

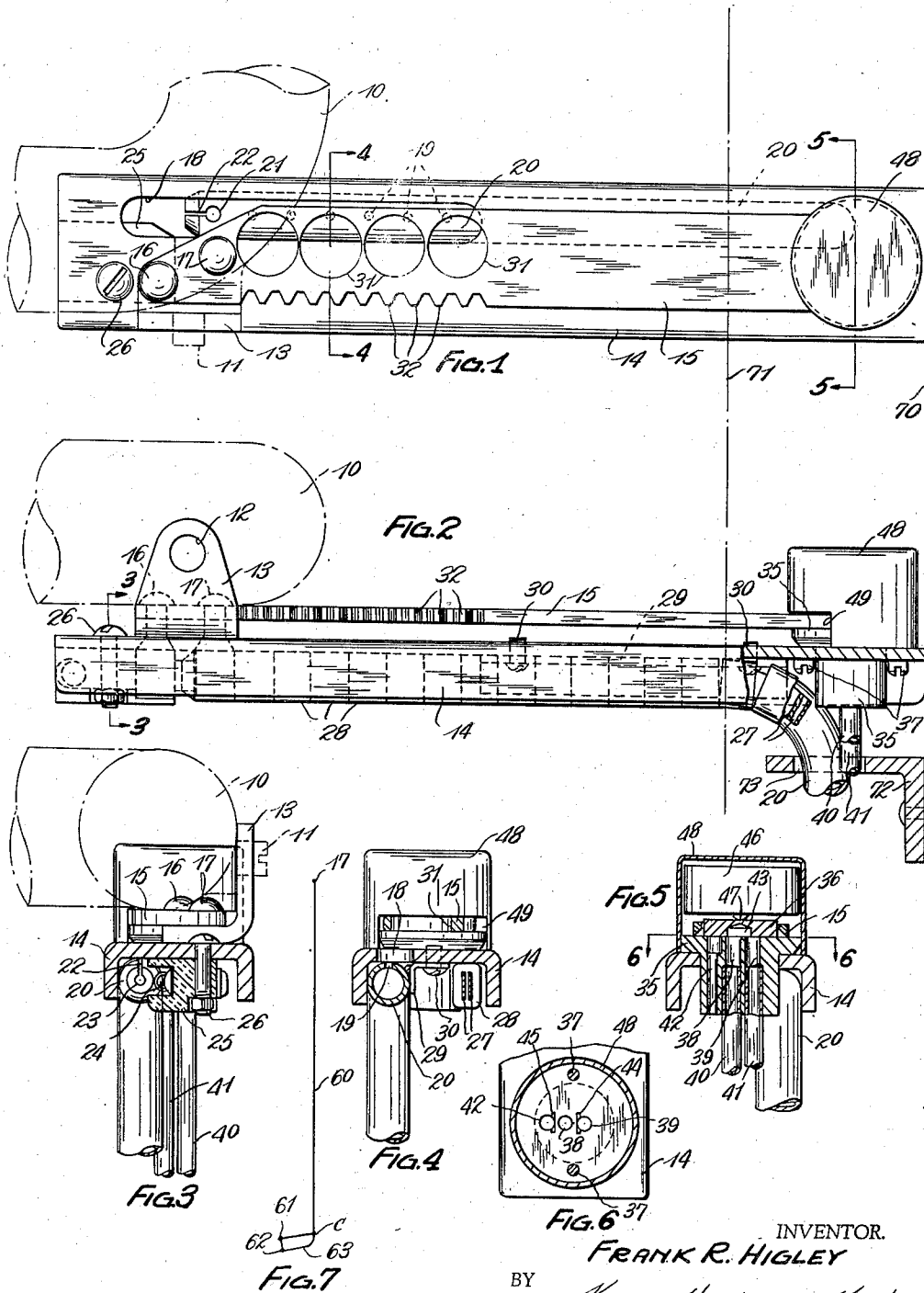
April 24, 1945.

F. R. HIGLEY

2,374,431

BURNER LIGHTER

Filed Aug. 24, 1940



UNITED STATES PATENT OFFICE

2,374,431

BURNER LIGHTER

Frank R. Higley, Cleveland Heights, Ohio, assign-
or to The Bryant Heater Company, Cleveland,
Ohio, a corporation of Ohio

Application August 24, 1940, Serial No. 354,062

15 Claims. (Cl. 236-101)

This invention relates to improvements in burner lighters, that is to say means for automatically lighting burners when the gas supply is turned on and embodying the safety feature of preventing the supply of gas to the burner when a pilot flame for igniting the gas fails to burn for any reason. The invention finds an important use in range lighters of the general character illustrated and described in my copending application Serial No. 354,061, filed of even date herewith, now Patent No. 2,300,156 of October 27, 1942.

One of the objects of the invention is the provision of a thermal unit to be associated with the pilot for a gas burner which shall be convenient and easy to install and shall be readily adaptable to ranges of different design and manufacture.

Another object is the provision of a thermal unit which shall be simple and compact and of relatively low cost.

Still another object is the provision of a novel valve for actuation by the thermal unit for the purpose of controlling the operation of an automatic gas valve in the line of supply to the main burner.

A further object is the provision of a slide valve and a thermal member for operating the same so heated by the pilot flame and the ambient heat from the burner that the valve piece moves in a closed path bringing about a scouring and polishing operation between the meeting faces of the valve and valve piece, the connection between the valve piece and the thermal member being such as to induce small increments of rotational as distinguished from back and forth oscillatory movement of the valve piece in addition to its motion of translation in a closed path.

Other objects and features of novelty will appear as I proceed with the description of that embodiment of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawing, in which

Fig. 1 is a plan view of my new thermal unit.

Fig. 2 is a side elevation of the same.

Fig. 3 is a cross-sectional view taken substantially on the line 3-3 of Fig. 2.

Figs. 4 and 5 are cross-sectional views taken substantially on the lines 4-4 and 5-5 of Fig. 1.

Fig. 6 is a sectional plan view taken substantially on the line 6-6 of Fig. 5, and

Fig. 7 is a diagrammatic view indicating the translatory motion of the valve piece.

In the drawing 10 represents one corner of a gas burner such as is used commonly in baking

or broiling ovens. Such a burner may be provided with a boss into which may be threaded a screw 11, see Figs. 1 and 3, that is of a size to be received somewhat loosely within a hole 12 in a bracket 13 constituting part of my unit. By this means the unit is supported at its inner end.

The unit comprises two elongated members 14 and 15 with different coefficients of expansion, connected together near their inner ends. While it would be possible to construct the unit of a single member bent upon itself to provide upper and lower legs, such a construction would not function as effectively as the two-metal unit herein disclosed for reasons which will appear hereinafter.

As herein illustrated the member 14 is an inverted channel and is constructed of a metal having a relatively low coefficient of expansion. Member 15 is flat and has a relatively high coefficient of expansion. The two members are spaced from each other by a foot portion of bracket 13, and are secured together by rivets 16 and 17 which pass through the bracket foot as well as through the two members 14 and 15.

Member 14 has a slot 18 punched therein and below this slot are located small perforations 19 in a pilot 20, and the flames from these perforations are adapted to pass through the slot without appreciably heating the member 14. A gas outlet 21 of larger size supplies the flame which ignites the main burner. This outlet is connected by a narrow slot 22 with an end opening 23 which discharges a stream of gas that flows over and to some extent through an electric igniter which, in the form herein illustrated, consists of a heating coil 24 mounted in a groove of a refractory block 25 that is attached to the member 14 by means of a bolt 26 or the like. Current for this coil may be supplied through a pair of ribbon conductors 27 which are insulated preferably by a series of refractory beads 28.

Pilot 20 is fitted into one of the angles of the channel, as shown particularly in Fig. 4, being held in place by a small angle bar 29, one arm of which is welded to the pilot 20 while the other arm is fastened to the web of the channel by suitable means, such as screws 30. The angle 29 furthermore constitutes a central rib for the channel and accordingly has the further function of reinforcing member 14 and counteracting distortion thereof.

In an intermediate portion of member 15 I form a series of holes 31 which rather effectively block the transmission of heat from one side of the member to the other. By this means an in-

intermediate zone of small mean mass is provided in the thermal member 15 with zones of larger mass on opposite sides thereof. One of the latter zones is located directly above the burner openings 19, so that it takes heat directly from the pilot when the latter is ignited. The surface area of the other zone of larger mass is increased by a series of serrations 32 in order that such heat as may be transmitted from the hot side of the member through the intermediate small mass zone will be dissipated the more quickly. As will be obvious, when the pilot flames play upon one side of this thermal member that side expands and causes the member to deflect, thereby imparting transverse movement to the free end of that member for effecting valve actuation.

The valve to be operated by the thermal unit in this case comprises a valve body 35 carried by the member 14 and a valve piece 36 adapted to slide over the face of the valve body in response to movements of the actuating member 15. As illustrated herein the valve body includes a cylindrical trunk which is projected through a round opening in the member 14, and a flat head which rests upon the top of that member and to which it is secured by a pair of screws 37 that extend through holes in the web part of the channel into threaded holes in the head portion of the valve body. The valve body may be ported in various ways, as the requirements of different installations may necessitate. In the case illustrated there are two ports 38 and 39 to which are connected tubular conductors 40 and 41 respectively and a third port 42 which communicates with atmosphere. Connections for the conductors 40 and 41 to effect control of an automatic gas valve are illustrated and described in my aforesaid copending application to which reference may be had for one example of a system in which the present invention may be utilized.

The valve piece 36 as previously stated is adapted to slide upon the surface of the valve body 35. These contacting surfaces are finely polished in order that leakage of gas may be precluded. In the lower side of the valve piece there is formed a pocket 43 which in the position illustrated bridges and connects the two ports 38 and 39. In a different position, that is when the member 15 is deflected by heat from the pilot, the pocket 43 bridges ports 38 and 42 and closes off port 39. In order that the opening of the ports 39 and 42 may be more rapid I cut small slots 44 and 45 into the valve body on the inner sides thereof and in communication with ports 39 and 42 respectively. Valve piece 36 is a round disk which fits with some clearance into a round hole in the thermal actuating member 15, the edges of this hole being made thin, as illustrated in Fig. 5, so that any warping or other deformation of the thermal member will not cause the valve piece or slide to be locked therein and hence prevented from resting upon and closely engaging the surface of the valve body.

In order that this close engagement may be maintained at all times I provide means for exerting a force downward upon the valve piece opposite the port or pocket 43 therein. I exert this force preferably by means of a weight 46 with a small rounded boss 47 at the center of its lower side. This weight is confined by a sheet metal cap or cover 48 that is secured in any suitable manner to the flat head of the valve body 35. This cover is generally cylindrical and has a cut-out 49 through which the member 15 extends with sufficient side clearance to accommo-

date the swing of that member. The cover does not tightly engage the sides of the weight, but the clearance is small enough so that there can be very little lateral movement of the weight.

The outer end of the unit is supported more or less loosely from one wall of the oven or other closed compartment in which the burner 10 is located. This is essential in that compensation must be provided for a considerable amount of expansion and contraction of the parts. In the drawing I have indicated by the lines 70 and 71 a double wall such as is frequently used for ovens, the valve parts and the tubular conductors 20, 40 and 41 being then enclosed within the wall. Incidentally however either one of the wall members 70 and 71 may be omitted, that is to say the valve and associated parts may be entirely within the oven where they are exposed to oven heat, or they may be outside the oven and thus in a cooler spot. The loose support above referred to may be a bracket 72 with its vertical leg secured to the oven wall, its horizontal leg having an opening 73 therethrough which loosely receives the tubular conductors and the vertical part of pilot 20.

The thermal members 14 and 15 are made of uniform length for installation in ranges of different design. If it is inconvenient in a given case to arrange the unit to project from an oven wall at right angles thereto, it may be set at any other angle necessary to bring the pilot flame into the desired position with respect to the oven burner. The unit may therefore accommodate itself to different ovens in which the distances between the burner and the wall vary between wide limits.

Operation.—When gas is turned into the pilot tube and the coil 24 is energized, as by a manual control consisting of a gas valve and electric switch operated simultaneously, the coil ignites the gas emerging from the pilot opening 23, and the pilot flame travels back through slot 22 to opening 21, which causes the gas from each of the small openings 19 to be ignited in sequence. One side of the thermal member 15 therefore gets hot quickly and the other side of that member remains comparatively cool, with the result that valve piece 36 is slid over the surface of valve body 35 away from the position illustrated in Fig. 5 to a position in which pocket 43 connects the valve ports 38 and 42. This functions by suitable means, as for example that disclosed in my aforesaid copending application, to turn on the gas to main burner 10, which is ignited by the flame from opening 21. The pilot continues to burn at all outlets, but generally the igniter coil will be extinguished automatically by means which form no part of the present invention. Now when the operator wishes to discontinue the operation of the burner he turns off the gas either to the pilot alone or to both the burner and the pilot. In either event the pilot goes out, the hot side of thermal member 15 cools and the valve piece slides back to the position illustrated in the drawing. This results in closing the automatic valve and putting the apparatus into condition for the next lighting cycle.

It will be observed that the deflection of member 15 is due to the uneven heating of the masses of that member on opposite sides of its intermediate low mass zone. This deflection may be said to take place in the plane of the member. Owing to the length of the member the deflection effect is multiplied and a motion of substantial amount results. There is also a relative motion of the valve piece and body due to relative expansion of

the thermal members 14 and 15 longitudinally under the influence of ambient heat from the main burner. If the two members 14 and 15 were formed of the same metal this motion would be practically nil, since the ambient heat affecting the two members is the same. The only longitudinal motion in that event would be that due to the somewhat greater expansion of the member 15 on account of pilot flame heat being added to ambient heat in the case of that member alone. However one of the features of my invention requires movement of the valve piece longitudinally as well as transversely, and consequently I use metals of different coefficients of expansion for the two members 14 and 15. Conveniently the member 15 is the high expansion member and the member 14 is the low expansion member. With the construction described there is a transverse motion back and forth when the pilot flame comes on and goes off and a longitudinal motion back and forth due to the increasing and decreasing ambient heat.

In an oven the ambient temperature may be of the order of 1200° F. Consequently in order to effect deflection of the member 15 of an extent sufficient for practical purposes, the added heat which is brought to bear upon that member to one side of the openings 31 by the flames from ports 19 must raise the temperature of that side of the member materially above 1200° F. Such high temperature necessarily sets up heavy internal strains. The member 15 is correspondingly weakened when this occurs.

Creep in the metal of the thermally responsive member is a function of the temperature, the time and the load. An oven may be in use for hours at a time and the pilot flame must be on all of that time. The temperature factor and the time factor are of course fixed by the requirements of the job. The load factor depends upon the valve and its operating mechanism. Applicant's slide valve of course presents a slight load due to friction between the valve and its seat, but the load is present only during motion of the valve at the beginning and end of the oven operation. During the great majority of the time there is no load on the operating member. The valve is operated in both directions positively by the thermally responsive member, instead of having to work against the opposition of a spring. This is in contradistinction to all previous arrangements of this character, where the valve operator works in one direction against a spring and therefore is subject to load throughout the operation of the oven, the spring shifting the valve to the opposite position when the pilot and consequently the main burner go off. The fact is that a spring in a hot spot is not permissible, as the best springs fail at temperatures far below oven heat. Of course the spring in such a case may be located at a distance from the pilot in a relatively cool spot, but in that event there must be a long transmission connection, whereas the construction of the present invention is compact and self-contained.

In Fig. 7 I have illustrated diagrammatically what occurs with respect to translatory motion of the valve piece. Let 60 represent the center line of member 15 and C the center of the circular opening in its free end. Now, when the pilot comes on and rapidly heats one large mass zone of member 15, that member deflects, moving point C over to the position marked 61. Gas to the burner then comes on and is ignited and ambient heat in the compartment is gradually built up,

which causes point C to move from position 61 to position 62, where it remains during the operation of the burner. Now, when the main burner and the pilot burner are extinguished, simultaneously or otherwise, the point C returns to its original position along a path somewhat as indicated by the line 63. Point C therefore moves through a closed path in the cycle of the apparatus. The resulting movement of the valve piece partakes of the nature of a scouring movement. If any minute particles of foreign matter collect between the faces of the valve body and valve piece this scouring motion prevents the travel of such particles back and forth in a line and therefore tends to prevent scratches in the mirror finish of the valve surfaces.

This closed path motion has the further effect of producing a rotation of the valve piece by small increments, as distinguished from back and forth or oscillatory increments. As previously stated the opening in member 15 is somewhat larger than the periphery of the valve piece. The engagement of the inner edge of this opening with the circular valve piece occurs at a different point for each of the movements of the valve piece charted in Fig. 7, and these changes in point of engagement progress around the valve. As a result the valve piece rotates in the direction opposite to the direction of its translatory motion. This rotational movement is in very small increments, but it is believed to be largely responsible for the self-clearing action which the valve possesses, and therefore is important.

Having thus described my invention, what I claim is:

1. In apparatus of the class described, a valve body, a thermal member adapted to move over the surface of said valve body in response to temperature changes, said thermal member having a circular opening therethrough with a thin inner edge, and a circular slide valve loosely disposed within said opening for sliding engagement with said valve body.

2. Valve means including a valve body having a port in one surface thereof, a valve piece cooperating with said valve body to open and close said port, and actuating means for moving said valve piece with respect to said valve body, said valve piece and said actuating means having interengageable parts for the purpose, one loosely disposed about the other, said actuating means having progressive motion in a closed path with opposite components of said motion serving to open and close the valve, whereby the bodily motion of the valve piece will be accompanied by progressive rotative impulses in the same direction.

3. Valve means including a valve body having a port in one surface thereof, a circular valve piece movable upon said body to open and close said port, and means for moving said valve piece comprising a ring loosely surrounding the valve piece, said ring having progressive motion in a closed path with opposite components of said motion serving to open and close the valve, whereby the bodily motion of the valve piece is accompanied by progressive rotative impulses in the same direction.

4. Slide valve means including a valve body having a port in one surface thereof, a circular valve piece having a flat surface slidable upon the valve body to open and close said port, and means for sliding said valve piece comprising a ring loosely surrounding the valve piece, said ring having progressive motion in a closed path with

opposite components of said motion serving to open and close the valve, whereby the bodily movement of the valve piece is accompanied by progressive rotative impulses in the same direction.

5. In apparatus of the character described, valve means comprising a valve body and a valve piece movable thereupon, means for operating said valve piece comprising an elongate thermally responsive member anchored at one end and adapted when one edge is heated to swing laterally and expand longitudinally and when cooled to return to its original position, said valve piece and said thermally responsive member having interengageable parts one loosely disposed about the other, whereby during a cycle of heating and cooling the thermally responsive member there will be imparted to the valve piece progressive motion in a closed path, opposite components of said motion serving to open and close the valve, and all components serving to impart to the valve piece progressive rotative impulses in the same direction.

6. In apparatus of the character described, valve means comprising a valve body and a circular valve piece movable thereupon, means for operating said valve piece comprising an elongate thermally responsive member anchored at one end and having a ring at its free end loosely surrounding said valve piece, whereby when one edge of the thermally responsive member is heated it will swing laterally and then expand longitudinally and when the thermally responsive member is cooled it will return to its original position, and whereby during such cycle of movements of the thermally responsive member said ring will impart to said valve piece progressive motion in a closed path, opposite components of said motion serving to open and close the valve and all components serving to impart to the valve piece progressive rotative impulses in the same direction.

7. In apparatus of the character described, valve means comprising a valve body having a port in one surface thereof, a circular valve piece slidable over said surface to open and close said port, means for moving said valve piece comprising an elongate thermally responsive member anchored at one end and having a ring at its free end loosely surrounding said valve piece, whereby when one edge of the thermally responsive member is heated it will swing laterally and then expand longitudinally and when the thermally responsive member is cooled it will return to its original position, and whereby during said cycle of movements of the thermally responsive member said ring will impart to said valve piece progressive motion in a closed path, opposite components of said motion serving to open and close the valve and all components serving to impart to the valve piece progressive rotative impulses in the same direction.

8. Valve means including a valve body having a port in one surface thereof, a valve piece movable over said surface to open and close said port, means for actuating said valve piece with translatory and rotational movement, pressure exerting means arranged to be applied to said valve piece on the side remote from the valve body with substantially point contact in line with the center of the valve body for maintaining bearing of the valve piece upon the valve body.

9. Valve means including a valve body having a port in its upper surface, a valve piece above said valve body adapted to open and close said port, means for actuating said valve piece with

translatory and rotational movement, weight means arranged to be applied to said valve piece on the side remote from the valve body with substantially point contact in line with the center of the valve body for maintaining bearing of the valve piece upon the valve body.

10. Apparatus of the class described for control of a burner by pilot means therefor, said apparatus comprising slide valve means including cooperating relatively ported valve piece and valve body parts, and thermally responsive means for actuating said valve means comprising a pair of elongated members alongside each other and interconnected at one end, each operatively connected at the other end with one of said valve parts and having different coefficients of expansion, one of said members having an opening therethrough intermediate its side edges to obstruct the transmission from one side thereof to the other of heat, whereby a difference in temperature as between said side edges will produce relative movement of said valve piece and valve body parts transversely of said members and changes in ambient temperature will produce relative movement of said parts longitudinally of said members.

11. Valve means including a valve body having a port in one surface thereof, a valve piece cooperating with said valve body to open and close said port, an actuating means for moving said valve piece over the face of said valve body, the connection between said actuating means and said valve piece comprising two members one loosely surrounding the other, said actuating means having motion in a closed path, whereby the point of bearing between said two members progresses through 360° for each cycle of movements of the actuator through said closed path.

12. Valve means including a valve body having a port in one surface thereof, a circular valve piece cooperating with said valve body to open and close said port, and actuating means for moving said valve piece with respect to said valve body comprising a ring loosely surrounding the valve piece, said actuating means having motion in a closed path, whereby the point of bearing between the ring and the valve piece progresses rotatively to cause the valve piece to turn in the opposite direction through small increments.

13. Slide valve means comprising a fixed ported valve body with a smooth upper surface and a valve piece slidably disposed thereupon in operative relation therewith, means for actuating said valve piece with translatory and rotational movement on said valve body, a weight arranged to bear upon the valve piece with contact limited to a location opposite the ported area of the valve body and substantially central of said valve piece, and means arranged to enclose said weight and limit its motion for substantially maintaining said contact location.

14. In a pilot of the character described, slide valve means comprising a body having a ported external face and a valve element slidable across said face to control flow through said valve means, burner means, a thermally responsive member for actuating said valve element in both directions and for the purpose adapted to have flexure between cold and hot positions under internal stresses responsive to high temperature from operation of said burner means, and yieldable means associated with said valve element for maintaining it, bearing against said face, in all positions independently of said member, whereby said member is relieved of external stress from said

valve element while in hot position during periods of exposure to maximum temperature.

15. Valve means including a valve body having a port in one surface thereof, a disc valve slidable over said surface to open and close said port, and an actuator traveling in a cyclic path for moving said valve from one position to the other, said actuator and valve having cooperating parts for

causing said actuator to engage the valve on opposite sides of the path of travel of the center of the valve during opposite portions of the actuator cycle, whereby rotational impulses in the same direction are imparted to the valve during its opening and closing movements.

FRANK R. HIGLEY.