

S. C. SHAFFNER.
GAS REGULATOR.
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1,065,973.

Patented July 1, 1913.

Fig 1

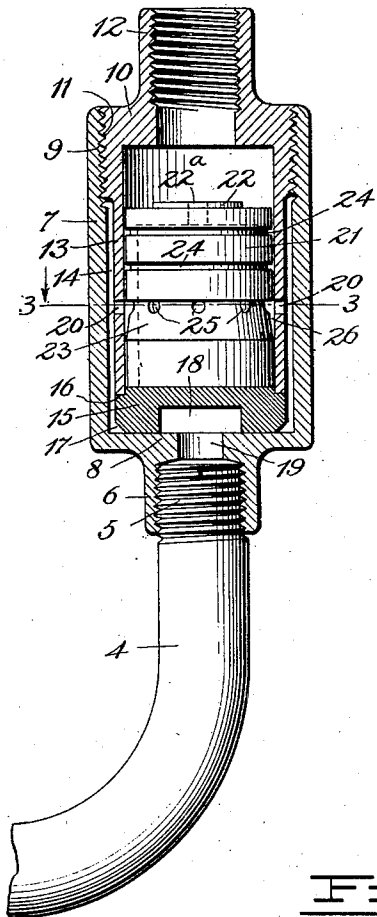


Fig 2

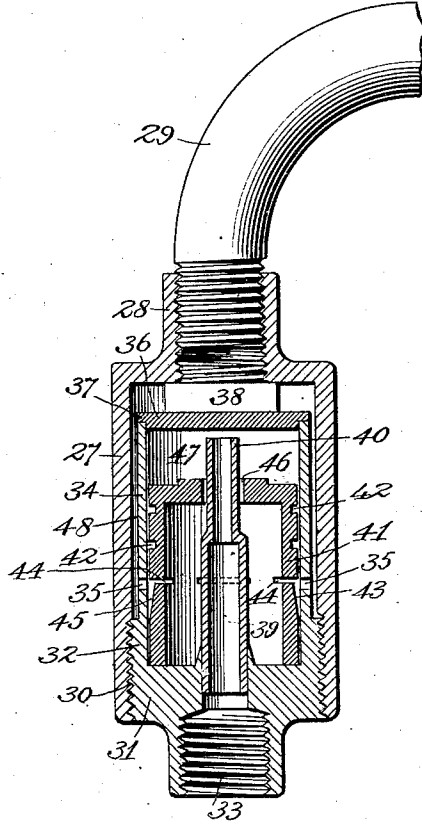
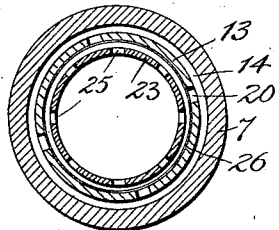


Fig 3



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UNITED STATES PATENT OFFICE.

SAMUEL C. SHAFFNER, OF EAST ORANGE, NEW JERSEY.

GAS-REGULATOR.

1,065,973.

Specification of Letters Patent.

Patented July 1, 1913.

Application filed November 7, 1911. Serial No. 659,063.

To all whom it may concern:

Be it known that I, SAMUEL C. SHAFFNER, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Gas-Regulators, of which the following is a specification.

My invention relates to gas regulators of the kind employed for rendering uniform the pressure, and consequently the rate of flow of gases generally; and more especially of gases used for the purposes of heating and illuminating.

More particularly stated, my invention comprehends a gas regulator of the general type just mentioned and containing a reducing valve of improved construction by the aid whereof the flow of the gas is regulated to a degree of nicety.

My invention further contemplates the incorporation, in the reducing valve used in this connection, of a gas floated valve member having a number of holes and a frusto-conical surface which co-act with the surface of a stationary member also provided with holes, in such manner as to regulate with great nicety the flow of gas between said surfaces and through all of said holes.

My invention further relates to the form of the gas floated valve member whereby it is rendered practically frictionless, perfectly balanced and substantially gas tight, without the use of a packing.

My invention further relates to the shape of the valve member just referred to, whereby said valve member is provided with means for preventing the excessive flow of gas around it, when it is suspended loosely, and floated upon a body of flowing gas.

While my invention is intended primarily for use as a gas regulator, it may sometimes be employed to advantage in other relations, and particularly in instances where it is desirable to render self-regulating the flow of any aeriform body, or even any fluid in motion, the supply of which is sought to be rendered constant.

Reference is made to the accompanying drawing forming a part of this specification, and in which like reference numerals indicate like parts.

Figure 1 is a substantially central, vertical section through one form of my improved gas regulator, the gas being supplied in this instance to the bottom of the device. Fig. 2 is a section somewhat similar to Fig.

1, but showing another form of my device, the gas in this instance being admitted from the top. Fig. 3 is a horizontal section on the line 3—3 of Fig. 1, looking in the direction of the arrow.

The supply pipe, commonly known as a gas pipe, is shown at 4, and is provided with a threaded end portion 5. Fitted upon this threaded end portion 5 is a sleeve 6 which is threaded internally for this purpose. This sleeve 6 is integral with a casing 7 and with a flange 8, the sleeve 6 and flange 8 constituting practically the bottom of the casing, which has a general cylindrical form. The upper end of the casing 7 is provided internally with a thread 9. A sleeve 10 is provided with a thread 11 mating the thread 9, and this sleeve is provided with a reduced annular portion 12, which is threaded internally and adapted to receive the burner, not shown. The sleeve 10 is provided with a reduced portion 13 integral with it and disposed within and concentric to the casing 7. The reduced portion 13, because of its form and location, I designate as the inner wall of the casing. Located between the casing 7 and the inner wall 13 is a cylindrical compartment 14 which extends some distance upward from the bottom of the casing. Located within the casing 7 is a spider 15 which is provided with an annular shoulder 16, and is further cut away so as to form an annular passage 17. The spider 15 is also provided with a slot 18 of suitable size, this slot communicating with an opening 19 in the flange 8,—or, in other words, in the bottom of the casing.

The wall 13 is provided with a number of holes 20 disposed radially and spaced equidistant. Mounted loosely within the wall 13 and adapted to float therein, when subjected to pressure of a gas flowing there-through under conditions hereinafter described, is a valve member 21. This valve member 21 is substantially cup-shaped and is provided with an annular bead 22 integral with it. The bead 22 forms a limiting stop for preventing excessive upward travel of the valve member. The valve member 21 is provided at its top with a hole 22^a, to facilitate the out-flow of gas, and is in addition provided with a reduced portion 23 having a general annular form and located a little below the middle of the valve member, reckoning from the normal position thereof as indicated in Fig. 1.

The hole 22^a is of a definite size, which is correlated to the mean gas pressure at the point where the hole is located. That is to say, the hole is of such area in cross-section that only a predetermined quantity of gas can flow through it per unit of time, if the pressure of the gas be kept constant, as elsewhere described herein, by the position assumed from time to time by the floating valve member. The valve member is further provided with a number of annular grooves 24 encircling it and adapted, when filled with gas as hereinafter described, to serve somewhat after the manner of packings. When said grooves are thus filled with gas the latter serves the purpose of a lubricant and also, because its pressure is applied radially inward and equally distributed, balances the floating valve member, on all sides. This valve member is thus practically frictionless and very sensitive to variations in the pressure of the gas. The valve member also is provided with radially disposed holes 25 located in the zone of greatest reduction of the reduced portion 23; that is, located at the top of the reduced portion 23 where the material is thinnest, as will be understood from Figs. 1 and 3. The internal diameter of the valve member 21 is uniform. The material of the valve member is, in this instance, aluminum, but any other suitable material may be employed. When the valve member is in position within the wall 13 there is formed by virtue of the reduced portion 23 an annular passage 26, the level of which, of course, varies whenever the valve member moves up or down relatively to the openings 20.

The operation of the device shown in Figs. 1 and 3 is as follows:—A burner being mounted above the casing and gas being supplied through the pipe 4, the gas passes through the opening 19 and slot 18 into the cylindrical compartment 14, and thence flows radially inward through the openings 20 and thus fills the annular compartment 26. The gas next flows through the holes 25 into the valve member 21 and upwardly therefrom through the opening 22^a, and thence out of the top of the casing to the burner where it is consumed. If now the gas pressure be very low the gas escapes through the holes 20, the annular compartment 26, and the holes 25, the flow being restricted, however, by the size of the hole 22^a, as above described, so that only a predetermined quantity of gas can flow through it per unit of time. If, now, the gas pressure rises, either owing to a curtailment of the flow at the burner or to the movement of a valve associated with the pipe 4, or, in fact, for any other reason, the valve member 21 is lifted and now floats freely, being supported entirely by the gas pressure

within the casing 7. The greater the gas pressure the higher the level at which the valve is floated. As a consequence, the holes 25 and the annular compartment 26 are raised relatively to the holes 20, and the passage of the gas into the barrel 13 is thus restricted. The net result is that the flow of gas is regulated by movements of the valve member 21.

In the form shown in Fig. 2, the casing appears at 27 and is provided at its upper end with a flange 28 threaded internally and fitted upon the supply pipe 29. The lower end of the casing 27 is provided internally with a thread 30. The bottom of the casing is shown at 31 and is provided externally with a thread mating the thread 30. The bottom 31 is provided with a flange 32 integral with it. The bottom is also provided with a threaded opening 33 to facilitate connection of a burner with the casing. Mounted upon the flange 32 and extending upwardly therefrom is a cylindrical portion 34 which I designate as the inner wall. It is provided with radially disposed holes 35 and is fitted with a circular spider 36, the latter having an annular shoulder 37 analogous to the annular shoulder 16 shown in Fig. 1. These shoulders may, if desired, be ground to insure accuracy, though this feature is not essential. The spider 36 is provided with a pair of upwardly extending lugs 38, integral therewith and spread apart so that gas from the supply pipe can readily enter the casing 29. A tube 39 is mounted upon the bottom 31 of the casing and is coaxial in relation to the casing 27. The tube 39 is provided adjacent to its upper end with a reduced portion 40. A substantially cup-shaped valve member 41 is provided with annular grooves 42, and is also provided with a reduced portion 43, having generally the form of a cone frustum. The valve member 41 is further provided with a number of radially extending slots 44 which merge into an annular passage 45, the latter being bounded in part by the reduced or conical portion 43 of the valve member. This valve member is also provided with a circular opening 46 through which extends the reduced portion 40 of the tube 39. The wall 34 is concentric to the casing 27 and is separated therefrom by a compartment 48 having generally a cylindrical form. An annular bead 47 encircles the reduced portion 40 and serves the purpose of a limiting stop for preventing excessive travel of the valve member.

The action of the form of my device shown in Fig. 2 will readily be understood in view of the foregoing explanations relative to the other figures. The gas passes downwardly through the supply pipe 29 and finds its way into the cylindrical compart-

ment 48 from which it passes through the holes 35 and into the annular compartment 45. It thence passes through the holes 44 into the valve member 41 next through the circular opening 46, thence upward into the vicinity of the spider 36, and downward through the tube 39 to the burner where it is consumed. When the gas has an exceedingly low pressure so that it is unable to lift the valve member 41, the gas tends to flow freely through the holes 35, but is restricted to the limited capacity of the hole 46. As soon, however, as the gas pressure rises from any cause the valve member 41 is lifted to a corresponding height and as the annular compartment 45 is thus raised the holes 35 are partially closed, or at least the flow of gas through them is partially restricted. The gas pressure, therefore, is within reasonable limits controlled or regulated by the relative position of the valve member 41, the action of the device as a whole being to regulate the gas pressure and being practically automatic.

It will be noted that the reduced or frusto-conical portion 23 (Figs. 1 and 3), like the reduced or frusto-conical portion 43 (Fig. 2) is located between the upper and lower ends of the valve member which carries it. The fact will also be noted that the thinnest part of the frusto-conical portion is located just below the middle of the valve member. The purpose of this arrangement is to insure at all times and under all conditions an adequate capacity for the annular compartment (26 or 45), so that the flow of gas through the openings 25 or 44 will always be uniform for a given level of the valve member. For instance, if owing to vicissitudes in the flow of gas the valve member is tilted slightly, or for a moment happens to be located askew relatively to the casing and barrel, the annular compartment 26 or 45 will nevertheless continue to present substantially the same area in horizontal cross-section, because if the compartment becomes a little thinner on one side it is correspondingly thinner upon the opposite side. Again, if the valve member should tilt so that at its top it presses against the inner surface of the cylindrical wall inclosing it, and at its bottom it also touches against the cylindrical wall, the zone of the annular compartment, being intermediate the top and bottom portions of the valve member, will still continue to maintain its position relatively to the barrel and casing—insofar at least as to present a constant area in cross section,—so that the flow of gas, other things being equal, remains constant notwithstanding the tilting of the valve member.

The annular grooves 24 and 42 serve to retain small quantities of gas and to so hold them that they act as packings. It is a fact that a surface provided with grooves of this

kind has a marked tendency to corral a flowing gas and to prevent the free travel of the same. Taking this view of the matter, it appears that the surface in question is acted upon by the gas, and when so acted upon acts to some extent after the manner of a surface provided with a packing. The restriction in the flow of a gas along a surface thus provided with grooves is doubtless an interference phenomena based upon the fact that when the grooves are filled with gas the gas thus filling them is, by occlusion, maintained at considerable density, and has a great tendency to entrain, mingle with and obstruct the flow of a larger volume of gas otherwise free to pass the surface in question. The several small quantities of gas retained in ring-like form within the annular grooves, as above described, and the thin film of gas passing between the valve member and the wall, serve very effectively the purpose of a lubricant, so that the valve member can easily respond to slight variations in the gas pressure supporting it, and the perfect balancing of the valve member still further increases its sensitiveness.

The maximum quantity of gas which can pass through either form of the regulator being restricted by the size of the hole 22^a or 46 a definite quantity per unit of time, and any rise in the pressure of gas within the supply pipe being sure to lift the valve member so as to curtail the flow of the gas capable of reaching the hole 22^a or 46, the flow of gas through the device as a whole is rendered constant.

I do not limit myself to the use of any particular materials in the construction of any or all of the parts above described. Neither do I limit myself to the precise manner in which these parts are fitted together, nor to the precise arrangement of these various parts relatively to each other, the scope of my invention being commensurate with my claims.

What I claim is:—

1. A device of the character described comprising a casing provided with a wall and with holes extending through said wall for permitting the passage of gas into the interior of said wall, and a valve member mounted loosely within said wall and provided with holes for admitting gas into said valve member, said valve member being further provided with annular grooves for holding small quantities of gas which thus serve the purpose of packings.

2. In a gas regulator, the combination of a barrel provided with openings, and a hollow valve member located entirely within said barrel and adapted to float freely therein when subjected to pressure of gas passing therethrough, said valve member being provided with openings coacting with said first-mentioned openings for the pas-

sage of gas through said barrel and into said valve member, and further provided with a surface having a number of grooves each of a size to corral a minute quantity of gas, and forming therewith practically a packing for preventing excessive flow of said gas relatively to said valve.

3. In a gas regulator, the combination of a receptacle provided with a wall and with openings extending through said wall, and a hollow valve member located entirely within said wall and loose relatively thereto, said valve member being provided with a reduced portion adapted to be brought adjacent to said openings in said wall, said valve member having openings extending through said reduced portion for facilitating the flow of an aeriform body through said openings in said wall and through said valve member, and further provided with annular grooves located in planes parallel with said reduced portion, for the purpose of corralling small quantities of gas and causing the same to serve as packings.

4. A device of the character described comprising a casing, a wall concentric thereto and provided with openings, means for admitting gas between said casing and said wall in order to cause said gas to flow through said openings, a valve member located within said wall and adapted to float upon a volume of gas passing thereinto through said openings, said valve member being provided with a plurality of grooves

disposed in parallel planes for holding minute quantities of gas and causing the same to serve as packings, said valve member being further provided with openings and with a reduced portion of substantially frusto-conical form through which said openings extend.

5. A device of the character described comprising a wall provided with openings through which a gas is admitted, and a valve member mounted loosely within said wall and adapted to rest upon a body of gas flowing therethrough, said valve member being provided with a substantially frusto-conical portion and with openings extending through said portion, said frusto-conical portion being located between the ends of said valve member for the purpose of maintaining approximately constant the area of space between said valve member and said barrel when said valve member is tilted relatively to said wall, said valve member being further provided with a plurality of annular grooves encircling it and disposed above said openings, for corralling minute quantities of gas and by aid thereof suspending said valve from its proximate upper end.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

SAMUEL C. SHAFFNER.

Witnesses:

EDW. O. HOOD,

E. STEIN.