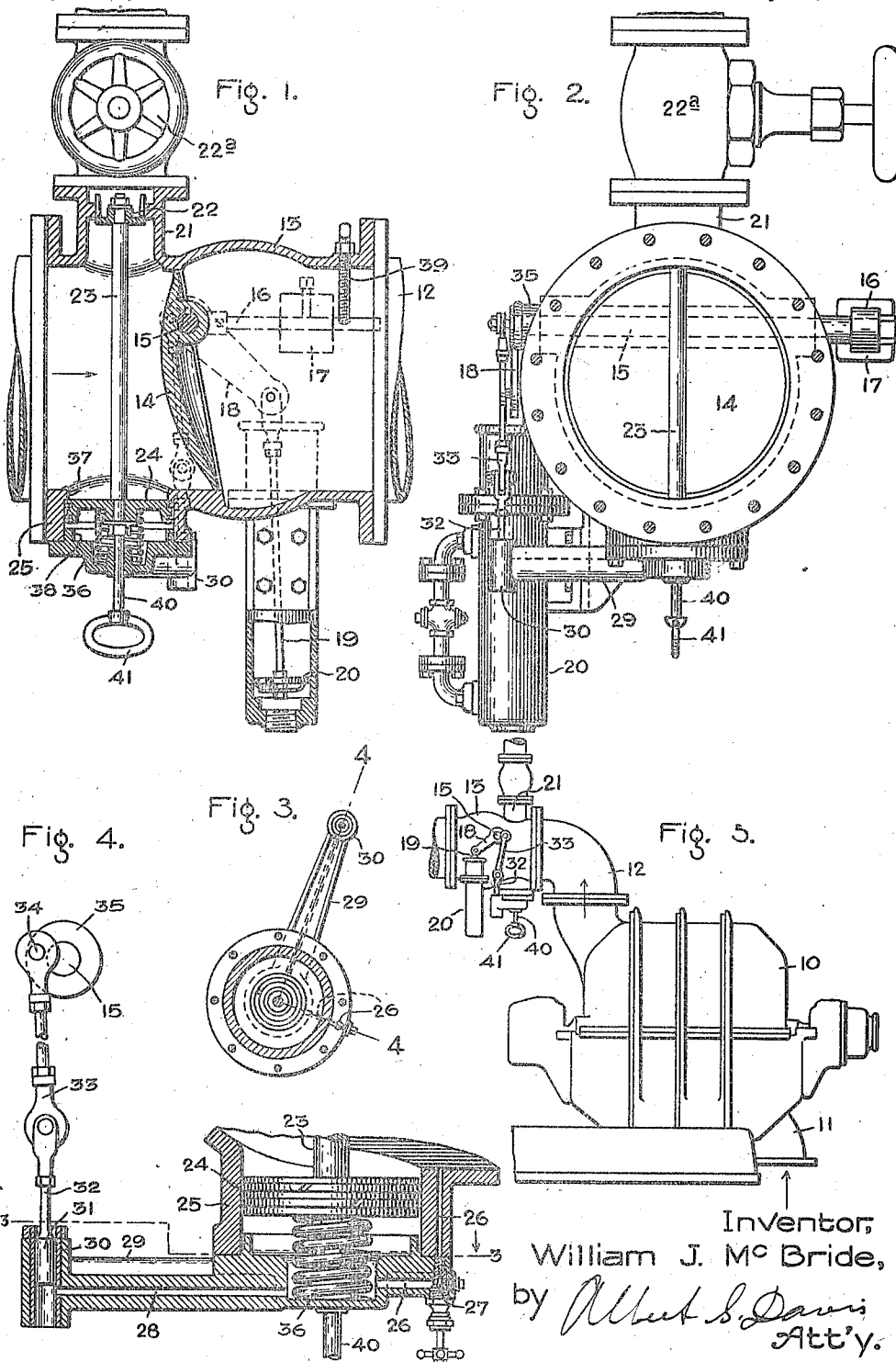


W. J. McBRIDE.
CENTRIFUGAL COMPRESSOR.
APPLICATION FILED AUG. 18, 1917.

1,267,880.

Patented May 28, 1918.



Inventor,
William J. McBride,
by *Albert S. Davis*
Att'y.

UNITED STATES PATENT OFFICE.

WILLIAM J. McBRIDE, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL COMPRESSOR.

1,267,880.

Specification of Letters Patent.

Patented May 28, 1918.

Application filed August 18, 1917. Serial No. 159,883.

To all whom it may concern:

Be it known that I, WILLIAM J. McBRIDE, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Centrifugal Compressors, of which the following is a specification.

The present invention relates to centrifugal compressors and particularly to an arrangement for preventing pulsations when the compressor is operating at light loads. As is well known, pulsations may be prevented by wasting air from the discharge side of the machine or by-passing it from the discharge side to the inlet side, and one object of my invention is to provide an improved automatically operating valve mechanism for this purpose.

A further object of my invention is to provide, in connection with such a valve mechanism, a flap valve which serves to operate such valve mechanism and also as a non-return valve to prevent fluid from being forced backward through the compressor which may occur for example in the case of a plurality of machines operating in parallel.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the accompanying drawing, Figure 1 is a sectional view through the improved pulsation preventing valve mechanism; Fig. 2 is a view at right angles to Fig. 1; Fig. 3 is a view of certain parts taken on the line 3—3, Fig. 4; Fig. 4 is a sectional view taken on line 4—4, Fig. 3, and Fig. 5 is a side elevation of a compressor showing the application of my pulsation preventing valve mechanism thereto.

Referring to the drawing, 10 indicates a centrifugal compressor having an inlet conduit 11 and a discharge conduit 12. Forming a short section of the discharge conduit is a valve casing 13 in which is located a flap valve 14. The valve 14 is keyed to a spindle 15 which is journaled in the casing 13, the two ends of the spindle being extended beyond the journals. On one end of spindle 15 is fixed an arm 16 carrying an adjustable counterbalancing weight 17, and on the other end is fixed an arm 18 which is connected to the stem

19 of a suitable dash pot 20 which is utilized to steady the movements of the flap valve 14. Leading from the valve casing 13 in advance of the valve 14 as regards the direction of flow is a conduit 21 which may discharge into the atmosphere or extend to the inlet side of the compressor as found desirable. 22 is a pulsation preventing valve located in conduit 21 and connected by a rod 23 to a piston 24 which slides in a cylinder 25. The upper surface of piston 24 is exposed directly to the pressure in discharge conduit 12. The cylinder 25 below piston 24 is connected to the discharge conduit by a passage 26, Fig. 4, in which is arranged a suitable valve 27 by which the flow from casing 13 to the under side of piston 24 may be regulated. Leading from the cylinder 25 below piston 24 to atmosphere or other region of lower pressure is a discharge passage 28 formed in a projecting arm 29. On the outer end of arm 29 is a cylinder 30 with which the discharge passage 28 communicates, and in this cylinder is a valve 31 adapted to cover and uncover the end of the discharge passage. The valve 31 has a stem 32 which is pivoted to one end of a link 33. The other end of link 33 is pivoted on a pin 34 carried by a collar 35 fixed on spindle 15. This forms in substance an eccentric or lever for raising and lowering valve 31 to uncover and cover the end of passage 28. The purpose of the arm 29 is to bring the valve 31 into line with the end of spindle 15. Bearing against the lower surface of piston 24 is a spring 36 which presses the valve 22 toward closed position. Above and below piston 24 are suitable stops 37 and 38 which limit the movements of the piston. In the conduit 21 beyond the automatically operated valve 22 is a hand valve 22^a of suitable structure. At 39 is an adjustable stop for limiting the upward swinging movement of the flap valve 14. Connected with the piston 24 is a rod 40 having a handle 41 at its end and by means of which the valve 22 may be manually opened and closed.

When the compressor 10 is in operation the air passing through the discharge conduit 12 strikes against the flap valve 14 tending to maintain it in open position, the valve acting as a vane. The weight 17 is adjusted on the arm 16 to give the desired balance to valve 14, such weight acting in

a direction to close the valve. When the valve 14 is opened to a predetermined amount the spindle 15 is turned so as to lower the valve 31 and close the discharge passage 28. The pressure on opposite sides of piston 24 will be balanced due to the leakage of pressure from the conduit 12 through passage 26 to the cylinder 25. The valve 27 is set to restrict the passage 26 to the desired amount so that the leakage past it will be comparatively slow. When the pressure on the two sides of the piston 24 is balanced the spring 36 will force the valve 22 to closed position and hold it there. This is the normal operating position of the various parts. If now for any reason the load on the compressor becomes so light that the machine is likely to pulsate, then the flap valve 14 will move toward closed position turning the spindle 15 and at a predetermined point the valve 31 will be lifted sufficiently to uncover the end of discharge passage 28. This permits the pressure to quickly leak out under the piston 24, the valve 27, as already stated, having been set to restrict the passage 26 so that the leakage to the under side of piston 24 is comparatively slow. When the pressure under piston 24 is thus relieved, the pressure in the conduit 12 acting on the upper side of the piston 24 overcomes the spring 36 forcing the piston 24 downward and opening the valve 22. Fluid will thus be wasted from the discharge conduit 12 and the occurrence of pulsations prevented. The hand valve 22^a may be used to regulate the escape of fluid when the pulsation preventing valve 22 is opened.

It will be understood, of course, that the length of valve stem 32 will be suitably adjusted as regards the particular machine upon which the valve mechanism is located so that when the pulsation point is approached for such machine the valve 24 will have moved sufficiently far toward closed position that the spindle 15 is turned enough to lift the valve 31 and uncover the discharge opening 28.

As soon as the load on the compressor becomes sufficient that pulsations are no longer likely to occur, then, due to the increased flow, the valve 14 will be lifted turning the spindle 15 and closing the valve 31. This cuts off the discharge passage 28 permitting the fluid which leaks past valve 27 to again build up the pressure under piston 24, thereby closing the valve 22. If at any time the valve 22 sticks, it can be either opened or closed manually by means of the rod 40 and handle 41. The valve can also be operated manually by this means when the unit is out of service to test it for friction and ease of operation.

Besides serving to prevent pulsations, the valve 22 also serves to keep a certain mini-

mum amount of fluid flowing through the compressor, thus cooling it and thus preventing it from heating up to such an extent as would be detrimental to the machine.

If for any reason there shall be a back flow of fluid through the compressor, such as might occur, for example, in the case of two or more machines operating in parallel, then the flap valve 14 will act as a non-return valve, closing the discharge conduit and at the same time causing the opening of the waste valve 22, thus insuring the flow of a certain amount of fluid through the compressor.

The above described arrangement has the advantages that it is very simple, compact, and self contained, and comparatively cheap to manufacture and install. It utilizes the pressure of the fluid being compressed for actuating the pulsation preventing valve mechanism so that no extraneous source of fluid pressure is required. Furthermore, there are few moving parts and no complicated mechanism to get out of order.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination with a centrifugal compressor, of a conduit for wasting fluid connected with the discharge side thereof, a valve in the conduit, a movable abutment connected to said valve and having its opposite sides subjected to the pressure on the discharge side of the compressor, means for biasing said valve toward closed position, means for relieving the pressure on one side of said abutment to permit the valve to open, and means actuated by the flow of fluid through the compressor for controlling said relieving means.

2. The combination with a centrifugal compressor, of a conduit for wasting fluid connected with the discharge side thereof, a valve in the conduit, a cylinder, a piston in the cylinder connected to said valve, said piston having its opposite sides subjected to the pressure within the conduit, means biasing the valve toward closed position, a passage connected with the cylinder on one side of the piston for relieving the pressure on such side to permit the valve to open, a valve controlling said passage, and a member which is moved by the flow of fluid through the discharge conduit for actuating the last named valve.

3. The combination with a centrifugal compressor having an inlet conduit and a

discharge conduit, of a waste conduit connected to the discharge conduit, a valve in the waste conduit, a cylinder carried by the discharge conduit, a piston in said cylinder, one side of which is exposed directly to the pressure in the discharge conduit, a restricted passage connecting the cylinder on the other side of the piston to the discharge conduit, an escape passage leading from the cylinder on the last referred to side of the piston, a valve controlling it, a member in the discharge conduit which is moved by the flow therethrough, a spindle upon which said member is pivoted, and means connecting the spindle to said last named valve for moving it to cover and uncover said escape passage.

4. The combination with a centrifugal compressor having an inlet conduit and a discharge conduit, of a conduit for wasting fluid connected with the discharge conduit, a valve in said conduit for wasting fluid, a

non-return flap valve in the discharge conduit which is actuated by the flow of fluid through such conduit, and means controlled by the movement of the flap valve for actuating the first named valve.

5. The combination with a centrifugal compressor having an inlet conduit and a discharge conduit, of a conduit for wasting fluid connected with the discharge conduit, a valve in said conduit for wasting fluid, means actuated by the pressure of the fluid in the discharge conduit for operating said fluid wasting valve, a flap valve in the discharge conduit which is actuated by the flow of fluid through such conduit, and means connecting said flap valve to said pressure actuated means for controlling the operation thereof.

In witness whereof, I have hereunto set my hand this 14th day of August, 1917.

WILLIAM J. McBRIDE.