Nov. 9, 1965 W. H. BRANCHE ETAL 3,216,479

FLUID CONTROL MEANS

Filed Sept. 15, 1961 2 Sheets-Sheet 1

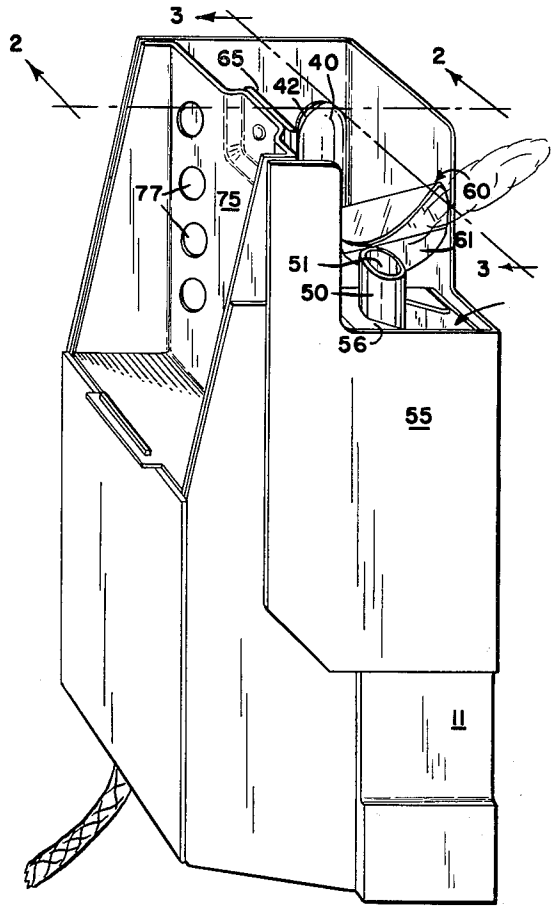


FIG. 1

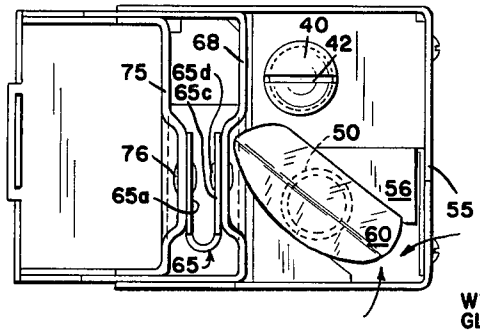


FIG. 4

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FIG. 2

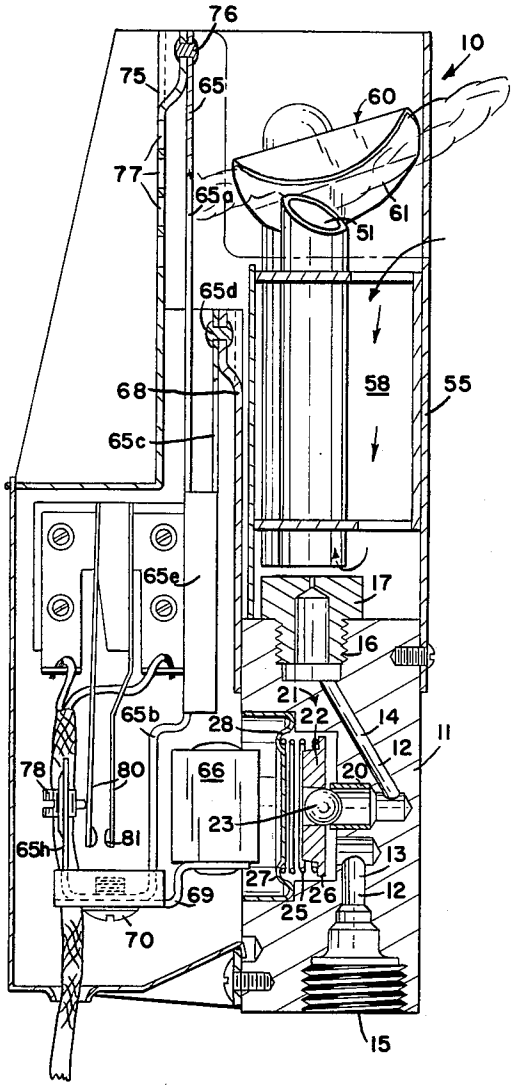
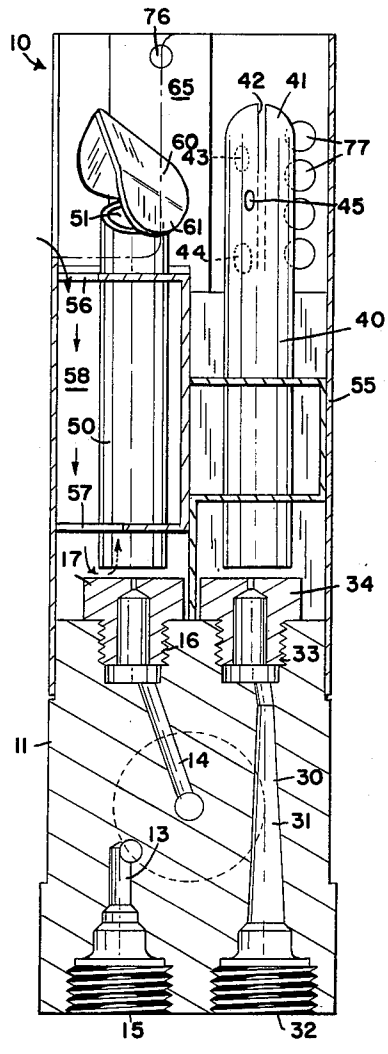


FIG. 3



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FLUID CONTROL MEANS

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4 Claims. (Cl. 158—140)

This invention relates to control means, more particularly to means controlling the flow of fluids in response to the proper utilization of the fluid at a desired delivery point. Particular reference will be had to an embodiment of the invention in connection with a pilot light for gas burners where the flow of gas to the pilot will be controlled in response to the presence of a flame at the pilot.

A variety of situations exist in which it is necessary to control the flow of fluid through a supply conduit so that the fluid flow will be stopped upon the occurrence of some undesirable condition at the point of delivery. To this end, different types of safety valves responsive to the desired condition have been evolved. The positioning of the valve to control fluid flow is effected by some sensing member arranged to detect the presence or absence of the desired condition.

In the case of gas burners, contemporary technological advances have given rise to the utilization of a pilot flame adjacent the gas burner serving to initiate operation of the burner. In most installations, the burner is not maintained operative continuously, and the pilot functions to ignite any gas supplied to the burner so as to permit the on-off operation required by automatic systems. As is apparent, any gas supplied to the pilot must be burned so as to prevent the flow of inflammable gas into an area where it might prove dangerous. In order to insure that gas is supplied to the pilot only when a flame is present, controls of the type here involved are employed.

As is the case with all burner equipment, it is desirable that any controls employed be relatively small, foolproof in operation, and utilizing a minimal number of components so as to minimize maintenance and production costs. It is additionally desirable to promote the proper mixture of air with the gas to attain combustion; and further to insure the sensing of the desired combustion by the sensing member.

It is with these problems and desiderata in mind that the present control means have been evolved, means providing for a compact pilot structure in which gas flow is controlled in a simple efficient manner; proper air-gas mixtures are implemented; and sensing of the flame is facilitated.

It is accordingly a primary object of this invention to provide an improved control for regulating the flow of fluids in response to conditions at a delivery point.

Another object of the invention is to provide an improved pilot light structure in which the flow of gas to the pilot will be stopped upon the extinguishment of the pilot flame.

A further object of the invention is to provide an improved valve arrangement subject to formation in a compact relatively small volume.

An additional object of the invention is to provide for an improved mounting for a thermally responsive element, insuring the transfer of heat to the element.

Another object of the invention is to provide a pilot structure in which the pilot flame will be relatively protected from extinguishment.

A further object of the invention is to provide for desired air-gas mixtures at the pilot.

These and other objects of the invention which will become hereafter apparent are achieved by provision of a duct through which fluid may be directed to a desired

point. A valve member is arranged to control the flow of fluid through said duct, and a member sensing the effect of proper utilization of said fluid at the discharge point of said duct controls the operation of the valve member. In the preferred embodiment of the invention here illustrated, the novel structure will be seen embodied in a pilot light assembly for gas burners. The duct is a pilot stem through which gas is directed to a target plate serving to direct the pilot flame partially to the burner to be lit thereby and partially to a valve controlling sensing element. An ignition or escapement stem is provided for igniting the gas supplied by the pilot stem. The valve is controlled by a magnetically actuated armature, and a magnet for actuation of the armature is coupled to a thermally responsive arm which is arranged to be impinged on by a portion of the flame striking the pilot target plate. A novel chimney structure is provided for mounting the pilot stem and the escapement stem so as to insure proper admixture of primary and secondary air with the gases, and serving to prevent the dissipation of heat and accidental extinction of the pilot flame.

An important feature of the invention resides in the improved construction of the magnetically actuated valve which permits formation of the valve as a simple compact structure occupying a minimal volume and simple in production and maintenance. By the use of a disc-shaped armature, proper valve operation is attained regardless of its orientation.

An additional feature of the invention resides in the novel chimney mounting for the pilot stem providing for the desired gas-air mixture.

A further feature of the invention resides in the mounting for the sensing element which insures a response of the element only to flame heat and not to other heat in the area.

Another important feature of the invention resides in the novel target which permits primary aeration.

An additional feature of the invention resides in the sensing arm structure with its warpage preventing structure.

The specific details of a preferred embodiment of the invention and their mode of functioning will be made most manifest and particularly pointed out in clear, concise, and exact terms in conjunction with the accompanying drawings wherein:

FIGURE 1 is a perspective view of a pilot assembly embodying the details of the instant novel control means;

FIGURE 2 is a cross-sectional view taken on line **2—2** of FIGURE 1 illustrating the relationship between the valve, the pilot stem, the target plate, and the sensing arm;

FIGURE 3 is a cross-sectional view taken on line **3—3** of FIGURE 1 illustrating the relationship between the ignition or escapement stem, the pilot stem, and the valve; and

FIGURE 4 is a top plan view of the assembly illustrated in FIGURE 2.

Referring now more particularly to the drawings, like numerals in the various figures will be employed to designate like parts.

The control means forming the subject of this invention is an improvement over the unit described in United States Patent No. 2,630,860, issued March 10, 1953. Reference may be had to the patent for a description of the preferred usage of the invention.

The pilot assembly **10** as best seen in FIGURES 2 and 3 is formed with a valve body **11** made up of a non-magnetic material such as zinc or aluminum. A pilot port **12** extends through the body **11** and is formed to extend along a straight path **13** and a skew path **14** from inlet **15** to outlet **16**. The outlet **16** is provided with a tapped recess to receive an orifice structure **17**.

A valve seat **20** is positioned in the pilot port **12** between the straight path **13** and skew path **14**, as best seen in FIGURE 2. The valve member **21** comprises an armature **22** of ferro magnetic material in the shape of a frusto-conical disc having an aperture within which a steel ball **23** is securely held. The diameter of ball **23** is such that it will seat on valve seat **20** blocking fluid flow through port **12**. Spring **25** is arranged to engage a flange **26** on armature **22** and bear against an emboss **27** in sealing cup **28**.

Escapement port **30** extends through valve body **11** and is formed in a straight path **31** between inlet **32** and outlet **33**, which is provided with an orifice structure **34**. Orifice structure **34** is a hexhead bolt with an appropriate opening formed therein to permit the passage of desired quantities of gas similar to orifice structure **17**.

The escapement stem **40** as best seen in FIGURE 3 is formed of an elongate cylindrical configuration having an open lower end adapted to extend about the opening in orifice structure **34**, and having its upper end closed off by dome structure **41**. A slot **42** extends through the dome structure and down a portion of the length of the stem so as to insure the burning of all of the gas fed to the stem orifices **43** and **44**. Where automatic ignition is desired, an aperture **45** is formed in stem **40**, and an electric ignition coil (not shown) of a conventional type is positioned adjacent this aperture to effect ignition of gases passing through the stem.

The pilot stem **50** is similarly formed of an elongate cylindrical configuration with an open lower end of a diameter encompassing the opening in orifice structure **17**. The upper end of pilot stem **50** is cut at a slant as best seen in FIGURES 2 and 3 to provide for outlet **51**.

A chimney mounting structure or shroud **55** is formed of sheet material such as sheet steel or the like and supports and encompasses the escapement stem **40** and pilot stem **50**. The escapement stem **40** is rigidly supported in position between a spaced upper escapement mounting plate **56** and lower escapement mounting plate **57**. As best seen in FIGURES 2 and 3 a space is left between the bottom of escapement stem **40** and the top of orifice structure **34** for a purpose to be made hereinafter more apparent. Pilot stem **50** is supported within a rectangular chamber **58** formed within mounting chimney **55**.

The target **60** formed as illustrated in FIGURES 2 and 3 is provided with a supporting arm **61** secured to a wall of the chamber **58** surrounding and supporting pilot stem **50**.

The configuration of the target **60** is such that most of the gas emitted from the outlet **51** of pilot stem **50** is directed outwardly, to the right as viewed in FIGURE 2, towards the burner to be ignited by the pilot. Some smaller portion of the gas is, however, directed to the left as viewed in FIGURE 2 against the thermally responsive arm **65**.

Arm **65** includes leg portion **65***a* anchored at one end **76** and joining at the other, a generally U-shaped portion **65***b* and a leg portion **65***c* fixed at one end **65***d* to housing **68** and connected to leg **65***a* through integral bridge portion **65***e*. Arm **65** is made up of a relatively thin band of rigid material such as stainless steel which will warp temporarily under the action of the flame directed thereagainst by the target. The lower end **65***b* of arm **65** has secured thereto a magnet **66** of Alnico or the like. The magnet **66** is secured to the arm by means of an adjustable bracket **69** fastened by screw **70** to U-shaped portion **65***b* of arm **65** made integral with the arm.

The upper end of arm **65** is secured to a mounting plate **75** by means of rivet **76** or the like fastener. Plate **75** is formed with heat dissipating apertures **77** serving to minimize the heat retention of the mounting plate, and functioning additionally to admit air to the shroud **55** to obtain the desired fuel air ratios.

As seen to the lower left in FIGURE 2, section **65***h* of U-shaped portion **65***b* of leg **65** has secured thereto an adjustable screw **78** which acts against contact blades **80** of switch **81** controlling flow of gas to the main burner serviced by the pilot forming the invention.

The purpose of the bracket **69** and adjusting screw **70** is to provide an adjustment for spacing the magnet **66** relative to the valve body **11**.

The instant structure reveals an embodiment of a control device by means of which the flow of fluid is controlled in response to the utilization of the fluid at the desired delivery point. It will be apparent to those skilled in the art that a variety of different types of fluids may be controlled by structures embodying the instant inventive concepts.

By way of example, the invention has been illustrated as utilized in conjuction with a gas pilot assembly **10**.

Such pilot assemblies are employed to provide automatic ignition of a gas burner when it is desired to utilize the burner. Thus where gas burners are employed for residential heating purposes, whether for the production of hot water, or area heat, some thermostatic control is generally employed to regulate the supply of gas to the burner. When the thermostat determines the need for heat, the burner gas supply valves are opened supplying necessary fuel to the gas burner. This fuel is ignited by the pilot flame which is constantly maintained.

Since the gas supply to the pilot is constant, it is necessary to provide some control in the event that the flame goes out for some reason such as a draft, liquid spillage or the like.

The instant structure permits this function to be attained. Thus, in use, gas is fed to the ignition or escapement stem **40** by means of some manually controlled valve. The operator initiates gas flow to the escapement stem **40**, and effects ignition thereof either manually with a match, or by means of an electric ignition coil. The flame produced by the escapement stem **40** extends into proximity with the discharge opening **51** of pilot stem **50** and against thermal arm **65**.

The action of the flame on thermal arm **65** held rigidly at points **76** and **65***d* is such as to cause the arm **65** to warp so as to move magnet **66** to the right as viewed in FIGURE 2. This movement of the magnet **66** results in an increase of flux density acting on armature **22** which causes the armature to move to the left as viewed in FIGURE 2, thereby displacing ball **23** from valve seat **20** which permits the flow of gas through pilot port **12** from inlet **15** to outlet **16**.

At outlet of orifice **17**, the gas is mixed with primary air from chamber **58** with the resultant air-gas mixture moving upwardly through pilot stem **50**. This air-gas mixture has secondary air added to it at outlet **51** and is ignited by the flame of escapement stem **40**. With the construction illustrated, the primary air for flow through the pilot stem is induced to pass under and in the proximity of the flame as it passes downwardly through chamber **58** accommodating the pilot stem. During operation of the pilot, the pilot flame and the pilot stem **40** heat the primary air to an extent determined by the size of the flame and the temperature of the stem. This feature established a relation between the primary air and the gas flow from orifice **17** such that substantially constant flame characteristics are obtained over a relatively large variation in the pressure of the gas supplied to the orifice. If, for example, the temperature of the flame rises, due to an increase in the pressure of the supply gas, the temperature of the air in proximity of the flame and the temperature of the stem also rises. The primary air is then subject to a flame and stem temperature of a higher value which, in turn, apparently reduces the rate of primary air flow as the air expands when subjected to the

increased temperature to maintain the flow described.

The action of the flames induces secondary air and also preheats primary air prior to its entrance into chamber **58** through a path indicated by the dotted arrows.

At this time the supply of gas to escapement stem **40** is shut off. The flame at the outlet of pilot stem **50** impinges on target **60** whence a major portion thereof is diverted to the right as viewed in FIGURE 2 towards the gas burner to be ignited thereby, and a secondary portion of the flame is diverted to the left as viewed in FIGURE 2 against thermal arm **65** to maintain same in a warped condition permitting magnet **66** to attract armature **22**.

So long as the pilot flame remains ignited, the arm **65** is warped to this position permitting attraction of the armature **22**. Upon the extinction of the flame, the arm cools returning to its original position pulling magnet **66** to a position sufficiently remote from armature **22** so that the flux density of magnet **66** no longer overcomes the force exerted by spring **25** so that the ball is again seated on valve seat **20** shutting off the flow of gas to the pilot stem **50**.

When arm **65** returns to its non-warped condition, contact blades **80** are separated, and if these contact blades are arranged in the thermostat circuit the supply of gas to the burner can no longer be initiated. Obviously a variety of signal circuits may be controlled by contacts **80** to indicate the extinction of the pilot flame.

It will be observed by those skilled in the art that the construction of the novel magnetic valve is such as to permit fabrication of the structure in a relatively small volume, light in weight, simple of assemblage and requiring minimal maintenance. The spring biased armature provides for positive orientation of the valve ball **23** against the seat regardless of the position of the valve. The sealing cup **21** serves to prevent any accumulations of foreign matter within the valve body.

An important feature of the valve **23**, together with its actuating mechanism, is the reliability of operation assured by a construction free of linkage or equivalent structure prone to mechanical failure. With the parts shown and described, adjustment may be made whereby the contacts **80** engage either before or after the gap between the magnet **66** and cup **21** is reduced to an extent such that attraction of the armature **22**, together with opening of the valve passage, is accomplished.

The mounting shroud **55** for the escapement stem **40** and pilot stem **50** provides for a chimney effect in which the desired flow of secondary and primary air to the gases supplied to the stems is insured.

The mounting plate **75** for arm **65** with its apertures **77** serves to permit air flow into the shroud **55** and additionally minimizes heat retention by the arm **65** thereby insuring proper functioning thereof.

It is thus seen that a simple means for controlling the flow of fluid has been provided which automatically cuts off fluid flow when the utilization of the fluid at the point of delivery is not as desired. The invention has been disclosed as embodied in a gas pilot whereby extinction of the pilot flame automatically results in a cessation of gas flow. The novel structure is compact, light in weight, with few moving parts, simple of manufacture and maintenance, and functioning regardless of orientation.

The above disclosure has been given by way of illustration and elucidation, and not by way of limitation, and it is desired to protect all embodiments of the herein disclosed inventive concept within the scope of the appended claims.

We claim:

1. In a fluid flow system having duct means through which the fluid is conducted to a point of utilization, and valve means regulating the flow of fluid through said duct means, control means for actuating said valve means, said control means comprising: sensing means arranged in proximity to the outlet of said duct means; target means against which the fluid passing through said duct means will impinge for deflection into a sensing relationship with said sensing means; and magnetic coupling means between said sensing means and said valve means for effecting orientation of said valve means to a position permitting fluid flow through said duct means upon the occurrence of the desired condition at the outlet of said duct means.

2. A gas pilot structure comprising: a valve body having a pilot port extending therethrough; a valve seat arranged in said port; a valve member movable from a position in said seat blocking the pilot port to a position remote therefrom permitting free flow of gas through the port; a pilot stem spaced slightly from the outlet of said port; a chamber surrounding said stem confining air in proximity with the path of travel of gas from the port to said stem; a target positioned adjacent the outlet of said stem upon which a flame produced by the ignition of the gas flowing through said stem will impinge; a thermally responsive arm positioned adjacent said target upon which a portion of the flame impinging said target will be deflected; a magnet supported by said arm in proximity to said valve; an armature supporting said valve member; and a spring biasing said armature and said valve member supported thereby against said valve seat whereby the heating of said arm will warp same to cause said magnet to move to a position attracting said armature against the action of said spring to permit the flow of gas through said valve port.

3. A pilot structure as in claim **2** in which an escapement stem is arranged adjacent said pilot stem through which gas may flow into proximity with said pilot stem; and said valve body is formed with an escapement port through which gas is directed to said escapement stem.

4. A pilot structure as in claim **3** in which said pilot stem and said escapement stem are enclosed within a shroud effecting air flow to the inlet of said stems.

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