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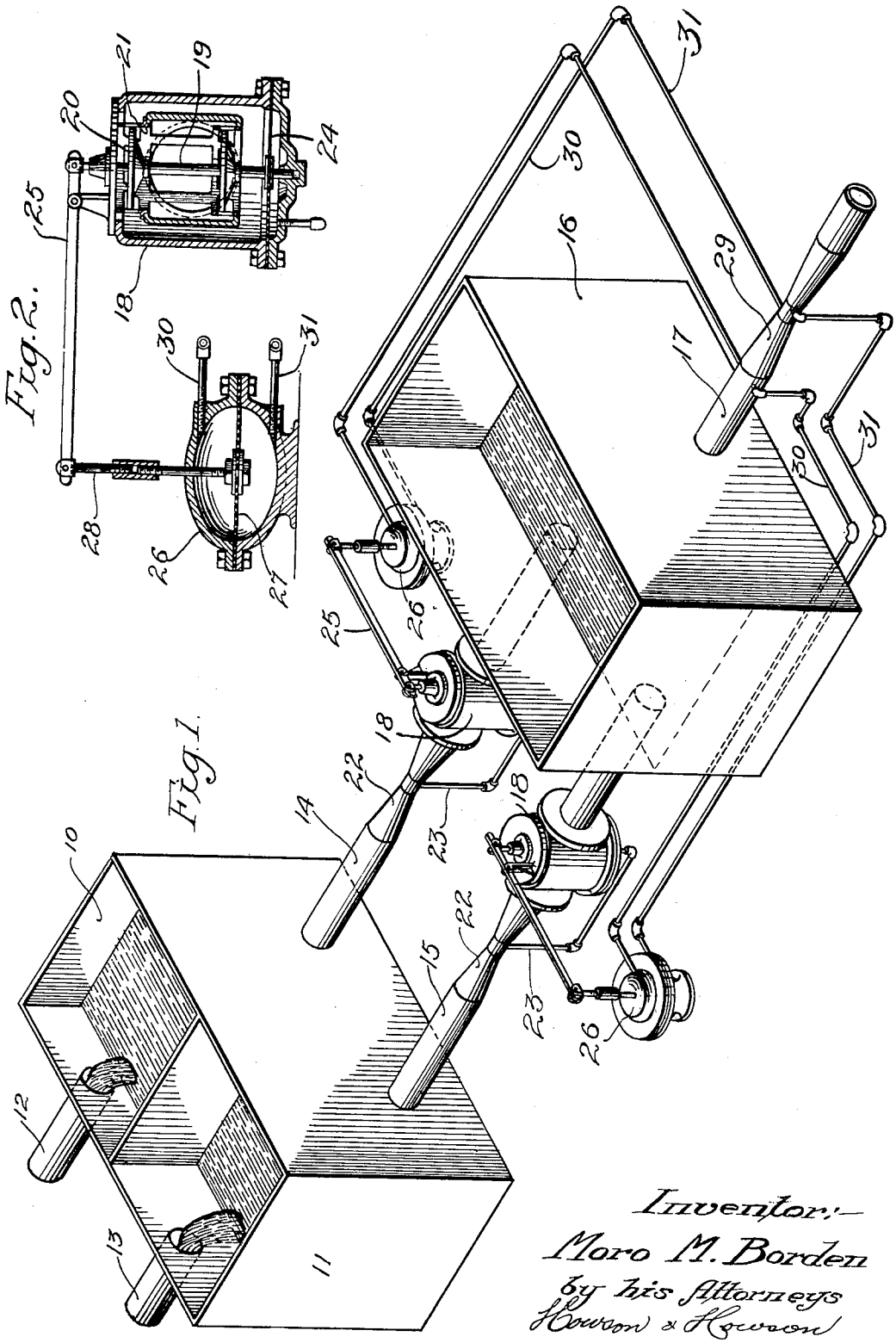
M. M. BORDEN

1,936,538

FLUID PROPORTION CONTROLLER

Filed Feb. 5, 1931

2 Sheets-Sheet 1



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FLUID PROPORTION CONTROLLER

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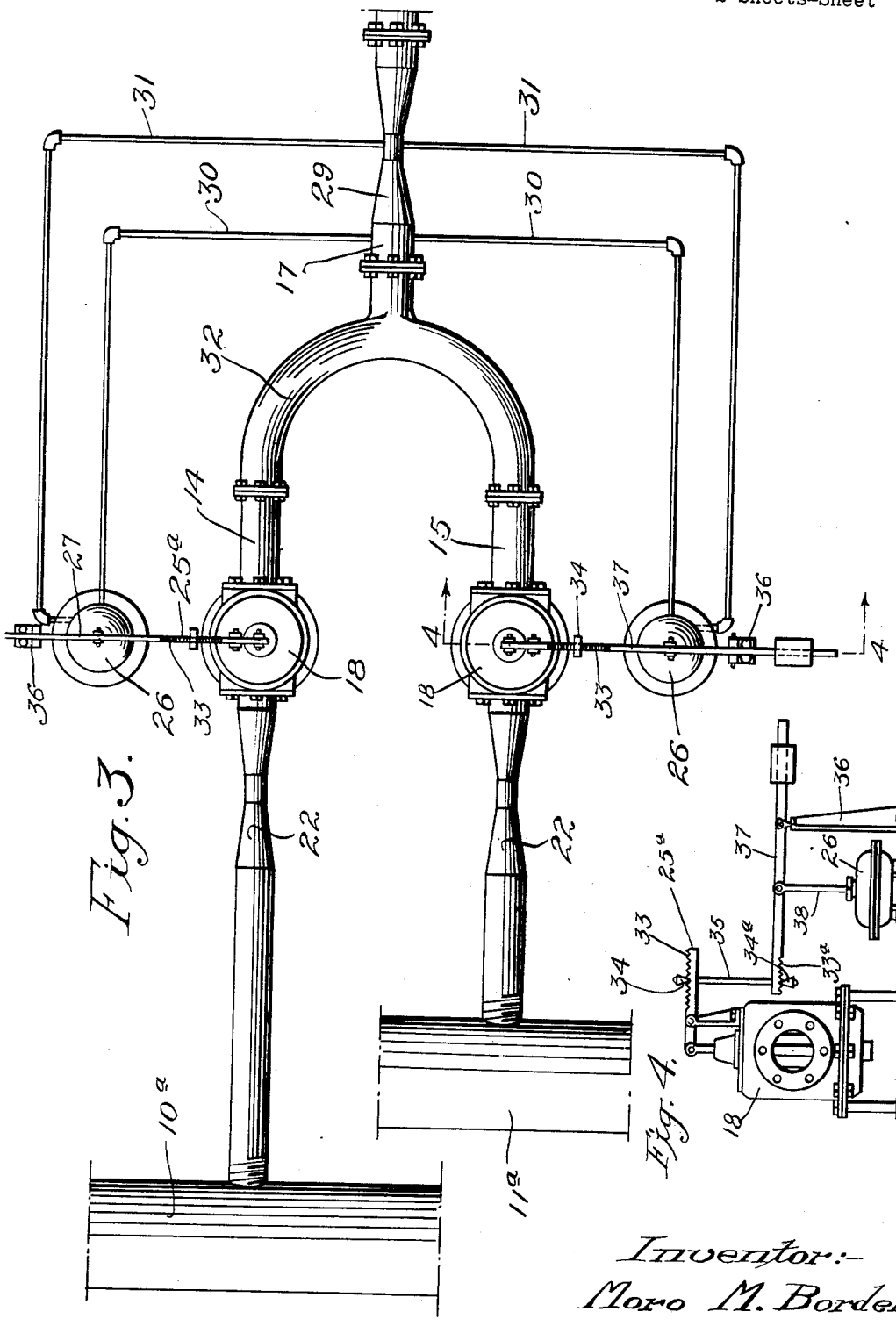


Fig. 3.

Fig. 4.

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FLUID PROPORTION CONTROLLER

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Application February 5, 1931. Serial No. 513,687

11 Claims. (Cl. 137—165)

This invention relates to an apparatus for controlling the proportions and volume of an aggregate flow, and more particularly to an apparatus for determining the proportions of a plurality of different liquids in their delivery to a point where they are to be used, and a quantitive delivery to such point.

An important object of the invention is to provide an apparatus of this character in which the necessary flow-controlling elements are reduced in number to a minimum while at the same time providing an accurate determination of both proportion and aggregate flow.

A still further object is to provide apparatus of this character which is readily incorporated in installations where the proportions of flow are regulated independently of the regulation of the aggregate flow.

A further object of the invention is the provision of an arrangement of this character in which the proportions of the elements of the aggregate flow may be readily varied as desired.

These and other objects I attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention and wherein:

Fig. 1 is a semi-diagrammatic perspective view of control apparatus constructed in accordance with my invention;

Fig. 2 is a sectional view through one of the units of the control apparatus;

Fig. 3 is a diagrammatic view showing a modification of the arrangement of Fig. 1; and

Fig. 4 is a section on line 4—4 of Fig. 3.

Referring now more particularly to the drawings, the numerals 10 and 11 designate head boxes, storage tanks or the like having leading thereto intake lines 12 and 13, and therefrom discharge lines 14 and 15 respectively. The lines 14 and 15 discharge to a common head box or storage tank designated at 16, which in turn has a discharge line 17. The tanks or head boxes 10 and 11 are each adapted to contain a treating fluid as, for example, lime softened water and zeolite softened water respectively, assuming that the contents of these tanks are to be delivered for use in softening water. It being desired that these fluids be delivered in predetermined proportions to the discharge line 17, I arrange in the lines 14 and 15 flow control mechanism at present shown as comprising a flow control valve 18 constructed in accordance with the showing of the prior patent to J. W. Ledoux, No. 950,208 granted February 22, 1910 although control valves of other types may be employed where so desired.

In a control valve of this character a stem 19 is provided having a plurality of valve elements 20 for co-action with port openings 21. These valve elements are to be moved in one direction or the other, depending upon differences in the head of the flow through pipe 14. In order to establish a pressure differential varying with the flow through pipe 14 I arrange in each of these pipes a venturi 22; the low pressure point 23 is connected with the valve casing 18 at a point beneath a diaphragm 24 connected by the valve stem and the valve casing, the opposite face of the diaphragm being subjected to the pressure of the fluid passing through the valve casing or to a high pressure point of the venturi. Obviously, as the differential in pressure increases as a result of an increase of head, the valve elements 20 will move toward their port-closing positions, and, conversely, as this pressure decreases, the valves will lift permitting a greater flow.

Such valves have the stems 19 thereof extended through the casing wall at one end of the casing and there connected to one end of a counterbalance lever 25 which is pivoted upon the casing. The opposite end of this counterbalance lever usually has arranged thereon a weight adjustable longitudinally of the lever to determine the pressure differential at which the valve elements shift. In accordance with my invention, this weight is eliminated and a counterbalance substituted comprising a diaphragm chamber 26 having a dividing diaphragm 27 which diaphragm is connected with the lever 25 through a transmission rod 28 adjustable as to length. In the discharge line 17 I provide a second means for causing a pressure differential responsive to the head of fluid in this line which is likewise shown as a venturi 29. From points of pressure differential established by this venturi, I lead transmission lines 30 and 31 to the diaphragm chamber at opposite sides of the diaphragm, the pressure differential upon the diaphragm 27 being similar to the diaphragm 24; that is to say, the low pressure line 31 communicates with that face of the diaphragm 27 corresponding to the face of diaphragm 24 which is subjected to low pressure. It will be obvious that the flow through lines 14 and 15 having once been determined by a setting of the valves 18, the discharges of these lines will always be proportionate. It will also be obvious that variations in the withdrawals

through discharge line 17 will cause a corresponding variation in velocity head in this line. If, for example, the tax resulting from withdrawal of fluids from line 17 exceeds the normal output of lines 14 and 15, there would be a corresponding variation in pressure differentials in lines 30 and 31. This will cause a shifting of the valve elements through diaphragm 27, link 28 and lever 25 to increase the flow through lines 14 and 15, thus maintaining the flow in discharge line 17 at a desired normal.

In Figs. 3 and 4 a slight variation of the structure just described is provided. In this figure the feed lines for the fluids to be controlled instead of being connected with storage tanks are led directly from mains 10—*a* and 11—*a* and the lines 14 and 15 are directly connected to the discharge line 17 through a Y 32 instead of through a head box 16 as in Fig. 1. In these figures I have likewise illustrated an arrangement permitting variation of the proportions of the supply lines with relation to one another, this arrangement being more clearly shown in Fig. 4 which is a characteristic elevation of a flow control valve diaphragm chamber and the connections therebetween as employed in this type of the apparatus. In this figure the lever 25—*a* connected with the valve element of the flow controller is provided in its upper surface with a series of notches 33 adapted to selectively receive the upper knife-edged cross bar 34 of a link 35. Associated with the diaphragm chamber is a stand 36 pivotally supporting a lever 37 an end of which is provided with an adjustable counterweight and the opposite end of which is connected with the diaphragm through a pull rod 38 and has in its under surface a series of notches 33—*a* adapted to interchangeably receive the lower knife-edged cross bar 34—*a* of link 35. It will be obvious that by adjusting the link 35 upon the respective levers 37 and 25—*a* the respective lengths of these levers may be altered, thus providing for a different flow control rate of the flow controller 18. This adjustment permits the relative flows in the feed lines to be varied at will within certain limits.

Since the arrangement is capable of a considerable modification, I do not wish to be understood as limiting myself to that herein illustrated except as hereinafter claimed.

I claim:

1. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller operated by pressure differentials arranged in each fluid flow line, each flow controller including a counterbalancing means and means for varying the effective value of the counterbalancing means of each flow controller in response to variations of the rate of flow in the mixture flow line.

2. Means for simultaneously determining the proportions of two fluids by the flow rate of an admixture of these fluids comprising a flow line for the mixture, flow lines for the fluids discharging to the mixture flow line, means controlled by the differential head resulting from the flow in each fluid flow line for controlling the flow of fluid through the line whereby the fluids are delivered to the mixture line in proportionate quantities and means for simultaneously biasing the first-named means proportionately to the rate of flow in the mixture flow line to control the flow of the mixture.

3. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller arranged in each fluid flow line, said flow controllers being adjusted to provide the desired proportions of the fluids and each including an adjusting means whereby the rate of flow therethrough may be regulated and means operated by pressure differentials varying in accordance with demand in the mixture flow line for automatically operating the adjusting means of the flow controllers.

4. The method of controlling the proportions and volume of a mixture of fluids consisting in controlling the flow of each fluid to the mixing point to insure the proportions of the mixture and simultaneously varying the controls of the fluid flows to the mixing point by the differential head due to the mixture flow to provide a constantly proportioned flow of the mixture.

5. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller arranged in each fluid flow line and operated by pressure differentials therein, each flow controller including a valve element, and means associated with each valve element for moving the same, the last-named means operating in response to pressure differentials as a result of velocity changes in the mixture flow line.

6. A flow controlling apparatus for simultaneously controlling the proportions by the flow of a mixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the flow lines discharge, means for controlling the flow in each fluid flow line whereby a predetermined proportion of fluid from each fluid flow line may be delivered to the mixture flow line and means simultaneously varying the first-named means in response to changes in the rate of flow in the mixture flow line to maintain a constantly proportioned flow therein.

7. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller in each fluid flow line including a movable valve element, a diaphragm connected to the movable valve element and subjected to pressure differentials resulting from the flow in the fluid flow line whereby to maintain a substantially constant flow in the line, a second diaphragm operatively connected to the valve element and means subjecting the second diaphragm to pressure differentials resulting from changes in the rate of flow in the mixture flow line.

8. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller arranged in each fluid flow line and operated by pressure differentials therein, each flow controller including a counterbalancing means, means for varying the effective value of the counterbalancing means of each flow controller in response to variations of the rate of flow in the

mixture flow line, and connections between each flow controller and its counterbalancing means for adjustably varying the value of each counterbalancing means with respect to its flow controller.

9. Means for simulaneously determining the proportions of two fluids by the flow rate of an admixture of these fluids comprising a flow line for the mixture, flow lines for the fluids discharging to the mixture flow line, means controlled by the flow in each fluid line for controlling the flow of fluid through the line whereby the fluids are delivered to the mixture line in proportionate quantities, means for simultaneously biasing the first-named means proportionately to the rate of flow in the mixture flow line to control the flow of the mixture, and means for adjustably regulating the effective value of said biasing means.

10. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising the flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller arranged in each fluid flow line, said flow controllers being adjusted to provide the desired proportions of the fluids and each including an adjusting means whereby the rate of flow therethrough may be regulated, means operated by pressure differentials in the mixture flow line for automatically operating the adjusting means of the flow controllers, and means for adjustably determining the extent of operation of the flow controllers by the last-named means in response to a given change in pressure differentials in the mixture flow line.

11. Means for providing a constantly proportioned flow consisting of an admixture of a plurality of fluids, said means comprising a flow line for each fluid, a flow line for the mixture into which the fluid flow lines discharge, a flow controller in each fluid flow line including a movable valve element, a diaphragm connected to the movable valve element and subjected to pressure differentials resulting from the flow in the fluid flow line whereby to maintain a substantially constant flow in the line, a second diaphragm, link and lever means connecting said second diaphragm and the valve element adjustable to determine the forces imposed upon the valve element by said second diaphragm and means subjecting the second diaphragm to pressure differentials resulting from changes in flow in the mixture flow line.

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