Sept. 8, 1964 W. L. LIVINGSTON ETAL 3,147,795

BURNER UTILIZING AN EDDY PLATE FOR PROPER MIXING OF FUEL AND AIR

Filed Dec. 27, 1961

FIG. 1

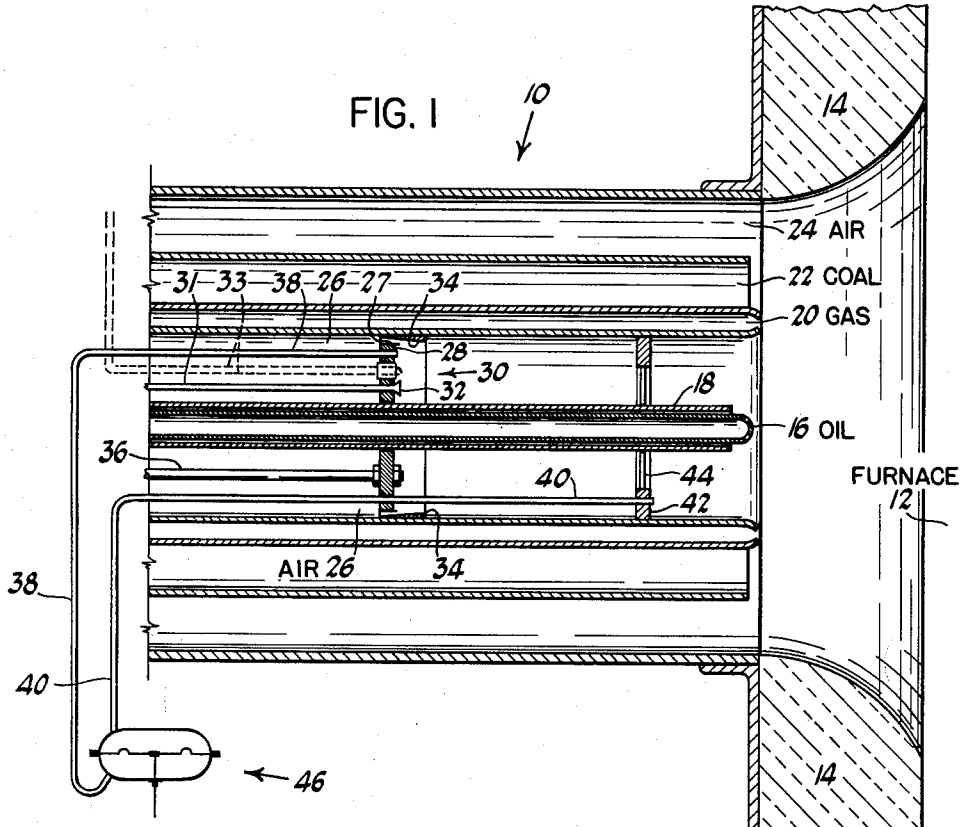
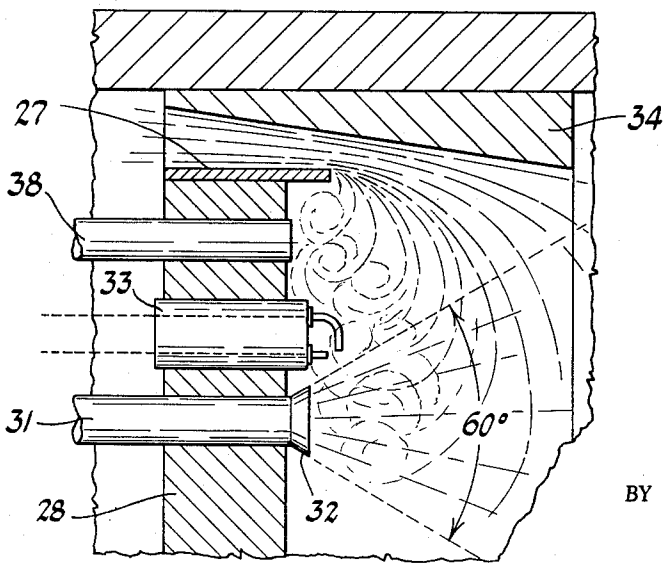


FIG. 2



INVENTORS:
WILLIAM L. LIVINGSTON
LESTER G. SHARP

BY

C. F. Bryant

ATTORNEY

United States Patent Office 3,147,795 Patented Sept. 8, 1964

3,147,795

BURNER UTILIZING AN EDDY PLATE FOR PROPER MIXING OF FUEL AND AIR

William L. Livingston, Bloomfield, and Lester G. Sharp, East Granby, Conn., assignors to Combustion Engineering, Inc., Windsor, Conn., a corporation of Delaware

Filed Dec. 27, 1961, Ser. No. 162,358
6 Claims. (Cl. 158—28)

This invention relates to a fuel burner and in particular to a fuel burner which accomplishes a thorough mixing of the combustion air with the fuel, so that a stable flame is established. This is especially significant in an igniter, or pilot burner, the purpose of which is to establish ignition of, or maintain ignition of, the fuel in a main burner.

It is an object of this invention to provide a pilot burner which has a stable flame by providing a thorough mixing of the fuel and air therefore.

It is a further object to provide a burner that is located a distance from the furnace, and is shielded from the heat therefrom, so that the spark plug of the pilot burner is not damaged by overheating.

It is a still further object to provide a burner whereby the size of the flame can be varied, and also the position of the flame can be varied.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein FIGURE 1 is a cross-sectional side view of a burner unit; and FIGURE 2 is an enlarged partial view of the apparatus shown in FIGURE 1.

Looking now to the drawings, numeral **10** designates a main burner unit secured or attached to the wall **14** of furnace **12** in any suitable manner. The main burner can use any of a number of different fuels. As illustrated, oil can be supplied through the centrally located oil gun **16**, which is slidable within oil gun guide pipe **18**. Gas can be supplied by means of annular passage **20**, and pulverized coal by means of annular passage **22**. The combustion supporting medium, air, flows through annular passage **24** in a spinning motion, so that it mixes well with whatever fuel is being burned in the main burner **10**.

Passage **24** supplies the air for combustion of the main fuel, whether it be oil, gas, or pulverized coal. The spinning motion of the air can be caused by any suitable structure, for example by vanes positioned in the inlet to passage **24**. The pulverized coal is caused to spin in the same manner as the air.

In order to initially ignite the main fuel, or to maintain burning thereof, for example when firing at low loads where a minimum amount of fuel is fired and flame stability is thus difficult, a pilot torch or burner **30** is positioned in the annular space between the oil gun guide pipe and the main burner gas pipe. Air, from a source independent of that supplied the main burner, is furnished to the pilot burner by means of passageway **26**. Oil is introduced by means of pipe **31** and nozzle **32**. Spark plug **33**, when energized, furnishes the spark necessary to ignite the air and fuel of the pilot burner.

A proper and thorough mixing of the fuel and air in the pilot burner is assured by means of eddy plate **28**, there being a restricted annular space between the plate **28** and the inner wall of passage **20**. Eddy currents are set up in the air as it flows past the edge of cylindrical member **27**, which forms part of the eddy plate **28**, as best seen in FIGURE 2, causing a small portion of the air to mix with the particles or droplets of oil issuing from tip or nozzle **32**, and thus a stable flame exists downstream of eddy plate **28**. This flame is not exposed to the high velocity flow of the main portion of the air flowing through

passageway **26**, which flows past the eddy plate substantially in the form of a hollow cylinder having a radius equal to that of the pipe, and thus there is no possibility that it will be extinguished or blown out by such high velocity air.

Apparatus **46** is a flame indicating device that indicates whether or not a flame is present in the pilot burner. The pressure differential between a point adjacent plate **28** and a point further downstream, adjacent ring **42**, is measured by apparatus **46** by means of pressure taps **38** and **40**, respectively. The pressure differential between these points is greater when a flame exists than when no flame exists. The operation of this device is more fully explained in U.S. application Serial No. 771,375 of W. L. Livingston.

Annular ring **42** is supported and maintained in position by means of three equally spaced legs **44**, there being passages therebetween. Besides acting to position pressure tap **40**, annular ring **42** also acts as a shield to prevent heat radiation from furnace **12** to burner **30**, which heat could damage the spark plug **33**.

Eddy plate **28** is positioned approximately one and one half feet from the furnace **12** so as to prevent damage to the spark plug due to heat radiation from the furnace. In order to have the pilot flame extend into the furnace a sufficient distance to properly ignite the fuel and air of the main burner, the fuel issues from nozzle **32** in such a manner that the main portion of such fuel does not start to burn until it is a substantial distance from the eddy plate, for example midway between the eddy plate **28** and annular ring **42**. This can be accomplished by having the fuel issue from nozzle **32** in a spray having approximately a 60° included angle, as shown in FIGURE 2. By replacing nozzle **32** with one having a different sized opening, it is possible to have the main portion of the fuel ignited at any point desired downstream of the eddy plate.

It is well known that it is much more difficult to ignite and maintain combustion of pulverized coal than it is for oil or gas. For this reason a larger pilot flame is needed when the main burner fuel is pulverized coal, and thus more fuel and air must be supplied to the pilot burner.

In order to accomplish this varying air supply for the pilot burner and still maintain a constant pressure drop across the eddy plate, thus having the desired eddy currents, a cammed annular ring **34** is fixed to the gas pipe wall. Eddy plate **28** is slidable on oil gun guide pipe **18**, and can be moved towards and away from the cammed surface **34** by means of rod **36**, thereby varying the size of the restricted annular space between the plate and the cammed surface. Thus when oil or gas are supplied to the main burner, and less fuel and air are being supplied to the pilot burner, plate **28** is moved forward, closer to the cammed surface **34**, thereby reducing the size of the annular opening, and maintaining eddy currents of air sufficient to provide a proper mixing thereof with the fuel so that a stable flame exists downstream of the eddy plate.

In operation, air is initially supplied to pipe **26**, and the position of the eddy plate is adjusted to obtain the desired pressure drop thereacross. The spark plug **33** is energized, and then fuel is supplied to nozzle **32** through pipe **31**, thereby establishing the pilot flame. At this time, the spark plug **33** can be de-energized, and the main burner fuel is introduced, it being ignited by means of the pilot burner flame. The ring **42** helps prevent radiation of heat from the furnace to the spark plug **33**, which heat could damage or burn up the electrodes of the plug.

While we have shown and described the preferred embodiment of the invention it is to be understood that the invention is not limited thereto but may be otherwise

variously embodied and practiced within the scope of the following claims.

What we claim is:

1. In combination a furnace, a burner unit attached to the furnace, said burner unit comprising: a first pipe to which main fuel is supplied, a second pipe concentric with and surrounding said first pipe, through which air flows, a third pipe concentric with and surrounding said second pipe and adapted to conduct air for supporting combustion of the main, an eddy plate surrounding first pipe and extending radially to a position closely adjacent to the inner wall of said second pipe so as to form a restricted annular passage therebetween, a fourth pipe extending through the annular space between said first and second pipes having an outlet positioned downstream of and adjacent to said eddy plate, through which fuel is supplied, the air flowing past the eddy plate supporting combustion of the fuel supplied through the fourth pipe, and ignition means in the annular space between the first and second pipes positioned downstream of and adjacent to said eddy plate for igniting the fuel flowing through said fourth pipe, whereby the fuel flowing through the fourth pipe forms a pilot for igniting the main fuel flowing through the first pipe.

2. The combination set forth in claim 1, including flame detecting means positioned in the annular space between said first and second pipes downstream of said eddy plate.

3. The combination set forth in claim 2, including means for adjusting the size of the restricted annular passage between the eddy plate and the inner wall of said second pipe.

4. The combination set forth in claim 3 including means positioned within the second pipe downstream of the eddy plate for protecting the ignition means from radiant heat within the furnace.

5. In combination a furnace, a burner unit attached to the furnace, said burner unit comprising: a first pipe to which main fuel is supplied, a second pipe surrounding said first pipe, through which air flows, a third pipe surrounding said second pipe and adapted to conduct air for supporting combustion of the main fuel, an eddy plate surrounding said first pipe and extending radially to a position closely adjacent to the inner wall of said second pipe so as to form a restricted passage therebetween, a fourth pipe extending through the space between said first and second pipes having an outlet positioned downstream of and adjacent to said eddy plate, through which fuel is supplied, the air flowing past the eddy plate supporting combustion of the fuel supplied through the fourth pipe, and ignition means in the space between the first and second pipes positioned downstream of and adjacent to said eddy plate for igniting the fuel flowing through the fourth pipe, whereby the fuel flowing through the fourth pipe forms a pilot for igniting the main fuel flowing through the first pipe.

6. The combination set forth in claim 5, including means for adjusting the size of the restricted passage between the inner wall of said second pipe and the eddy plate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,801,431	Irish	Apr. 21, 1931
1,995,099	Herr	Mar. 19, 1935
2,284,708	Woolley	June 2, 1942
2,325,893	Vollmer	Aug. 3, 1943
2,360,548	Conway	Oct. 17, 1944

FOREIGN PATENTS

677,697	Great Britain	Aug. 20, 1952