April 30, 1935. G. A. REHM 1,999,782

FURNACE DOOR

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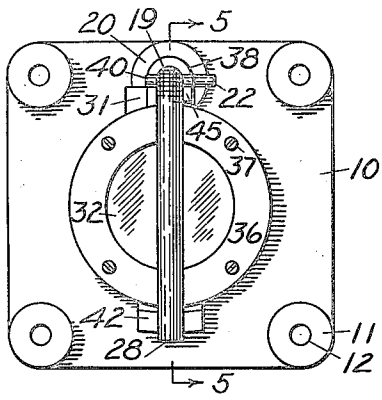


Fig. 1

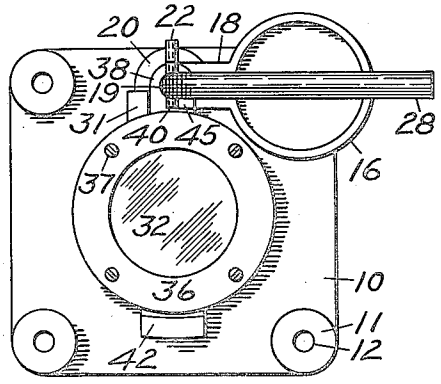


Fig. 2

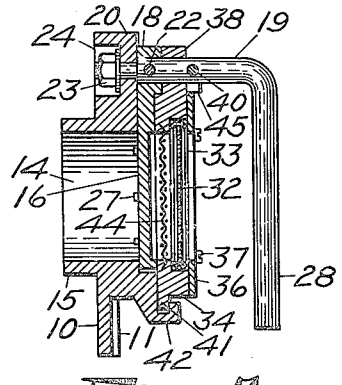


Fig. 5

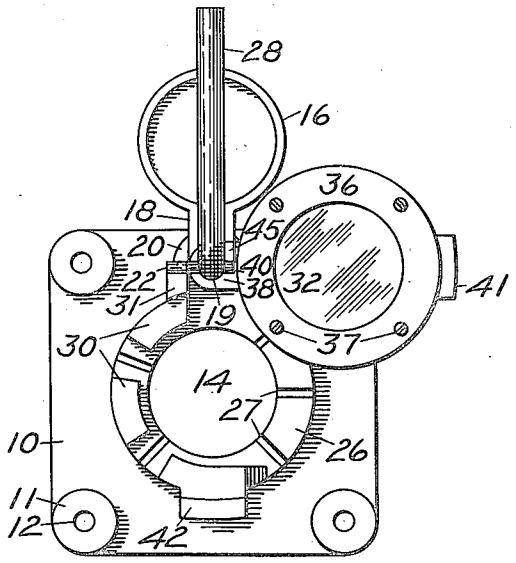


Fig. 3

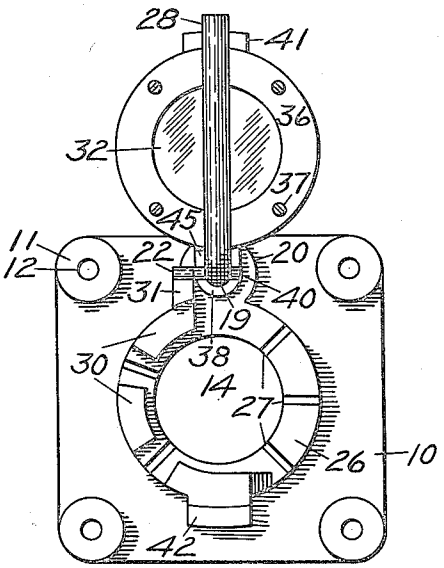


Fig. 4

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FURNACE DOOR

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7 Claims. (Cl. 126—200)

This invention relates to furnace doors, and more particularly to a door adapted to be mounted on the wall of a combustion furnace and arranged to permit inspection of the furnace interior.

It is necessary for a furnace operator to know what is actually taking place inside the furnace chamber, so that he may be able to make any adjustments required to improve combustion efficiency. If a large door is opened in the furnace wall, a great volume of air will rush into the furnace and disturb combustion conditions to such an extent as to render inspection valueless. Furthermore, the glaring light and the intense radiant heat transmitted through the large opening are extremely uncomfortable to the operator and greatly hinder his work. An accurate inspection of the fuel bed, combustion flame, or furnace linings is impossible under these conditions.

It has heretofore been proposed to overcome these difficulties by providing a small inspection door having a colored glass therein, through which the operator may view the furnace interior. Such prior constructions have not proven entirely satisfactory, since it is found that the glass is subject to frequent breakage, either from the heat or from accidental blows. Furthermore, the doors of the prior art have been expensive to manufacture and awkward and inconvenient to use.

It is accordingly the main object of the invention to provide a simple and inexpensive furnace door which will assist the operator in obtaining an accurate knowledge of the combustion conditions within the furnace, and which will protect the operator from the excessive heat and glare of the combustion flame.

It is a further object of the invention to provide a furnace inspection door which will have a long life of useful service and be free from breakage difficulties.

It is a further object to provide a simple construction for a furnace door which can be conveniently used for inspection, for taking of furnace temperatures, or for the insertion of a slice bar or steam lance if occasion demands.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention, and in which like reference numerals indicate like parts,

Fig. 1 is an elevation of a furnace door in closed position;

Fig. 2 is an elevation of the door in position for inspection of the furnace interior;

Fig. 3 is an elevation of the door in position to permit the taking of furnace temperature, as by means of an optical pyrometer;

Fig. 4 is an elevation of the door in position for insertion of a slice bar or steam lance; and

Fig. 5 is a section on the line 5—5 of Fig. 1.

The embodiment illustrated comprises a door frame 10 shown as a flat square plate provided with a slightly raised boss 11 at each corner. Each boss has an opening 12 therethrough so that the plate may be readily bolted against the outside of a furnace wall. In the center of the door frame I have shown a circular opening 14, which it will be understood will register at installation with an opening in the furnace wall. This opening 14 is preferably surrounded on the furnace side by an annular projection or flange 15 (Fig. 5), which fits into the opening in the refractory material of the wall. While I do not wish to be limited to any particular sizes for the various parts, I have found that a diameter of four inches for the opening 14 is satisfactory in actual practice.

The opening 14 is normally closed by means of a manually operable door or shutter 16, shown as a circular disk slightly larger in diameter than the opening. The disk 16 is provided with a radially projecting lug or ear 18 which is pivotally connected to the door frame by means of a rod 19. This rod extends horizontally through both the lug 18 and a boss 20 located on the outer face of the plate 10 and above the opening 14. The rod 19 is rigidly fastened to the lug 18, preferably by means of a transverse pin 22 extending through these parts, and a nut 23 (Fig. 5) is screw threaded to the inner end of the rod to hold it in place without preventing rotation thereof. The rear face of the plate 10 may be recessed at 24 to receive this nut, so that the furnace wall need not be cut away at installation. The plate 10 is provided with an annular flange 26 surrounding the opening 14 and flush with the boss 20, and when the shutter 16 is in its closed position the rear face thereof contacts with this flange.

In order to prevent overheating of the door 16, I provide means for passing a slight amount of cool air adjacent to the surface thereof. For this purpose I have shown shallow radial grooves 27 in the face of the flange 26, through which grooves small streams of air from the atmosphere

flow into the opening 14 and thence into the furnace under the influence of the furnace draft.

The door 16 may be manually operated by means of a handle 28, which is preferably formed by bending the outer portion of the rod 19 at right angles and in line with the center of the door. By thus forming the handle 28 integral with the pivot rod 19, the construction is considerably simplified. Stops 30 may be provided on the flange 26 at one side of the door opening 14 to limit the movement of the door in one direction. These stops preferably project from the flange a distance equal to the thickness of the door. The door movement may be limited in the opposite direction by the pin 22 which cooperates with a lug 31 on the door frame. In the illustrated embodiment, the door is free to swing through an arc of 180 degrees, from the position shown in Fig. 1 to the position shown in Fig. 3.

In order to protect the operator from the brilliant glare of the furnace and permit a more accurate observation of combustion conditions, I provide a plate 32 of a suitable semi-transparent material, such as colored glass, which is positioned in front of the opening 14. This plate is preferably shaped as a circle slightly larger in diameter than the opening 14 and may be supported in a ring 33 of asbestos (Fig. 5) located in a recess in an annular frame 34. A flat annular plate 36 is fastened against the outside of the frame 34 by means of screws 37, and serves to hold the glass 32 in place. The annular frame 34 is pivotally supported from the rod 19 by means of a radially projecting ear or lug 38. A pin 40 extends transversely through the rod 19 just outside the lug 38, and holds the frame 34 closely adjacent to the outer surface of the door 16. A tongue 41 projects radially from the frame 34 opposite to the lug 38, and this tongue fits the upwardly open slot in a hook-shaped projection 42 formed integral with the annular flange 26 below the opening 14. This construction locks the frame 34 in place against any internal pressure which may accidentally develop within the furnace chamber. The lug 31 preferably projects a little above the face of the stops 30, and thus serves as an abutment to limit the movement of the frame 34.

It will now be apparent that when the door 16 is swung to the open position shown in Fig. 2, the operator may observe the furnace interior through the glass 32. Moreover, this movement of the door allows an increased volume of air to flow into the furnace between the frame 34 and the flange 26 through the space normally occupied by the door, thus cooling the glass during the observation period. Still further protection for the glass is obtained by providing a coarse wire mesh screen 44 on the furnace side thereof. This screen is supported by the annular frame 34 and may be integrally joined thereto during the operation of casting the frame. The screen 44 intercepts a considerable part of the radiant heat which would otherwise reach the glass.

In case it is desired to measure the furnace temperature by means of an optical pyrometer, it is necessary to swing the glass 32 away from the opening 14. For this purpose I provide a lost-motion connection between the handle 28 and the frame 34. The preferred construction illustrated comprises a projecting lug 45 formed integral with the frame 34 and arranged to cooperate with the pin 40. When the handle is swung upwardly to the position shown in Fig. 2 the pin 40 will strike the lug 45, and if the handle is moved further it will carry the frame 34 with it, as shown in Fig. 3. If the handle is released the parts will return by gravity to the closed position shown in Fig. 1. In the event that the operator wishes to use both hands on a slice bar or steam lance, he may swing the frame 34 to a position directly above the opening 14, as shown in Fig. 4. The parts will then retain this position until the operator completes his work and closes the door by swinging the handle 28 downwardly.

It will now be clear that when the door is fully closed, as shown in Figs. 1 and 5, the glass 32 is shielded from radiant heat by the shutter 16, and the latter is cooled by the small streams of air flowing through the grooves 27. The glass is furthermore protected against accidental breakage from the outside by the handle 28, which extends across its face. When the operator wishes to view the furnace interior he grasps the handle 28 and swings the shutter 16 laterally and upwardly to the position shown in Fig. 2. The glass is then cooled by the increased air flow between the flange 26 and the frame 34, and is partially shielded by the screen 44. If a gas explosion occurs in the furnace while the operator is making an observation, his face is thoroughly protected, since any outward blast will be directed laterally. A further movement of the handle will swing the glass clear of the opening for direct observation of the furnace, as shown in Fig. 3. With the parts positioned as shown in Fig. 4, the door will remain fully open and it is unnecessary to retain hold of the handle.

The construction is comparatively simple and inexpensive to manufacture and there is nothing which is likely to cause trouble in actual operation. The glass is protected from heat and accidental breakage, and the entire apparatus is well adapted to the purposes for which it is intended.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A furnace door assembly comprising a frame having an opening therein, a plate of semi-transparent material in front of the opening, a shutter supported between the plate and the frame to shield the plate from radiant heat, the shutter and frame being so shaped and arranged as to provide passages therebetween which direct air across the furnace side of the shutter and thence through the opening, and means to move the shutter away from the shielding position to permit an observation of the furnace interior through the opening.

2. A furnace door assembly comprising a frame having an opening therein, a plate of semi-transparent material in front of the opening, a shutter supported on the furnace side of the plate to shield the plate from radiant heat, both the plate and shutter being movable to expose the opening, a handle to operate the shutter, and a lost motion connection between the shutter and the plate, whereby a predetermined movement of the handle will move the shutter from behind the plate without moving the plate, and a further movement of the handle will move the plate from in front of the opening.

3. A furnace door assembly comprising a frame having an opening therein, a rod rotatably mounted in the frame above the opening, a shutter rigidly connected to the rod and normally closing the opening, a plate of semi-transparent ma-

terial mounted outside of the shutter, and a handle connected to the rod and extending across the outer face of the plate, the handle serving to protect the plate from breakage and to aid in swinging the shutter from behind the plate when it is desired to observe the interior of the furnace.

4. A furnace door assembly comprising a frame having an opening therein, a rod rotatably mounted in the frame above the opening, a shutter rigidly connected to the rod and normally closing the opening, an annular frame located outside of the shutter and pivotally supported from the rod, a plate of semi-transparent material mounted in the annular frame, means providing a lost motion connection between the rod and the annular frame, and a handle connected to the rod, said parts being so constructed and arranged that turning the rod by means of the handle will first swing the shutter from in front of the opening and then swing the annular frame from in front of the opening.

5. A furnace door assembly comprising a frame having an opening therein, a rod rotatably mounted in the frame above the opening, a shutter rigidly connected to the rod and normally closing the opening, an annular frame located outside of the shutter and pivotally supported from the rod, a plate of semi-transparent material mounted in the annular frame, means providing a lost motion connection between the rod and the annular frame, a handle connected to the rod, a tongue projecting from the annular frame, and a hook shaped projection on the first mentioned frame below the opening, said projection normally overlying the tongue and thus supporting the plate and annular frame against any pressure which may develop in the furnace.

6. A furnace door assembly comprising a frame having an opening therein, a rod rotatably mounted in the frame above the opening, a shutter rigidly connected to the rod and normally closing the opening, an annular frame located outside of the shutter and pivotally supported from the rod, a plate of semi-transparent material mounted in the annular frame, and means providing a lost motion connection between the rod and the annular frame, the outer portion of the rod being bent to form a handle extending across the plate when the shutter is in closed position.

7. A furnace door assembly comprising a frame having an opening therein, a plate of semi-transparent material in front of the opening and spaced from the frame to provide a passage leading to the opening, and a shutter supported between the frame and the plate in such a position as to prevent excessive air flow through the passage and to shield the plate from radiant heat, the shutter being movable away from the shielding position to permit an observation of the furnace interior through the opening and to allow a large volume of air to flow through the passage in contact with the rear surface of the plate and thence to the opening.

GUSTAV A. REHM.