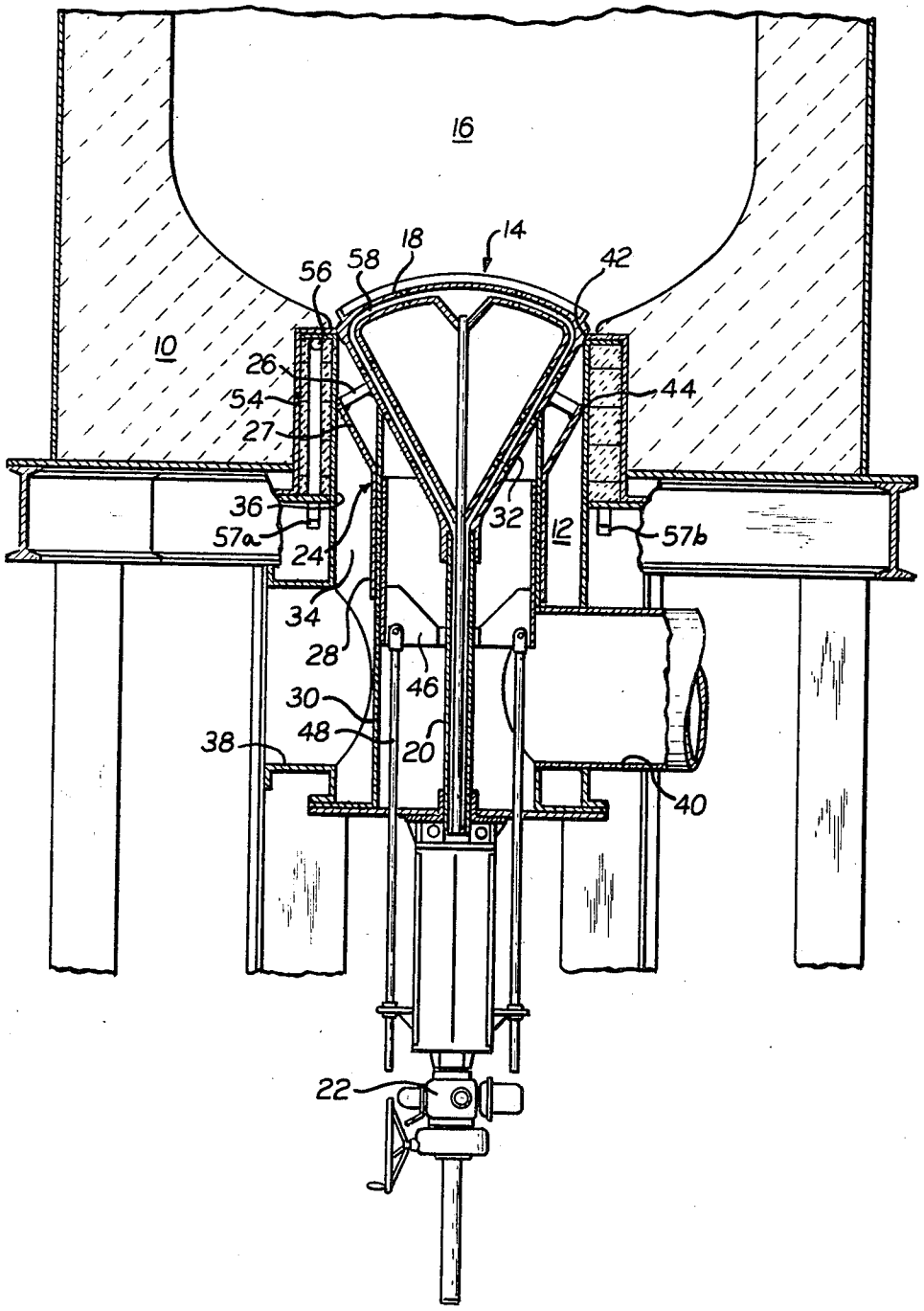
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BURNER CONSTRUCTION

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FIG. 1.



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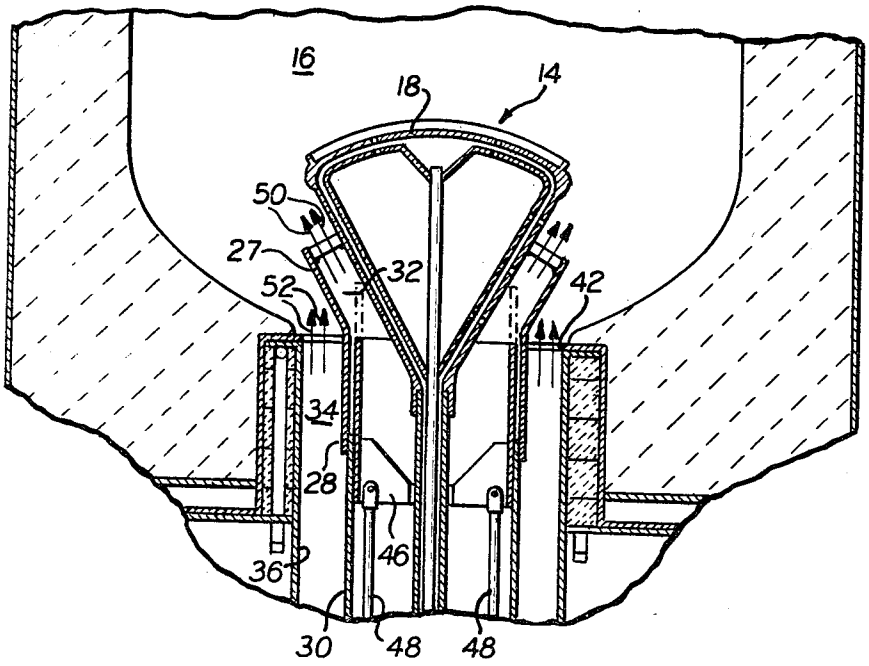
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FIG. 2.



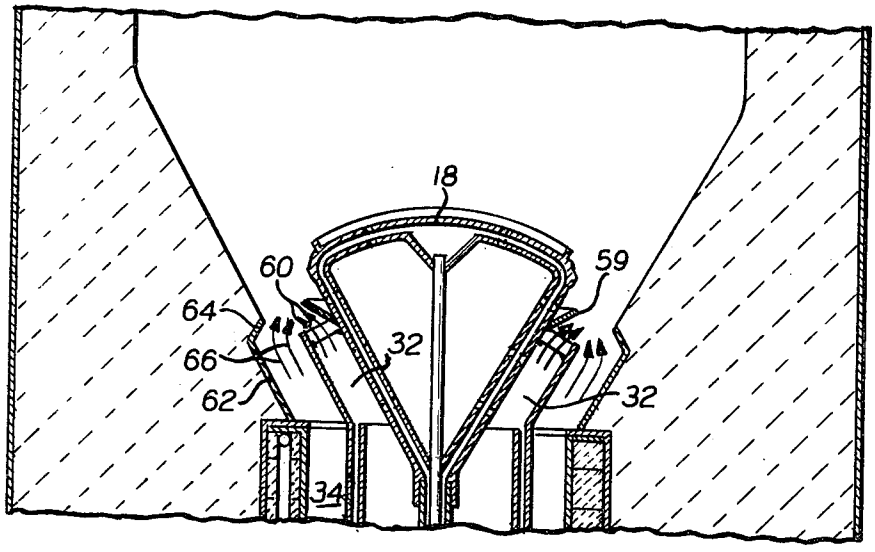


FIG. 3.

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BURNER CONSTRUCTION

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Int. Cl. F23d 15/02
U.S. Cl. 431—160 14 Claims

ABSTRACT OF THE DISCLOSURE

A burner for a hot blast stove disposed in an open chamber for admitting separate supplies of air and fuel to an area outwardly of said chamber. The burner includes an inner cone member which carries a shell in spaced relation therewith so as to define an inner passageway between the inner cone member and the shell for one of the gaseous mediums and an outer passageway between the shell and the peripheral wall of the open-chamber for the other gaseous medium. The inner cone member is axially movable from one end position thereof in which it closes the open chamber to a plurality of other positions in which both inner and outer passageways are in fluid communication with the area outwardly of the chamber. The extent of such axial movement controls the velocity of the gaseous medium through the outer passageway and a tube type valve is provided in the inner passageway to independently control the velocity of the gaseous medium therein. The shell is shaped so as to provide different directions of flow for the two gaseous mediums in order to obtain a more intimate mixing thereof.

BACKGROUND OF THE INVENTION

In conventional burner arrangements for hot blast stoves, the burner is usually positioned in such manner that the flames produced during the combustion are directed against the combustion chamber wall opposite the burner exit. This portion of the combustion chamber wall is of a critical nature because the same is subjected to very high temperatures during the ON GAS cycle of the hot blast stove and to very cold temperatures of the cold blast during the ON BLAST cycle. These significant variations in temperature, from very hot to very cold, frequently cause injury to the brick work of the combustion chamber and also cause what is known as "short circuiting" of the hot blast stove, namely, the diametrical flow of flue gas through the wall of the combustion chamber into the lower part of the stove and into the chimney so that the heat is not transferred to the brick work. When such short circuiting takes place, it is often accompanied by a deterioration of the steel support for the brick work which in turn often results in a complete breakdown of the brick work. Another serious deficiency in conventional burners is that these provide for only limited control of the path and velocity of both mediums passing through the burner, namely, air and fuel which in turn makes intimate mixing of the two mediums virtually unachieveable. Further, the inability to obtain complete mixing because of the lack of control of the flow velocities of the air and the fuel produces unfavorable conditions both as regarding the flames of combustion as well as the combustion itself.

SUMMARY OF THE INVENTION

The burner construction of the present invention eliminates the several deficiencies in conventional burner arrangements described above. In accordance with the invention, the burner comprises separate passages for the air and the fuel, respectively, with each passage being controlled independently of the other so that the velocity of each of the two mediums can be controlled independently of the other. The direction of flow of both mediums in the burner provides relative flow directions for both mediums assured to provide intimate mixing.

The above results are achieved by providing an inner cone which forms a closure member for the open chamber which leads into the combustion chamber, This inner cone has a conical shell attached thereto with an inner passageway for one of the mediums being defined between the shell and the inner cone member and an outer passageway for the other medium being defined between the shell and the peripheral wall of the open chamber. Axial movement of the inner cone member provides communication between both inner and outer passageways and the combustion chamber. The extent of axial movement controls the velocity of the medium in the outer passageway while an independently controllable tube valve controls the velocity of the medium in the inner passageway.

With such arrangement the direction of the fuel and the air into the combustion chamber is such that the flames shoot in a generally upward direction and do not touch directly the wall of the combustion chamber. Accordingly, the difference in temperature between the ON GAS and ON BLAST cycle as felt by the combustion chamber wall is far lower than in conventional prior art burner arrangements. Axially moving cone shaped members in burners per se have been used before as shown in U.S. Pat. No. 1,779,647, but without any of the additional improvements and refinements of the present construction.

The vertical burner construction in accordance with the invention, because of its arrangement, can be located in any one of a plurality of positions. For example, such burner can be installed in the dome of the stove and could also be most advantageously used in stoves with internal as well as external combustion chambers.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical cross-sectioinal view of the burner in accordance with the invention;

FIG. 2 is a view similar to FIG. 1 showing the burner in open position; and

FIG. 3 is a view similar to FIG. 2 of another embodiment of the burner.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, there is shown in FIG. 1 a portion of furnace wall **10** having an open chamber **12** in which there is mounted a burner **14**. Burner **14** comprises an inner cone member **18** having a stem **20** operatively connected to an actuator **22** for axially moving inner cone member **18** from its lowermost position as shown in FIG. 1 wherein it defines a closure for chamber **12** to selective upper positions in which an air fuel mixture controlled by the burner is admitted into combustion chamber **16**.

Inner cone member **18** is provided with a shell **24** connected in spaced relation to inner cone member **18** by means of flat iron bars **26**. Shell **24** comprises an upper conical portion **27** and a downwardly extending tubular portion **28**, the latter being in telescopically sliding relation with inner tube **30** of the burner. An inner passageway **32** is defined between inner cone member **18** and shell **24** and an outer passageway **34** is defined between shell **24** and peripheral wall **36** of chamber **12**. Inlet means **38** is in fluid communication with outer passageway **34**, and inlet means **40**, generally opposite to inlet means **38**, is in fluid communication with inner passageway **32**. Inlet

means **38** and **40** are connected to the supplies of the two mediums passing through the burner, namely, air and fuel.

In the position of the burner shown in FIG. 1, inner cone member **18** defines a closure for chamber **12**, there being provided suitable seating means **42** at the upper ends of peripheral wall **36**. Upper edge **44** of conical shell **24** is in sliding relation with peripheral wall **36** of chamber **12**. As the burner is opened in response to upward axial movement of inner cone member **18** by means of previously mentioned actuator **22**, upper edge **44** of shell **24** glides along peripheral wall **36** and, after sufficient axial movement is imparted, upper edge **44** will pass beyond seating means **42** establishing fluid communication between inner passageway **32** as well as outer passageway **34** with combusition chamber **16**.

As such axial movement continues, it will correspondingly increase the exit opening from outer passageway **34** into combustion chamber **16**. Thus, with a constant volume of fluid medium, such as for example air, being admitted through inlet means **38**, the velocity of such medium can be varied by axial movement of the inner cone member, with maximum velocity existing immediately following the passage of upper edge **44** beyond seating means **42** down to the minimum value for such velocity when the axial movement has reached its final position as shown in FIG. 2. Thus, it is seen that velocity of the medium admitted through inlet means **38** can be varied by the above described axial movement, with the desired velocity of the medium being obtained at the primary combustion zone, where the mediums of the combustion mixture are burnt.

Axial movement of inner cone member **18** also creates fluid communication between inner passageway **32** and combustion chamber **16**, whereby the fluid medium, such as for example gas, admitted through inlet means **40** passes through inner tube **30** and inner passageway **32** into the combustion chamber **16**.

As previously stated, downwardly extending tubular portion **28** of shell **24** is telescopically movable with respect to inner tube **30** of the burner. Such inner tube **30** is provided with a tube type (Rohrschieber) valve **46** which is in gliding relation with the inner periphery of tube **30**. Valve **46** is operatively connected through linkage rods **48** to actuator means for independently imparting axial movement to valve **46**. Such axial movement of valve **46** controls the velocity of the medium passing through inner passageway **32** and out into the combustion chamber. In FIG. 2, valve **46**, as shown by the full lines, is in its lowest position in which the fluid medium admitted through inlet means **40** passes into combustion chamber **16** through passageway **32** at a maximum section thereof to provide minimum medium velocity. The uppermost position of valve **46** is shown by the dashed lines in FIG. 2.

By means of the arrangement and construction of burner **14** is aforedescribed, it is clear that the velocity of both mediums admitted into combustion chamber **16** are adjustable, independently of each other, to the optimum values as may be dictated by the requirements of the blast furnace operation. As best shown in FIG. 2 the fluid medium introduced into combustion chamber **16** through inner passageway **32** is in an oblique direction as indicated by arrow **50**. On the other hand, the fluid medium introduced into combustion chamber **16** through outer passageway **34** is in the direction of arrows **52**. The difference in the directions of both mediums forms a whirling motion resulting in a thorough and intimate mixing of the two mediums. Thoroughness of the mixing is further increased by the exact control of the velocity of both fluid mediums available in accordance with the burner construction for the reasons described above. The net result obtained is nearly complete combustion and most efficient operation of the burner.

The burner in accordance with the present invention also enables the provision of convenient cooling means for the burner elements. More specifically, a peripheral passageway **54** is defined in surrounding relation with chamber **12** in which passageway there is provided spiral guide means **56** which is connected to a circulating cooling system, which enables the passage of a coolant at a high velocity around peripheral wall **36** of chamber **12**, which coolant is admitted as at **57***a* and exits as at **57***b*. It will also be noted that the peripheral walls of inner cone member **18** are hollow, defining a passageway **58** through which a coolant can be circulated, which coolant is admitted and exits through suitable passages in stem **20**.

FIG. 3 represents a modification of the burner construction of FIG. 1, in accordance with which a more intimate and thorough mixing of the two fluids is obtained. The burner construction in FIG. 3 is substantially identical to that of FIG. 1 and is further provided with a circumferential baffle **59** on inner cone member **18**, slightly above the upper end of inner passageway **32**. Baffle **59** performs the function of deflecting the gas which exits from inner passageway **32** so that it travels in the direction shown by arrow **60**. In conjunction with such modified burner construction, furnace wall **10** is also modified to define immediately above chamber **12** a diverging section **62** generally parallel to upper conical portion **27** and a converging section **64**. Such modified furnace wall conformation directs the air exiting out of outer passageway **34** in the direction shown by arrow **66**. The modifications in burner construction and furnace wall conformation shown in FIG. 3 cause the two mediums entering the combustion chamier to travel in directions generally perpendicular to each other resulting in increased thoroughness of mixing as compared to the embodiment in FIGS. 1 and 2 in which the air and gas confront each other at an angle substantially less than 90 degrees. With the arrangement shown in FIG. 3 the two medium velocities can be adjusted and a thoroughness of mixing can be obtained so as to produce a desirable short flame not produceable in the embodiments of FIGS. 1 and 2.

While we have herein shown and described the preferred embodiments of our invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that in the illustrated embodiments certain changes in the details of construction and in the form and arrangement of parts may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A burner disposed in an open chamber for admitting separate supplies of a pair of gaseous mediums to an area outwardly of said chamber comprising,

(a) an inner cone member,

(b) a shell carried by said inner cone member in spaced relation therewith whereby to define an inner passageway between said inner cone member and said shell and an outer passageway between said shell and the peripheral wall of said chamber,

(c) said inner cone member being axially movable to a plurality of positions in which said inner and outer passageways are in fluid communication with said area outwardly of said chamber,

(d) said shell having an upper conically shaped portion for providing different directions of flow for said gaseous mediums admitted into said area from said inner and outer passageways, respectively, whereby intimate mixing of said mediums is obtained,

(e) said peripheral wall of said open chamber being cylindrical whereby the size of the opening of said outer passageway into said area is controlled by the extent of said inner cone member axial movement for correspondingly adjusting the velocity of the gaseous medium admitted through said outer passageway, and

(f) a valve provided in said inner passageway for independently controlling the velocity of the gaseous medium flowing therethrough.

2. A burner disposed in an open chamber for admitting separate supplies of a pair of gaseous mediums to an area outwardly of said chamber comprising,

(a) an inner cone member,

(b) a shell carried by said inner cone member in spaced relation therewith whereby to define an inner passageway between said inner cone member and said shell and an outer passageway between said shell and the peripheral wall of said chamber,

(c) said inner cone member being axially movable to a plurality of positions in which said inner and outer passageways are in fluid communication with said area outwardly of said chamber,

(d) said shell having an upper conically shaped portion for providing different directions of flow for said gaseout mediums admitted into said area from said inner and outer passageways, respectively, whereby intimate mixing of said mediums is obtained,

(e) said peripheral wall of said open chamber being cylindrical whereby the size of the opening of said outer passageway into said area is controlled by the extent of said inner cone member axial movement for correspondingly adjusting the velocity of the gaseous medium admitted through said outer passageway,

(f) a fixed inner tube defining a partition between said inner and outer passageways,

(g) said shell having a lower tubular portion in telescoping relation with said inner tube for guiding said shell during axial movement of said inner cone member, and

(h) a tube type valve provided for movement along the inner surface of said inner tube for controlling the velocity of the gaseous medium flowing through said inner passageway.

3. A burner in accordance with claim 2, wherein said area outwardly of said chamber is the combustion chamber of a hot blast stove and wherein said gaseous mediums comprise air and fuel, respectively, and wherein said inner cone member is axially movable to a position in which it defines a closure between said open chamber and said combustion chamber.

4. A burner disposed in an open chamber for admitting separate supplies of a pair of gaseous mediums to an area outwardly of said chamber comprising,

(a) an inner cone member,

(b) a shell carried by said inner cone member in spaced relation therewith whereby to define an inner passageway between said inner cone member and said shell and an outer passageway between said shell and the peripheral wall of said chamber,

(c) said inner cone member being axially movable to a plurality of positions in which said inner and outer passageways are in fluid communication with said area outwardly of said chamber,

(d) said shell having an upper conically shaped portion for providing different directions of flow for said gaseous mediums admitted into said area from said inner and outer passageways, respectively, whereby intimate mixing of said mediums is obtained,

(e) said peripheral wall of said open chamber being cylindrical whereby the size of the opening of said outer passageway into said area is controlled by the extent of said inner cone member axial movement for correspondingly adjusting the velocity of the gaseous medium admitted through said outer passageway,

(f) said area outwardly of said chamber being the combustion chamber of a hot blast stove and said gaseous mediums comprising air and fuel, respectively, and

(g) a baffle provided on said inner cone member adjacent the exit of said inner passageway for deflecting the gaseous medium exiting from said inner passageway in a direction away from said inner cone member.

5. A burner in accordance with claim 4, wherein the combustion chamber wall adjacent the exit of said outer passageway includes portions for deflecting the gaseous medium exiting from said outer passageway in a direction away from said wall.

6. A burner in accordance with claim 3, wherein a baffle is provided on said inner cone member adjacent the exit of said inner passageway for deflecting the gaseous medium exiting from said inner passageway in a direction away from said inner cone member, and wherein the combustion chamber wall adjacent the exit of said outer passageway includes portions for deflecting the gaseous medium exiting from said outer passageway in a direction away from said wall.

7. A burner in accordance with claim 6, wherein the inner cone member includes a peripheral passageway for passing a cooling medium therethrough, and wherein cooling means are provided externally of said open chamber.

8. A burner in accordance with claim 1, wherein there is further provided a fixed inner tube defining a partition betweeen said inner and outer passageways, and wherein said shell has a lower tubular portion in telescoping relation with said inner tube for guiding said shell during axial movement of said inner cone member.

9. A burner in accordance with claim 1, wherein said area outwardly of said chamber is the combustion chamber of a hot blast stove and wherein said gaseous mediums comprise air and fuel, respectively.

10. A burner in accordance with claim 1, wherein said inner cone member is axially movable to a position in which it defines a closure for said open chamber.

11. A burner in accordance with claim 9, wherein said inner cone member is axially movable to a position in which it defines a closure between said open chamber and said combustion chamber.

12. A burner in accordance with claim 9, wherein the direction of flow of said mediums results in flames of combustion directed away from the wall of said combustion chamber.

13. A burner in accordance with claim 1, wherein the inner cone member includes a peripheral passageway for passing a cooling medium therethrough.

14. A burner in accordance with claim 13, wherein cooling means are provided externally of said open chamber.

References Cited

UNITED STATES PATENTS

1,490,008	4/1924	Hetsch	239—414
3,126,941	3/1964	Mohr et al.	431—160

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U.S. Cl. X.R.

239—407, 416.4; 431—181, 189, 348