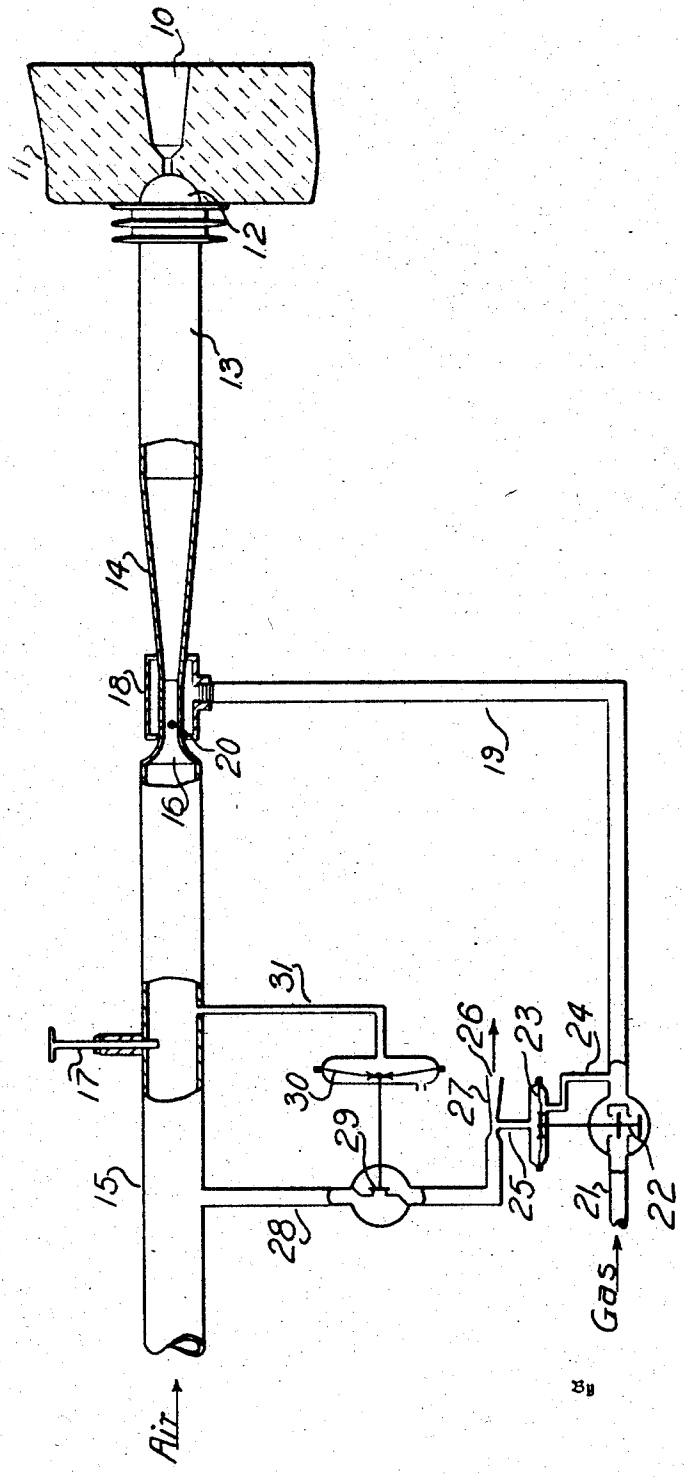
Feb. 14, 1939. H. B. BARBER 2,147,568

GAS SHUT-OFF MEANS FOR MIXING APPARATUS

Filed April 3, 1937



By

Inventor
H. B. Barber
Charles A. Lind
Attorney

Patented Feb. 14, 1939 2,147,568

UNITED STATES PATENT OFFICE

2,147,568

GAS SHUT-OFF MEANS FOR MIXING APPARATUS

Hugh B. Barber, Toledo, Ohio, assignor to Surface Combustion Corporation, Toledo, Ohio, a corporation of New York

Application April 3, 1937, Serial No. 134,888

5 Claims. (Cl. 158—119)

This invention relates to improvements in gas mixing and proportioning apparatus of the type disclosed in patent to Peters 1,574,107, dated February 23, 1926. In this type of apparatus, air under pressure is caused to flow through a Venturi tube and gas is supplied to the tube at relatively low pressure which is usually atmospheric pressure, the gas being drawn into the tube by the entraining effect of the air flowing therethrough. The gas pressure is controlled by a governor comprising a valve and a diaphragm, the arrangement being such that as the entraining effect of the air flowing through the Venturi tube decreases, due to decrease in air flow, the diaphragm tends to move the valve toward closed position (by reason of the increase in pressure between the Venturi tube and the governor valve) to compensate for the lesser amount of gas required to form the desired mixture. Suppose now that the air flow to the Venturi tube is entirely shut off or shut off to such degree that the air passing through the said tube exerts no appreciable entraining effect on the gas: In such case it is desirable that the governor valve should be tightly closed to prevent leakage of gas into the furnace whereinto the burner discharges. However, since the pressure which must be relied on to actuate the diaphragm to close the valve, when the air is shut off, is substantially atmospheric pressure, the valve, under ordinary operating conditions, does not close tightly enough to prevent leakage of gas past the valve and, therefore, into the furnace.

Now, therefore, the object of the present invention is to provide simple and practical means for tightly closing the governor valve when the air flow to the Venturi tube is shut off. The way in which this object is accomplished will be fully explained in the detailed description taken in connection with the accompanying drawing wherein the single figure is a diagrammatic view of the preferred form of the invention.

10 indicates a burner port in the wall 11 of a furnace which is not otherwise shown; 12 a burner nozzle positioned to discharge into said port; 13 a mixture supply pipe delivering to the burner nozzle from the Venturi mixing tube 14; 15 a conduit for delivering air under pressure to the mouth 16 of the said tube for flow through the latter, and 17 a gate valve or the like for regulating the amount of air supplied to said tube.

Surrounding the tube 14 at its restricted portion is a chamber 18 to which the gas flows from a supply pipe 19, the tube having radial inlet ports 20 in its restricted portion. The pressure of the gas flowing to the chamber 18 is low, usually atmospheric pressure, the gas being drawn into the tube 14 by the entraining effect of the air flowing therethrough.

In the main gas supply pipe 21 is a governor comprising a balanced valve 22, a diaphragm 23 and a pipe 24 leading from the pipe 19 to the underside of the diaphragm, the arrangement being such that if the pressure in the pipe 19 exceeds atmospheric pressure, the diaphragm will be operated to move the valve 22 toward closed position. Ordinarily the diaphragm 23 will be arranged in a vertical plane and the valve 22 and its stem to move in a horizontal plane in order that the weight of the parts shall not be a factor in determining the regulated pressure.

The apparatus thus far described is to all intents and purposes the same as that shown in the aforesaid patent to Peters 1,574,107.

Under ordinary operating conditions the non-valve side of the governor diaphragm 23 is exposed to the atmosphere as by a vent in the diaphragm case. In the present instance it is so exposed by way of passages 25 and 26, the passage 25 being a small pipe and the passage 26 being part of a small Venturi tube whose discharge end is open to the atmosphere, said pipe connecting with said tube at its restricted portions. Leading from the air conduit 15 at the upstream side of the valve 17 is a pipe 28 which leads to the mouth of the Venturi tube 27. In this pipe 28 is a valve 29. If this valve 29 is open, air will flow from the conduit 15 through the small Venturi tube 27 and by its entraining effect in flowing through said tube 27 will produce a negative pressure on the adjacent (or non-valve) side of the diaphragm 23 with the result that the diaphragm will move the valve 22 to closed position. Under ordinary operating conditions the valve 29 in the pipe 28 will be held closed by means including a diaphragm 30 connected to the valve 29 and a pipe 31 leading from the air conduit 15 at the downstream side of the valve 17. The area of the diaphragm 30 is many times greater than the area of the valve 29 in order that the pressure of the air in the conduit 15 at the downstream side of the valve 17 may reach a low value before the pressure in the air conduit at the upstream side of the valve 17 can open the valve 29 and thereby permit air to flow to the small Venturi tube 27 for the purpose of causing the governor valve 22 to close. By way of illustration, suppose that the air in the conduit 15 at the upstream side of the valve 17 is one pound. The relative areas of the valve 29

and the diaphragm 30 would then be so proportioned that a pressure of say one inch of water in the conduit 15 at the downstream side of the valve 17 would suffice to hold the valve 29 closed. This is equivalent to saying that the valve 17 in the air conduit 15 may be moved toward closed position to such degree that so long as the air pressure at the downstream side of the valve 17 does not fall below one inch of water, the valve 29 in the pipe 28 will remain closed and thereby permit the gas governor to function normally until such time as the valve 17 is practically closed. As previously indicated the object of closing the governor valve 22 is to prevent the leakage of gas into the furnace when the supply of air to the Venturi mixing tube 14 is shut off or so nearly shut off as will amount to shutting off the burner 12.

Although the air conduit valve 17 has been shown as a manually operable valve, it will nevertheless be understood that it may be automatically controlled by temperature responsive means in the furnace. Such temperature responsive means will ordinarily cause the valve 17 to be fully open or fully closed. The desirability of preventing the leakage of gas into the furnace when the valve 17 is closed will be readily appreciated by those skilled in the art.

The Venturi tube 27 associated with the gas governor will ordinarily be a relatively minute affair as compared with the Venturi mixing tube 14. The valve 29 will also be a relatively small affair comparable to a needle valve. It will, therefore, be understood that the various parts in the drawing are not necessarily shown in their proper proportion with respect to each other, since the view is intended to be diagrammatic only.

From the foregoing description it will be readily appreciated that the present invention provides a relatively simple and practical way for insuring closing of the governor valve when the air supply to the Venturi mixing tube 14 is decreased to some definite value.

What I claim is:

1. In apparatus for producing and supplying a mixture of gases in substantially constant proportion and comprising a mixing tube, air and gas conduits delivering to said tube in such a way that the air in flowing through the tube tends to draw the gas into the tube, a valve in the gas conduit, a diaphragm exposed on one side to the pressure of the gas flowing to said tube and adapted to control the operation of said valve whereby to control the pressure of the gas flowing to said tube, and a shut-off valve in the air conduit, the combination with said apparatus, of means for automatically closing the gas conduit valve when the pressure difference across the air conduit valve exceeds a predetermined amount, said means comprising a suction-producing device for decreasing the pressure on that side of the said diaphragm that is not exposed to the pressure of the gas flowing to said mixing tube, and another diaphragm exposed to the pressure prevailing in the air conduit at the down-stream side of the shut-off valve therein for controlling the operation of said suction-producing device.

2. In apparatus for producing and supplying a mixture of gases in substantially constant proportion and comprising a mixing tube, air and gas conduits delivering to said tube in such a way that the air in flowing through the tube tends to draw the gas into the tube, a valve in the gas conduit, a diaphragm exposed on one side to the pressure of the gas flowing to said tube and adapted to control the operation of said valve whereby to control the pressure of the gas flowing to said tube, and a shut-off valve in the air conduit, the combination with said apparatus, of means for automatically closing the gas conduit valve when the pressure of the air in the air conduit at the down-stream side of the said valve therein decreases to a predetermined amount, said means comprising a fluid-operated suction producing device for actuating said diaphragm, a valve which when closed prevents operating fluid from flowing to said device, and a diaphragm coupled to the last mentioned valve and exposed on one side to the pressure prevailing at the down-stream side of said air valve.

3. In firing apparatus comprising a burner to which air and gas are to be delivered, the combination of a pressure-air supply line and an air shut-off valve therein, a movable element which is held in one position by the air pressure at the discharge side of said valve when the latter is open and which is held in another position by the air pressure at the intake side of said valve when the latter is closed, a gas supply line, a gas valve in said gas line which is normally open when the said air valve is open, and means controlled by said movable element for positively closing said gas valve when said air valve is moved to closed position.

4. In firing apparatus comprising a burner to which air and gas are to be delivered, the combination of a pressure-air supply line and an air shut-off valve therein, a gas supply line and a diaphragm-controlled gas valve therein, a device for producing suction at one side of said diaphragm whereby to close the gas valve whenever said suction device is actuated, and means responsive to the position of said air shut-off valve for actuating said suction device whenever said air shut-off valve is closed.

5. In the combination specified in claim 3, said movable element comprising two interconnected pressure responsive members of different pressure area, the small area member being exposed to the air pressure at the intake side of said air valve and the large area member being exposed to the air pressure at the discharge side of said air valve, whereby when the ratio of the pressure at the intake side of said air valve to the pressure at the discharge side of the same exceeds a predetermined value, said members will be moved as a unit.

HUGH B. BARBER.