March 9, 1937. J. A. HEIDBRINK 2,073,372

FLUID METER FOR GAS ADMINISTERING MACHINES

Filed Oct. 23, 1933

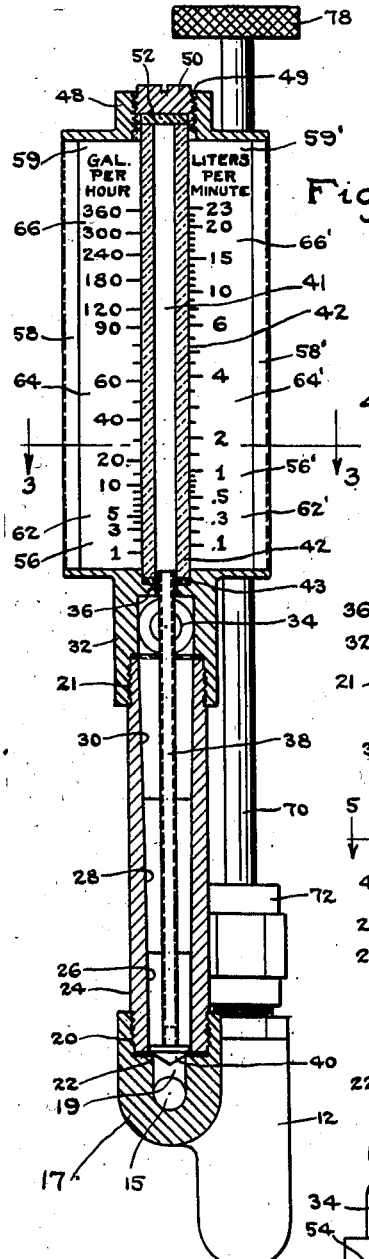


Fig.-1

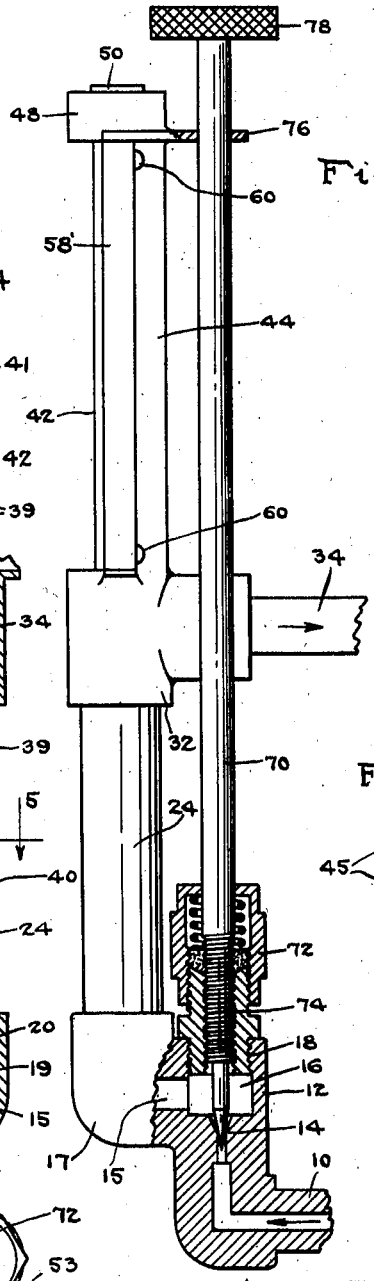

Fig.-2.

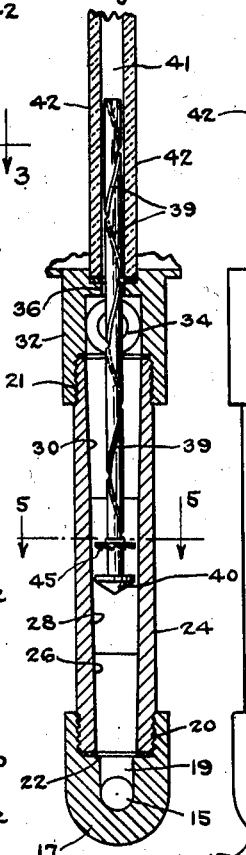

Fig.-4

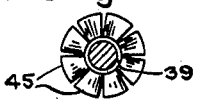

Fig.-5

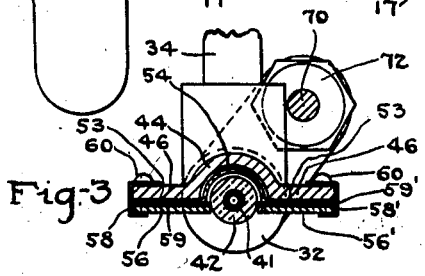

Fig.-3

Inventor:
Jay A. Heidbrink.
By Whiteley and Ruckman
Attorneys

Patented Mar. 9, 1937 2,073,372

# UNITED STATES PATENT OFFICE

2,073,372

## FLUID METER FOR GAS ADMINISTERING MACHINES

Jay A. Heidbrink, Minneapolis, Minn.

Application October 23, 1933, Serial No. 694,818

2 Claims. (Cl. 73—209)

My invention relates to fluid meters for gas administering machines. It is an object of the invention to provide a device to be connected in the line of gas flow to the patient which will enable the operator to have accurate control over the volume of gas being delivered to the patient, and which will accurately indicate that volume in small quantities or large quantities regardless of the pressure at which the gas is being delivered. This indication is shown as a definite volume delivered per unit of time, as so many liters per minute or so many gallons per hour. The gases are those which either singly or in considerable mixtures are administered to patients for inducing in the patient the desired state of anaesthesia or analgesia.

In carrying out my invention I provide a transparent tube held in relation to calibrated scales, one of which has calibrations indicating liters per minute and the other indicating gallons per hour. Within this tube is an elongated member, preferably either constructed as a spool or having thereon a spiral line and which is of light weight and hence adapted to be lifted readily by the gas, and which is connected with a head or piston movable in a gas passageway of slightly expanding inner transverse dimensions up the passageway so that as the piston is raised by the pressure of gas behind it, a larger and larger annular opening is formed which has a direct relation to the calibrations on the paper scales, and which relation varies throughout the length of the delivery tube by reason of varying increases of transverse inner dimensions thereof. The first or lowest portion of the gas passageway having the smallest expansion of progressive inner dimensions is adapted to register very small flow of gases, as from one to ten gallons per hour, or from .1 to 1 liter per minute. An intermediate portion of the passageway has an increased rate of internal expansion and registers more rapid flow of gases, as from 10 to 90 gallons per hour or from 1 to 6 liters per minute. The last or upper portion of the gas passageway has the greatest degree of internal expansion and is adapted to control and effect the registry of relatively large flow of gases, as from 90 to 360 gallons per hour or from 6 to 23 liters per minute. Associated with the elongated member, which may be a helically fluted rod, or a rod with a helical line appended thereon, is a member such as a set of vanes adapted to be impinged by gas flowing through the passageway and cause the indicating member to whirl, thus giving visual evidence that the gas is flowing

The full objects and advantages of my invention will appear in connection with the detailed description thereof, and the novel features of the invention will be more particularly pointed out in the claims.

In the accompanying drawing, which illustrates one form of my invention,—

Fig. 1 is a front elevation view of the device largely in vertical section and showing the face of the calibrated scales. Fig. 2 is a side elevation part sectional view taken in a direction at right angles to Fig. 1. Fig. 3 is a sectional view taken on line 3—3 of Fig. 1. Fig. 4 is a fragmentary sectional view of what is shown in Fig. 1 showing the means for causing the indicator to turn. Fig. 5 is a sectional plan view taken on line 5—5 of Fig. 4.

As illustrated in the embodiment shown in the drawing, a tube 10 leads from a source of supply of gases under pressure (which may be a mixing chamber), and is formed with an upwardly-turned extension 12 provided with a needle valve 14 which opens a communication to a chamber 16, said chamber 16 being closed at its top by a valve nut 18 having a packing nut 72 threaded thereon. A needle valve stem 70 is threaded through the nut 18 at 74 and is held in a guide 76 and controlled by a hand nut 78 whereby the flow of gas may be regulated as shown by the indicating mechanism hereinafter described, all as clearly shown in Fig. 2.

The chamber 16 is extended at 15 through a boss 17 formed on the piece 12 and into a vertical passageway 19 which is topped by a circumferential valve seat 22.

A tubular member 24 is threaded at 20 into the member 17, and at 21 into a hollow casting member 32 with a centrally positioned opening 36 through its upper wall, and a discharge tube 34 leading therefrom, preferably at right angles as shown. The interior of tubular member 24 has portions 26, 28 and 30 which successively are each progressively expanded in internal dimensions and at increasing ratios, the expansion shown in the drawing being somewhat exaggerated for illustrative purposes. Under this arrangement the portion 26 expands very slowly and hence controls flow indications of relatively small volumes of gas. The portion 28 expands more rapidly and controls indications of intermediate volumes of flow, and the portion 30 expands much more rapidly than either of the other two portions and controls indications of relatively large flows of gases. The member 32 is provided with an extension 44 substantially

semi-circular in cross-section at its intermediate portions and provided with vertical side flanges 46. The central or semi-circular portion is extended into a boss 48 provided with an opening 49 through which a transparent tube 42 is adapted to be inserted. The bore 41 of tube 42 registers with the opening 36, and the tube 42 seats upon a gasket 43 within a depression of member 32 surrounding the bore 36. A nut 50 threaded in the opening 49 engages a second gasket 52 by which the upper end of the transparent tube 42 is closed. As best shown in Figs. 1 and 4, a rod-like member 38, which may be in the form of a helix 39 as in Fig. 4, or which may have a helical line appended thereon, is formed with a piston-like head 40 which seats in the valve seat 22 from passageway 19. The other end of rod 38 or 39 passes through opening 36 to within the transparent tube 42 and the pressure of gas upon the piston head 40 will lift the same more or less according to the degree of such pressure and the rate of flow of the gas whereby the end of the member 38 or 39 will appear at different points elevated to different heights in the transparent tube 42. In the form shown in Fig. 4, a vane-like device 45 is secured to the stem 39 whereby when gas is flowing said stem will be caused continuously to rotate, and the movement of the helical lines thereon will give visual evidence that the gas is flowing.

Upon the member 44 and its wings 46 is a metallic plate concaved to closely surround the tube 42 as indicated at 54 in Fig. 3. Upon the wings 53 of this plate are positioned a pair of printed cardboard scale members 59 and 59', one indicating flow by gallons per hour and the other by liters per minute, as clearly shown in Fig. 1. It will be understood as a matter of course that similar scale members are used with the form shown in Fig. 4. Each of these scale members is divided into portions, 62 and 62' corresponding to the portion 26 of the flow tube 24, 64 and 64' corresponding to the portion 28 of said flow tube, and 66 and 66' corresponding to the portion 30 of said tube. Overlying the scale members 59 and 59' are a pair of glass covers 56 and 56' which are held in position by clips 58 and 58' secured in position by screws 60 threaded into the respective wings 46, as clearly shown in Figs. 2 and 3. The calibrations on the strip 59 are from 1 to 10 (indicating gallons per hour) for the first portion 62, from 10 to 90 for the second portion 64, and from 90 to 360 for the third portion 66. The calibrations on the printed card 59' are from .1 to 1 (liters per minute) for the first portion 62', from 1 to 6 for the second portion 64' and from 6 to 23 for the third portion 66'.

From an inspection of the numbering of these calibrations it will appear that the increase in volume indicated is slow for the first portions 62 and 62' thereof, is much more rapid for the second portions 64 and 64', and great increases are indicated for the portions 66 and 66'.

In operation the device is connected with the delivery line of any gas administering machine where a gas or mixture of gases is delivered past needle valve 14 as controlled by the operator and pushes up piston 40 to a degree determined by the pressure (and consequently the rate of flow) of the gas delivered. This will simultaneously lift said piston and the stem 38, which will indicate with its end against the numberings on the calibrating scales 59 and 59' the actual volume of gas being delivered, and which volume may thus be determined accurately by the operator in manipulating the needle valve 14 by the hand nut 78. In the form shown in Fig. 4, the upwardly moving stream of gas passing through the vane member 45 will rotate the stem 39 so that the helical markings thereon will be constantly turning and give visual evidence to the operator of continued flow of gas.

The advantages of my invention will be apparent from a consideration of its features and detail as hereinafter pointed out. Absolutely certain indication of the volume of flow both in gallons per hour and in liters per minute is always given in view of the operator. Further, the use of printed cardboard scales adds greatly to the accuracy of the construction as well as the economy of production, since such scales may be determined empirically and then printed with absolute faithfulness to such determination, whereas if the scales are to be etched upon the glass or upon metal alongside of the glass there is great likelihood of inaccuracy resulting. Also, if desirable for any reason the cardboard scales may be readily replaced by new ones. Furthermore, the position of the transparent tube and the stem moving up into it is such as greatly to facilitate quick and continued observation of flow volumes. A further very great advantage from the standpoint of manufacture and accuracy comes from the fact that the inspection part of the indicator, i. e., the transparent glass tube and the calibrated scales alongside of the same, are dissociated from the flow tube. The flow tube being entirely of metal can readily have its tapered portion, or its different tapered portions, machined to the utmost accuracy and thereafter will neither shrink nor expand except for the normal uniform expansion and contraction from changes of temperature, so that at a given temperature, such as, for example, the ordinary room temperature of operating rooms, where the device will be largely employed, the flow passageways will always be exactly the same. This would not be true if the flow passageway were itself made transparent and the calibrations milled thereon. Further, to mill a transparent member would have a tendency to interfere with visibility through it—would, in a word, tend to make it opaque or blurred. With the arrangement here shown such disadvantages are entirely avoided, and the advantage of machining a casting, or other production, of suitable metal is fully secured.

I claim:

1. A fluid meter for gas administering machines comprising a tube leading from a supply of gas under pressure, an upwardly turned extension joined to the delivery end of said tube, said extension containing a chamber communicating with said tube through an opening, a needle valve for controlling passage of gas through said opening, a nut closing the upper end of said chamber, a stem for said valve threaded through said nut, a hand wheel on the upper end of said stem, a hollow boss in communication with said chamber formed laterally on said extension, said boss having a vertical passageway, a valve seat in said passageway, a tubular member having its lower end threaded in to the upper end of said boss, a hollow casting into which the upper end of said tubular member is threaded, a discharge tube leading from said hollow casting, an upward extension carried by said hollow casting and having a portion substantially semi-circular in cross section, vertical side flanges on said upward ex-

tension, a boss on the upper end of said extension, said boss having an internally threaded opening, a transparent tube extending down from the lower portion of said opening and having gas tight connection with said hollow casting, a nut threaded into said opening for closing the upper end of said transparent tube in gas tight manner, a rod-like indicating member in said tubular member and said hollow casting adapted to move upwardly into said transparent tube, a head on the lower end of said rod like member adapted to rest upon said valve seat and prevent backward flow of gas, and scale members positioned upon said side flanges, said scale members carrying calibrations representing the volume of gas supplied to the patient in a given time and with which said indicating member is adapted to register.

2. A fluid meter for gas administering machines comprising a tube leading from a supply of gas under pressure, an upwardly turned extension joined to the delivery end of said tube, said extension containing a chamber communicating with said tube through an opening, a needle valve for controlling passage of gas through said opening, a nut closing the upper end of said chamber, a stem for said valve threaded through said nut, a hand wheel on the upper end of said stem, a hollow boss in communication with said chamber formed laterally on said extension, said boss having a vertical passageway, a valve seat in said passageway, a tubular member having its lower end threaded into the upper end of said boss, said tubular member in upward direction having successive internally expanding portions with each succeeding portion having a greater ratio of expansion than the preceding portion, a hollow casting into which the upper end of said tubular member is threaded, a discharge tube leading from said hollow casting, an upward extension carried by said hollow casting and having a portion substantially semi-circular in cross section, vertical side flanges on said upward extension, a boss on the upper end of said extension, said boss having an internally threaded opening, a transparent tube extending down from the lower portion of said opening and having gas tight connection with said hollow casting, a nut threaded into said opening for closing the upper end of said transparent tube in gas tight manner, a rod-like indicating member in said tubular member and said hollow casting adapted to move upwardly into said transparent tube, a head on the lower end of said rod like member adapted to rest upon said valve seat and prevent backward flow of gas, and scale members positioned upon said flanges, said scale members carrying calibrations representing the volume of gas supplied to the patient in a given time and with which said indicating member is adapted to register.

JAY A. HEIDBRINK.