

F. S. MILLER.
CONTROLLING VALVE FOR PUMPING SYSTEMS.
APPLICATION FILED AUG. 30, 1909.

977,823.

Patented Dec. 6, 1910.

2 SHEETS—SHEET 1.

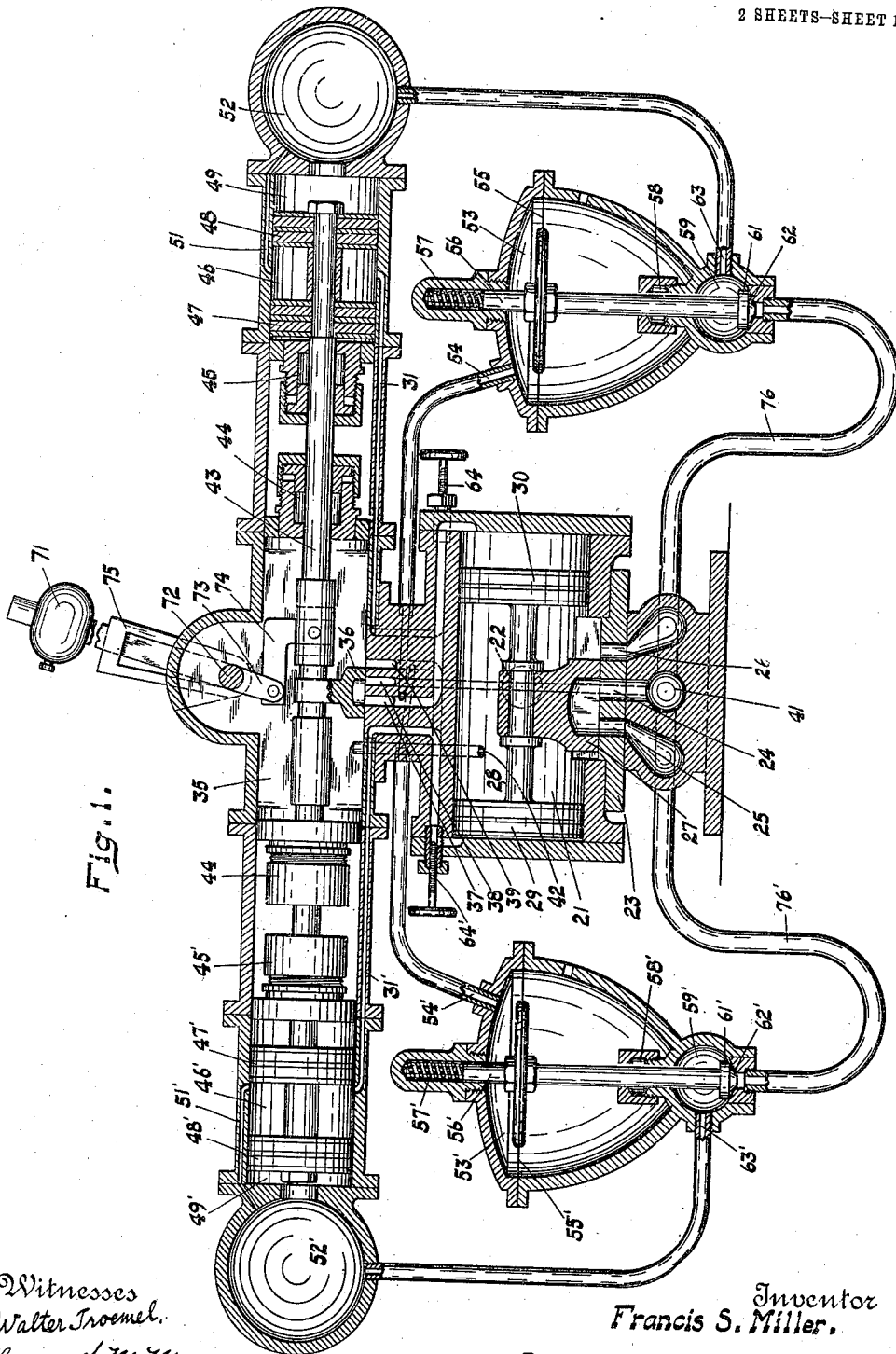


Fig. 1.

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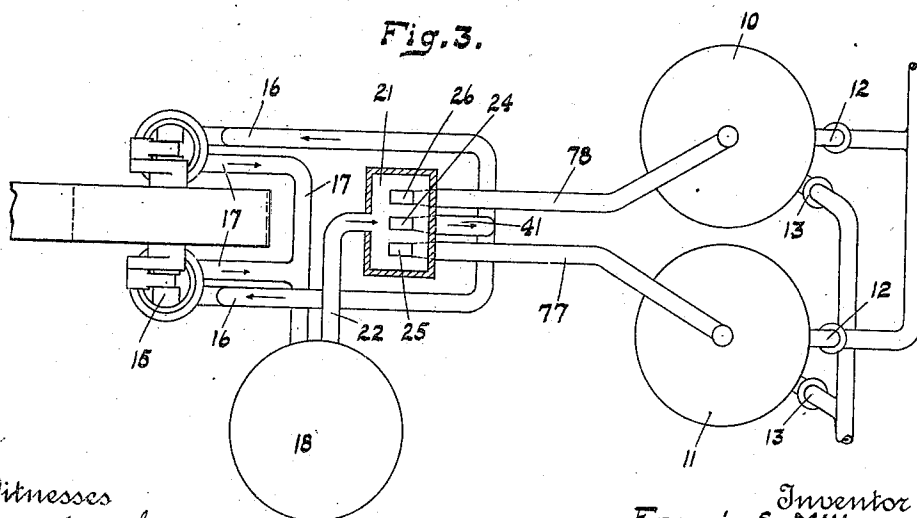
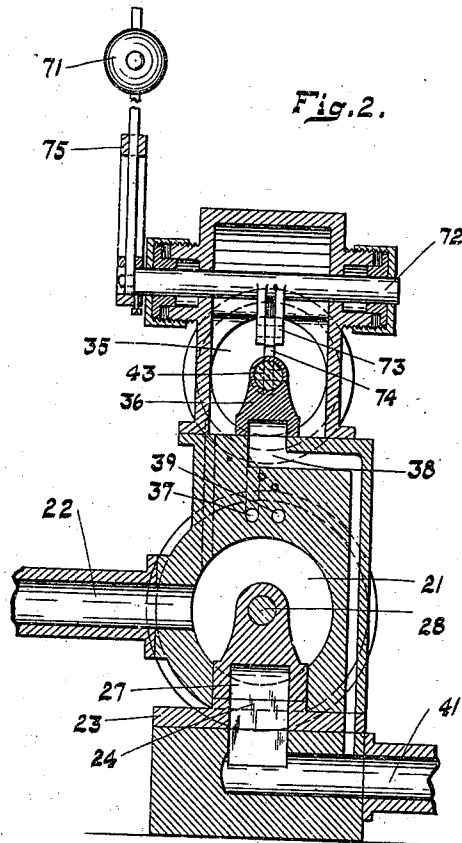
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UNITED STATES PATENT OFFICE.

FRANCIS S. MILLER, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO HARRIS AIR PUMP COMPANY, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

CONTROLLING-VALVE FOR PUMPING SYSTEMS.

977,823.

Specification of Letters Patent.

Patented Dec. 6, 1910.

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To all whom it may concern:

Be it known that I, FRANCIS S. MILLER, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Controlling-Valves for Pumping Systems, of which the following is a specification.

In the use of compressed air and a vacuum for lifting and transporting water, it is quite customary to have a system comprising two air tight tanks connected with the water supply and with an air compressor in such manner that, while the suction side of the compressor is connected with one of the tanks so as to produce a vacuum therein and a consequent flow of water thereto, the other tank will be connected with the compression side of the compressor so that water within said tank will be forced out. In such systems it has also been common to provide a mechanism for automatically reversing the connections between the compressor and the two tanks but, so far as I am aware, many of such devices have been dependent upon the movement of floats within the two tanks.

The object of my present invention is to produce a controlling mechanism connected to the tanks but wholly independent of any float mechanism, for accomplishing the automatic reversal of connections between the compressor and tanks.

The accompanying drawings illustrate my invention.

Figure 1 is an axial section of my controller; Fig. 2 a transverse section through shaft 72, and Fig. 3 a diagram of the system in which my apparatus is placed.

In the drawings, 10 and 11 indicate the two tanks provided with water induction pipes 12, 12 and water eduction pipes 13, 13. The compressor 15 is provided with suction pipes 16, 16 and with compression pipes 17, the pipes 17 being connected with an equalizing chamber 18.

My improved controller is provided with a main valve chamber 21 which is connected by pipe 22 with the equalizing chamber 18, and arranged in chamber 21 is a valve plate 23 having an intermediate exhaust port 24 and two flanking eduction ports 25, 26. Mounted on the valve plate 23 and cooperating with the ports 24, 25 and 26 is a D-valve 27. In order to operate valve 27 I connect the same to the central stem 28 of

a pair of piston heads 29 and 30 mounted in opposite ends of chamber 21, the piston heads being packed to prevent flow of compressed air from the intermediate portion of chamber 21, to its ends.

The movement of valve 27, when it does move, needs to be fairly rapid, but the periods of rest at the opposite ends of the stroke of the valve need to be varied in accordance with the volume of water delivery from the system and I therefore provide the following mechanism for throwing valve 27. Arranged adjacent chamber 21 is a valve chamber 35 in which is mounted a D-valve 36 which controls three ports 37, 38 and 39. Port 37 leads to the right hand end of chamber 21 so as to control pressure applied to the outer end of piston head 30, and port 39 leads to the opposite end of chamber 21 so as to control pressure applied to the outer end of piston head 29. Port 38 leads to an exhaust passage 41 which is connected to the suction pipe 16. Leading from the middle portion of chamber 21, at a point always between the two piston heads 29 and 30, is a passage 42 which leads into chamber 35. Valve 36 is connected to a stem 43 which is projected through suitable packing glands 44, 44 at opposite ends of chamber 35. One end of rod 43 is continued through a packing gland 45 into a chamber 46 and provided with a pair of separated piston heads 47 and 48, thus forming an end chamber 49 in chamber 46 at the outer end of piston head 48. Similarly the opposite end of stem 43 is projected through a packing gland 45' into a chamber 46' and provided with a pair of piston heads 47' and 48' so as to form a chamber 49' in the outer end of chamber 46'. Leading into the chamber 46 between piston heads 47 and 48 is a passage 31 which leads past a needle valve 64 into the right hand end of chamber 21 so as to control pressures upon the outer end of piston head 30. Similarly a passage 31' leads from chamber 46', between piston heads 47' and 48', past a needle valve 64' into the left hand end of chamber 21, so as to control pressures on the outer end of piston 29. Leading from chamber 46, at a point between the piston heads 47 and 48, is a passage 51 which leads to a chamber 52 in free communication with chamber 49, and similarly a passage 51' leads from chamber 46' to a chamber 52' which is in free com-

munication with chamber 49'. Leading from passage 37 to a diaphragm chamber 53 is a passage 54, the diaphragm chamber being closed at one side by a diaphragm 55, the stem 56 of which is normally urged in one direction by means of spring 57. Stem 56 is carried through a packing gland 58 into a valve chamber 59 and provided with a valve 61 which is normally held to its seat 62 by spring 57. Leading from chamber 52 to chamber 59 is a passage 63. Similarly, a passage 54' connects passage 39 with a diaphragm chamber 53' provided with a diaphragm 55' the stem 56' of which is acted upon by spring 57'. Stem 56' extends through a packing gland 58' into a chamber 59' and is provided with a valve 61' normally seated in a seat 62'. A passage 63' connects chamber 52' and 59'.

In order to make sure of the movement of the valve 36 to either extreme I provide the weighted lever 71 which is carried by rock shaft 72 lying within chamber 35 and provided with an arm 73 engaging a bracket 74 carried by stem 43. As the stem 43 shifts longitudinally, weight 71 is carried past the vertical center and drops against an arm 75 rigidly secured to shaft 72 and permitting a slight movement of the weighted lever 71 relative to the shaft so as to deliver a slight blow upon the shaft and thus insure the full movement of valve 36. Beyond valve seat 62 a pipe 76 forms a communication between chamber 59 and the exhaust pipe 41 and a similar pipe 76' forms a communication between chamber 59' and the exhaust pipe 41. Port 25 is connected by a pipe 77 with the top of tank 11 and port 26 is connected by a similar pipe 78 with the top of tank 10.

With the parts in the position shown in Fig. 1 the operation is as follows: Chamber 21 is in direct communication, through port 26, with pipe 78 and the pressure is being exerted upon the water in tank 10 to drive it from the tank. At the same time the pressure within chamber 21 is communicated through the passage 42 to chamber 35 and passes from thence through passage 39 to the left hand end of chamber 21 so as to act upon the outer end of piston 29. At the same time the suction side of the compressor is connected to port 25 and therefore is producing a vacuum in tank 11 and is also acting through passages 38 and 37 to exhaust the pressure away from the outer end of piston 30 so that a movement of valve 27 toward the right will be produced so as to reverse the connection between tanks 10 and 11 and the compressor. In the meantime the pressure which is acting upon the outer end of piston head 29 is leaking through the needle valve 64' and passing from thence through passage 31' into chamber 46' (where it expands and is thus tempo-

rarily interrupted in its flow to chamber 52') and from thence through passage 51' into chamber 52' where it accumulates against the outer end of piston head 48'. There is however a counterbalancing pressure within chamber 49 and there will be no movement of valve 36 until the pressure within chamber 49 is released by the withdrawal of valve 61, so as to connect chamber 52 with the vacuum side of the compressor. This can only be accomplished by an exhaustion of pressure in chamber 53 to a point in excess of the spring pressure 57 and this is accomplished by reason of the exhaustion of air through passage 54 and passage 37. This exhaustion of pressure is comparatively slow, so that the movement of stem 43 and valve 36 does not take place until a considerable time after valve 27 has been shifted. In the meantime a pressure has been building up in chamber 52' so that, as soon as valve 61 is opened, stem 43 is moved to the right and valve 36 consequently shifted so as to connect passage 39 with the exhaust passage 38 and passage 37 with chamber 35. Thereupon pressure passes into chamber 21 through passage 37 so as to act upon the outer end of head 30 and the operation is repeated in the manner already described. While pressure is passing from chamber 35 into the left-hand end of cylinder 21 and pressure is thus passing through passages 31' and 51' into chamber 52', the piston structure 29—30 is moving to the right and thus substantially maintaining a pressure in passages 31 and 51 which counteracts the tendency of flow through said passages from chamber 52. The movement of air through passages 31' and 51' to chamber 52', at this time, is comparatively slow but is sufficient, as soon as the pressure in chamber 52 is released, to shift stem 43 to the right.

I claim as my invention:—

1. A controller for air lift systems comprising a main valve, a piston structure for shifting the same, a valve controlling the flow of motive fluid to said piston structure, a piston structure connected with said second valve, and means for controlling the flow of motive fluid to and from said piston structure in opposite directions, said means comprising a pair of pressure-controlled valves, and pressure connections for said pressure-controlled valves.

2. A controller for air lift systems comprising a main valve chamber, a valve mounted therein and controlling the ports thereof, a double headed piston structure mounted in the main valve chamber and connected with the valve, a controlling-valve chamber, a controlling valve mounted therein and controlling passages between the controlling valve chamber and the opposite ends of the main valve chamber, a stem con-

5 nected with the controlling valve provided at opposite ends with a piston, a pair of cylinders in each of which is mounted one of said pistons, communicating passages between each of said cylinders and one end of the main valve chamber, a connection between each of said cylinders and the vacuum passage, a valve arranged in each of said passages, means for normally holding said valve closed, and means for producing a vacuum acting upon each of said valves in opposition to said closing means.

10 3. A controller for air lift systems comprising a main valve chamber, a valve mounted therein and controlling the ports thereof, a double headed piston structure mounted in the main valve chamber and connected with the valve, a controlling-valve chamber, a controlling valve mounted
15 therein and controlling passages between the controlling valve chamber and the opposite ends of the main valve chamber, a stem connected with the controlling valve and provided at opposite ends with a double piston,

a pair of cylinders in each of which is mounted one of said double pistons, communicating passages between each of said cylinders and one end of the main valve chamber, the connection with each of said cylinders being between the two parts of the double piston and also to the outer side of one of the parts of the double piston, a connection between each of said cylinders and the vacuum passage, a valve arranged in each of said passages, means for normally holding said valve closed, and means for producing a vacuum acting upon each of said valves in opposition to said closing means.

In witness whereof, I have hereunto set my hand and seal at Indianapolis, Indiana, this 11th day of August, A. D. one thousand nine hundred and nine.

FRANCIS S. MILLER. [L. s.]

Witnesses:

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