April 6, 1937. W. E. MacKENZIE 2,076,155

GAS BURNING UNIT

Filed June 13, 1932 2 Sheets-Sheet 1

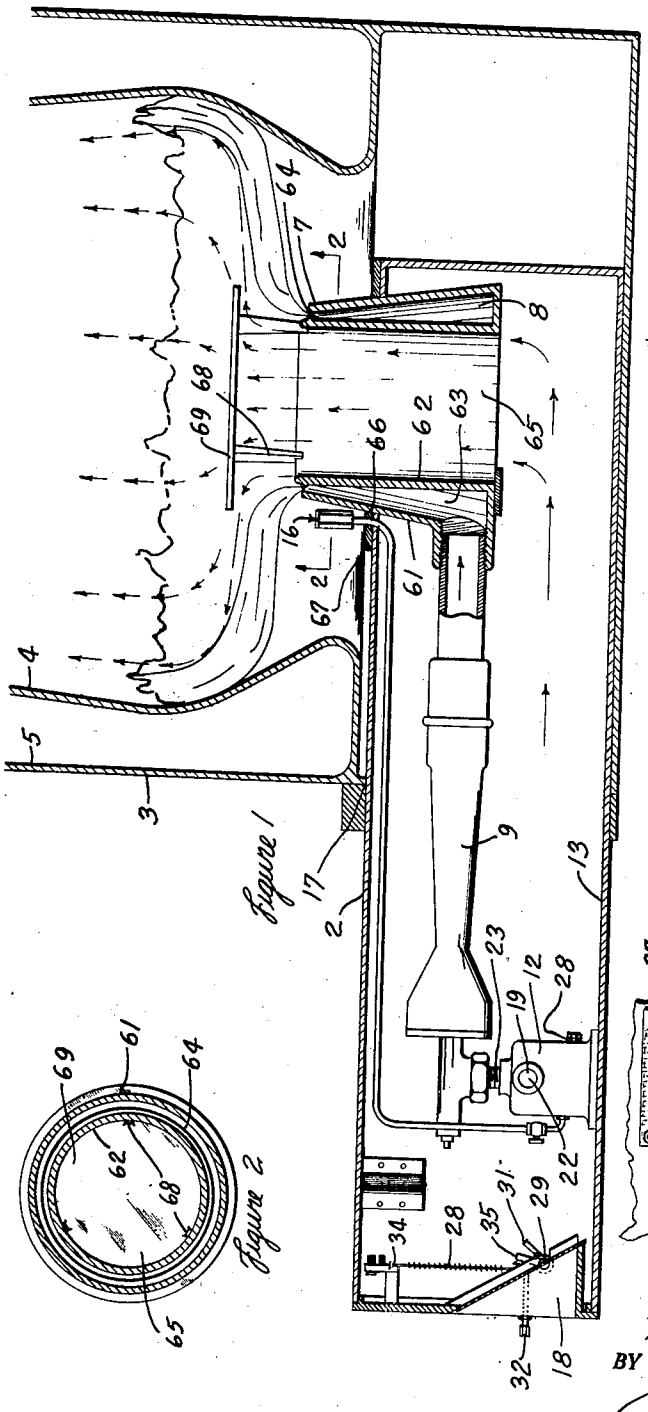


Figure 1

Figure 2

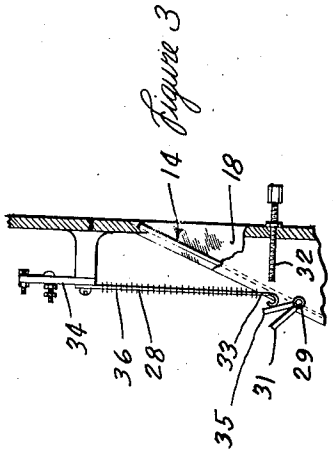


Figure 3

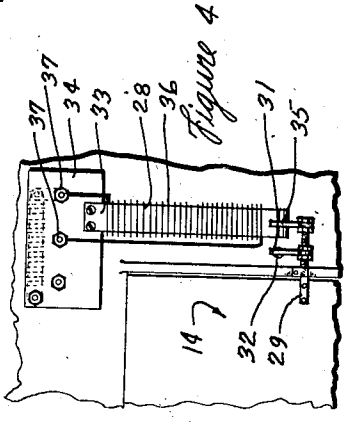


Figure 4

INVENTOR.
William E. MacKenzie
BY Joseph B. Gardner
ATTORNEY

April 6, 1937. W. E. MacKENZIE 2,076,155

GAS BURNING UNIT

Filed June 13, 1932 2 Sheets-Sheet 2

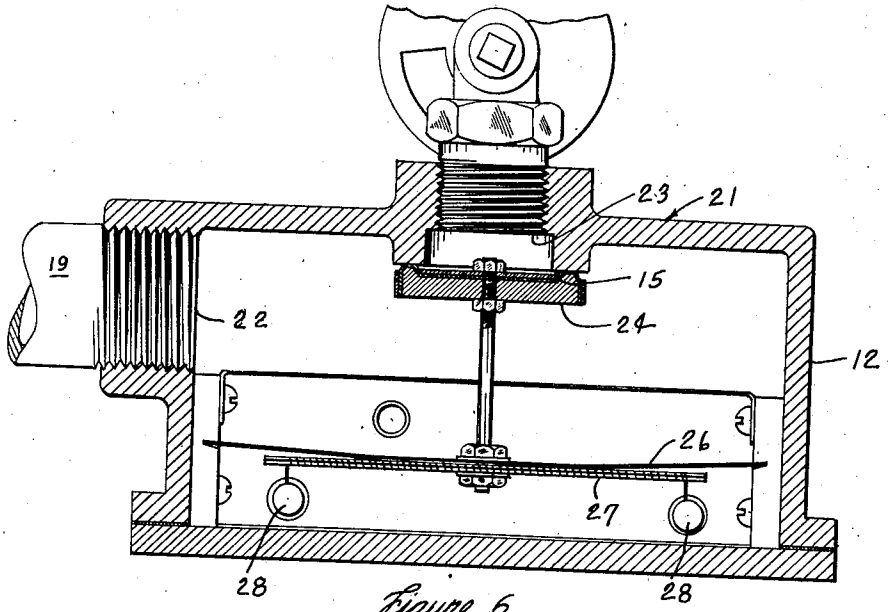


Figure 6

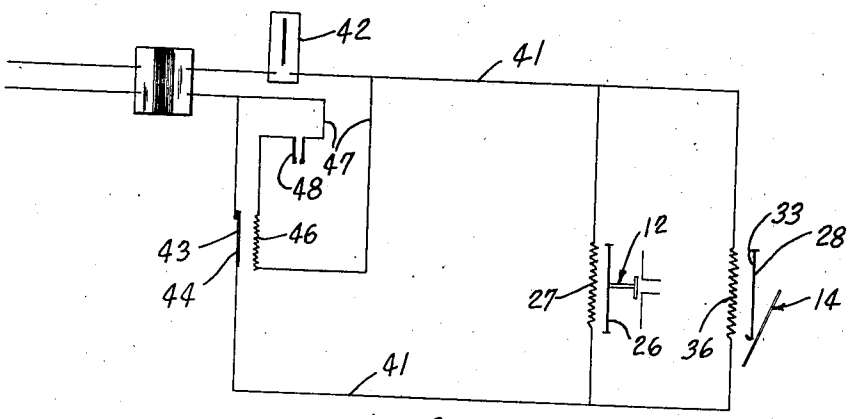


Figure 7

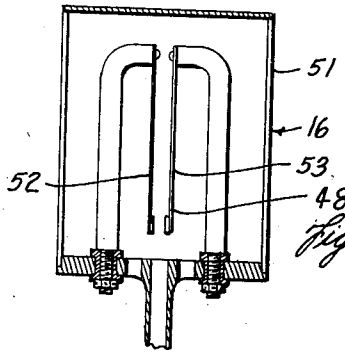


Figure 5

INVENTOR.
William E. Mackenzie
BY Joseph B. Gardner
ATTORNEYS.

Patented Apr. 6, 1937 2,076,155

UNITED STATES PATENT OFFICE

2,076,155

GAS BURNING UNIT

William E. MacKenzie, Oakland, Calif.

Application June 13, 1932, Serial No. 616,939

2 Claims. (Cl. 158—99)

The invention relates to a gas burning unit for furnaces and particularly adapted in its present form for use in coal-fired furnaces so as to convert the latter into automatic gas-fired heating plants. It will be understood, however, that the unit in whole or in part may be used effectively in other types of heating plants or installations. Certain features of the present disclosure not included in the appended claims are being more specifically claimed in my copending application Serial No. 753,888, filed November 20, 1934.

In the type of gas heating plants above described, it has been found advantageous in the operation thereof to allow the uninterrupted passage through the furnace of a current of air for insuring combustion during the burning of the gas. On the other hand, such passage of air through the furnace is not desired when the gas is turned off, particularly while the furnace is hot, since the draft of cool air chills the furnace and boiler walls and thus appreciably shortens the length of time during which heat is effectively given off by the plant after the gas is closed. Heretofore the opening of the air valve has been arranged to take place simultaneously with the opening of the gas valve, and likewise the closing of the air valve has been arranged to be effected simultaneously with the closing of the gas valve. Such a control however has several disadvantages, for example, in the starting operation the static condition of the air in the furnace offers such a resistance to the flow of the gas that a back-flow of the latter through the gas-conduit frequently results, and conversely on the simultaneous shutting off of the gas and air the consumption of the air by the remaining gas in the burner causes a reduction of pressure in the furnace and the consequent difficulty in maintaining the pilot light lit.

In view of the foregoing, it is an object of my invention to provide in a gas burning unit of the character described, means which will automatically cause a draft of air to be set up through the furnace in advance of and as a prerequisite to the opening of the gas burner valve, and furthermore the discontinuance of the air draft will be effected only after the gas valve has been fully closed and combustion entirely completed.

Another object of the invention is to provide for the automatic operation of the gas valve a thermostatic element including an actuating means arranged entirely within the gas chamber of the valve and deriving its heat source independently of the temperature of the furnace associated with the valve.

Another object of the invention is to provide a thermostatic element for causing operation of a member of the unit, which is so arranged that the actuating force thereof will be applied, not when the element is heated to the relatively high temperatures, but when cooled and returned to its normal state, whereby straining of the element and the consequent weakening of the structure and distortion of operation will be eliminated.

A further object of the invention is to provide in the unit a gas pilot light having a thermostatic switch for controlling operation of the gas valve, which will be actuated by the heat of pilot flame and at the same time will be prevented from over-expansion by the cooling effect of the gas supply to the pilot.

An additional object of the invention is to provide a gas burner arranged to be inserted within a furnace and so designed that the flame will be caused to spread and be directed radially outward therefrom against the inner side walls of the furnace completely around the same.

A still further object of the invention is to provide a burner as above set forth which will provide for an extremely effective flame spread without requiring the use of refractory brick or other flame-impervious spreader.

Yet another object of the invention is to provide a burner of the character above described in which the flame will be caused to be deflected angularly from its normal course solely by the secondary air supplied thereto and in such manner that substantially no portion of the flame will come in contact with the burner or cooperating parts thereof.

Yet a further object of the invention is to provide a burner arranged to be set in a furnace as aforesaid, in which the entire supply of secondary air admitted into the furnace will be caused to first pass over the flame of the burner whereby contact of cold air with the furnace will be avoided.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawings:

Figure 1 is a vertical sectional view of the unit

of my invention operatively arranged in a furnace.

Figure 2 is an inverted horizontal sectional view of the burner.

Figure 3 is an enlarged view of the air intake control as shown in Figure 1.

Figure 4 is an elevation of the intake control taken at right angles to Figure 3 and viewing the control from the inside of the unit.

Figure 5 is a longitudinal sectional view of the pilot light member.

Figure 6 is a longitudinal sectional view of the gas burner valve and control therefor.

Figure 7 is a dagrammatic representation of an electrical circuit used for automatically controlling the flow of air and gas for the operation of the unit.

As illustrated in the drawings the gas heating plant of my invention comprises a gas burning unit 2 operatively inserted in a furnace 3 which as here shown is of a type provided with an annular water jacket formed by inner and outer walls 4 and 5. The unit 2 in its present form includes in general a gas burner 7 provided with a mixing chamber 8 and Venturi feed pipe 9, a gas control valve 12, a shell 13 enclosing the gas mixing chamber and control valve and which defines a passage for secondary air for the burner, an inlet control valve 14 for the air passage, a safety pilot light member 16 for the burner having means associated therewith for controlling the gas valve, and means for automatically governing the relative opening of the gas and air valves and the relative closing of said valves.

Preferably the entire portion of the gas burning unit, except the portion containing the gas and air inlet, sits within the furnace and with the burner extending upwardly and between the walls 4. An air tight fit is desirably effected in any suitable manner between the sides of the unit shell and the sides of the opening 17 of the furnace so that the air admitted to the furnace will be exclusively by way of an intake opening 18 controlled by the valve 14 aforementioned.

Gas is preferably supplied to the unit through a pipe 19 which leads to the valve 12 which in turn controls the gas supply to the mixing chamber 8 of the burner. The valve 12 as here shown comprises a body 21 having inlet and outlet openings 22 and 23 respectively, the opening 15 being engageable for the closing thereof by a valve member 24. The latter is arranged, and is of a design particularly appropriate for operation by a thermostatic element located entirely within the gas chamber formed by the valve body. The element here used is adapted to be heated electrically and comprises a thermostatic strip 26 supported at its opposite ends in spaced insulation blocks and arranged to maintain the valve 24, to which it is preferably secured, in closed position when the strip is at room or like relatively cool temperature. Secured to the strip 26 and extending longitudinally therealong is an electric heating element 27 having its terminal secured to binding posts 28 insulated from and extending through the valve body. When the heating element is energized the thermostatic strip 26 will be flexed downwardly to thereby draw the valve 24 from its seat to thereby permit the flow of gas into the outlet 23. It is important to note that the operation of the thermostat element is such that when a force is being applied thereby, such as when keeping the valve closed, the element is relatively cold and easily able to counteract the resisting force of the valve to closing, and on the other hand as the element becomes hot no force is applied or resisted thereby and thus no fatigue of the element and consequent impairment of its operation will result.

The opening and closing of the air intake valve 14 is arranged to be effected by a thermostatic element 28 in a manner similar to that of element 26 in connection with the gas valve. As clearly shown in Figures 3 and 4 the valve 14 for controlling the opening 18 is mounted on horizontally extending pivot members 29 disposed intermediate the upper and lower edges of the valve, the axis of rotation being so located that normally the valve will endeavor to assume an open position with an abutment 31 thereof in engagement with an adjustable stop 32 on the shell. The element 28 includes a thermostatic strip 33 affixed at its upper extremity to an insulated terminal block 34 and arranged to engage at its lower extremity an abutment 35 on the valve to hold the valve in closed position, that is when the element is not heated. Heating of the element strip is arranged to be effected by an electric heating element 36 surrounding the strip and having its terminals connected to posts 37 on the block 34. As is the case with the thermostatic element 26, the element 28 is designed to exert its force while relatively cold and to be relieved of external stress while relatively hot. Thus when the electrical element 36 is heated the strip 33 will reflex with its free extremity retreating to allow the advance of the abutment 35 and the corresponding opening movement of the valve 14 motivated by its own weight as aforesaid.

Means are provided for causing the air valve, at the initiation of operation of the burner, to be automatically opened in advance of the opening of the gas valve and to be held in such open position during the entire time of operation of the burner and for a given time thereafter. In the present embodiment such operation of the valves is effected through a difference in the action of the two thermostatic strips 26 and 33. As will be clear from the drawings, since the strip 26 is of about the same length as the strip 33, but is supported at both ends instead of at one end as is strip 33, and provides a greater initial resistance to flexure than does the strip 33, and furthermore as the distance between the supporting point and valve engaging point of strip 26 is less than the corresponding distance on the strip 33, simultaneous heating of the strips will cause an earlier initial action of the element associated with the air valve than the element associated with the gas valve. In this manner, on starting the operation of the burner an air draft will have been set up through the furnace prior to the opening of the gas valve so that when the latter is opened the gas will not meet with immobile air in the burner but will be permitted an unrestrained flow in the proper direction.

It will likewise be noted that on the other hand, on the return of the thermostatic strips from heated to cold condition, the strip 26, due to the fact that its course of movement is much shorter than that of the strip 33, will effect a closure of the gas valve much sooner than will the strip 33 effect a closure of the air valve. Therefore the admission of air to the burner and furnace will continue for some time after the admission of gas has stopped. In this manner, not only will combustion of the gas be fully completed, but any reduction of the pressure of the air in the furnace due to the insufficient presence of

air for combustion, and the consequent danger of the pilot light going out, will be avoided.

In Figure 7 there is illustrated an electric circuit for operating the thermostatic elements of the unit. As shown, the electrical heating elements 27 and 36 for the thermostatic elements 26 and 33 are arranged in a circuit 41 containing the master control thermostat 42 and a circuit breaker 43 arranged to be held in closed position as long as the pilot light is lit. Actuation of the circuit breaker is accomplished by a thermostatic element 44 which when heated will be flexed to break the circuit 41. Heating of the element 44 is effected by an electrical heating unit 46 arranged in a circuit 47 with a switch 48 thermostatically operated by the heat generated by the pilot flame. In the present embodiment, and as clearly shown in Figure 5, the pilot light member comprises a shell 51 slotted to provide jet openings and connected to a source of gas supply such as to the chamber of the gas valve body 21. Within the shell 51 in the direct path of the gas flowing therethrough is a pair of thermostatic element strips 52 and 53 forming the contacts for switch 48 and so designed as to remain in spaced relation when heated and to become engaged when cooled. Thus it will be seen that with the pilot lit the heat generated by the flame thereof will create sufficient warmth in the zone of the strips to keep them separated, overheating however of such strips being prevented by cooling effect of the gas and air flowing thereby. On the other hand, as will be readily understood, should the pilot light become extinguished the circuit 47 will be completed and the circuit breaker 43 opened to in turn open circuit 41 and thus prevent further flow of gas and air to the burner.

An important factor in the efficiency of the unit of my invention is the novel construction and operation of the burner and the manner in which the same is positioned in and coacts with the furnace. As here shown the body of the burner is arranged to extend partially upwardly into the furnace in centrally disposed relation, and comprises outer and inner shells 61 and 62 forming therebetween a gas chamber 63 communicating with the gas feed pipe and defining at the top thereof a circular fissure 64 for the issuance of the gas for burning. The shell 62 provides therein a chamber 65 for secondary air, and the outer shell of the burner is fitted tightly within the opening 66 of a partition 67 at the base of furnace walls 4 so that passage of air to the furnace introduced through the intake opening 14 may be only by way of the chamber 65.

It will be evident that with the burner as above described, the gas when ignited at the orifice 64 will be projected straight upward into the furnace without coming into intimate contact with the furnace walls. Means are accordingly provided for deflecting the flame angularly toward the walls 4 and entirely around same. To accomplish such deflection without the use of refractory brick or the like in the furnace and without the flame coming in contact with any part of the burner or cooperating part thereof, is as previously explained one of the principal features of the invention. Superimposed over the burner and preferably removably supported thereon in spaced relation such as by means of spacing legs 68, is an air deflecting member 69 designed in the form of a disc. It will now be seen that the air rushing through the chamber or passage 65, due to the draft created in the furnace, will strike the deflector and in spreading will force the flame radially outwardly directly against the walls 4 of the furnace, it being noted that spreading of the flame having taken place without contact thereof with the deflector. With the secondary air thus forced so effectively against the flame, efficient combustion of the gas is likewise assured. Furthermore, since no air may pass into the furnace except after intimate contact with the hot flame, any chilling of the furnace walls by contact with air is entirely avoided.

It will be clear that the unit of my invention is well adapted to the accomplishment of the objects hereinbefore referred to.

I claim:

1. A gas burning unit having a burner and separate inlets for gas and secondary air, valves for regulating the inflow of gas and air through said inlets, means including an electric circuit for automatically operating said valves for admitting air to said unit in advance of the admission of gas thereto upon initial operation of the burner to establish a moving column of secondary air prior to the introduction of gas and for stopping the flow of air a time period after stopping the flow of gas upon extinguishing the burner so as to supply an abundance of air to support final combustion, said means comprising a thermostatic member connected to each of said valves and arranged to open same on being heated, an electric heating element arranged to heat each of said members, and means for energizing said circuit, said member and element associated with said air control valve being faster in actuation than the other member and element upon simultaneous energization of said elements and slower in regaining a valve closing position on de-energizing of said elements.

2. In a gas burning unit provided with a burner and separate gas and secondary air inlets therefor, valves associated with for opening and closing said inlets, thermostatic members arranged to flex when heated and connected to said valves for maintaining the latter closed when cool and opening same on flexure, electric heating elements for heating said members, the member connected to said gas control valve being supported at its ends and connected to said last named valve at an intermediate portion of the member, the other member being mounted at an end thereof and connected adjacent the other end thereof to said air control valve whereby the flexure of said last named member will be greater and faster than will be that of the other member upon simultaneous energization of said elements and the return thereof to normal valve closing position upon deenergizing of said elements slower than that of the other member, an electric circuit including said heating elements and means for energizing said circuit.

WILLIAM E. MacKENZIE.