

March 15, 1938.

J. C. WOODSON

2,111,484

AUTOMATIC AIR CUT-OFF FOR BURNERS

Filed Aug. 19, 1936

Fig. 1.

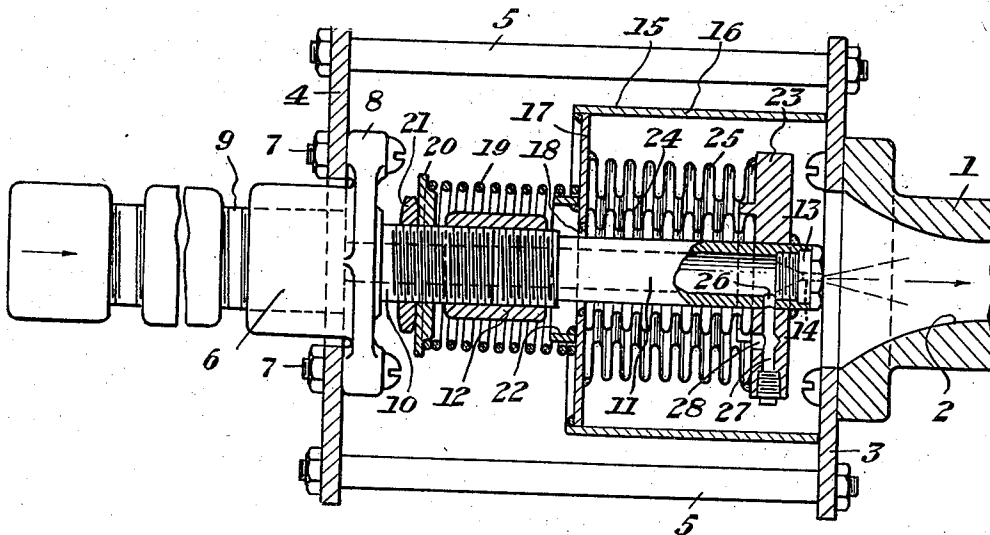
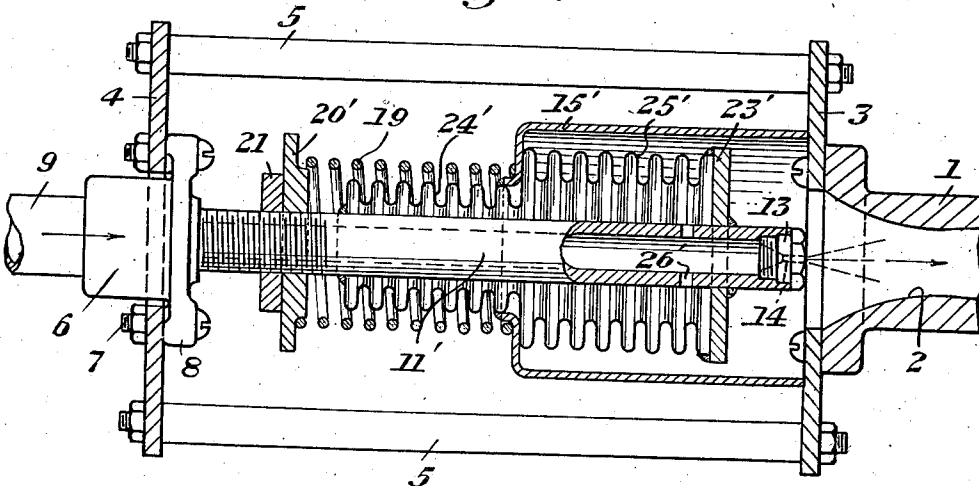


Fig. 2.



INVENTOR

James C. Woodson
by his attorneys
Stebbins, Blenko & Parmelee

UNITED STATES PATENT OFFICE

2,111,484

AUTOMATIC AIR CUT-OFF FOR BURNERS

James C. Woodson, Cleveland, Ohio, assignor to
Lee Wilson, Cleveland, Ohio

Application August 19, 1936, Serial No. 96,806

2 Claims. (Cl. 158—119)

This invention relates to a fuel burner and, in particular, to a device for automatically controlling the amount of air supplied to support combustion.

5 Radiant tubes heated by combustion gases passing therethrough have proved highly successful for general heating applications, such as the annealing furnace described and claimed in United States patent to Wilson No. 1,952,402. It has been found, however, that when such apparatus is operated at a relatively low rate, the induction of air through the radiant tubes caused by natural draft abstracts an excessive amount of heat and prevents efficient operation.

15 It is an object of my invention to provide means for preventing the induction of excessive amounts of cold air through radiant heating tubes, and the resulting loss of heat. In accordance with my invention, I provide a movable valve or closure member for restricting the inflow of air to the burner when operating under low fuel pressures. The closure member may conveniently take the form of a cup adapted to abut with its edge a flange plate extending from the inspirator tube usually incorporated in fuel burners to induce air for combustion therein. Fuel is supplied to the inspirator by a nozzle, and I mount the cup or closure on the nozzle for movement relative thereto. An expansible chamber subject to the pressure of the fuel in the nozzle serves to move the cup to the position in which it permits free induction of air, when the fuel pressure is at a maximum. At lower fuel pressures, the cup moves to partially or completely closed position under the influence of a closing spring.

25 A preferred form of the invention and a modification thereof are illustrated in the accompanying drawing to which reference is made for a complete understanding of the invention. In the drawing,

Fig. 1 is a longitudinal sectional view through the device of my invention, parts being shown in elevation; and

45 Fig. 2 is a similar view of a modification.

50 An inspirator tube 1 having a Venturi throat 2 is adapted to deliver a combustible mixture of fuel and air to a heat exchange tube (not shown) for combustion therein. The end of the inspirator 1 projects a short distance into the heat exchange tube. A flange plate 3 is secured to the inspirator tube and has an opening in alignment with the Venturi throat thereof. An end plate 4 is connected to the flange plate 3 by means of tie rods 5 and has a central opening through

which a threaded sleeve 6 extends, being secured thereto by bolts 7 extending through ears 8 formed on the sleeve. A fuel-supply connection 9 is threaded into the outer end of the sleeve 6.

A nipple 10 is threaded into the inner end of the sleeve 6 and carries a nozzle 11 being connected thereto by a coupling 12. The nozzle 11 has a tip 13 with a central bore 14 which is adapted to deliver a jet of fuel into the throat of the inspirator tube 1 when fuel under pressure is delivered to the connection 9.

A cup 15 having a cylindrical side wall 16 and a rear wall 17 is adapted to engage the flange plate 3 with its edge. The cup 15 is disposed coaxially with the nozzle 11, the wall 17 thereof having an opening 18 through which the nozzle extends. The edge of the cup 15 is normally urged against the plate 3 by a compression spring 19 disposed between a washer 20 backed up by a nut 21 threaded on the nipple 10 and the rear wall 17 of the cup 15. A collar 22 extending around the opening 18 in the rear wall 17 of the cup 15 provides a seat for the spring 19.

A plate or disc 23 is secured on the nozzle 11, having a hole through which the nozzle extends. Coaxial bellows 24 and 25 are secured at opposite ends to the plate 23 and the wall 17 of the cup 15. These bellows define an annular expansible chamber. The nozzle 11 has a port 26 in alignment with a radial passage 27 in the plate 23. An axial passage 28 in the latter intersecting the radial passage admits fuel from the nozzle 11 to the annular chamber defined by the bellows.

It will be apparent from the foregoing description that when the fuel supplied to the nozzle 11 is under sufficient pressure, the bellows 24 and 25 will extend against the pressure of the spring 19, and move the cup 15 away from the flange plate 3. Air for combustion may then be induced into the inspirator 1 through the space between the plate 3 and the edge of the cup 15. The size of this space and the amount of air induced therethrough will vary with the pressure under which the fuel is supplied. This is determined by the setting of the burner-control valve (not shown). On a decrease in the fuel pressure resulting from partial closing of the control valve, for example, the spring 19 will partially collapse the bellows 24 and 25 and cause the edge of the cup 15 to move toward the plate 3, thus restricting the induction of air into the inspirator tube in accordance with the decreased fuel pressure. When the control valve is entirely closed, the edge of the cup 15 will engage the plate 3 and

entirely cut off flow of air through the inspirator and heat exchange tube which would otherwise result from the natural draft due to the heated condition of the radiant tube.

5 Fig. 2 illustrates a modification in which several elements are the same as those of Fig. 1, or similar thereto, and these have been designated by the same reference numerals. The device of Fig. 2 includes a nozzle 11' on which a disc 23' is mounted. A valve or closure member in the form of a cup 15' is movably mounted on the nozzle 11, a bellows 25' having one end secured to the disc 23', and the other end to the rear wall of the cup 15'. Another bellows 24' has one end attached to the rear wall of the cup 15' and the other end to the nozzle 11'. The bellows 24' merely provides a seal between the cup 15' and the nozzle 11, and does not affect the expansion of the bellows 25' under the pressure of the fluid fuel. Ports 26' in the tube 11' admit fuel from the nozzle to the space within the bellows.

The operation of the device of Fig. 2 is similar to that of the apparatus shown in Fig. 1, and no additional explanation thereof is necessary.

25 It will be clear from the above description that my invention provides a simple and comparatively inexpensive device for automatically controlling the amount of air induced into a radiant tube for combustion therein, in accordance with the pressure under which the fuel is supplied and, therefore, the amount of fuel available for combustion. The apparatus serves not only to proportion the amount of air induced to the amount of fuel available, so as to obtain efficient combustion at all times, but prevents the loss of heat resulting from the induction of an excessive amount of cold air through the heated radiant tube.

40 Although I have illustrated and described but one preferred embodiment of the invention and a modification thereof, it will be understood that

changes in the exact details of construction herein disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a fuel feed and air cut-off apparatus for cooperation with an inspirator tube, the combination with a fuel injector nozzle spaced from one end of said tube whereby to discharge a fuel jet into the tube and induce air into the latter from the space thereabout with the fuel, and a flange extending outwardly from one end of the tube, of a cup arranged coaxially of said nozzle with its rim adjacent said flange, an expansible chamber through which the nozzle extends, the end of the chamber adjacent the discharge end of the nozzle being secured to the latter, and means providing communication between the nozzle and the chamber, said cup being secured to said chamber at a point spaced from the fixed end of the latter for movement away from said flange when said chamber expands under the pressure of the fuel supplied to the nozzle.

2. A fuel feed and air cut-off device for cooperation with an inspirator tube comprising a fuel nozzle positioned to direct a jet into said tube, a flange extending outwardly from one end of the tube and having an opening therethrough in line with the tube, a cup disposed coaxially with the nozzle and extending back therealong from the discharge end of the nozzle, the rim of the cup being disposed adjacent said flange, and an expansible chamber subject to the pressure of the fuel supplied to said nozzle, said chamber having one end fixed to the nozzle adjacent the discharge end thereof, and said cup being secured to said chamber at a point spaced from the fixed end thereof for movement away from said flange on expansion of said chamber.

JAMES C. WOODSON.