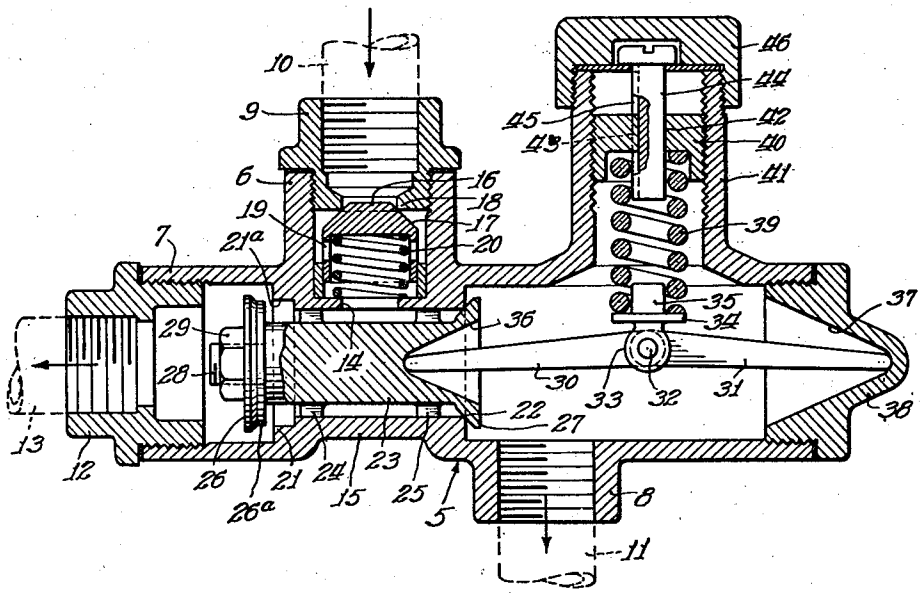
Dec. 10, 1946. E. A. ROCKWELL ET AL 2,412,428

UNLOADING DOUBLE CHECK VALVE

Filed Dec. 24, 1943



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Patented Dec. 10, 1946 2,412,428

UNITED STATES PATENT OFFICE

2,412,428

UNLOADING DOUBLE CHECK VALVE

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Application December 24, 1943, Serial No. 515,604

3 Claims. (Cl. 137—153)

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The present invention relates to pressure regulating valve arrangements and particularly to arrangements of this type effective to receive a pressure fluid from a constantly operating generator and deliver the same to and maintain a selected range of pressures in an accumulating system, unloading or relieving the generator to the low pressure return when a selected maximum pressure is obtained.

It is an object of this invention to simplify the construction of an unloading valve assembly such as contemplated herein, and to improve the efficiency and operation thereof.

A more particular object is the provision of an improved control valve assembly including a pressure delivery valve and a relief return valve, the two valves being connected together against relative movement and being effective to alternately engage respective corresponding valve seats and having adjustable resilient means for urging the relief return valve in the direction of seating position thereof with a force which has a maximum value in the closed position of said valve decreasing as said valve is moved in the direction of open position to thus insure complete opening movement of said relief return valve and complete closing movement of said pressure delivery valve once such movement has been initiated.

Additional objects, aims and advantages of the present invention will be apparent to persons skilled in the art after the construction and operation of this double check unloader valve is understood from the within description.

It is preferred to accomplish the numerous objects of this invention and to practice the same in substantially the manner hereinafter fully described and as more particularly pointed out in the appended claims, reference being made to the accompanying drawing that forms a part of this specification and wherein the single figure is a longitudinal sectional view taken axially through a valve structure incorporating a preferred embodiment of the present invention.

The drawing is to be understood as being of a more or less schematic character for the purpose of disclosing typical or preferred forms of the improvements that are contemplated herein.

Referring in greater detail to the drawing, a hollow housing 5 of elongate cylindrical shape is provided with a lateral high pressure inlet stub 6, an axial high pressure outlet stub 7 for the flow of fluid from the pump to an accumulator or accumulating system (not shown), and a low pressure return or unloading stub 8 that projects laterally from the housing in a direction opposite

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the inlet stub. Inlet stub 6 is threaded to receive a coupling 9 for the feed pipe 10 leading from the pump (not shown), and the relief or unloading stub 8 is threaded to receive the fluid return pipe 11 that leads from the housing back to the pump. The outlet stub 7 is threaded to receive a flanged coupling 12 having a threaded central opening for connection with the pipe 13 leading from the housing to an accumulator or like structure (not shown).

The inlet stub 6 is provided with a port 14 to discharge the fluid into a neck portion 15 of the housing that is between the outlet stub 7 and return or unloading stub 8. This flow is controlled by a one-way outward pressure check valve 16 that functions to prevent reverse flow of the fluid backward into the inlet stub. Said check valve 16 is cup-shape in axial section and it has a chamfered portion 17 that is engageable with a valve seat 18 at the inner edge of coupling 9, and it also has passages 19 through its cylindrical wall which permit the fluid to flow to the discharge port 14 when this check valve is unseated. A coil compression spring 20 is interposed between check valve 16 and the wall of the housing that bounds the outlet port 14, and this spring urges the check valve in a direction toward its seat 18. The pressure of the fluid from the pump will push the valve away from its seat to effect the passage of the fluid into the housing and any tendency of the fluid to reverse its normal direction of flow will result in the closure of the valve.

The neck portion 15 of the housing provides a guide for the spindle of a double check valve assembly and at ends of this neck portion there are valve seats 21 and 22 that face in opposite directions away from each other. The spindle 23 is provided adjacent its ends with splines 24 and 25 that guide the spindle in reciprocal sliding movement in the neck, the said splines also permitting the passage of the fluid in either direction through said neck. The spindle terminates adjacent the seats 21 and 22, and at its ends it is provided with check valves 26 and 27 that are alternately engageable with the respective seats 21 and 22 to control flow through the outlet stub 7 or the return stub 8. These valves 26 and 27 have their chamfered portions facing in opposed directions toward each other. The valve 26, which has a greater area than that of the valve 27, is preferably a separate element that is anchored upon a threaded stub 28 at the adjacent end of the spindle by a clamp nut 29 providing for ready assembly and disassembly.

Yieldable means are provided to urge the re-

ciprocal double check valve assembly in one direction of its movement to normally seat the check valve 27 and open the valve 26. These respective positions, which are shown in the drawing, are such that the flowing fluid moves past check valve 26 to pass out of the housing through the high pressure outlet stub and pipe 13 to the accumulator, while the check valve 27 is closed due to the action of the yieldable means which is under compression greater than the pressure of the fluid from the pump.

The yieldable means above mentioned embodies a toggle having elongate arms 30 and 31 fulcrumed on a pin 32 mounted in the ears of a yoke 33 that is provided with disc-shaped seat 34 and an upstanding post 35. In the arrangement shown the outer or free end of arm 30 bears against the inner end of a tapered recess 36 in the spindle 23 of the reciprocal check valve assembly, and the free end of arm 31 bears against the inner end of a tapered recess 37 in a threaded conical plug 38 that is screwed into the end of the housing adjacent the relief return stub 8. The recess 36 extends a considerable distance into the spindle 23 so that the end of arm 30 has its bearing located at a point between the respective check valves 26 and 27 and beyond the axis of the inlet check valve. The seating of check valve 27 provides a stop for arresting the downward movement and prevents straightening of the toggle thereby preventing the fulcrum 32 reaching a dead center position.

The fulcrum or knee of the toggle is urged downward, tending to straighten the arms 30 and 31, by the action of a coiled tension spring 39 that is interposed between the disc-shaped seat 34 and a follower 40 that is adjustably mounted in a tubular boss 41 on the housing above the fulcrum 32 of the toggle. The follower 40 has a threaded edge that engages internal threads in the boss 41 and it has a central aperture 42 that is provided with an inwardly projecting lug 43. The means for rotating the follower 40 comprises an elongated winding rod 44 that passes through aperture 42 and has a longitudinal groove 45 to accommodate the lug 43. A flanged apertured cap 46 screwed upon the upper end of boss 41 provides a mounting for the winding rod 44 and permits rotation of the rod but also prevents longitudinal movement thereof. The adjustment of spring tension is readily accomplished to cause the follower to be moved up or down in the boss 41.

To further insure the completion of opening movement of relief return valve 27, once the same has been initiated there may be provided a piston-like masking surface 26*a* on pressure delivery valve 26 cooperating with a complementary cylinder masking surface 21*a*. When the closing movement of valve 26 has been initiated the masking surfaces 21*a* and 26*a* are brought into cooperative relation thus restricting the flow past valve 26. The corresponding opening of relief return valve 27 causes a momentary drop of pressure within the reduced neck portion 15 of the housing below that pressure existing on the accumulator side of pressure delivery valve 26 with the result that the accumulator pressure acts on valve 26 as a piston insuring the movement of the assembly to the right in the drawing.

While this invention has been described in detail in its present preferred form or embodiment, it will be apparent to persons skilled in the art, after understanding the improvements, that various changes and modifications may be made therein without departing from the spirit or scope thereof.

We claim:

1. In an unloading valve arrangement including a housing having an inlet port, a high pressure outlet port, and a low pressure unloading port, valve seats in said housing at opposite sides of said inlet port, a double check valve assembly cooperating with said seats comprising a reciprocal spindle, valves on said spindle alternately engageable with said seats, one valve controlling flow through said low-pressure unloading port and the other valve controlling flow through said high pressure outlet port, means defining a tapered recess extending into said spindle from the back of the low pressure valve and forming a bearing disposed axially between said valves thus improving the balance and stability of operation, a toggle having a first link engaged at one end in said recessed bearing and having a second link engaging a fixed bearing at its other end, and resilient means exerting pressure against said toggle tending to extend the same to seat said one valve and to unseat said other valve.

2. In an unloading valve arrangement including a housing having inlet, outlet, and unloading ports, a one-way outward pressure check valve controlling flow through said inlet port, double check valves connected to each other for simultaneous operation to effect alternate opening and closing of said outlet and unloading ports, a toggle engaged at one end with said connected double check valves, said toggle acting to normally open said outlet valve and to seat said unloading valve, the seating of said unloading valve providing a stop to limit extendable movement of the arms of said toggle in one direction, the seating of said outlet valve providing a stop to limit the collapsing movement of the arms of said toggle in the opposite direction, said outlet port and said associated valve being provided with cooperating masking surfaces effective to improve the positive opening characteristics of said unloading valve, and an adjustable tension spring operating against said toggle to urge the toggle arms in said extendable direction of movement.

3. An unloading valve arrangement comprising a housing having inlet, outlet and unloading ports; an outward pressure check valve controlling said inlet port; valve seats in said housing at opposite sides of said inlet port; a double check valve unit arranged for reciprocal movement to alternately engage said seats thereby to control flow through said outlet port and said unloading port; spring loaded toggle means between said valve unit and a wall of said housing, said toggle means being effective to normally seat the unloading port valve, said seating being adapted to limit extensible movement of said toggle means; and cooperating masking surfaces on said outlet port and said outlet valve, said masking surfaces being effective to improve the positive opening characteristics of said unloading port valve.

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