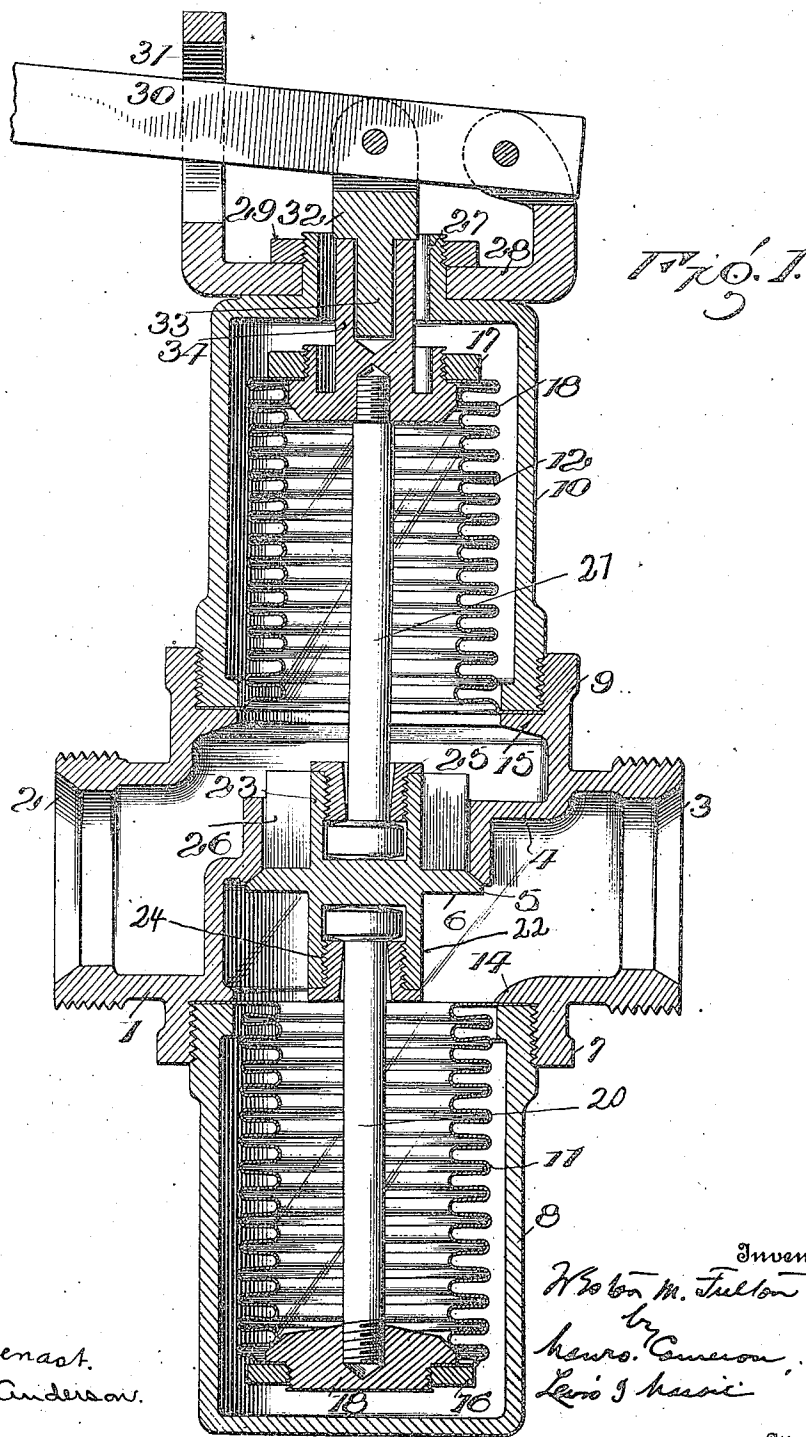


W. M. FULTON.
BALANCED VALVE.
APPLICATION FILED AUG. 28, 1914.

1,153,681.

Patented Sept. 14, 1915.
2 SHEETS—SHEET 1.



Witnesses
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Geo. St. Anderson.

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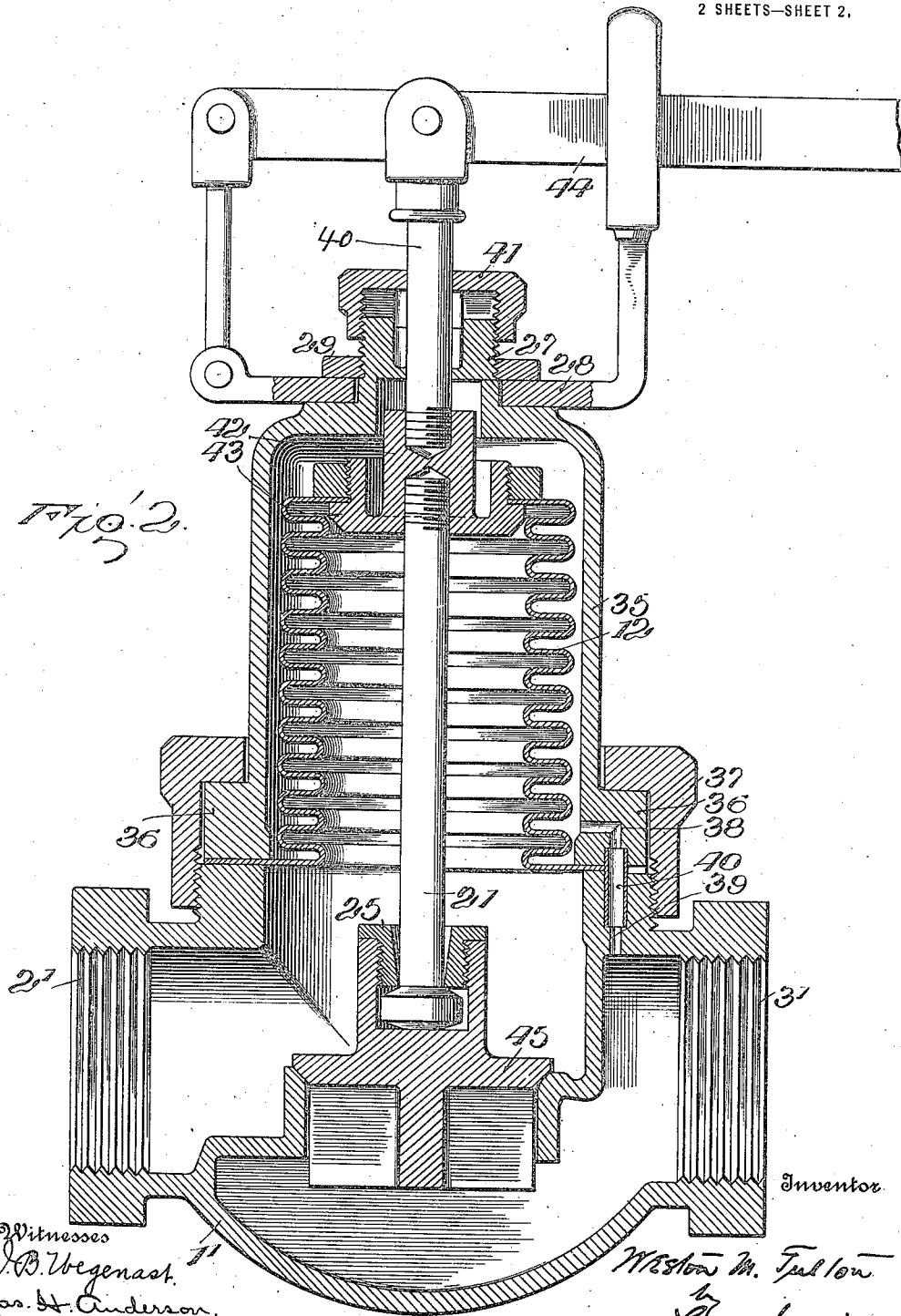
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UNITED STATES PATENT OFFICE.

WESTON M. FULTON, OF KNOXVILLE, TENNESSEE, ASSIGNOR TO THE FULTON COMPANY, OF KNOXVILLE, TENNESSEE, A CORPORATION OF MAINE.

BALANCED VALVE.

1,153,681.

Specification of Letters Patent.

Patented Sept. 14, 1915.

Application filed August 28, 1914. Serial No. 859,061.

To all whom it may concern:

Be it known that I, WESTON M. FULTON, a citizen of the United States of America, and a resident of Knoxville, Tennessee, have invented a new and useful Improvement in Balanced Valves, which invention is fully set forth in the following specification.

This invention relates to improvements in balanced valves, and more particularly to means for balancing single seated valves.

The invention has for its principal objects to overcome leakage, to prevent wire drawing, and to secure quick movement of the valve when it is unseated and when it approaches the seating position, and to secure, in single seated valves, the benefits of balanced valves of the double seated type while avoiding their objectionable features.

In my copending application Serial No. 861,676, filed Sept. 14, 1914, I have described and broadly claimed a construction for balancing fluid pressure on a valve by means of a flexible corrugated tubular wall having an effective diameter equal that of the valve, and have explained how to determine such diameter for any given valve. Briefly stated, the effective diameter of a wall of this kind is less than the larger diameter of the corrugated wall and greater than the smaller diameter, and for practical purposes may be found from the formula—

$$X = \sqrt{R(R + .5858 A) + .2929 A^2},$$

in which $2X$ is the effective diameter, R the smaller radius of the wall, and A the depth of the corrugations. It has been found that the effective diameter of a wall of this character slightly decreases when the wall is decreased, and increases when the wall is extended. The wall, therefore, acts under fluid pressure during collapsing as if the area of the end wall were decreasing, and acts as if it were increasing when the wall is extended.

My invention, in general terms, resides in providing a single seated valve such as used in controlling an opening in a partition located in a valve casing or conduit, and a flexible corrugated tubular wall having an effective diameter equal that of the valve and having its movable end closure connected to one side of the valve and providing means for balancing fluid pressure on the opposite

side of the valve. The latter means may assume various forms, such as a second tubular wall like the first-named, having its movable end connected to the opposite side of the valve; or means may be provided for using a single tubular wall and applying thereto fluid pressure from the delivery side of the valve.

In order that the invention may be readily understood, reference is had to the accompanying drawings illustrating, by way of example, two constructional forms embodying the inventive idea. The drawings are designed merely to assist the description and not as defining the limits thereof.

Figure 1 is a vertical central sectional view showing a single seated valve provided with my improvement; and Fig. 2 is a similar view showing a modified form of my improvement.

In Fig. 1 is shown a valve casing 1 having an inlet 2 and an outlet 3, each provided with external threads for pipe connections, a partition 4 in which is formed a valve port 5 for seating a valve 6. On the lower side of the valve casing the wall is extended to form an interiorly threaded portion 7 for receiving a housing 8, and on the upper side of the casing the wall is provided with a similar tubular portion 9 receiving a housing 10. In these housings are located flexible corrugated tubular walls 11, 12, the flanged open ends of which are clamped against ledges 14 and 15, extending from the casing wall, by means of the threaded ends of the housing. The movable ends of the tubular corrugated walls are closed by means of nut plates 16, 17 and flattened bolts 18, 19 which clamp the flanged ends of the tubular wall against the plates. In the example given, the upper vessel is exposed to inlet pressure and its effective diameter is made equal the diameter of the port opening or that of the valve face exposed to this pressure. If the opposite or lower face of the valve were to be exposed to inlet pressure, the lower vessel would be given an effective diameter equal the diameter of the lower face. The opposite vessel is preferably made of the same effective diameter, but the vessels need not be of the same length.

The valve 6 is provided on opposite sides

with means for connecting with valve stems 20, 21, and as shown consists of interiorly threaded sockets 22, 23 receiving the heads of the valve stems which are held in place by screw-plugs 24, 25 having tapered openings to give slight play to the valve stems and heads. Wings 26 are provided on the valve for guiding it to its seat. Into the end closures of the tubular walls are screwed the ends of the valve stems, as shown. Housing 10 is provided with a tubular projection 27 over which fits a two-arm bracket member 28 secured in place on the top of the housing 10 by a nut 29. A valve-operating lever 30 is pivoted to one arm of the bracket and is guided in its up and down movements in a slotted opening 31 in the other bracket arm. To lever 30, in a line with the axis of the valve, is pivoted a plunger 32 having a reduced portion 33 which enters a recess formed in the end of a projection 34 extending up from the end closure of vessel 12.

The operation of the device is as follows: When steam or other fluid enters the casing through inlet 2 and the valve 6 is in closed position, the fluid pressure on the upper face of the valve is the same as that on the vessel 12 and the two pressures balance each other. The same is true of pressures acting on the underside of valve 6 and vessel 11, whatever the difference of pressure on the opposite sides of the valve. The valve has therefore no tendency to open because of fluid pressures in the casing. To open the valve, the valve lever 30 is depressed thereby acting through its plunger 32 to compress vessel 12 and extend vessel 11, thus diminishing the effective diameter of the upper vessel and increasing the effective diameter of the lower vessel and giving an acceleration to the movement of the valve while moving away from its seat. The valve is thus given a positive quick action at opening, and chattering and wire-drawing are eliminated. When the valve is closed, the conditions are reversed and the movement of the valve is accelerated in the opposite direction with the same advantageous results.

It will be obvious that the valve may be operated by screw-means instead of a lever, and that the valve may be located on the inlet side of the partition instead of on the outlet side, without departing from the spirit of my invention.

In Fig. 2, one of the corrugated vessels is omitted and both sides of the vessel are used for balancing the valve. The valve casing 1' is formed on its upper side with a threaded nipple 34 and is provided with an inlet 2' and an outlet 3'. The housing 35 is provided with a flange 36 for receiving a union nut 37 which secures the housing and the flanged end of the tubular wall 12 in place on the casing. In the body of the

housing flange 36 is formed a duct 38 which is adapted to register with a duct 39 formed in the wall of the casing. To insure a tight connection and to facilitate registering, a short tube 40 is adapted to enter enlarged portions of the ducts as shown. Communication is thus established between the delivery space of the valve casing and the space outside the tubular corrugated wall 12. This wall is of the same construction as that previously described and has an effective diameter equal that of the face of the valve exposed to inlet pressure. To prevent leakage past the plunger 40, a packing joint 41 is provided. The plunger is secured to a projection 42 on the closure 43 and is operated by a lever 44 as previously described. The valve 45 in this construction is opened against inlet pressure instead of against outlet pressure as in the first described construction. When steam or other fluid enters the casing through inlet 2', pressures on the valve and on the inside of vessel 12 are equal and in opposite directions. When the valve is opened by raising lever 44, fluid passes the valve and part of it enters the housing and acts on the outside of vessel 12 and establishes a force substantially equal and opposite that on the lower side of the valve. The pressures on both sides of the valve are therefore balanced and the valve in closed position has no tendency to open and has the advantages described in connection with the construction previously described.

What is claimed is:—

1. In combination, a valve casing having a valve port and a valve controlling the same, flexible tubular walls arranged one on each side of said valve and connected thereto and each having an effective diameter equal the diameter of said port whereby fluid pressure on said walls balances the fluid pressure on the said valve.

2. In combination, a valve casing having a valve port and a valve controlling the same, flexible tubular walls arranged one on each side of said valve and connected thereto and each having an effective diameter equal the diameter of said port whereby fluid pressure on said walls balances the fluid pressure on the said valve, and means for opening and closing said valve.

3. In combination, a valve casing having a valve port and a valve controlling the same, a flexible corrugated tubular wall connected to said valve and having an effective diameter equal that of said port, and means for balancing fluid pressure on the delivery side of said valve.

4. In combination, a valve casing having a valve port and a valve controlling the same, corrugated expansible and contractible vessels arranged on opposite sides of said valve and in line with said port, and

exposed interiorly to fluid pressure in said casing and adapted to balance fluid pressure on both sides of said valve, end closures for the movable ends of said vessels connected to
5 said valve, the opposite ends being stationary, and means for opening and closing said valve.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WESTON M. FULTON.

Witnesses:

J. V. GIESLER,
H. T. PATTON.