

[54] **COMBUSTION CONTROL APPARATUS
USING A LIQUID SPRAY**

[75] Inventor: John Dunn, Mountvale, N.J.

[73] Assignee: Peabody Engineering Corporation,
New York, N.Y.

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431/187, 278, 202

[56] **References Cited**

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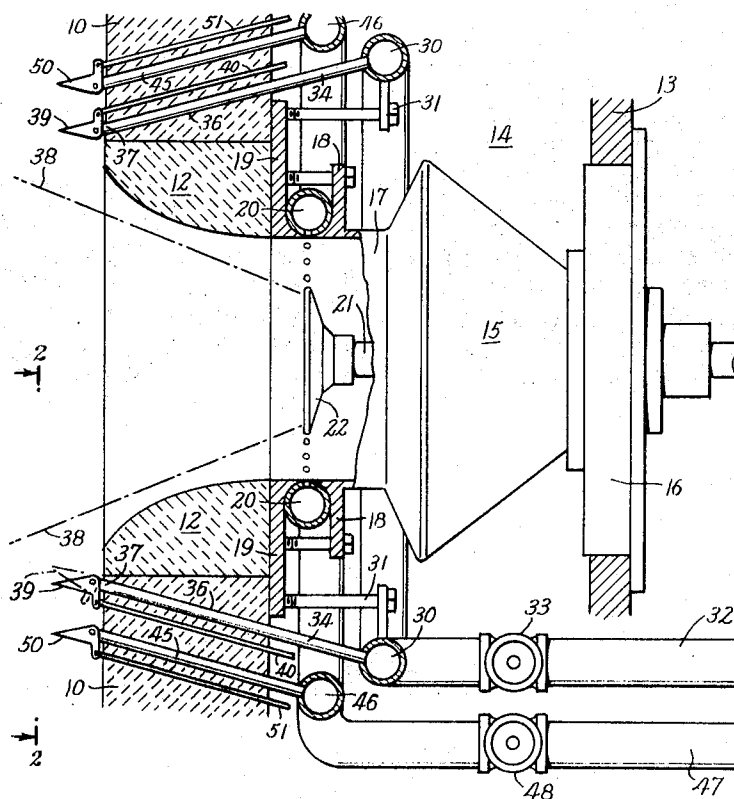
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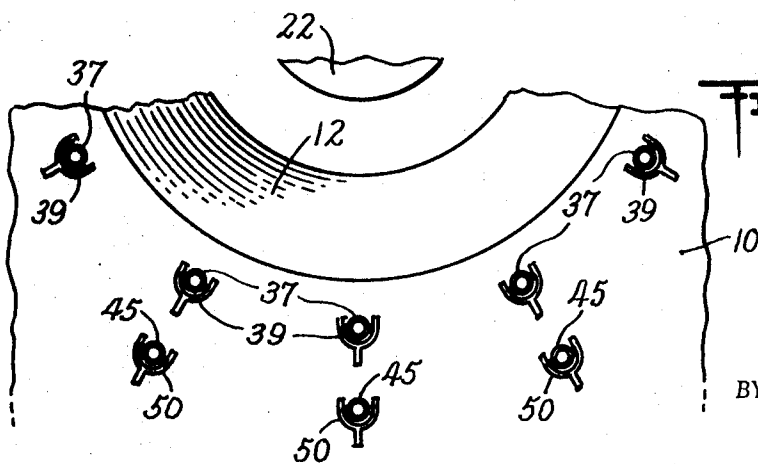
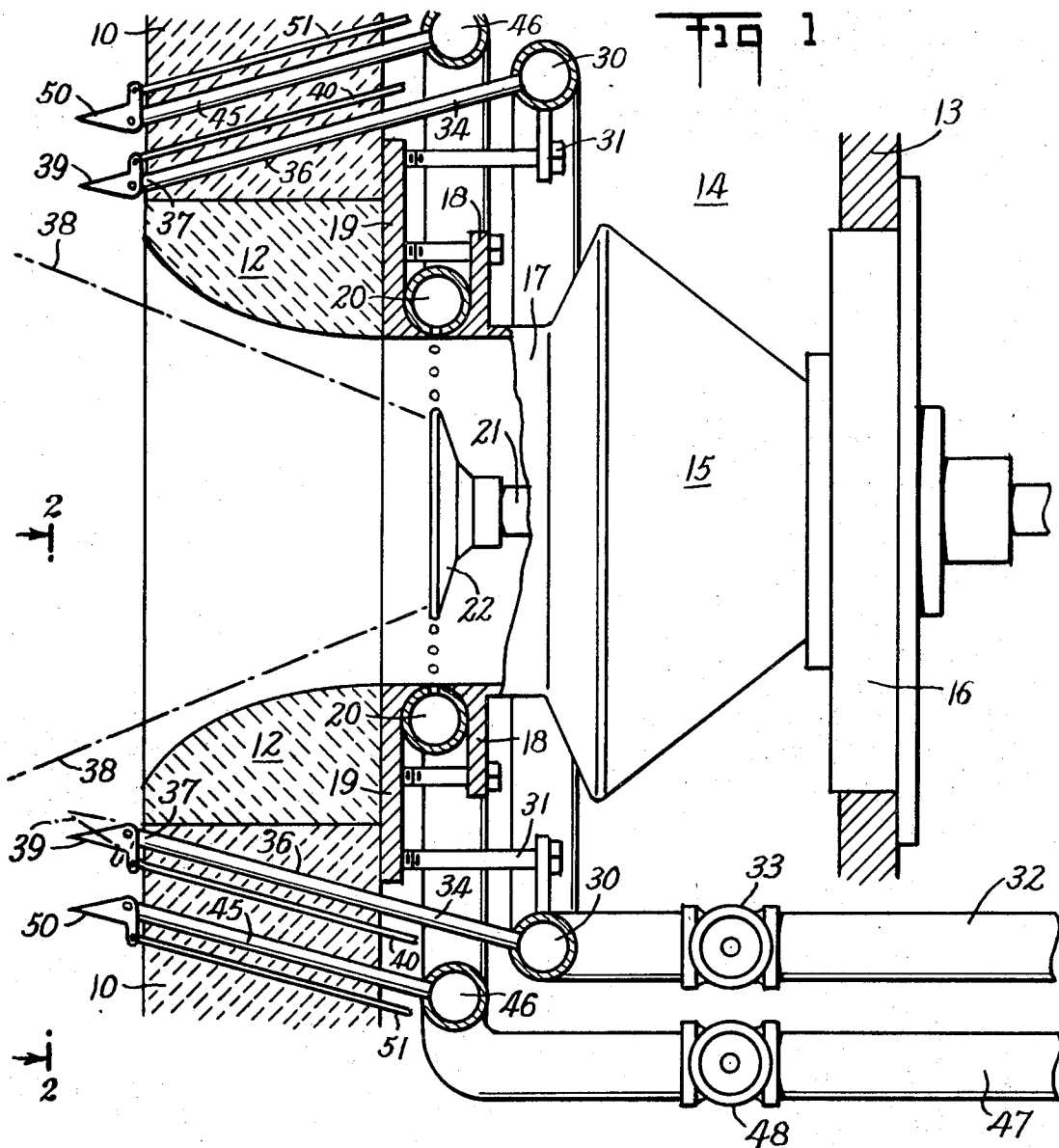
Primary Examiner—William O'Dea
Assistant Examiner—William C. Anderson
Attorney—Nathaniel L. Leek

[57] **ABSTRACT**

Combustion control apparatus for use with a burner of the type having a centrally located liquid fuel atomizer or a gas ring or center fuel gas arrangement mounted to produce a cone of flame in a combustion chamber. The control apparatus includes a ring of nozzles disposed around the burner and adapted to direct a jet or spray of water or other fluid, such as a slurry or air borne solids onto the flame and an additional duct adapted to direct a stream of air or other fluid onto the flame. The fluid is adapted to eliminate excessively hot combustion zones by cooling the flame at such zones and eliminating temperature peaks for thereby increasing the period of combustion in the chamber so as to reduce or eliminate the formation of undesirable oxidation products which are formed at high temperature.

9 Claims, 2 Drawing Figures





INVENTOR.
John Dunn
 BY
W. L. Leek
 ATTORNEY

COMBUSTION CONTROL APPARATUS USING A LIQUID SPRAY

This invention relates to combustion control apparatus and has for an object to control the period of combustion in a manner to eliminate or reduce the formation of undesirable oxides.

A more specific object is to eliminate or reduce the formation of oxide as of nitrogen.

Another object is to provide means for introducing a cooling fluid or a chemical reactant into a flame at zones selected to produce the above result.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

In accordance with the present invention a ring of liquid nozzles is disposed around the throat opening of a fuel burner in such a manner that water or other liquid can be directed upon the cone of flame at various selected locations. The liquid is intended to prevent local hot zones in the flame which tend to produce undesired combustion products such as oxides of nitrogen or other elements which are known in the art to be undesirable from the standpoint of flue gas contaminants and as an indication of incomplete combustion.

The nature of the invention will be better understood from the following description, taken in connection with the accompanying drawing in which a specific embodiment has been set forth for purposes of illustration.

In the drawing:

FIG. 1 is a longitudinal section of a burner embodying the invention with parts in elevation for clarity; and

FIG. 2 is a partial elevation of the burner throat showing the arrangement of the spray and air openings of the invention.

Referring to the drawing more in detail, the burner is shown as embodying a fuel burner firing into the combustion chamber of a furnace having a wall 10 with a burner throat opening 11 formed by a ring of throat tile 12. A front wall 13 is spaced from the furnace wall 10 to form a plenum chamber 14 therebetween. The burner elements include an air register 15 having a front plate 16 secured to the front wall 13 and registering axially with a burner tube 17 having a rear flange 18 bolted to a plate 19 secured to the wall 10. Gas ring 20 of usual type for supplying gaseous fuel is secured between the flange 18 and the plate 19 adjacent throat opening 11. A fuel barrel 21 of the type carrying gaseous liquid or pulverized fuel extends axially through the air register 15 and burner tube 17 with an atomizing tip 22 disposed axially at the burner throat 11.

The elements thus far described are of standard construction and only so much thereof has been shown as is necessary for an understanding of the invention.

For the purpose above described a liquid ring 30 is disposed around the burner throat opening 11 and spaced radially outwardly from the gas ring 20. The liquid ring 30 is secured to the plate 19 by suitable means shown as bolts 31 and is supplied with water or other fluid through a pipe 32 having a control valve 33. A plurality of pipes 34 extend from the liquid tube 30 through axially inclined openings 36 in the wall 10 and terminate in nozzles 37 which are disposed around the throat opening 11 at an angle such that a spray of water or other fluid is directed onto the flame 38 from the burner tip 22. The angle of the spray from the nozzles 37 may be controlled by deflectors 39 which are piv-

oted to the nozzles and are controlled by rods 40 extending through the wall 10 and connected to any suitable manual or automatic control means. Deflectors 39 may be adjusted to control the radial angle of the liquid spray from the nozzles 37 so as to direct the spray onto any selected portion of the flame 38. This spray of water is adapted to control the flame temperature in a manner to reduce the formation of undesired combustion components.

For an additional control of the flame temperature and the combustion conditions a series of air ducts 45 are shown extending through the wall 10 around the throat opening 11 for admitting air from duct 47 controlled by a valve 48, a manifold 46 having an inlet duct 15 which may be connected to admit air or other fluid from any suitable source or may be open to the plenum chamber 14 for admitting air from such chamber into the ducts 45. Deflector plates 50 may be pivoted manually on the ducts 45 and controlled by rods 51 by any suitable means for controlling the angle at which the air or other fluid from the ducts 45 is discharged onto the flame 38.

In operation the deflector plates 39 and 50 are adjusted in accordance with the combustion conditions to cause the liquid or gas streams from the nozzles 37 or ducts 45 to impinge on any excessively hot portions of the flame 38 so as to reduce the temperature and retard combustion at such portions and thus increase the period of combustion in the combustion chamber to an extent suited to cause complete combustion and to avoid the formation of undesirable oxidation products.

The jet from the nozzles 37 may comprise water or a chemical composition or slurry which may be particularly adapted to control the combustion products. Likewise the jets from the ducts 45 may comprise air or a reagent or an inert gas as may be required for the above purpose. Various combustion control materials are well known in the art and may be used in the present apparatus.

What is claimed is:

1. In combination with a furnace having a wall provided with an opening forming a burner throat, a burner tube connected to supply air for combustion to said throat and a fuel barrel disposed axially of said burner tube and having a tip adapted to produce a cone of flame, a series of nozzles extending through said wall around said throat opening and adapted to project a liquid spray onto said cone of flame, an annular header disposed to supply liquid to said nozzles, and means to adjust the radial angle of said spray for controlling the zone of impingement of said liquid spray on said cone of flame.

2. Apparatus as set forth in claim 1 in which said means for adjusting the radial angle of said liquid spray comprises deflector plates disposed adjacent each nozzle to direct the spray onto selected portions of said cone of flame.

3. Apparatus as set forth in claim 2 including means for adjusting the angular positions of said deflector plates.

4. Apparatus as set forth in claim 1 including a set of gas passages extending through said wall around said throat opening adapted to direct a gas onto said cone of flame.

5. Apparatus as set forth in claim 4 including means supplying a gas to said passages and means to control the quantity of such gas.

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6. Apparatus as set forth in claim 5 in which a manifold is connected to said passages and means is provided to supply a controlled quantity of a gas to said manifold.

7. Apparatus as set forth in claim 4 in which said gas passages are peripherally displaced around said throat opening.

8. The method of controlling the flame in a fuel burner having a burner adapted to produce a cone of flame in a throat opening in a furnace wall which comprises directing a liquid spray onto said cone of flame

from a plurality of sources disposed peripherally around said throat opening and controlling the angular direction of said spray to eliminate local hot zones and to thus increase the period of combustion so as to eliminate the formation of undesirable oxides in the products of combustion.

9. The method set forth in claim 8 in which a gas is projected onto said cone of flame from a plurality of external sources disposed around said throat opening.

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