March 6, 1962 D. E. BENSON ET AL 3,024,014

HOT BLAST STOVES

Filed Nov. 25, 1958

Fig. 1.

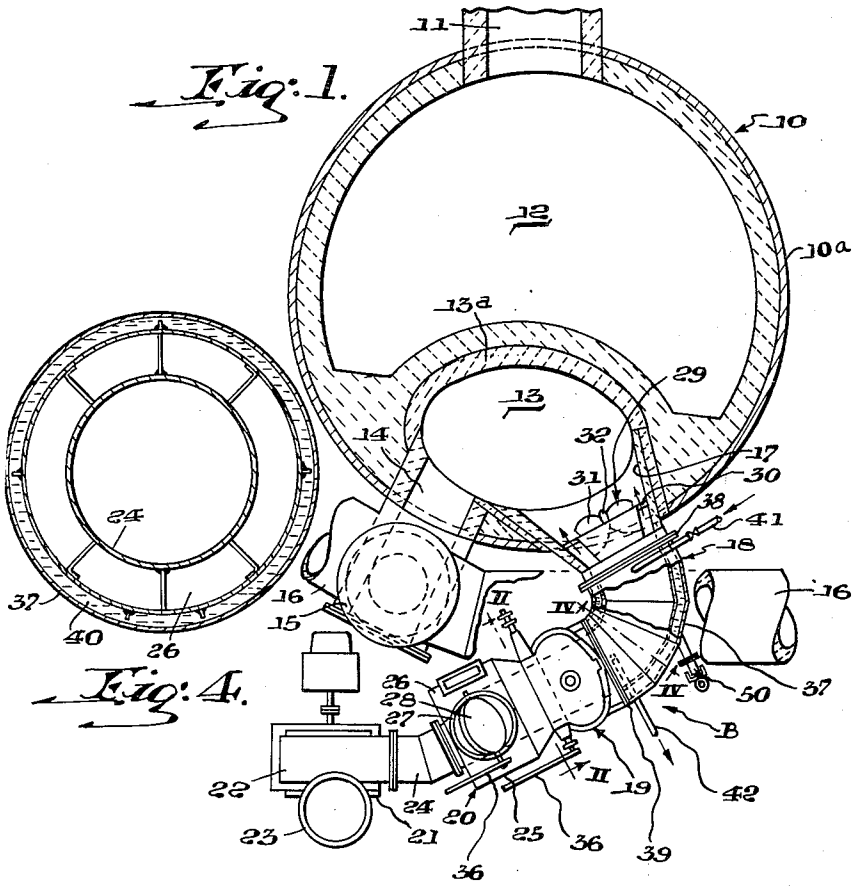


Fig. 4.

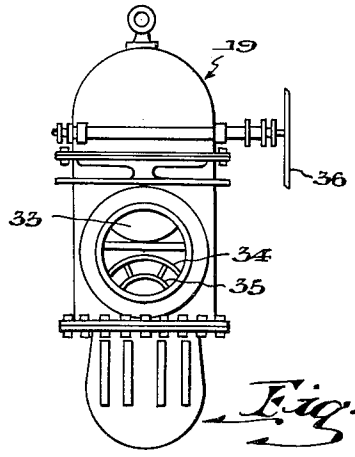


Fig. 2.

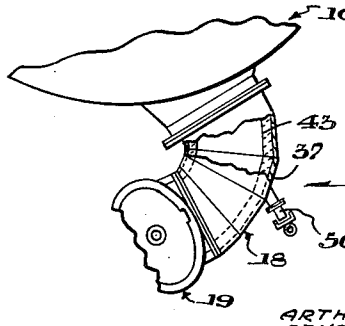


Fig. 3.

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United States Patent Office

3,024,014

Patented Mar. 6, 1962

1

3,024,014

HOT BLAST STOVES

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Filed Nov. 25, 1958, Ser. No. 776,328

5 Claims. (Cl. 263—19)

This invention relates to hot blast stoves employed in blast furnaces for preheating the charge of air used therein, and more particularly, to an improved hot blast stove characterized by a novel burner for introducing the gaseous fuel and air mixture into the stoves.

Hot blast stoves conventionally comprise a burner through which a mixture of combustible gas and air is introduced through a burner intake into the combustion chamber of the stoves. The flow of gas and air into the combustion chamber is controlled by a valve commonly known as a burner shutoff valve located in the burner housing between the burner head and an air and gas supply main. Cold blast air, from a source separate from the combustion air provided for the burner, is introduced under pressure into the stove and is raised to a temperature of above 2000° F. This heated air is known as hot blast and leaves the stove combustion chamber through a hot blast outlet connected to the hot blast main. Flow of the hot blast from the combustion chamber is controlled by a hot blast valve located exterior to the stove in a connection between the stove hot blast outlet and the hot blast main. In the United States, the design and structure of the hot blast stove is such that the hot blast outlet is generally located below, above, or in close proximity to the burner opening into the stove combustion chamber. When the hot blast outlet is located below or adjacent to the burner opening into the combustion chamber, the hot blast flows past the burner opening in a manner such that the burner shutoff valve is subjected to excessive heating from radiation and convection. This excessive heating of the valve is undesirable since it causes operating difficulties and may cause failure of the valve.

It is an object of the present invention to provide a new and improved stove burner installation which avoids the difficulties encountered heretofore.

By the present invention, it is proposed to construct a burner in a manner such that the transfer of heat from the hot blast in the combustion chamber to the burner shutoff valve is substantially minimized. To this end, the burner shutoff valve is angularly disposed with respect to the axis of the burner inlet into the stove and an angularly bent burner connector unit is connected between the combustion chamber opening and the burner shutoff valve so that the valve is not directly exposed to the radiant heat and convection currents from the hot blast air. To absorb the radiant heat and convection currents, the burner connection unit is provided with a heat absorbent means.

FIG. 1 is a top plan view partially in cross-section of a hot blast stove embodying the present invention.

FIG. 2 is an elevation taken along the line 2—2 of FIG. 1 showing details of the burner shutoff valve.

FIG. 3 is a fragmentary plan view similar to FIG. 1 showing a second embodiment of a burner housing incorporating therein a ceramic lining.

FIG. 4 is a cross-sectional view taken along the line 4—4 of FIG. 1.

Referring now to FIG. 1, there is shown a hot blast stove **10** enclosed in circular steel shell **10***a* having an air intake **11** through which cold blast air is introduced into the bottom of the checker chamber **12** of the hot blast stove. The construction of hot blast stove **10** itself is

2

conventional as shown and described in greater detail in "The Making, Shaping and Treatment of Steel," published by United States Steel Company (sixth edition, copyright 1951) on pages 308–312. The cold blast air passes up through the checker chamber **12** and down through the combustion chamber **13** and in passing through these chambers is heated to a temperature above 2000° F. In the combustion chamber **13** there is provided a hot blast outlet **14** in the form of an outward projecting conduit which is lined with ceramic so as to withstand the temperatures of the hot blast passing therethrough from the stove. Arranged angularly with respect to the longitudinal axis of the hot blast conduit **14** is a hot blast valve **15**, the details of which are not shown, for controlling the flow of hot blast from the combustion chamber **13** to the hot blast main **16**.

Located below and in close proximity to the hot blast conduit **14** is inlet **17** forming a frustro-conical opening into the combustion chamber. Connected to the inlet **17** is a burner unit generally designated as B comprising a burner connector assembly **18**, a burner shutoff valve **19**, a burner **20**, and an air supply unit **21**.

The air supply unit includes a motor-driven fan having an inlet **23** through which atmospheric air is drawn and discharged under pressure to an outlet conduit **24** connected to the burner **20**.

The burner **20** comprises a cylindrical housing **25** arranged coaxially with the air conduit **24** so as to form an annular passage **26** into which gas is introduced from a downcomer **27**. Located in the downcomer is a gas shutoff valve **28** for controlling the flow of gas into the burner.

A burner head **29** fixed to the discharge end of air conduit **24** is located in the combustion chamber inlet **17** and supported by circumferentially spaced spokes **30**. The head **29** is formed with vanes **31** arranged in a corkscrew fashion, which cooperate with a coaxially mounted bullethead **32** such that the air swirls outwardly from the conduit **24** and commingles with the gas flowing from the annular passage **26**. In this manner, the air and gas are mixed so as to form a readily combustible mixture.

To prevent the hot blast from escaping through the burner during the period in which the cold blast is being heated by the stove checker chamber **12** and delivered to the blast furnace, there is provided the burner shutoff valve **19**. This valve is of well known construction and designated in the art as a Freyn-Jansen burner shutoff valve manufactured by Koppers Company, Inc., Pittsburgh, Pennsylvania. As shown in FIG. 2, the valve comprises a vertically movable disc **33** to the bottom of which is attached a pair of coaxial cylinders **34** and **35** of such size that when the valve **19** is open, the cylinder **35** is aligned with the air conduit **24** and the cylinder **34** is aligned with the annular passage **26**. The valve **19** is placed to its closed position with the disc **33** in the lowered position during the operation of heating cold blast air for the blast furnace and to its open position with the disc **33** raised during the operation of heating the hot blast stove checker chamber **12** by the combustion of gas. The valve disc **33** is manipulated by the lever **36** in the well known manner.

The present invention is primarily concerned with the positioning of the valve **19** relative to the combustion chamber inlet **17** so as to minimize heat transfer from the combustion chamber **13** to the valve. Heat flows into the inlet by radiation from the combustion chamber wall **13***a* and convection currents from the hot blast. The radiant heat travels in straight lines, while the convection currents are carried by the swirling hot air.

Heretofore, burners have been constructed with the housing and air conduit axially aligned with the combustion chamber intake. With such an arrangement, heat

is radiated from the combustion chamber wall 13–*a* straight against the burner shutoff valve 19 and its disc 33 and convection currents of hot blast travel a short path into the valve.

By the present invention, there is provided a novel burner construction in which the angularly bent connector assembly 18 is interposed between the combustion chamber inlet 17 and the burner shutoff valve 19 so as to place the valve out of the path of the heat radiated from the combustion chamber wall 13–*a*. The connector assembly 18 forms a more circuitous path through which the convection currents of hot blast travel prior to reaching the valve 19.

As shown, the burner connector assembly 18 comprises an elbow 37 of which the axes of the inlet and outlet are arranged to intersect at substantially right angles. The elbow 37 is detachably fastened at one end by bolts to the flange 38 on the combustion chamber inlet 17 and at its other end to a flange 39 on the valve 19. The air conduit 24 is formed as a separate complementary bent section 24 of which one end is supported on the valve 19 and the other end carrying the burner head 29 is supported on the inlet 17 as described above.

To absorb heat entering the connector assembly 18, there is provided, as shown in FIG. 1 and FIG. 4, a jacket 40 through which cooling water is circulated by way of lines 41 and 42. A ceramic refractory lining 43, as shown in FIG. 3, may also be used. It is, of course, to be understood that heat absorbing means other than the water jacket or heat resisting means other than ceramic material may be used.

Advantageously, there is provided in the elbow 37 an inspection port 50 for inspecting the flame and through which a flame ignitor torch may be inserted to ignite the gas at the burner head 29. Heretofore, prior structures have required that the inspection port be located adjacent the air supply device such that long torches are used. These torches are oftentimes snuffed out by the draft prior to reaching the burner head. By locating the inspection port 50 in the elbow 37, this difficulty is obviated.

What is claimed is:

1. A burner unit for separately and simultaneously supplying a plurality of gases to a burner head in the inlet to the combustion chamber of a hot blast stove; said hot blast stove being housed within a shell; said burner unit comprising a burner housing located externally of and separate from said shell; said burner housing enveloping a central conduit passing therethrough being spaced therefrom; said central conduit providing the path of flow for a first gas; said burner housing receiving the controlled flow of a second gas into the space around said central conduit; a burner shutoff valve adjustable to a closed position and to an open position; said valve being located externally of said shell and having its inlet connected to the outlet from said burner housing; the first and second gases being separately and simultaneously discharged from said burner housing through said valve when said valve is in the open position, and a burner connector assembly connecting the outlet of said valve with the combustion chamber inlet; said burner connector assembly having a bend therein located entirely outside said shell; said connector assembly comprising an inner bent conduit receiving the first gas from said valve and providing a path of flow therefor to said combustion chamber inlet and an outer bent conduit spaced from and surrounding said inner bent conduit receiving the second gas from said valve and providing a path of flow therefor to said combustion chamber inlet.

2. A burner unit as recited in claim 1 wherein the bends in the inner bent conduit and the outer bent conduit substantially simultaneously produce a change of direction in the paths of flow of the first and second gases of about 90°.

3. A burner unit for separately and simultaneously supplying a plurality of gases to a burner head in the inlet to the combustion chamber of a hot blast stove; said hot blast stove being housed within a shell; said burner unit comprising a burner housing located externally of and separate from said shell; said burner housing enveloping a central conduit passing therethrough being spaced therefrom; said central conduit providing the path of flow for a first gas; said burner housing receiving the controlled flow of a second gas into the space around said central conduit; a burner shutoff valve adjustable to a closed position and to an open position; said valve being located externally of said shell and having its inlet connected to the outlet from said burner housing; the first and second gases being separately and simultaneously discharged from said burner housing through said valve when said valve is in the open position, and a burner connector assembly connecting the outlet of said valve with the combustion chamber inlet; said burner connector assembly having a bend therein located entirely outside said shell; said connector assembly comprising an inner bent conduit receiving the first gas from said valve and providing a path of flow therefor to said combustion chamber inlet; an outer bent conduit spaced from and surrounding said inner bent conduit receiving the second gas from said valve and providing a path of flow therefor to said combustion chamber inlet; and means located in the region of said bend in said connector assembly to absorb heat entering said connector assembly from the combustion chamber.

4. A burner unit as recited in claim 3 wherein the bends in the inner bent conduit and the outer bent conduit substantially simultaneously produce a change of direction in the paths of flow of the first and second gases of about 90°.

5. In a burner unit for supplying a gas to the inlet to the combustion chamber of a hot blast stove; which hot blast stove is enclosed in a shell and which burner unit comprises a burner housing located externally of said shell; a burner shutoff valve located externally of said shell with its inlet connected to the outlet from said burner housing, and a burner connector assembly connected between the outlet from said valve and the combustion chamber inlet whereby gas received into said burner housing is conducted therethrough, through said valve and said burner connector assembly and delivered to said combustion chamber inlet, the improvement comprising a bend in said burner connector assembly located entirely outside said shell, the angularity of said bend being sufficient to preclude line-of-sight communication between said valve and said combustion chamber inlet.

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