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G. H. GILMAN

FLUID METER

Filed Feb. 11, 1920

Fig. 1.

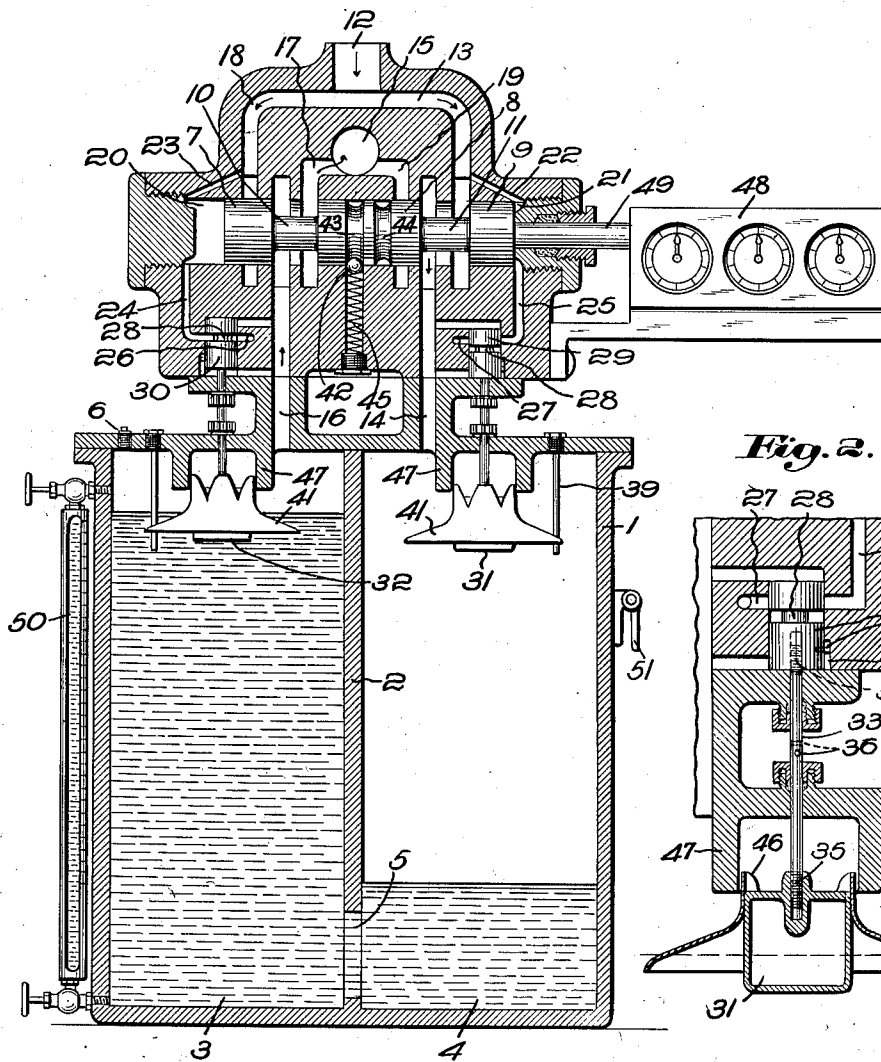
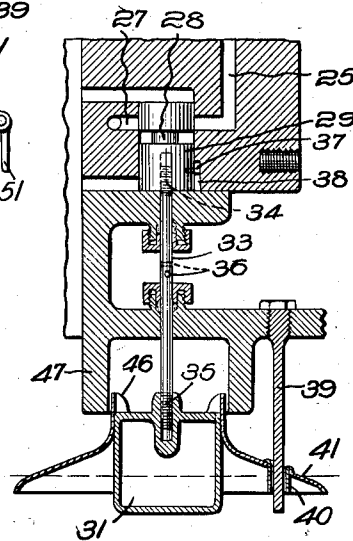


Fig. 2.



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UNITED STATES PATENT OFFICE.

GEORGE H. GILMAN, OF BOSTON, MASSACHUSETTS.

FLUID METER.

Application filed February 11, 1920. Serial No. 357,912.

To all whom it may concern:

Be it known that I, GEORGE H. GILMAN, a citizen of the United States, and a resident of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Fluid Meters, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

My invention relates to meters for measuring the flow of fluids and particularly, but not exclusively, to those for measuring air or other gases, and comprehends among its objects the provision of a convenient, compact, simple and accurate mechanism for securing this result.

My invention will be best understood from the following description and accompanying drawings of a specific embodiment of my invention submitted for illustrative purposes, while the scope of my invention will be best understood from the appended claims.

In the drawings:

Fig. 1 illustrates an elevation of the embodiment of my invention herein submitted for illustrative purposes, the parts of the figure being shown mainly in section; and

Fig. 2 shows a detail of Fig. 1 on an enlarged scale.

Referring to the drawings, I have shown a container 1, provided with a centrally located partition 2 dividing the container into compartments 3 and 4, these compartments having a common cover 4^a and being placed in communication by an opening 5 formed in the lower portion of the partition. The container I partially fill through an opening 6 with a suitable liquid such as water, oil or the like and by this means provide an expansible chamber comprising a cylinder and a liquid piston.

The fluid to be measured which hereinafter will be termed air is admitted under pressure above the liquid in one compartment which tends to depress said liquid and force it through the opening 5 into the opposite compartment. This causes the liquid in the said opposite compartment to rise if the air above the liquid therein is permitted to escape. By alternately admitting the air to and permitting its discharge from the spaces above the liquid of the two compartments a substantially continuous flow is

maintained through the meter without materially reducing the pressure of the air.

For controlling the admission and the discharge of air to and from the meter, I may use any suitable valve and, as submitted, specifically one having the heads 7, 8 and 9 and the reduced portions 10 and 11 intermediate the heads. When the valve is moved to the position shown by Fig. 1 of the drawings, the inlet connection 12 is placed in communication with the upper portion of the right hand compartment 4 by passages 13 and 14 which in this position of the valve are put in communication by means of the reduced portion 11 of the valve. Simultaneously with this occurrence the space above the compartment 3 is placed in communication with the outlet connection 15 of the meter by the passages 16 and 17 which in this position of the valve are put in communication by means of the reduced portion 10 of the valve. When the valve is shifted to its left hand position as viewed in Fig. 1, the inlet connection is placed in communication with the space above the liquid in the compartment 3 by means of the passages 18 and 16 which are then placed in communication by means of the reduced portion 10 of the valve and at the same time the space above the right hand compartment 4 is placed in communication with the outlet 15 by means of the passages 14 and 19 which are then placed in communication by means of the reduced portion 11 of the valve. When the valve is in its left hand position, the air which has entered the right hand compartment 4 is permitted to discharge from the meter through the outlet 15.

In the embodiment of my invention submitted I hold the valve in its extreme positions by means of a non-positive stop in the form of a ball 42, yieldingly held in position by means of a spring 45 and adapted to engage the grooves 43 and 44 formed in the valve.

For actuating the valve in my submitted embodiment, I have shown means for subjecting the ends of the valve to intermittent pressure. For this purpose, I provide passages 22 and 23 for conveying air under pressure to the opposite ends 20 and 21 of the valve casing, these passages communicating with the intake passages 13 and 18. Leading from the chambers 20 and 21 of the valve casing respectively are passages

24 and 25 which respectively are adapted to be alternately put in communication with the passages 26 and 27 leading to the atmosphere. As will be obvious, when one of the chambers 20 or 21 is placed in communication with the atmosphere, the air therein will be considerably reduced in pressure and this pressure will be less than the pressure acting on the opposite end of the valve. By alternately connecting opposite ends of the valve to the atmosphere the valve is caused to reciprocate.

For controlling the communication between the passages 25 and 27 I show a pilot valve 29 and a similar pilot valve 30 for controlling the communication between the passages 24 and 26. Each valve is provided with a reduced portion 28 adapted when the valve is in its raised position, to establish communication between the passages just mentioned. I may move these valves by any suitable means and as shown, I provide floats 31 and 32 positioned in the upper ends of the respective compartments and connected by means of stems 33 to the respective valves. It will be noted that these floats relate to a means for controlling the meter and actuating the valve in response to the level of the liquid and further that I have provided such a controlling means responsive to the height of the liquid or more generically to the expansion of the expansible chamber heretofore referred to.

Preferably, in the present embodiment of my invention I provide means for adjusting the relative distance between the floats and the valves and to this end I provide the valve stems with screw threaded portions 34 and 35 of different pitch, which respectively engage the valve and float. As will be obvious, when the stem is rotated relatively to the float and the valve, the distance between the latter will be varied. For rotating the same, I form the stem with suitable apertures 36 in which may be inserted any suitable instrument convenient for performing this operation.

In order that the valves and floats may not rotate when the stems are turned I provide the valves with pins or lugs 37 engaging slots 38 in the valve casings and for a similar purpose I may provide the stems 39, which engage the tubes 40 secured to the baffles 41 connected to the floats as will be hereinafter described.

Under normal conditions, owing to the resistance of flow through the conduits or apparatus with which the discharge connection 15 communicates, the liquid in the compartments will move slowly, but it may happen under certain conditions that the liquid will rise violently enough to tend to pass into either of the passages 14 and 16 and hence to the outlet connection. To prevent this, I provide a baffle which, in the embodi-

ment of my invention submitted takes the form of the bell-shaped members 41 secured to the floats. These bell-shaped members flare downwardly in order that the same may readily rise through the portion of the liquid which may partially submerge them and further, in order that they may trap air or vapor beneath them and the surface of the liquid to aid in moving the valve. The tube 40 in an obvious manner prevents leakage of air from under the bell-shaped member.

The bell-shaped members 41 are secured to the float by frictional contact having for this purpose their upper cylindrical portions split or crenelated to provide resilient upstanding members 46. The cover 4* on its lower side is provided with annular flanges 47 which form cylindrical float chambers. For guiding the floats the upstanding members 46 are adapted to loosely fit the inner walls of the flanges 47.

For registering the flow through the meter, I provide a counting mechanism 48 which may be connected to any of the moving parts of the device and specifically in the embodiment submitted, to the main valve by means of a stem 49. As will be obvious, the reciprocations of the valve are registered by the counting mechanism and the readings of the latter are a measure of the flow through the meter.

For indicating the level of liquid in the container, I provide a gauge-glass 50 which may be calibrated either to indicate the linear height of the liquid or the effective volume of the space above the same.

In the embodiment disclosed, my meter is of the portable type and for carrying the same I may provide suitable handles 51.

Although I have described for purposes of illustration, one specific embodiment of my invention, it is to be understood that the same except as limited by the scope of the appended claims is not confined to the particular mechanical details thereof or to the proportion or arrangements of parts and that the omission of elements and the substitution of equivalent elements may be resorted to without departing from the spirit thereof.

Claims:

1. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber, valvular means adapted to control said conduit means, said valvular means being actuated by said fluid, and means for controlling said fluid for actuating said valvular means.

2. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber,

valvular means adapted to control said conduit means, said valvular means being actuated by said fluid, and means responsive to the expansion and contraction of said expandable chamber for controlling said fluid for actuating said valvular means.

3. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, and means for operating said valvular means directly by fluid pressure to effect such control.

4. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, means including a valve for operating said valvular means by fluid pressure to effect such control, and means responsive to the height of the liquid for operating said valve.

5. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, means including a valve for operating said valvular means by fluid pressure to effect such control, and a float responsive to the level of the liquid for operating said valve.

6. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber, valvular means adapted to control said conduit means, means for continuously subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, and means for moving said valvular means in said last named direction.

7. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber, valvular means adapted to control said conduit means, means for continuously subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, and means for moving said valvular means in said last named direction, and means controlled by the expansion of said chamber for operating the pressure relieving means.

8. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, and means controlled by the expansion of said chamber for operating only one of said pressure subjecting and relieving means.

9. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, and means responsive to the height of the liquid for operating one of said pressure subjecting and relieving means.

10. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, and a float responsive to the level of the liquid for operating one of said pressure subjecting and relieving means.

11. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, and a pilot valve for operating one of said pressure subjecting and relieving means.

12. In a fluid meter, means providing an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said cham-

- ber, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, and a pilot valve controlled by the expansion of said chamber for operating only one of said pressure subjecting or relieving means.
13. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, a pilot valve for operating one of said pressure subjecting and relieving means, and means responsive to the height of said liquid for operating said pilot valve.
14. In a fluid meter, a container, a body of liquid therein adapted to form with said container an expansible chamber, conduit means for alternately admitting and discharging the fluid to be measured to and from said container, valvular means adapted to control said conduit means, means for subjecting said valvular means to fluid pressure to cause motion thereof in one direction, means for relieving said fluid pressure to permit said valvular means to move in another direction, means for moving said valvular means in said last named direction, a pilot valve for operating one of said pressure subjecting and relieving means, and a float responsive to the level of the liquid for operating said pilot valve.
15. In a fluid meter, means providing a chamber, a body of liquid therein having its upper surface in contact with the fluid to be measured, conduit means communicating with said chamber providing an outlet therefrom for the fluid to be measured, and a baffle located adjacent the place of such communication whereby egress of liquid from said chamber is prevented.
16. In a fluid meter, means providing a chamber, a body of liquid therein having its upper surface in contact with the fluid to be measured, a discharge passage for the fluid to be measured communicating with said chamber above the surface of said liquid, a valve controlling said discharge, and means located at the top of said chamber and responsive to the impact of said liquid for operating said valve.
17. In a fluid meter, means providing a chamber, a body of liquid therein having its upper surface in contact with the fluid to be measured, inlet and outlet connections for said meter, conduit means adapted to establish communication between said chamber and outlet connection, a valve controlling said connection, and means located at the top of said chamber and responsive to the impact of said liquid for controlling said valve.
18. In a fluid meter, means providing a chamber, a body of liquid therein, a discharge passage for the fluid to be measured communicating with said chamber above the surface of said liquid, a valve controlling said discharge, and a pilot valve responsive to the impact of said liquid for operating said valve.
19. In a fluid meter, means providing a chamber, a body of liquid therein, inlet and outlet connections for said meter, conduit means adapted to establish communication between said chamber and outlet connection, a valve controlling said connection and a pilot valve responsive to the impact of said liquid for controlling said valve.
20. In a meter for a gaseous fluid under pressure, means providing an expansible chamber having a liquid piston, means for automatically and alternately admitting and permitting the escape of such gaseous fluid to and from said chamber to actuate said piston, and said means including a main valve and a pilot valve, the latter being responsive to the level of said liquid piston.
21. In a meter for a gaseous fluid under pressure, means providing an expansible chamber having a liquid piston, means for automatically and alternately admitting and permitting the escape of such gaseous fluid to and from said chamber to actuate said piston responsive to motion of said piston, and means actuated by such gaseous fluid for controlling the last named means.
22. In a meter for a gaseous fluid under pressure, means providing an expansible chamber having a liquid piston, means for automatically and alternately admitting and permitting the escape of such gaseous fluid to and from said chamber to actuate said piston, and fluid pressure means actuated in response to the position of said piston for controlling the last named means.
23. In a meter for a gaseous fluid under pressure, means providing an expansible chamber having a liquid piston, means for automatically and alternately admitting and permitting the escape of such gaseous fluid to and from said chamber to actuate said piston, and float controlled fluid pressure actuated means for controlling the last named means.
24. In a meter for pressure fluids, means providing an expansible chamber and piston, valve means for controlling said meter,

and said valve means being actuated by pressure fluid controlled by said piston.

25. In a meter for pressure fluids, means providing an expansible chamber and piston, valve means for controlling said meter, and means for actuating said valve means directly by such pressure fluid in response to the motion of said meter.

26. In a meter, a liquid piston, intake and escape conduits for said meter, valve means for controlling said conduits and comprising a cylinder and a piston, a connection from said cylinder to said intake, a connection from said cylinder to the atmosphere, and means responsive to the position of said liquid piston for controlling one of said connections.

27. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, means for admitting and permitting the escape of a pressure fluid to be measured to and from the upper portion of each compartment, a fluid pressure actuated controlling means for such pressure fluid, and valve means responsive to the height of the liquid in one of said compartments for causing motion of said controlling means.

28. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, means for admitting and permitting the escape of a pressure fluid to be measured to and from the upper portion of each compartment, a fluid pressure actuated controlling means for such pressure fluid, a float in one of said compartments, and a valve operated by said float for causing motion of said controlling means.

29. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a valve mechanism for admitting and permitting the escape of a pressure fluid to be measured to and from the upper portion of each compartment, said valve mechanism comprising a piston and cylinder, means for conducting such pressure fluid to said cylinder for acting on said piston, means for conducting such fluid from said chamber to the atmosphere, and a float in one of said compartments for interrupting the flow through one of said means.

30. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a valve mechanism for admitting and permitting the escape of a pressure fluid to be measured to and from the upper portion of each compartment, said valve mechanism comprising a piston and cylinder, means for conducting such pressure fluid to said cylinder for operating said piston in opposite directions, means for conducting such fluid from said chambers to the atmosphere, and a pair of

floats actuated by said liquid for controlling one of said means for each chamber whereby high and low pressure conditions are alternately and oppositely created in the said chambers for giving motion to said valve mechanism.

31. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow of fluid through said meter, a valve casing for said valve, means for alternately and oppositely creating high and low pressure conditions at the opposite ends of said valve, and a pair of floats for actuation by said liquid for controlling said means.

32. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow of fluid through said meter, a valve casing for said valve, means for alternately and oppositely creating high and low pressure conditions at the opposite ends of said valve, and a float in each compartment and actuated by said liquid for controlling said means.

33. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow through said meter, a valve casing for said valve, and float controlled means for changing the pressure conditions at the ends of said valve casing to cause actuation of said valve.

34. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow through said meter, a valve casing for said valve, means for admitting pressure fluid to the ends of said valve casing, means for conducting such fluid from said casing to a place of low pressure, and float controlled means actuated by the fluid in said compartments for alternately interrupting one of said means for each end.

35. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow through said meter, a valve casing for said valve, means for admitting pressure fluid to the ends of said valve casing, means for conducting such fluid from said casing to a place of low pressure, and float controlled auxiliary valve means actuated by the fluid in said compartments for alternately interrupting one of said means for each end.

36. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow through said meter, a valve casing for said valve, means for admitting pressure fluid to the ends of said valve casing, means for con-

ducting such fluid from said casing to a place of low pressure, and a pair of floats actuated by the fluid in said compartments for alternately interrupting one of said means for each end.

37. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow through said meter, a valve casing for said valve, means for admitting pressure fluid to the ends of said valve casing, means for conducting such fluid from said casing to a place of low pressure, and a pair of float controlled pilot valves actuated by the fluid in said compartments for alternately interrupting one of said means for each end.

38. In a meter, a pair of liquid containing compartments having means permitting liquid to flow from one to the other, a piston valve for controlling the flow through said meter, a valve casing for said valve, means for admitting pressure fluid to the ends of said valve casing, means for conducting such fluid from said casing to a place of low pressure, a float for each compartment, a pilot valve for each float, and said pilot valves being arranged to affect said last named means to alternately interrupt the flow from the opposite ends of said valve casing.

39. In a meter, a container, a partition located in said container for dividing the latter into a plurality of chambers, a common cover for said chambers, said cover coacting with said partition for preventing fluid communication between the upper portions of said chambers, and valve mechanism in said cover for controlling said meter.

40. In a meter, a container, a partition located in said container for dividing the latter into a plurality of chambers, a common cover for said chambers, said cover coacting with said partition for preventing fluid communication between the upper portions of said chambers, valve mechanism in said cover for controlling said meter, and floats controlling said valve.

41. In a meter, a container, a partition located in said container for dividing the latter into a plurality of chambers, a common cover for said chambers, a valve mechanism in said cover for directing the fluid to be measured alternately to said chambers, means for controlling said valve mechanism including a float, and a float chamber for said float and formed in said cover.

42. In a meter, means affording an expansible chamber having a piston, means for alternately admitting and permitting

the escape of pressure fluid to be measured to and from said cylinder, a counter, and means operated by the direct action of the fluid being measured for actuating said counter.

43. In a meter, means forming a pair of pistons connected for simultaneous movement and cylinders for said pistons, valvular means for alternately admitting fluid to be measured to said cylinders to act on said pistons and cause motion of the latter, and fluid actuated means controlled by said pistons for controlling said valvular means.

44. In a fluid meter, means providing an expansible chamber with a movable wall, conduit means for alternately admitting and discharging the fluid to be measured to and from said chamber, valvular means for controlling said conduit means, means for continuously subjecting opposed pressure surfaces associated with said valvular means to the pressure of the fluid being measured, and means responsive to the motion of said wall for alternately relieving the pressure on the several opposed pressure surfaces for causing actuation of said valvular means.

45. In a fluid meter for gaseous fluid, means providing a pair of chambers in communication at only their lower portions, a body of liquid in said chambers, a supply connection for said meter, a valve and conduits controlled by said valve for alternately connecting said supply and discharge connections to the upper portions of said chambers, means forming a pair of opposed pressure surfaces for said valve, conduit means continuously connecting the space behind said opposed pressure surfaces to said supply connection, and valvular means responsive to the height of said liquid for alternately connecting the space behind said opposed surfaces to the atmosphere.

46. In a fluid meter for gaseous fluid, means providing a pair of chambers in communication at only their lower portions, a body of liquid in said chambers, a supply connection for said meter, a valve and conduits controlled by said valve for alternately connecting said supply to the upper portions of said chambers, means forming a pair of opposed pressure surfaces for said valve, conduit means for connecting the space behind each of said opposed surfaces to both said supply connection and the atmosphere, and valvular means responsive to the height of said liquid for alternately interrupting one of said connections for each surface.

In testimony whereof, I have signed my name to this specification.

GEORGE H. GILMAN.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,554,811, granted September 22, 1925, upon the application of George H. Gilman, of Boston, Massachusetts, for an improvement in "Fluid Meters," an error appears in the printed specification requiring correction as follows: Page 6, line 110, claim 46, after the word "supply" insert the words *and discharge connections*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of January, A. D. 1926.

[SEAL.]

WM. A. KINNAN,
Acting Commissioner of Patents.