July 7, 1942. S. KARRER ET AL 2,288,715

PILOT BURNER CONTROL

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Fig. 1.

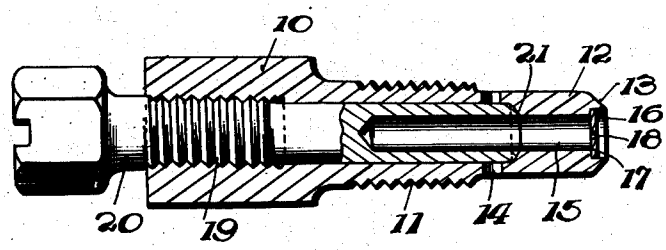


Fig. 2.

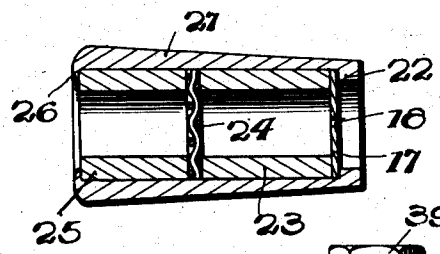


Fig. 4.

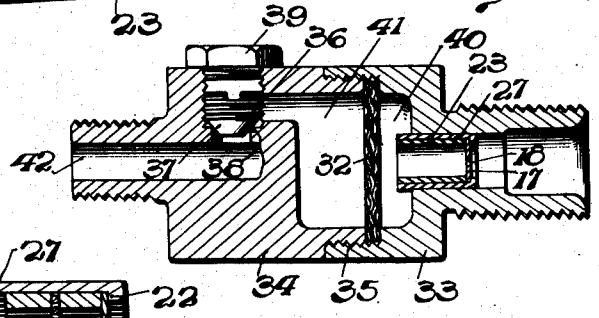
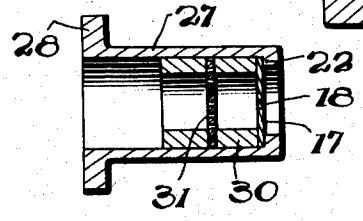


Fig. 3.



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UNITED STATES PATENT OFFICE

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PILOT BURNER CONTROL

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Application May 10, 1939, Serial No. 272,898

7 Claims. (Cl. 158—99)

This invention relates to means for predetermining the flow of gas through passageways to pilot burners and the like, and more particularly to means for minimizing obstruction of such a passageway by the particles of gum, dust, scale, rust, etc., which are usually present in the gas.

In the construction of devices for controlling the flow of gas to pilot burners it has heretofore been the usual practice to employ a needle valve or a stop cock to provide an opening which is adjustable in size or a fixed orifice tubular in nature. Experience has demonstrated that such constructions are susceptible to stoppage, and consequently require frequent cleaning, because the finely divided material, such as gum, dust, scale, rust, etc., that is suspended in the gas, and carried along with it, deposits and accumulates in the opening provided by the needle valve, stop cock, or tubular orifice, with a resultant decrease and even cessation of gas flow to the pilot burner. Examination of specimens of such control devices which have been stopped up in service has revealed that the deposition of material takes place where there is a sudden change in direction of the gas flow, and that in the usual needle valve, for example, wherein the passage at the valve is in the form of an annulus whose width is relatively small when compared with its circumferential extent, the shape of passage used tends to accelerate the rapidity with which the material is deposited and accumulated, while in a stop cock which is partially closed, for example, there is a decided narrowing of the passageway because of the ellipsoidal shape of the opening when the stop cock is adjusted for slow gas flow.

Although attempts have already been made to employ a single unobstructed orifice for predetermining the rate of gas flow it has been customary to make the length of the orifice large relative to its diameter. Structures of this character, so far as we are aware, have not heretofore been found practicable or satisfactory in use where the rate of gas flow is as small as that ordinarily required by a pilot burner, with the result that needle valves and stop cocks are being used generally notwithstanding the tendency of the passageways thereby provided to become restricted, or even closed, by accumulation of the fine particles usually present in the gas.

We have discovered that the obstruction of the passage for gas flow to the pilot burner by particles of suspended matter carried by the gas can be minimized and largely avoided by controlling the gas flow by means of an orifice in a plate, provided the ratio between the diameter of the orifice and the thickness of the plate, or to express it otherwise, between the diameter of the orifice and its length.

It is therefore an object of the present invention to provide means for predetermining gas flow to a pilot burner which will largely prevent the deposit of solid particles therein and thereby avoid the need for frequently cleaning the same.

Another object of this invention is to provide a means of the type characterized which avoids the annular or ellipsoidal character of passageway heretofore existing when needle valves and stop cocks have been used, to the end that the area of passage provided for obtaining the desired gas flow may be had without such constriction of any dimension of said area as to tend to facilitate obstruction thereof by an accumulation of particles therein, is made less than a certain maximum value which has been found to be critical.

Another object of this invention is to provide means of the type characterized in association with screening or filtering means which removes particles of a size exceeding a predetermined value.

Other objects will appear as the description of the invention proceeds.

The invention is capable of receiving a variety of mechanical expressions, some of which are illustrated on the drawing, but it is to be expressly understood that the drawing is for purposes of illustration only and is not to be construed as definitions of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the accompanying drawing, wherein the same reference characters indicate corresponding parts in the several figures,

Fig. 1 illustrates an embodiment wherein the present invention is incorporated in a screw;

Figs. 2, 3 and 4 illustrate other constructions in which the present invention may be embodied.

In order to minimize or overcome the obstruction of such a gas flow passage as heretofore referred to, we have discovered that in place of the usual needle valve, stop cock, tubular orifice or the like, the gas flow should be controlled by a small, substantially circular orifice made in a sheet of thin metal and having the length of the orifice (i. e., the dimension in the direction of the thickness of the plate) such that the ratio of length to diameter does not exceed 0.2. In measuring the length of the orifice any roughness or burr surrounding the orifice must be taken into consideration, and therefore it is important that the orifice be clean-

ly made with right angle corners at the faces of the plate, and without any raggedness or irregularities which have the effect substantially of changing the predetermined size of the orifice, or which will tend to catch and retain fine particles suspended in the gas. Moreover, as corrosion of the plate tends to produce a roughness around the orifice, and may therefore increase its effective length or decrease its diameter as just pointed out, the plate is preferably made of a metal such as aluminum or stainless steel which is noncorrodible by the gas. By employing a circular orifice a uniform transverse dimension is obtained, as well as the largest linear dimension for a given area of opening. The diameter and consequent area of said opening will of course vary in different installations in accordance with the rate of gas flow desired for the particular installation, but the ratio of the length to the diameter of the orifice has been found to be critical and should not exceed the aforesaid figure of 0.2. When such ratio is maintained the tendency of solid particles suspended in the gas to impinge on and attach themselves to the wall of the orifice is minimized and largely eliminated, whereby experience has demonstrated that such a gas control orifice may be used for a relatively long period of time, if not indefinitely, without becoming materially restricted by deposition of particles therein. The explanation of this phenomenon appears to be that the direction of the streamlines of gas flow changes when entering the orifice, so that there is imparted to the suspended particles traveling with the gas along said streamlines a tendency to be displaced therefrom by centrifugal force in a tangential direction toward the orifice wall, and if the aforesaid ratio is maintained the curvature of the path does not give rise to a centrifugal force sufficient to displace the particles from the streamlines while they are passing through by a distance great enough to cause impingement on the orifice wall, but while that is now believed to be the explanation of the results obtained we do not wish to be bound thereby if any other phenomenon not now appreciated may hereafter be found to explain the results obtained in full or in part.

Referring now to the drawing, the embodiment shown in Fig. 1 illustrates a construction that is of particular utility in controlling the flow of gas to certain pilot burners which are in use on many gas ranges, and comprises a screw 10 threaded at 11 for entry into a suitable opening, and having an unthreaded portion 12 of smaller diameter that terminates in a beveled portion 13, said portion 12 having one or more lateral apertures 14 designed to communicate with a surrounding gas chamber and admit the gas from it to an axially disposed passage 15. As shown, passage 15 is enlarged at its outer end, as illustrated at 16, and retained therein in any suitable way is a relatively thin disk 17, preferably of aluminum or stainless steel, provided with an orifice 18 that is of circular configuration and of such diameter that the area for gas flow permits the desired volume of gas to pass therethrough in a unit of time, dependent upon the requirements of the installation. Plate 17 is of such thickness that the ratio of the length of the orifice 18 to its diameter as above explained does not exceed 0.2. The structure illustrated in Fig. 1 also provides a valve for closing off the gas flow, and to this end the enlarged outer end of the screw 10 is interiorly threaded at 19 to receive a screw 20 whose inner end 21 is formed to seat on a shoulder surrounding the passage 15 and act as a valve to prevent communication between the aperture or apertures 14 and said passage 15.

In Fig. 2 the invention is embodied in a tapered bushing 27 which may be readily driven into the end of a standard pilot tube, said bushing having an inwardly directed shoulder at 22 against which the thin apertured disk 17 is retained in any suitable way, as by a sleeve 23 forced into or otherwise suitably secured in the bore of the bushing 27 to hold the disk 17 fixedly in position. Sleeve 23 may obviously extend the full length of the bushing 27, but the present embodiment as shown employs intermediate its length a fine-mesh gauze or screen 24 to prevent particles of a size that would stop up the orifice 18 from reaching the chamber on the inlet side of said orifice. To this end the meshes of the screen are preferably so fine that their diagonal dimension is smaller than the diameter of the orifice 18. Screen 24 is retained in position by forming the sleeve 23 in two sections and clamping the screen therebetween, the outer section 25 being held in the bore of bushing 27 in any suitable way. As shown the end of the bushing is rolled or forced over the end of sleeve section 25, as shown at 26, to lock the sleeve sections, screen and apertured disk in the bore of the bushing.

In Fig. 3 the embodiment illustrated includes a sleeve 27 provided with a mounting flange 28 and an inwardly directed shoulder 22 against which is seated an apertured disk 17 retained in position in any suitable way as by an internal sleeve or sleeves 30 forced or otherwise suitably secured in the bore of the sleeve 27. As here shown sleeve 30 is made in two sections, which may conveniently take the form of split spring rings that are sprung into clamping engagement with the bore of the sleeve 27, and clamp between the same a filter, fine-mesh gauze or screen, or other suitable filtering element 31 to remove from the gas any particles that might otherwise obstruct the orifice 18.

In Fig. 4 still another embodiment of the invention is shown consisting of a housing made in two parts 33 and 34, which may be separated at the threaded portion 35. These housing parts 33 and 34 have recesses or chambers 40 and 41, which together form a gas passageway, across which is disposed a filtering means 32 held fixedly in position by screwing the housing parts 33 and 34 tightly together. Gas enters the housing through tubular passageway 42, passes through the valve means consisting of a screw 36 having a beveled end 37, which is preferably opened wide when gas flow is desired to provide a relatively unrestricted gas passage, but which may be forced tightly against valve seat 38 when it is desired to shut off the gas flow completely. A screw 39 closes the aperture by which access may be gained to valve 36, 37. After passing through the valve means the gas enters the recess 41, and thence passes through the filter 32 into recess 40. From said recess it passes through the orifice 18 in the thin disk 17 held by a sleeve 23 in a tapered bushing 27, which may be similar in construction to that shown in Fig. 2, and thence to the pilot burner. The rate of gas flow through the device to the pilot burner is controlled by the area of the orifice 18 selected in accordance with the requirements of the particular installation, and the valve means 36, 37 is preferably used only to shut off the gas flow completely.

It will therefore be perceived that the present invention provides means for controlling the

flow of gas to a pilot burner or the like which, by reason of its form and dimensions, minimizes or largely eliminates the obstruction to gas flow arising from accumulation of particles such as have heretofore collected on the passage walls where needle valves, stop cocks, tubular orifices or the like have been used. Experience has demonstrated that controlling means constructed in accordance with the present invention are substantially free of accumulation of solid particles at the orifice after relatively long periods of service and the present indication is that they may be used almost indefinitely without need for cleaning or otherwise servicing.

While the embodiments of the invention illustrated on the drawing have been described with considerable particularity, it is to be expressly understood that the invention is not restricted thereto, as the present invention may be embodied in a wide variety of constructions dependent upon the requirements of the individual installation, as will now be readily apparent to those skilled in the art. It is also to be expressly understood that the area of the orifice may be varied as required to provide the desired rate of gas flow to suit the requirements of the particular installation provided that the critical ratio of length to diameter herein disclosed is not exceeded. Reference is therefore to be had to the claims appended hereto for a definition of the limits of the invention.

What is claimed is:

1. In a device for constricting the flow of gas to a pilot burner, and in combination with means providing a passage for gas flow, a relatively thin disk disposed across said passage and containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2.

2. In a device for constricting the flow of gas to a pilot burner, and in combination with means providing a passage for gas flow, a relatively thin disk of non-corrodible material disposed across said passage and containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2.

3. In a device for constricting the flow of gas to a pilot burner, and in combination with means providing a passage for gas flow, a relatively thin disk disposed across said passage and containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2, said orifice having its peripheral wall throughout its periphery at substantially right angles to the faces of said disk.

4. In a device for constricting the flow of gas to a pilot burner, and in combination with means providing a passage for gas flow, a relatively thin disk disposed across said passage and containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2, and filtering means disposed in said passage on the inlet side of said disk and provided with apertures whose maximum dimensions are less than the diameter of said orifice.

5. In a device for constricting the flow of gas to a pilot burner, and in combination with means providing a passage for gas flow, a relatively thin disk disposed across said passage and containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2, and a fine-mesh screen disposed in said passage on the inlet side of said disk and having apertures whose diagonals are less than the diameter of said orifice.

6. As an article of manufacture to be installed for constricting the flow of gas to a pilot burner, a screw containing a passage having one or more inlet openings and an outlet opening communicating therewith, a relatively thin disk carried in unitary relationship by said screw and disposed across said passage, said disk containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2, and valve means mounted in the passage of said screw for closing said passage.

7. As an article of manufacture to be installed for constricting the flow of gas to a pilot burner, a bushing containing a passage and having an interior shoulder, a relatively thin disk carried in unitary relationship by said bushing and disposed across said passage, said disk containing a substantially cylindrical orifice the ratio of the entire length of said orifice through said disk to its diameter being not in excess of 0.2, and means in said bushing for retaining said disk against said shoulder.

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