

Jan. 18, 1944.

F. O. HESS ET AL

2,339,477

FURNACE WALL BURNER

Filed Jan. 9, 1941

2 Sheets-Sheet 1

Fig. 2.

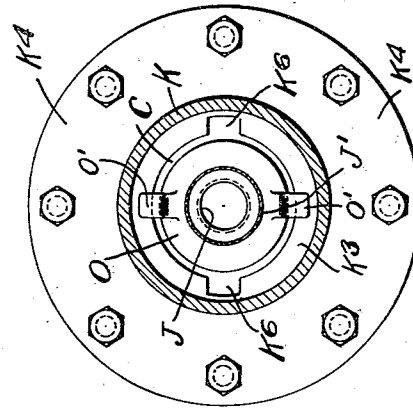
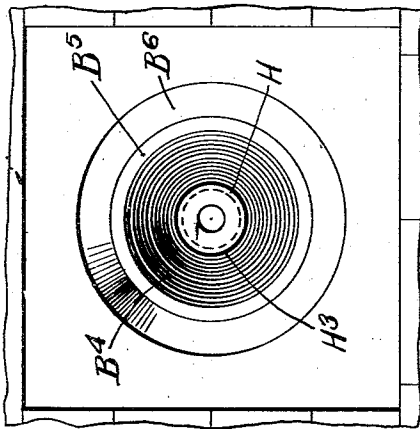


Fig. 3.

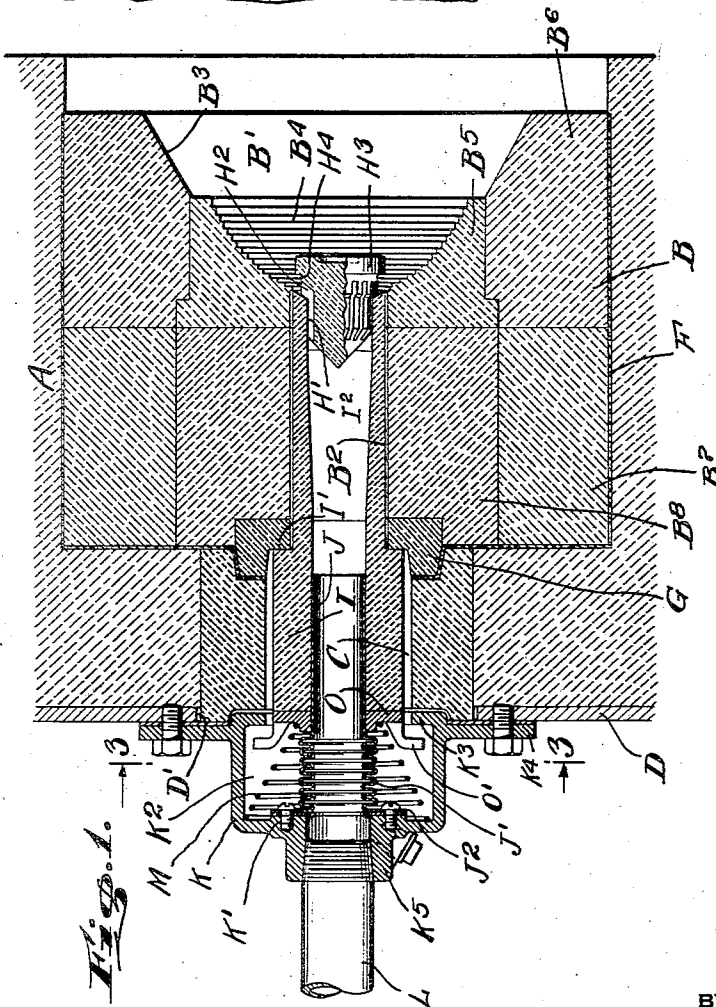


Fig. 1.

INVENTORS  
FREDERIC O. HESS  
JOSEPH EHLINGER

BY

John E. Beal  
ATTORNEY

Jan. 18, 1944.

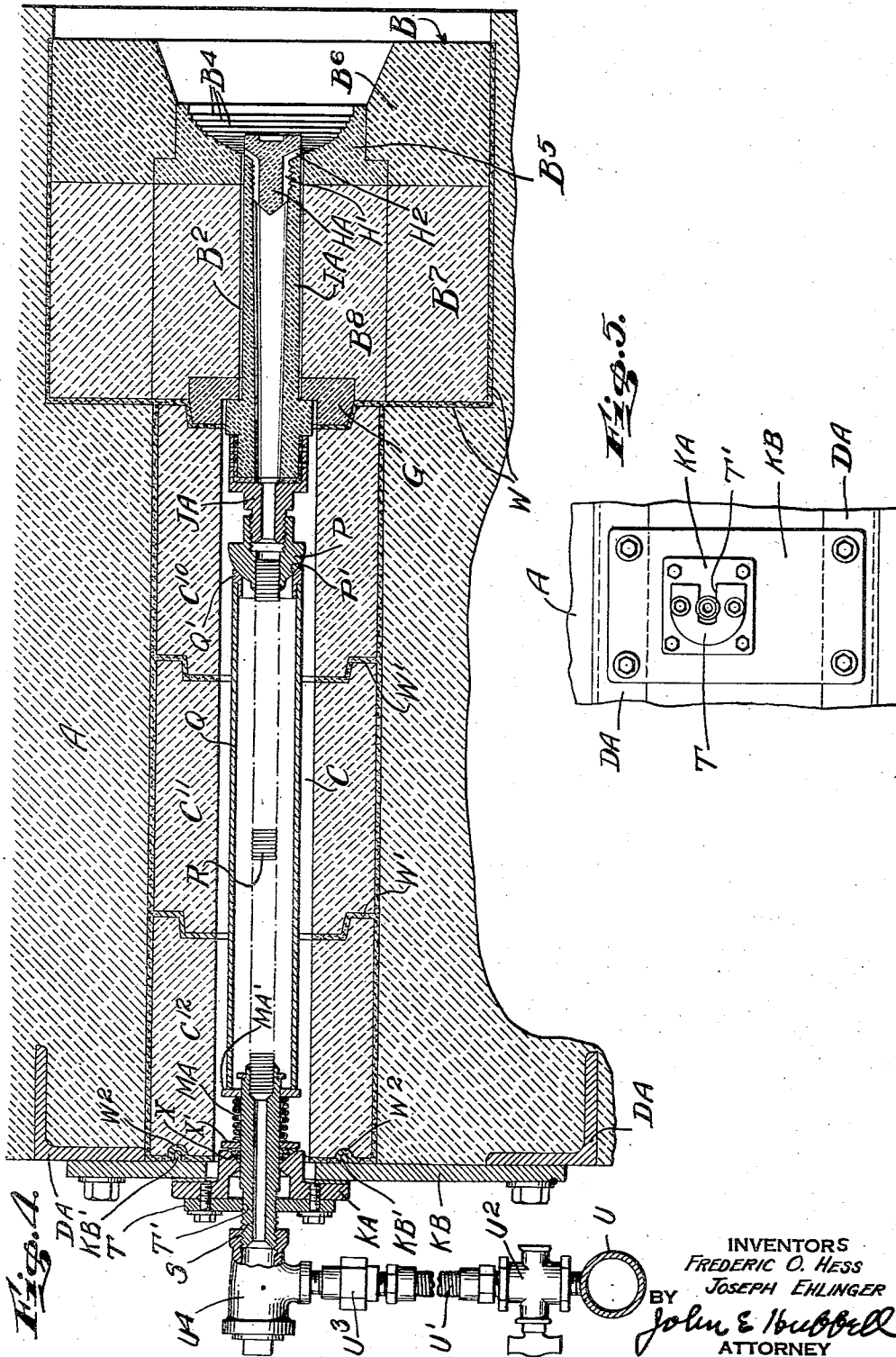
F. O. HESS ET AL

2,339,477

FURNACE WALL BURNER

Filed Jan. 9, 1941

2 Sheets-Sheet 2



INVENTORS  
FREDERIC O. HESS  
JOSEPH EHRLINGER  
BY *John E. Hubbell*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,339,477

## FURNACE WALL BURNER

Frederic O. Hess, Germantown, and Joseph Ehlinger, Conshohocken, Pa., assignors to The Selas Company, Philadelphia, Pa., a corporation of Pennsylvania

Application January 9, 1941, Serial No. 373,728

15 Claims. (Cl. 158—7)

The general object of the present invention is to provide an improved furnace wall burner construction.

More specifically, the object of the invention is to provide improvements in a furnace wall burner arrangement of the commercial type disclosed in the prior Patent 2,287,245, granted June 23, 1942, on the application, Serial No. 205,681, filed May 3, 1938, of Frederic O. Hess, one of the applicants herein. In the burner disclosed in said prior application, an accurately formed combustion chamber block of refractory material is permanently incorporated in a furnace wall. Said block is formed with a combustion chamber or space open at its inner end to the furnace chamber, and is formed with a passage opening into, and extending outwardly from the combustion chamber, and through which replaceable burner parts may be inserted and removed from the outer side of the furnace wall.

One specific object of the present invention is to modify the capacity of the combustion chamber wall to radiate heat and to maintain ignition, and in practice, we attain this object by grooving or roughening the combustion chamber wall. Another specific object of the invention is to improve the thermal and mechanical characteristics of the combustion chamber block by forming different integrally connected portions of the combustion chamber block out of different materials.

Another and practically important object of the invention is to provide a burner of the type described, with improvements which facilitate the removal of burner nozzle and associated conduit parts for inspection, repairs or replacement, and which will accommodate the relative thermal expansion and contraction of different parts of the furnace wall and burner construction, and will minimize the risk of objectionable gas leakage.

A further specific object of the present invention is to provide a burner unit adapted to insertion in a furnace wall and comprising a ceramic body portion, a metallic outer end portion, and a spring which in the normal use of the burner comes between the ceramic body and metallic outer portions to snugly hold the ceramic portion of the burner unit in engagement with a seat formed for the purpose in the furnace wall, and in which said ceramic and metallic portions and spring may be factory-assembled into a unit conveniently adapted to be shipped as a unit and inserted in the furnace wall as a unit.

The various features of novelty which characterize the invention are pointed out with par-

ticularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which we have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a section through a portion of the furnace wall and burner mounted therein;

Fig. 2 is an elevation of a portion of the burner, as seen from the inner side of the furnace wall; and

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a partial section taken similarly to Fig. 1 illustrating a modification; and

Fig. 5 is an outer end view of the burner shown in Fig. 4.

In the construction shown in Figs. 1-3, A represents the refractory body portion of the wall of a furnace adapted to be heated in whole or in part, by one or more, usually more, burners mounted in the furnace wall. The improved furnace wall burner construction shown in the drawings comprises an accurately molded combustion chamber block of ceramic material B, incorporated in the furnace wall and forming a portion thereof. Customarily, and as shown, the block B is rectangular in outline, and is formed at its inner side with a cup-shaped combustion chamber or space B', and with a central passage B<sup>2</sup> coaxial with, and extending outwardly from, the combustion chamber. At the outer side of the block B, the passage B<sup>2</sup> opens into a burner well or passage C, extending to the outer face of the furnace wall. As shown, the furnace wall comprises an outer metallic armor or casing D. Advantageously, the block B is permanently anchored in the furnace wall proper by a suitable high temperature fire brick cement F, adapted to firmly bond the block to the adjacent portion of the furnace wall.

As shown, the combustion chamber B' comprises an outer portion having a conical surrounding wall B<sup>3</sup> and a cup-shaped inner portion, the wall of which is roughened, as shown, by providing it with a series of ribs B<sup>4</sup>. Each rib has a cylindrical inner wall coaxial with the passage B<sup>2</sup>, and a second wall transverse to the passage B<sup>2</sup>. The cylindrical inner walls of the ribs B<sup>4</sup> progressively increase in diameter and axial extent as the distance from the inner face of the block B diminishes. With combustible mixture jets discharged into the combustion space in the known manner hereafter described, the ribs B<sup>4</sup>

increase the heat radiating surface and the amount of heat radiated, particularly when the burner is operating at relatively low capacity. The corner edges of the ribs will then be heated to temperatures substantially higher than would be attained by similarly located portions of the combustion chamber wall if the latter were smooth. The burners thus substantially increase the percentage of the heat liberated in light load operation which is radiated into the furnace chamber. Because of their high corner edge temperatures, they aid in maintaining ignition in operation with high burner pressures and velocity.

In the preferred form of the present invention, we advantageously form different portions of the block B of different refractory ceramic materials, each of which is especially desirable for use in its particular location in the block. The different materials are suitably compacted and worked into a unitary refractory mass by a molding operation in which the block is given its shape. As shown, the portion B<sup>5</sup> of the block which surrounds the outer end portion of the combustion chamber B' may advantageously be made of refractory material having especially high heat-shock resisting properties. The annular portion B<sup>6</sup> surrounding the portion B<sup>5</sup> may well have somewhat better heat insulating properties than the material of the portion B<sup>5</sup>. The annular portion B<sup>7</sup> of the block extending from the outer side of the portion B<sup>6</sup> to the outer side of the block, may advantageously have still higher heat insulating properties than the material in the portion B<sup>6</sup>, and the central portion B<sup>8</sup> of the block at the outer side of the portion B<sup>5</sup> is advantageously formed of a material having still higher heat insulating properties. Advantageously and as shown, the outer end, or mouth of the passage B<sup>2</sup> is lined by a body G of hard refractory material which is accurately formed and is wear resistant. The body G may well be a preformed and prefired body of porcelain, incorporated in the block in molding the latter prior to the firing operation which gives the block portions B<sup>5</sup>-B<sup>8</sup> their final form and character and unites those portions to one another and to the block part G.

Jets of a combustible mixture of air and gas are delivered to the combustion chamber B' by a burner nozzle element comprising a burner tip member H and a tubular burner tip holder I, each of refractory ceramic material. The tip holder I is axially disposed in the passage B<sup>2</sup>, and is provided intermediate its ends with a shoulder I', having a radial surface which fits against the porcelain or other hard refractory insert G. The surface of the latter, engaged by the shoulder I', may be accurately ground after the block B is formed. Ordinarily, the portion of the tip holder I at the inner side of its shoulder I' substantially fills the passage B<sup>2</sup> through the block B. Advantageously, however, the cross section of the burner well C is sufficiently larger than that of the outer portion of the burner tip member I to provide ample clearance between the latter and the wall of said well to accommodate changes in relative positions of the parts resulting from the thermal and mechanical stresses to which the furnace structure is subjected in operation. Such stresses sometimes destroy the initial, axial alignment of the passage B<sup>2</sup> and well C.

The tip holder part I, as shown, is formed with a tapered axial passage I<sup>2</sup> with its largest diameter at its inner end. The burner tip member

H comprises a body portion shown in Fig. 1 as cemented in place in the inner end of the passage I<sup>2</sup>, though it may be threaded into the inner end of the passage I<sup>2</sup>, as is the tip member HA shown in Fig. 4. The tip H has an enlarged head at its inner end, which overlaps the inner end of the holder I and comprises an inner portion H<sup>3</sup> and an intermediate portion H<sup>4</sup>. The diameter of the portion H<sup>4</sup> is less than that of the part H<sup>3</sup> but is greater than that of the body portion. As shown, the inner end of the axial passage I' is outwardly flared sharply to form a conical seat engaged by the inner conical side of the head portion H<sup>4</sup> of the tip member H.

The peripheral surface of the body portion and portion H<sup>4</sup> of the burner tip member H is formed with channels or grooves H' which extend longitudinally of the member along the full length of its body portion. The channels H' terminate in the portion H<sup>4</sup> in outwardly inclined, inner end portions H<sup>2</sup>, having their bottom walls substantially parallel to the immediately adjacent portions of the conical end surface of the holder I against which the head of the tip H seats. With the described arrangement, the combustible mixture when supplied at a suitable pressure to the outer end of the passage I<sup>2</sup> is discharged into the combustion space in jets inclined outwardly away from the axis of the burner and generally parallel to the adjacent portion of the combustion chamber wall. As those skilled in the art will recognize, the burner shown is thus of the extensively used duradant type, disclosed and claimed in Patent No. 2,215,079, granted September 17, 1940.

In the heretofore more usual form of the Duradant burner, the inclined channel portions H<sup>2</sup> extend to the periphery of the portion of the tip member H. In Fig. 1, however, the head portion H<sup>3</sup> projects laterally beyond the outer ends of the orifice portions H<sup>2</sup> alongside the jets issuing from the latter and is thereby heated to incandescence even when the burning jets are short and small and the incandescent portion of the burner tip member is in an advantageous position to maintain ignition. The special burner tip construction shown in Fig. 1 is especially desirable because it facilitates the maintenance of ignition, particularly under light load operation with a combustible mixture including a slow burning gas.

The burner tip member H may be inserted and removed with the tip holder member I through the burner well C in the furnace wall when the maximum tip holder diameter is not greater than the minimum diameter of the passage B<sup>2</sup> as is the case in the construction shown in Figs. 1-3. However, it is not always necessary to shape the burner tip and tip holder to permit the tip to be inserted and removed through the passage B<sup>2</sup>, since, in many cases, it is practically feasible to remove and replace the burner tip member from or through the furnace chamber.

As shown, the conduit means through which the combustible mixture is supplied to the outer end of the tip holder passage I<sup>2</sup> comprises a tubular metallic coupling part J having a plain, inner, tubular portion extending into the passage I<sup>2</sup> and cemented to the wall of that passage and having an outer end portion J' which is of increased diameter and corrugated, and forms an integral, expansible bellows portion of the member J. Said bellows portion is connected at its outer end to an annular flange or end part J<sup>2</sup>, which, as shown, is clamped against the inner

side of the outer end wall K' of a spring and bellows chamber K<sup>2</sup> in a metallic burner plate member K. The latter is formed at the inner end of the chamber K<sup>2</sup> with an internal flange portion K<sup>3</sup>. The member K is also formed with an outwardly extending flange portion K<sup>4</sup> which, in normal use is clamped against the metallic furnace casing D, at the margin of the opening D' formed therein and surrounding the corresponding burner seat in the furnace wall. The plate member K is formed at its outside with a hollow boss K<sup>5</sup> internally threaded to receive the end of an external supply pipe L.

In the working condition of the apparatus shown in Fig. 1, a helical spring M acts between the burner plate wall K' and a metallic washer or bearing member O which surrounds the body portion of the member J and abuts against the outer end of the ceramic tip holder I. Advantageously, and as shown, the member O is formed with fingers or projections O' which in the working condition of the apparatus shown in Fig. 1, extend in front of and are spaced outwardly away from the internal burner plate flange K<sup>3</sup>. In the shipping, or transportation condition of the burner unit comprising the parts H, I, J, K, L, M and O, the projections O' are held in engagement with the flange K<sup>3</sup> by the spring M the tension of which is sufficient to prevent accidental displacing of the parts in transportation. To permit the ready, factory assemblage of the parts, the internal flange K<sup>3</sup> is formed with suitably disposed radially extending openings K<sup>6</sup>, shown in Fig. 3, one for each of the different projections O' and through which the latter are passed in the initial, factory assembly of the unit. After the projections O' are moved through the slots K<sup>6</sup>, the member O is rotated about its own axis relative to the burner plate member K to move the projections O' out of registry with the openings K<sup>6</sup>.

An important, practical advantage of the construction shown in Figs. 1 to 3, is that it prevents substantial movements of the outer portion of the furnace wall relative to the block B and longitudinally and transversely of the burner axis which may be produced by the stresses of operation, from interfering with the burner efficiency or capacity and from giving rise to air leakage into, or gas leakage out of, the furnace chamber through the passage B<sup>2</sup>. As will be apparent, the member J with its bellows portion J' forms a flexible pipe section between the burner tip member and the fuel supply pipe external to the furnace wall. In the arrangement shown in Figs. 1 to 3, the flexible metallic pipe portion J' is located at the outer side of the refractory portion of the furnace wall in position to radiate heat to the enclosing metallic casing element K and to be correspondingly cooled. This is especially important when the refractory portion of the furnace wall is relatively thin so that the temperature of its outer portion may be appreciably higher than when the furnace wall is thicker.

In Figs. 4 and 5 we have illustrated a form of our invention including a burner block B mounted in the furnace wall adjacent the furnace chamber, as in the construction first described. Mounted in the passage B<sup>2</sup> of the burner block B is a burner tip holder IA which differs in form from the previously described member I, in that it is internally threaded at its inner end to receive the burner tip member HA. The latter omits the special head portion H<sup>3</sup> of

the member H. At its outer end the tip holder IA is connected to a tubular metallic coupling part JA having its axial passage enlarged at its inner end to form a socket in which the outer end of the ceramic tip holder IA may be cemented. As shown, the socket wall is formed with openings J<sup>10</sup> to facilitate the cementing operation. The outer end portion of the member JA is of reduced diameter and is externally threaded and has screwed onto it a metallic ball joint element P formed with an axial passage and with a spherical outer end surface P'. The flexible metallic pipe R has its inner end secured in the outer end of the axial passage of the member P and has its outer end secured in the enlarged inner end of the bore of a nipple element S which extends through a member KA bolted to a removable burner plate KB, and forming a closure for an aperture in said plate in register with the burner well C. The plate KB forms part of the metallic casing or armor for the wall K. Said armor comprises angle bar elements DA.

As shown, the furnace wall A is much thicker relative to the axial extent of the burner block B in Fig. 4 than in Fig. 1. In Fig. 4 the elongated burner well C is formed by the registering axial bores of tubular tiles C<sup>10</sup>, C<sup>11</sup>, and C<sup>12</sup>, arranged end to end and extending from the outer side of the block B to the outer side of the furnace wall. Advantageously, to accommodate the unequal thermal expansion and contraction of the burner parts and to reduce the gas leakage risk, a non-hardening, high temperature cement W' is inserted in the joints between the adjacent end to end tiles C<sup>10</sup>, C<sup>11</sup> and C<sup>12</sup> and between the inner end of the tile C<sup>10</sup> and the block B. Advantageously, the block B in this construction, as in the construction first described, is permanently incorporated in the furnace wall by a suitable, high temperature, fire brick cement W adapted to firmly bond the block to the furnace wall. As shown, a gasket W<sup>2</sup> is interposed between the outer end of the outer tile C<sup>12</sup> and the burner plate KB and the latter is formed at its inner side with a circular rib KB' which extends into an annular groove, formed for the purpose in the outer end of the tile part C<sup>12</sup>.

Associated with the member KA are stuffing box provisions for establishing a gas tight joint between the member KA and the cylindrical portion of the member S passing through the member KA. As shown, those provisions comprise a flexible packing X pressed into a conical enlargement of the inner end of the passage through the member KA by a sealing washer X' which fits about the cylindrical body portion of the member S and is pressed against the packing by a spring MA. The latter acts between the sealing washer X' and a second washer MA' surrounding the member S. The spring MA acts through the washer MA' on the adjacent outer end of a tubular metallic member Q which surrounds the flexible pipe R and is provided at its inner end with a bearing part Q' having a spherical bearing surface in engagement with the spherical surface P' of the member P.

The outer end of the nipple S is externally threaded for connection with the combustible mixture supply piping. As illustrated, the external piping comprises a manifold pipe U which may supply combustible mixture to each of a plurality of burners, and is mounted in the furnace wall, through a branch including a flexible pipe section U', a regulating valve U<sup>2</sup>, union U<sup>3</sup>,

and an elbow U<sup>4</sup>. To prevent the nipple S from transmitting torsion stresses to the tip holder IA and connecting parts within the burner well C, we advantageously provide a spline connection between the casing part KA and the nipple S. As shown most clearly in Fig. 5, the spline connection is formed by flattening the sides of an outer portion of the nipple S and by straddling the flattened portion of the nipple by the bifurcated portion of a locking plate member T which is formed with an open ended slot T' of a width smaller than the full diameter of the nipple S but large enough to receive the flattened portion of the nipple. As shown, the locking plate T is bolted to the closure part KA.

As will be apparent to those skilled in the art, the construction shown in Figs. 4 and 5 possesses the general operating advantages mentioned above as obtainable with the construction shown in Figs. 1 to 3. Moreover, the construction shown in Figs. 4 and 5, while somewhat less simple than that shown in Figs. 1 to 3, is well adapted for use in a relatively thick furnace wall having its outer portion formed by insulating bricks or other metallic heat insulating material of relatively small mechanical strength. In such a wall, the use of the tubular well tiles C<sup>10</sup>, C<sup>11</sup> and C<sup>12</sup> which may be formed of relatively strong ceramic material, is especially desirable.

For a full appreciation of the practical merit and advantages of the present invention, account should be taken of the operating conditions for which our improved furnace wall burners were devised and are adapted. Such burners are customarily, though not invariably, used in heating furnace chambers to very high temperatures. In some cases, the furnace chamber temperature attained is as high as 2900° F. In many uses of the burners, it is highly important, also, that the products formed by the combustion of the combustible mixture shall be of a predetermined and uniform character. With the type and form of burner disclosed, the combustion of the mixture jets supplied to the combustion chamber are completed in that chamber, and the products formed are thus predetermined by the composition of the mixture supplied to the furnace, provided there is no air leakage into the combustion chamber. Generally speaking, also, air leakage through a furnace wall is objectionable even if the precise character of the furnace chamber atmosphere is not important.

The relative thermal expansion of burner and associated furnace wall parts, as a result of the wide range of temperatures to which they are subjected, tends to wall cracks and open joints, lateral and consequent leakage through the furnace wall. The temperature range may extend from a combustion chamber temperature of 3000° F. or so to atmospheric temperature in the case of the outer end of the flexible metallic pipe connection to the burner. Each of the constructions illustrated is well adapted to accommodate the relative thermal expansion of the burner parts, resulting from the wide temperature range and to maintain gas tight joints so as to prevent the leakage of atmospheric air into the combustion chamber through the passage B<sup>2</sup>. Each construction is also well adapted to remain in good operative condition notwithstanding lateral displacement of the metallic wall armor and external supply piping relative to the burner block B.

Operation with the high burner temperatures

obtained without objectionable local overheating in the combustion chamber, requires extreme accuracy in form and disposition of the combustion chamber wall and the burner nozzle orifices through which the combustible mixture jets are discharged into the combustion chamber. That accuracy is insured with applicant's construction, by the use of a molded combustion chamber block which can be formed with a high degree of accuracy, and by the use of associated burner nozzle parts which are practically possible of construction with the accuracy required for their interchangeable use. Their capacity for interchangeable use is practically essential since, with the extremely high temperatures experienced, there is an inevitable need for the frequent replacement of burner tip members, and for the occasional replacement of tip holder members. With each of the described constructions, the burner tip holder and associated supply conduits may be removed and accurately replaced quickly and easily. To effect their removal, it is necessary only to open the union U<sup>3</sup>, and to take out the bolts normally securing the closure member K to the plate D in Fig. 1 and the bolts normally securing the closure plate KA to the plate KB in Fig. 4.

This application is a continuation in part of our application Serial No. 365,440, filed November 13, 1940, and containing claims on a novel burner tip construction disclosed but not claimed herein.

While in accordance with the provisions of the statutes, we have illustrated and described the best forms of embodiment of our invention now known to us, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of our invention, as set forth in the appended claims and that in some cases certain features of our invention may be used to advantage without a corresponding use of other features.

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

1. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and providing a burner seat at the inner end of an outer portion of said passage, of a tubular burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, and a conduit supplying combustible fluid to said burner body comprising a section adjacent and rigidly secured to the outer end of said burner body and a flexible section more remote from said body and having its outer end secured to said wall and in fixed relation therewith.

2. The combination with a furnace chamber wall comprising a body portion of ceramic material and an outer metallic casing, and formed with a burner passage opening through said wall to said furnace chamber and providing a burner seat at the inner end of an outer portion of said passage, of a tubular burner body mounted in said seat and insertable therein and removable therefrom from the outer end of said passage, and a combustible fluid supply conduit having one end secured to said burner body and having its other end secured to said casing and comprising a flexible intermediate portion.

3. The combination with a masonry furnace chamber wall formed with a burner passage

opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, resilient means holding said burner body in said seat and means for supplying combustible fluid to said burner body comprising a flexible supply conduit section.

4. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, and means for supplying combustible fluid to said burner body comprising a pipe section rigidly connected to said wall and a flexible supply conduit section extending between said pipe section and burner body.

5. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, and means resiliently pressing said body against said seat.

6. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with a burner seat at the inner end of an outer portion of said passage, of a tubular molded refractory burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, a metallic part detachably secured to said wall and extending across the outer end of said passage and formed with an aperture opening to said passage, and means for supplying combustible fluid to said burner body comprising a flexible pipe connecting said part and burner body and communicating with said aperture.

7. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular molded refractory burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, a metallic part detachably secured to said wall and extending across the outer end of said passage and formed with an aperture opening to said passage, a supply pipe extending into said passage through said aperture, joint packing means surrounding said supply pipe at the inner side of said part, and resilient means acting between said last-mentioned means and burner body and tending to move each away from the other.

8. The combination with a masonry furnace

chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular molded refractory burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, a tubular metallic structure cemented to the outer end of the burner body and formed with an outwardly facing spherical surface, and resilient means engaging against said surface and holding said burner body against said seat.

9. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular molded refractory burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, a tubular metallic structure cemented to the outer end of said passage and formed with an outwardly facing spherical surface, a flexible combustible supply pipe connected to said metallic part, and resilient means engaging against said surface and holding said burner body against said seat.

10. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and formed with an annular burner seat at the inner end of an outer portion of said passage and surrounding an intermediate portion of said passage which is of lesser diameter than said outer portion, of a tubular molded refractory burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, a metallic part detachably secured to said wall and extending across the outer end of said passage and formed with an aperture opening to said passage, and means supplying combustible fluid to said burner body comprising a rigid supply pipe section extending into said passage through said aperture and in splined engagement with said metallic part and a flexible pipe connecting said part and burner body.

11. A masonry furnace chamber wall including in combination a molded block of refractory material permanently mounted in the inner portion of said wall and having a passage which extends through said block and through the portion of said wall at the outer side of said block, said block comprising portions differing from one another in composition and including a prefired porcelain burner seat portion surrounding the outer end of the passage in said block and integrally fired to the other portions of the block subsequent to the block molding operation.

12. The combination with a masonry furnace chamber wall including a molded block of refractory material permanently mounted in the inner portion of said wall and having a passage which extends through said block and through the portion of said wall to the outer side of said block, said block comprising integrally connected portions differing from one another in composition and being formed with a burner seat surrounding the outer end of the passage in said block, of a tubular burner body seated in said seat

and insertable therein and removable therefrom through the outer end of said passage.

13. The combination with a masonry furnace chamber wall including a molded block of refractory material embedded in said wall with one side facing said chamber and formed with a cup shaped combustion space recess in said side and with a channel extending outward from the bottom of said recess and with a burner seat surrounding the outer end of said channel, the wall of said recess being grooved, a tubular burner body seated in said seat and insertable in and removable therefrom through the outer end of said passage, and means for supplying a combustible fluid to said combustion space through said burner body.

14. The combination with a masonry furnace chamber wall including a molded block of refractory material embedded in a portion of said wall adjacent the furnace chamber and formed with a passage extending between the furnace chamber side and the opposite side of the block, and including a plurality of hollow tiles arranged end to end between the outer side of said wall and the outer side of said block, said tiles having their bores coaxial with one another and with said passage, and of greater diameter than said passage at the outer end of the latter, of a tubular burner body seated against the outer side

of said block with its bore coaxial with said passage and insertable into and removable from its position of engagement with said block through the bores of said tiles, a metallic outer wall part engaging the outer end of the outer tile, means for supplying combustible fluid to said burner body extending through said metallic wall portion and through the bores of said tiles, and means acting between said metallic wall part and said burner body to resiliently press the latter against said block.

15. The combination with a masonry furnace chamber wall formed with a burner passage opening through said wall to the furnace chamber and providing a burner seat at the inner end of an outer portion of said passage, of a tubular molded refractory burner body mounted in said seat and insertable therein and removable therefrom through the outer end of said passage, and means for supplying combustible fluid to said burner body comprising a tubular metallic element comprising an inner end portion rigidly secured to the outer end of said burner body and an outer end portion rigidly attached to an outer portion of said wall and an intermediate portion circumferentially corrugated to form a flexible portion of said element.

FREDERIC O. HESS.  
JOSEPH EHLINGER.