Jan. 11, 1938. H. E. CARLETON 2,105,309

FURNACE

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Fig. 1.

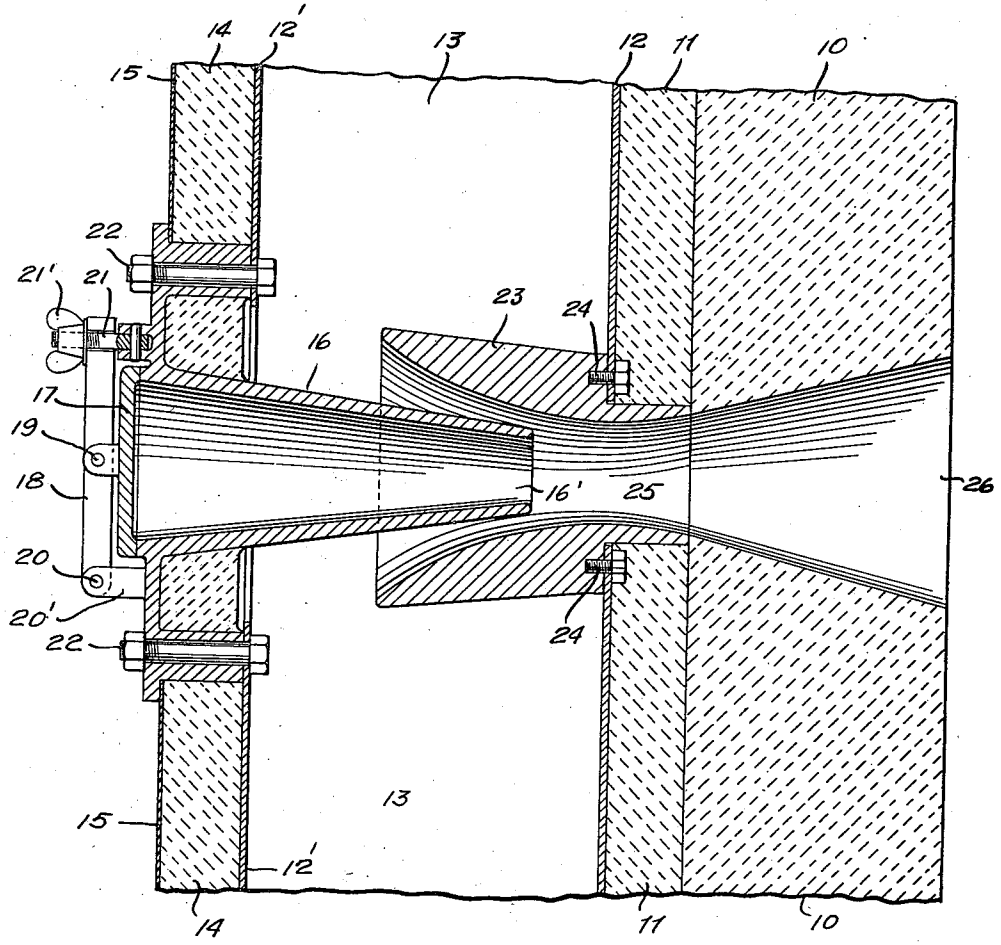

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Fig. 2.

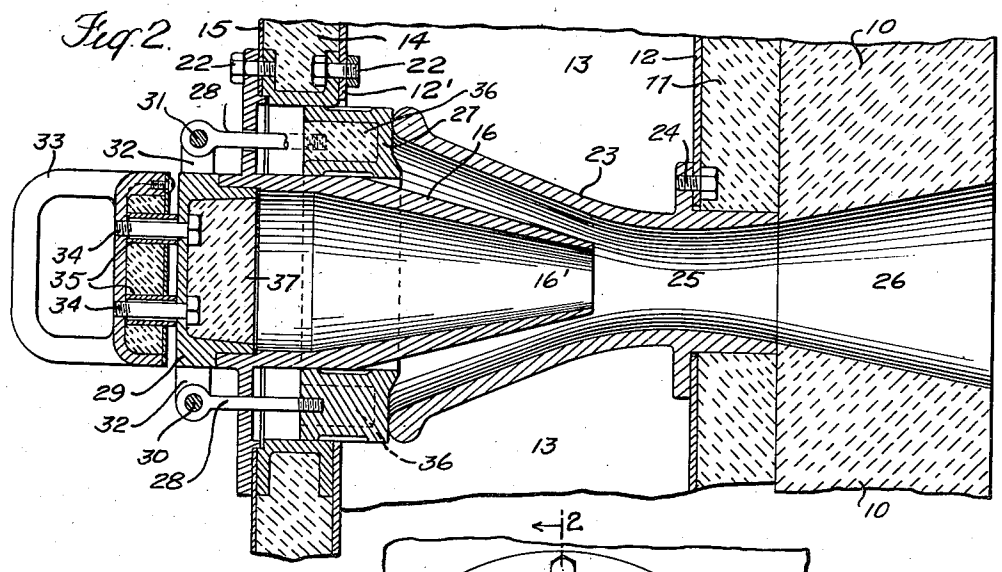


Fig. 3.

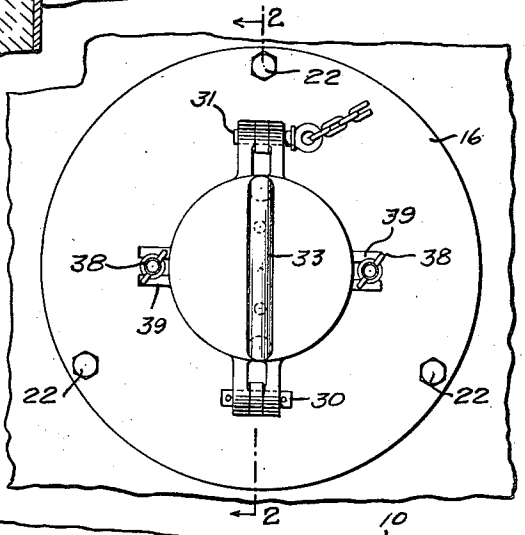
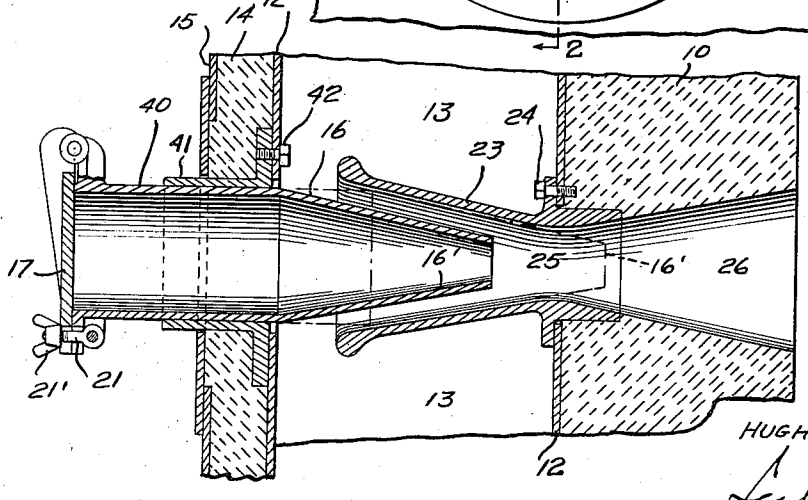


Fig. 4.



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Patented Jan. 11, 1938

2,105,309

UNITED STATES PATENT OFFICE

2,105,309

FURNACE

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Application July 7, 1936, Serial No. 89,287

18 Claims. (Cl. 126—190)

My invention relates to furnaces, and particularly to an improved means for permitting observation of combustion and internal furnace conditions, and the action of the burning gases on the refractory walls of a high temperature furnace chamber and on any tubes or other devices disposed therein. More particularly, my invention pertains to furnaces in which the furnace chamber is wholly or partially surrounded by an air duct or air chamber, the pressure in which is higher than that existing in the furnace, and provides an aperture or peephole of special design that opens to the atmosphere in a boiler room or firing isle, and extends inwardly therefrom through the air duct and refractory furnace wall to the furnace, whereby a clear vision may be had into the furnace chamber whenever desired, and without the use of any interposed transparent material, such as glass or mica, which has numerous disadvantages.

In attaining the objects of my invention, advantage is taken of the pressure differential existing between the air duct and the furnace, to create a flow of air from the air duct of sufficient momentum to oppose any flow of gases from the furnace, and of sufficient velocity to entrain from outside the air duct, when the peephole is open, some additional air at atmospheric pressure. The mixture is then forced into the furnace through a Venturi nozzle assembly and a diffuser.

In the practice of my invention, neither hot gases from the furnace, nor any excessive amount of the preheated air from the air duct, the temperature of which may be around 300° or 400° F., will enter the boiler room or firing isle or other enclosure wherein the furnace is disposed during periods of inspection. Any one of the operating personnel is enabled to inspect thoroughly, and without the danger of injury from a blast of hot air or furnace gases, the inner walls of the furnace and the prevailing combustion conditions whenever occasion demands.

For a better understanding of the particular features that characterize my invention, reference may be had to the following description, considered in connection with the accompanying drawings, forming a part thereof and in which:

Fig. 1 is a vertical sectional view of apparatus embodying the invention;

Fig. 2 is a vertical sectional view, taken on line 2—2 of Fig. 3, illustrating another form of the invention;

Fig. 3 is an elevation of the outer end of the arrangement shown in Fig. 2; and

Fig. 4 is a vertical sectional view, illustrating still another form of the invention.

Like reference characters refer to like parts throughout the several views.

Referring to Fig. 1 of the drawings, reference character 10 designates the inner refractory lining of a furnace chamber having an outer lining 11 of suitable refractory material, while 12 and 12' indicate the inner metallic casing walls of an air duct or chamber 13 which may entirely surround the furnace or may be disposed on and exteriorly of, one or more walls thereof. The outer wall is formed by heat insulating material designated 14 and outer metallic casing 15. Suitable means are provided to maintain a pressure in the air chamber which is higher than the pressure in the furnace, or that of the surrounding atmosphere.

The peephole arrangement provided by this form of the invention includes a tapered sight tube 16 having an inner end portion 16' and a laterally extending annular flange at its outer end. The inner end of the sight tube extends into the throat or reduced portion 25 of a nozzle member 23 of suitable refractory or metal, which is secured by bolts 24 to casing 12, and forms in combination with an enlarged furnace opening 26, a Venturi shaped nozzle assembly and diffuser which is arranged and adapted to provide the desired volume and velocity of air flow therethrough from the air chamber to the furnace, and at the same time to permit a wide range of vision within the furnace when the sight tube cover plate 17 hereinafter described, is removed. Cover plate 17 is secured to an intermediate portion of a latch 18 by a pin 19, and the latch is hinged at one end by pin 20 on spaced studs 20' extending from the annular flange on the sight tube 16. The other end of the latch 18 is provided with a slot which receives a swinging bolt 21 secured to said annular flange, and the cover plate 17 is secured in closed position by a wing nut 21' threaded on the bolt 21. The sight tube 16 is supported on the outer wall of the air chamber by means of the annular flange thereon and by bolts 22 that pass through the flange and the outer wall.

In operation, when it is desired to use the peephole assembly illustrated in Fig. 1, wing nut 21' is loosened, bolt 21 is swung free of the latch 18 and the latch and cover plate are swung downwardly free of the outer end of the sight tube thus permitting clear vision through the peephole into the furnace. With this arrangement, it will be perceived that neither furnace gases nor pre-

heated air will flow outwardly so as to cause injury to the person using the peephole.

The form of the invention shown in Fig. 2 is similar generally to the form illustrated in Fig. 1, excepting for a control valve and the cover for the outer end of the sight tube. In Fig. 2, reference character 27 designates a sliding valve for controlling flow through the nozzle member 23 and comprises an annular metallic channel member that has a snug sliding fit in the annular space between sight tube 16 and the outer casing wall. Diametrically opposed eye bolts 28 secured to valve 27, pass through openings in the flanged end of sight tube 16 and secure the valve to a plug 29 by pins 30 and 31 which pass through the eyes of the bolts 28 and lugs 32 projecting from opposed portions of the plug. A handle 33 is secured to plug 29, in spaced relationship therewith for cooling purposes by bolts 34 which pass through spacing thimbles 35. With this arrangement, it will be apparent that the valve 27 may be moved in a longitudinal direction, and thus control the volume of air flow from the air duct 13 through nozzle member 23. When valve 27 is in the fully closed position illustrated, no preheated air will flow from the air duct through the nozzle member as a result of which furnace gases will enter the nozzle member and the sight tube. On account of the high temperature of the furnace gases, both the annular space in the channel member of valve 27 and the plug 29 are packed with heat insulating material such as asbestos cement indicated at 36 and 37 respectively. To prevent leakage resulting from the pressure of the furnace gases on plug 29, when the flow of preheated air through nozzle 23 is cut off, additional securing means are provided for the plug, such as studs and wing nuts 38 which engage oppositely disposed lugs 39 on the plug.

With this embodiment of my invention, when the peephole is not in use and when the valve 27 is moved inwardly to closed position against the nozzle member, there is no possibility of excess air from the air duct entering the furnace. When the peephole is to be used the valve must first be moved outwardly far enough to assure a positive flow of air to the furnace through the nozzle member and to permit the plug 29 closing the outer end of the sight tube to be swung outwardly about pin 30 as a pivot. Before the plug and valve are moved, the wing-nuts must, of course, be removed from engagement with lugs 39 on the plug. Pin 31 is then removed, after which the plug is swung outwardly to open the sight tube.

The form of the invention illustrated in Fig. 4 is, in general, similar to the form shown in Fig. 1, excepting that the sight tube is adjustably supported to provide a control for the flow of air from the air duct into the furnace through the nozzle member. In Fig. 4, the sight tube 16 has an elongated cylindrical section 40 that extends in a snug sliding fit through a supporting and guiding member 41 secured in the outer casing wall by suitable securing means such as the bolts 42 shown. This arrangement makes it mechanically possible to adjust the position of the conical or tapered portion 16' of the sight tube with respect to nozzle member 23. The extreme inward or closed position of the sight tube is indicated in dotted lines in which position, flow through the nozzle member from the air duct to the furnace is entirely cut off. It is obvious that by thus moving the sight tube axially one way or the other, the volume of air admitted to the furnace from the air duct may be controlled within all limits from zero to maximum for the arrangement. Otherwise the apparatus operates in substantially the same manner as in the form of apparatus shown in Fig. 1.

It will be understood that the nozzle member may be constructed and arranged so that it will extend entirely through the furnace wall, rather than extending only partially therethrough as illustrated in the several views in the drawings.

It will thus be perceived that the invention provides means whereby any one from the outside may view through a hole in the furnace wall, in which there is neither glass nor any other transparent substance, the interior of the furnace, wherein a pressure exists higher than that of the atmosphere and less than that of an air chamber or duct, without subjecting the viewer to a blast of hot gas from the furnace or an undue blast of air from the air chamber. The arrangement and proportions of the several parts of the peephole device is such that when it is in use, neither the blast of air from the air chamber to the furnace is of undue proportions nor is the flow of air from the air chamber to the atmosphere outside such as to inconvenience or injure the observer. In other words, the arrangement, proportions, and relative disposition of the several parts of the peephole device are such as to provide a sufficient momentum for the air flowing through the annular space between the sight tube and the nozzle member so that this momentum opposes and exceeds the pressure existing in the furnace. In this manner, flow of air is assured from the air chamber to the furnace rather than from the air chamber or furnace to the surrounding atmosphere. The volume or flow area of this annular space may be determined and fixed at the time the furnace and setting are designed, or it may be adjusted by some means such as shown in Figs. 2, 3 and 4 of the drawings, to obtain the desired flow area therefor to suit the relative pressures existing in the air chamber, the boiler room or firing isle and the furnace.

Although the embodiments of my invention herein disclosed are preferred forms, it is to be understood that changes may be made in the forms and structure without departing from the principles of the invention, which is not to be limited except by the scope of the appended claims.

What I claim is:

1. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, and a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube.

2. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, and a sight tube having a tapered portion extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube.

3. In a furnace having an air chamber outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a flared aperture in a refractory wall of the furnace, a nozzle in axial alignment with said

aperture and extending into the air chamber, and a sight tube having a tapered portion supported by the wall of the air chamber and so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube.

4. In a furnace having an air chamber outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a flared aperture in a refractory wall of the furnace, a nozzle in axial alignment with said aperture and extending into the air chamber, and a sight tube supported by the wall of the air chamber and so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube.

5. In a furnace having an air chamber outside at least one wall thereof, a peephole comprising an inwardly flared aperture in the wall of the furnace, a nozzle extending outwardly into the air chamber and in axial alignment with said flared aperture, a sight tube extending through the wall of the air chamber and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, and means for closing the outer end of the sight tube.

6. In a furnace having an air chamber outside at least one wall thereof, a peephole comprising a flared aperture in the furnace wall, a nozzle member supported by said furnace wall and in axial alignment with the flared aperture therein, a sight tube having a tapered portion extending from the wall of the air chamber to the throat of the nozzle member, an annular space between the sight tube and said nozzle member, and valve means for controlling the area of said annular space.

7. In a furnace having an air chamber outside at least one wall thereof, a peephole comprising a flared aperture in the furnace wall, a nozzle member supported by said furnace wall and in axial alignment with the flared aperture therein, a sight tube having a tapered portion extending from the wall of the air chamber to the throat of the nozzle member, an annular space between the sight tube and said nozzle member, and valve means comprising an annular channel member for controlling the flow of air through said annular space.

8. In a furnace having an air chamber outside at least one wall thereof, means for observing internal combustion conditions in the furnace comprising a sight tube having a laterally extending annular flange secured to the wall of the air chamber, and a tapered portion extending inwardly through the air chamber to the throat of a nozzle member supported by the furnace wall and in axial alignment with a flared aperture in said furnace wall, closure means for said sight tube, and a valve comprising an annular member arranged for operation with said closure means for controlling the flow of air from the air chamber through said nozzle member.

9. In a furnace having an air chamber outside at least one wall thereof, a peephole comprising a flared aperture in the furnace wall, a nozzle member supported by said furnace wall and in axial alignment with the flared aperture therein, a sight tube having a tapered portion extending inwardly and in axial alignment with said nozzle member and a cylindrical portion extending outwardly through the wall of the air chamber and movably mounted thereon for axial movement.

10. In a furnace having an air chamber outside at least one wall thereof, a peephole comprising a flared aperture in the furnace wall, a nozzle member supported by said furnace wall and in axial alignment with the flared aperture therein, a sight tube having a tapered portion extending inwardly and in axial alignment with the nozzle member, and a cylindrical portion extending outwardly through, and movably mounted in the wall of the air chamber, the arrangement being such that movement of the sight tube will control the flow of air from the air chamber through said nozzle member.

11. In a furnace having an air chamber outside at least one wall thereof, a peephole comprising in combination, a flared aperture in the furnace wall, a nozzle member supported by said furnace wall and in axial alignment with the flared aperture therein, and a sight tube slidably supported on the wall of the air chamber having a tapered portion extending into the throat of said nozzle member and cooperating therewith to provide an annular space between the tapered portion of the sight tube and said nozzle member, the arrangement being such that axial movement of the sight tube will vary the flow area of said annular space.

12. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, and valve means for controlling the flow of air from the air duct through the nozzle.

13. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, means for closing the outer end of the sight tube, and valve means for controlling the flow of air from the air duct through the nozzle.

14. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, a cover plate for closing the outer end of the sight tube, and means for securing the cover plate in closed position.

15. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, closure means for the sight tube, and a valve arranged for operation with said closure means to cut off the flow of air from the air chamber through the nozzle when the sight tube is closed.

16. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, a sight tube extending through the wall of the air duct

and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, closure means for the sight tube, and a valve arranged for operation with said closure means to simultaneously cut off the flow of air from the air chamber through the nozzle and to close the sight tube.

17. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, closure means for the sight tube, and a valve arranged for operation with said closure means to cut off the flow of air from the air chamber through the nozzle when the sight tube is closed, the arrangement being such that the closure means can be opened only when there is a flow of air from the air chamber through the nozzle.

18. In a furnace having an air duct outside at least one wall thereof, means for observing combustion and internal furnace conditions comprising a nozzle in a wall of the furnace, and a sight tube extending through the wall of the air duct and having its inner end so disposed with respect to the nozzle that fluid flow through the latter causes air flow inwardly through the tube, said sight tube being axially movable and having a portion cooperating with the nozzle to control the flow of air through the nozzle.

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