well 14 through the opening 15. The oil in the well is free to flow through the passage 16 in shaft 3 and then into the compressor by way of the keyway 17 to thus provide lubrication for the movable parts of the compressor. In order that the oil may be forced into the compressor under pressure during operation of the compressor, the body of oil in the oil dome is caused to be subject to the fluid under pressure discharged from the compressor. This is accomplished by having the discharge port 10 connected to a pipe 18 which extends above the oil line. An oil separator 19 removes any excess oil which may be discharged from the compressor together with

the compressed air. The discharge port 10 has associated therewith a check valve 20 for preventing any of the compressed air from returning to the compressor. The oil dome communicates with the compressed air receiver or tank 21 by a conduit 22 and a check valve 23 prevents return of compressed air to the dome. The compressed air may be used for any purpose desired, as for example, the actuation of vehicle brakes.

In accordance with my invention, I provide an improved valve mechanism generally indicated by the numeral 24 by which the intake of the compressor can be shut off and the oil reservoir vented to atmosphere to thereby completely unload the compressor. The valve mechanism comprises two casings 25 and 26 bolted together and mounted on the compressor as a unit adjacent the intake passage 9.

The casing 25 is provided with a passage 27 for placing the intake passage 9 in communication with the atmosphere through an air cleaner 28 mounted on casing 25. The passage 27 has associated therewith a valve seat 29 and cooperating therewith is a movable valve member 30 positioned in a chamber 31 forming an extension of the passage 27. The valve member is guided in its movement by a guide sleeve 32 which also acts as a stop against which the valve is normally held open by a light spring 33. The valve member is adapted to be moved to closed position against the bias of the spring by a fluid motor which comprises a bellows 34 secured to the valve member at one end and clamped at the other end to the wall of the chamber 31 by a perforated nut 35 whereby the bellows can communicate with a chamber 36 at the connection between the two casings 25 and 26.

The casing 25 is also provided with two chambers 37 and 38 interconnected by a bore 39 which communicates with the chamber 31 adjacent the valve seat therein by a passage 40. The chamber 37 is in constant communication with the oil reservoir by a conduit 41. The bore 39 has associated therewith a valve element 42 for controlling the flow of fluid from the chamber 37 and the oil reservoir through the bore and passage 40 and then to the atmosphere through the air cleaner. The valve element 42 is mounted on a fluted valve stem 43 which extends through the bore 39 into the chamber 38. This valve element is normally biased to closed position by a light spring 44, thus sealing the oil reservoir from atmosphere. The valve element

42 is moved to open position by a fluid motor also in the form of a bellows 45 which is situated in the chamber 38. One end of the bellows is secured to the stem 43 and the other end to the wall of the chamber by a perforated nut 46 which permits the bellows to communicate with the previously mentioned chamber 36.

The casing 26 is provided with a cylindrical bore 47 open to atmosphere and with a chamber 48. A passage 49 connects the bore with chamber 36 and a second passage 50 and conduit 51 places the bore in communication with the air tank 31. A spool-type valve member 52 is reciprocally mounted in the bore 47 and is provided with a stem 53 extending into the chamber. The end of the stem carries a cup-shaped member 54 and cooperating therewith is a spring 55 which normally biases the valve stem and valve 52 to such a position in the bore that the passage 49 leading to the chamber 36 will be in communication with the atmosphere through an air cleaner 56 in the open end of the bore. This position of the valve also prevents any communication between the passage 50 and 49. The valve 52 is actuated by a fluid motor in the form of a bellows 57 lying in the cup-shaped member 54 and having one end secured to the stem 53 and the other end sealed to the wall of the chamber 48 by a closure plug 58. The interior of the bellows is in constant communication with the air tank by a conduit 59. The spring 54 is of predetermined strength and is capable of maintaining the valve 52 in the position shown whereby passage 49 communicates with atmosphere as long as the tank pressure is less than a predetermined value, say for example, ninety pounds per square inch. When the pressure is exceeded, the valve will begin to be moved and then connect the passage 49 to the air tank when the air tank pressure reaches a higher value, as for example, one hundred pounds per square inch which is sufficient to compress the spring 55 the required amount.

Referring to the operation, the parts assume the positions shown when the compressor is operating and the tank is at a pressure below ninety pounds per square inch. Under these conditions air enters the compressor through the air cleaner 28, the open valve member 30 and then through passages 27 and 9. The compressed air is forced out into the oil reservoir through the check valve 23 and by way of conduit 22. The valve element 42 is closed and the oil reservoir is closed. The pressure in the oil reservoir will be substantially the same as the pressure in tank 21. Due to the pressure in the oil reservoir, the oil in well 14 will be under pressure and thus be forced into the compressor to properly lubricate the same. Any oil carried by the compressed air will return to the reservoir.

When the pressure in the air tank reaches the value of ninety pounds per square inch, the bellows 57 will begin to expand and compress spring 55 whereby the spool valve 52 will be moved toward the right. As pressure continues to be built up and the valve moved, passage 49 will be cut off from atmosphere. When the pressure in the tank reaches approximately one hundred pounds per square inch, the valve 52 will have been moved such a distance that the passage 49 will be placed in communication with the air tank. This will cause the air tank pressure to be effective on both bellows 34 and 35 causing them to quickly expand. Consequently, the valve member 30 will be immediately closed and

the valve member 42 immediately opened, thereby closing the intake to the compressor and venting the oil reservoir to atmosphere.

The compressor will now be substantially completely unloaded. No more air will be drawn into the compressor. Any air that is in the compressor or which may leak in will be easily forced out through the discharge port 10 since there is no pressure other than the spring of the check valve acting to hold the check valve closed and against which the compressor must work. If the oil reservoir were not vented, the air in the compressor could not be easily forced out the discharge port and consequently, some air would remain in the compressor and be continuously circulated and recompressed. The compressor will now run free and perform no work, thus requiring a minimum of power to turn it. Also since the blades 7 are doing no compressing, they will move freely in their slots and have little wear.

With the oil reservoir vented to atmosphere when the compressor inlet is closed, the oil in well 14 will no longer be forced into the compressor by a high pressure and the oil supplied to the compressor will only be that which flows in under the action of gravity and that which may be pulled in by the partial vacuum in parts of the compressor. This amount of oil is sufficient for lubricating the idling compressor but not such an amount that the compressor will "choke up" with oil as would be the case if the oil reservoir were not vented and oil were continued to be forced in under a high pressure.

When air is used from the air tank, the pressure therein will drop. This permits the valve 52 to move to the left under the action of spring 55. When the pressure reaches ninety pounds per square inch, the spring will have moved the valve to such a position that the passage 49 will be connected to atmosphere. This will cause a release of the air pressure acting on the two bellows 34 and 45 and permit the valve member 30 to be opened by spring 33 and the valve element 42 to be closed by spring 44. Air can now again be drawn into the compressor and then forced into the tank in a manner already described since the oil reservoir is sealed.

Being aware of the possibility of modifications in the particular structure herein described without departing from the fundamental principles of my invention, I do not intend that its scope be limited except as set forth by the appended claims.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with a compressor provided with an intake port and a discharge port, a storage receiver for receiving compressed fluid from the compressor, a check valve between the compressor discharge port and the receiver, automatically operable means for closing the intake port and connecting the discharge port to the source of fluid to be compressed, said means comprising a normally open valve for the intake port, a fluid motor for closing the valve, a normally closed valve for placing the discharge port in communication with the atmosphere, a second fluid motor for opening the last named valve, means including a slide valve for placing both fluid motors in communication with the receiver or with the atmosphere, said valve having a position in which the fluid motors are not connected with either the receiver or atmosphere, a

spring for biasing the valve to a position where the motors are in communication with atmosphere, and means operable by a predetermined pressure in the receiver for moving the valve to a position where the motors are in communication with the receiver.

2. In combination with a compressor provided with an intake port and a discharge port, a storage receiver for receiving compressed fluid from the compressor, a check valve between the compressor discharge port and the receiver, automatically operable means for closing the intake port and connecting the discharge port to the source of fluid to be compressed, said means comprising a valve for the intake port, a spring for biasing the valve open, a bellows-type fluid motor connected to the movable element of the valve, means including a second valve for connecting the discharge port to atmosphere, a spring for biasing said valve closed, a bellows-type fluid motor connected to the movable element of the second valve, and means for causing fluid pressure from the receiver to operate both fluid motors when the pressure in said receiver is a predetermined value.

3. In combination with a compressor provided with an intake port and a discharge port, a storage receiver for receiving compressed fluid from the compressor, a check valve between the compressor discharge port and the receiver, automatically operable means for closing the intake port and connecting the discharge port to the source of fluid to be compressed, said means comprising a valve for the intake port, a spring for biasing the valve open, a bellows-type fluid mo-

tor connected to the movable element of the valve, means including a second valve for connecting the discharge port to atmosphere, a spring for biasing said valve closed, a bellows-type fluid motor connected to the movable element of the second valve, means comprising a third valve for simultaneously connecting both fluid motors to the receiver or to atmosphere, a spring for biasing said third valve to a position connecting the motors to atmosphere, and a fluid motor operable by a predetermined pressure in the receiver for moving the last named valve to a position to connect the motors to the receiver.

4. In combination with a rotary compressor provided with an intake port and a discharge port and having associated therewith an oil reservoir communicating with the compressor for providing lubricant for the working parts of the compressor and wherein the oil in the reservoir is subject to the discharged compressed fluid from the compressor prior to passage through a check valve to a receiver, automatically operable means for closing the intake port and venting the oil reservoir to atmosphere, said means comprising two valves one of which is normally open and the other normally closed, a fluid motor associated with each valve, and means including a pressure-controlled third valve of the slide type for simultaneously causing one fluid motor to close the normally open valve and the other fluid motor to open the normally closed valve when the fluid pressure in the receiver is a predetermined value.

BURNS DICK. 35