March 14, 1944. E. C. NEWBURG 2,343,873

COMBINATION GAS AND LIQUID FUEL BURNER

Filed May 9, 1941 2 Sheets-Sheet 1

Fig. 1.

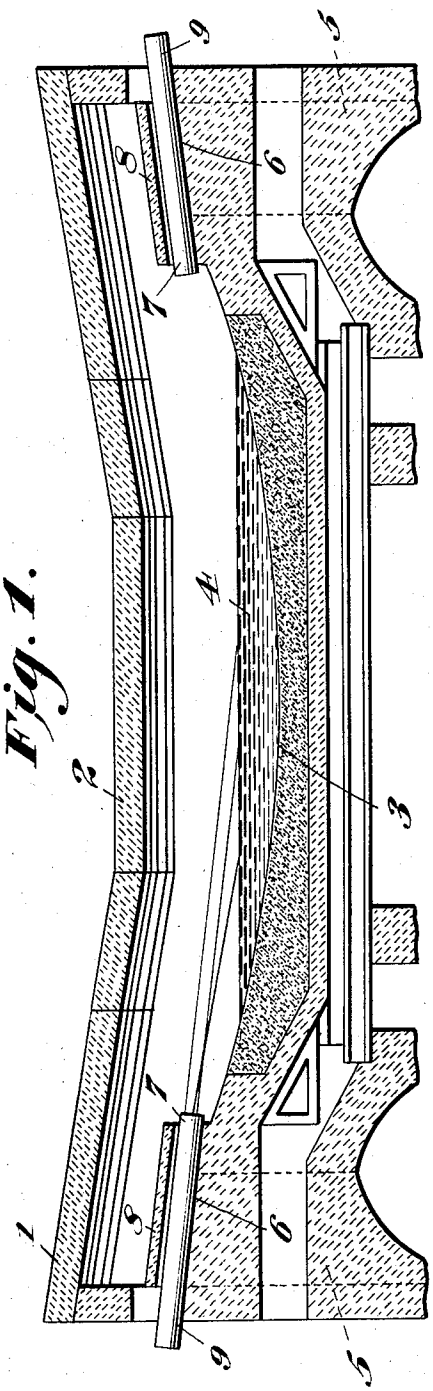
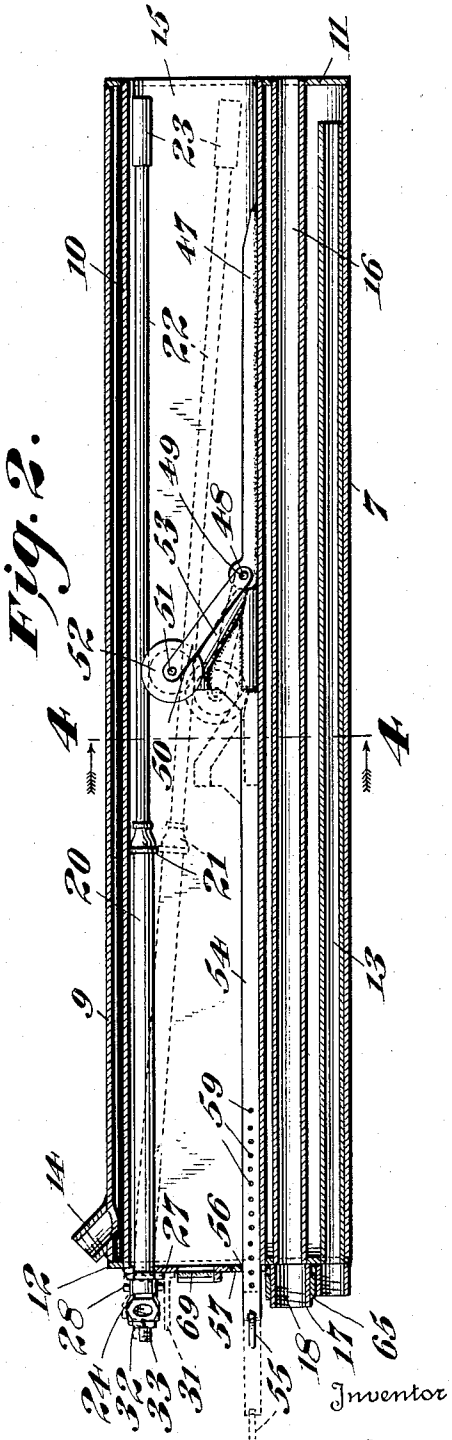


Fig. 2.



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Fig. 6.

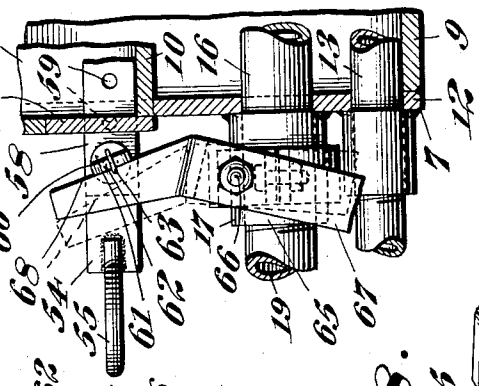


Fig. 8.

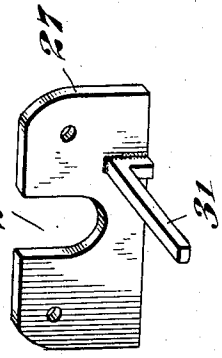


Fig. 9.

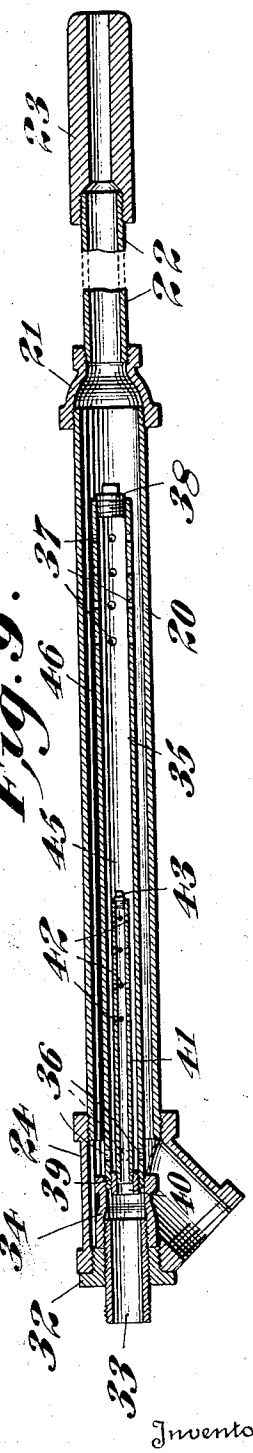


Fig. 5.

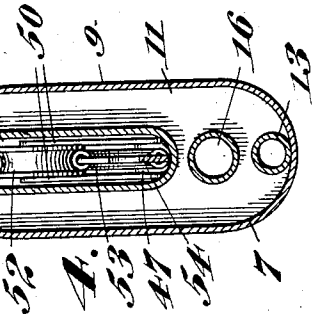


Fig. 7.

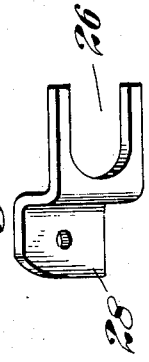


Fig. 4.

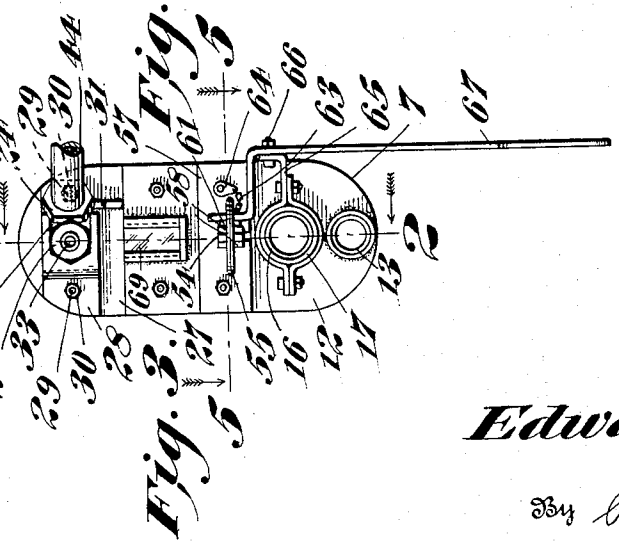


Fig. 3.

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UNITED STATES PATENT OFFICE

2,343,873

COMBINATION GAS AND LIQUID FUEL BURNER

Edward C. Newburg, Lackawanna, N. Y., assignor to Bethlehem Steel Company, a corporation of Pennsylvania

Application May 9, 1941, Serial No. 392,691

8 Claims. (Cl. 158—11)

My invention relates to combination burners for introducing liquid and gaseous fuels into high temperature furnaces, such as open hearth furnaces used in the production of steel, in which it is necessary to provide water-cooled jackets through which the fuel pipes are introduced into the melting or heating chambers.

Where burners are used in heating open hearth reversing furnaces which have regenerators at opposite sides of the furnace a burner is located at each end of the furnace.

When the burner at one end of the furnace is in operation the burner at the other end of the furnace is shut off. In this manner the flame then passes over the bath and the waste gases of combustion therefrom pass downwardly through the uptakes and through a regenerator at that side of the furnace thereby heating the same, and then pass to the stack.

As the incoming cool air passing through the regenerator for the burner in operation soon cools the regenerator at that side of the furnace this burner is shut off and the other burner opened, and the operation is reversed, all of which is well known in this art.

Heretofore when burners have been used for heating furnaces of this type, it has been the usual practice to have a burner provided with a water-cooled jacket having a single jet, or a plurality of jets mounted therein in fixed relation at each end of the furnace which had to be adjusted as a unit at times to direct the flame at a proper angle over the furnace hearth, which in the case of large furnaces and long burners is not easily accomplished.

One of the objects of my invention is to provide a combination burner having a water-cooled jacket which can be set in a fixed position in the furnace having two fuel injection pipes one of which is mounted in the water-cooled jacket in fixed relation thereto, while the other fuel injection pipe is mounted for adjustment in relation thereto in an elongated chamber extending longitudinally through the water-cooled jacket.

Another object of my invention is to provide a simple, accessible vertical adjustment for a liquid fuel injection pipe in a water-cooled jacket, so that its position can be readily changed with respect to the height of the burner tip above the bath and also with regard to the angle of the burner from the bath level, thereby providing a better control of the flame with respect to the charge.

Another object of my invention is to provide a liquid fuel burner in which a more perfect atomization of the liquid fuel, and thereby a more nearly perfect combustion of the fuel, is obtained.

My burner is designed to include a fuel injection pipe for burning coke oven gas or the like in combination with a liquid fuel burner injection pipe.

Another object of my invention is to provide means for mounting the liquid fuel burner pipe in the water-cooled jacket so it can be easily and quickly adjusted or may be removed when it is burned out or becomes defective and a new liquid fuel burner pipe inserted in place thereof.

Other objects of my invention will hereinafter appear.

Having thus given a general description of the advantages of my invention, I shall now in order to make the same more clear refer to the annexed two sheets of drawings forming a part of this specification and in which like characters of reference indicate like parts:

Figure 1 is a longitudinal section taken through the upper portion of an open hearth furnace showing diagrammatically a burner at each end of the furnace.

Fig. 2 is a vertical longitudinal section through the burner taken on the line 2—2 of Fig. 3.

Fig. 3 is a rear end elevation of the burner.

Fig. 4 is a vertical transverse section taken on the line 4—4 of Fig. 2.

Fig. 5 is a detail horizontal section of the rear end of the burner taken on the line 5—5 of Fig. 3.

Fig. 6 is a detail view illustrating the manner of holding the pin for retaining the burner actuating bar in position.

Fig. 7 is a perspective view of the outer keeper for the rear end of the liquid fuel burner pipe.

Fig. 8 is a perspective view of the inner keeper for the rear end of the liquid burner pipe, and

Fig. 9 is a longitudinal sectional view of the liquid fuel burner injection pipe.

Referring now to the various characters of reference on the drawings the numeral 1 designates an open hearth furnace as a whole, 2 the roof, 3 the hearth and 4 the bath on the hearth. Each end of the furnace is provided with the usual air uptakes 5 communicating with the regenerators (not shown) through which the heated air is received for the burner in operation or the waste gases are discharged from the combustion chamber. An opening 6 is formed in each end of the furnace for the reception of a burner 7 which preferably has a hood 8 of refractory material extending over the burner.

As each of these burners are of the same construction a description of one will apply to both.

The burner has an outer casing 9 formed of a standard pipe which is flattened to form an oval tubular shaped member and an inner casing 10 also formed of a standard pipe of smaller diameter flattened in a similar manner and disposed at an intermediate point in spaced relation within the upper portion of the outer casing 9. The front and rear ends of the outer and inner casings 9 and 10 are connected together by means of plates 11 and 12 respectively thereby forming a water jacket for the circulation of water which is supplied through a water inlet pipe 13 and withdrawn through an outlet pipe 14. In this arrangement the inner casing 10 is adapted to form an elongated chamber 15 extending longitudinally through the upper central portion of the water jacket.

Extending through the lower portion of the water jacket beneath the inner casing 10 and in parallel relation with the walls of the casing is a gas injection tube 16 which extends through the end plates 11 and 12 and is welded thereto. The rear end of the tube 16 is provided with a coupling 17 which is welded to the rear end plate 12 and extends rearwardly therefrom and is screw threaded as at 18 for connecting a pipe 19 thereto for supplying coke oven gas or the like to the injection pipe 16.

In the elongated chamber 15 of the water jacket is mounted an adjustable liquid fuel burner structure provided with a mixing chamber having an outer tubular shell portion 20, to the forward end of which is coupled by means of a reducer 21 a pipe 22 having a burner tip 23 threaded on its outer end. The rear inner end of the tubular shell 20 is threaded into a Y-coupling 24 which is supported or hinged for adjustable swinging movement of the burner in the notches 25 and 26 of keepers 27 and 28 respectively which are secured by means of stud bolts 29 and nuts 30 to the upper portion of the rear end plate 12, and keeper 27 is further provided with a bracket 31 adapted to form an additional support for the Y-coupling and the rear end of the burner.

A bushing 32 is threaded into one end of the Y-coupling for receiving a nipple 33 to one end of which is adapted to be coupled an oil supply pipe while the opposite end of the said nipple projects into the Y-coupling beyond the bushing 32 for receiving a reducer 34 for coupling one end of a tube 35 thereto. This tube 35 extends into the outer shell portion 20 of the mixing chamber in spaced relation therewith having holes in the side walls near the inner and outer ends as at 36 and 37 and the other end of said tube is closed by means of a plug 38 threaded therein. The rear end of the tube 35 is threaded internally as at 39 to receive a thimble 40 in which is threaded the rear end of a liquid fuel receiving pipe 41 adapted to extend into the tube 35 in spaced relation therewith and is perforated with holes as at 42 with its opposite end closed by means of a plug 43. A steam inlet pipe 44 is also threaded into the Y-coupling 24 for supplying steam to the mixing chamber.

In operation oil from the oil supply pipe connected to the nipple 33 is admitted into the liquid fuel receiving pipe 41 and forced under pressure through the perforations 42 into an initial mixing chamber 45 where it is mixed with steam from the steam supply pipe 44 which is admitted thereto through holes 36 where the oil and steam are initially mixed and then forced through perforations 37 into a final mixing chamber 46 and then advanced through the pipe 22 to the burner tip 23 disposed adjacent to the front end of the water jacket.

By constructing the mixing chambers of the burner in this manner a more perfect atomization of the liquid fuel is obtained, and therefore a more nearly perfect combustion of the fuel.

Heretofore burners having liquid fuel injection pipes used in open hearth furnaces or the like provided with water-cooled jackets were not adapted for vertical adjustment independently of the water jacket, but the entire structure had to be adjusted as a unit which is a difficult operation on account of the heat and weight of the burner.

With my design the burner incorporates a simple, accessible vertical adjustment for the liquid fuel injection pipe, so that its position can be readily changed with respect to the height of the burner tip above the bath and also with regard to the angle of the burner from the bath level.

To accomplish this purpose I have secured near the outer end of the elongated chamber 15 in the water jacket formed by the inner casing 9 the anchor bar 47 which is welded in position and provided with an eye 48 at one end to receive a pin 49 for pivoting thereto the lower ends of a pair of links 50. The opposite ends of said links are connected by the axle 51 for a grooved roller 52 adapted to have its upper surface engage the pipe 22 of the liquid fuel burner while the lower surface of the said roller engages an inclined track 53 at the forward end of an actuating bar 54 having a handle 55 at its rear end for vertically adjusting the liquid fuel burner as indicated in Fig. 2. The actuating bar 54 extends rearwardly through a slot 56 in a plate 57 which is provided with ears 58 having perforations therein adapted to register with perforations 59 in the actuating bar to receive a pin 60 having an annular shoulder 61 and a flange 62 provided with an opening for attaching a chain 63 thereto which is secured at its opposite end to a washer 64 riveted to the plate 57.

In order to hold the pin 60 in a locked position after the lifting bar has been adjusted a bracket 65 is secured on the coupling 17 to which is pivoted as at 66 a lever 67 having its upper end formed with an offset portion provided with an inclined edge 68 for engaging the annular shoulder 61 and flange 62 of the pin 60. As indicated more clearly in Fig. 6, when the inclined edge 68 of the upper end of the lever is in the position shown in full lines the pin 60 will be held in locked position and when the lever is moved to the dotted line position the pin may be removed and the actuating bar adjusted and the pin then reinserted in another hole in the actuating bar and then locked again.

In order to see the adjusted position of the liquid fuel injection pipe a glass sight 69 is provided in the rear end of the burner.

For illustration I have described my invention as a combination oil and gas burner particularly adapted for use in an open hearth furnace, but I wish it understood that it may be used with other kinds of furnaces equally as well and I may use tar or any other desirable liquid fuel instead of oil and use liquid fuel with or without gas or gas entirely if I so desire.

Although I have shown and described my invention in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of my invention or as are pointed out in the claims.

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

1. A burner unit comprising inner and outer vertically elongated tubular casings, an end plate welded to and connecting each of the front and rear ends respectively of the inner and outer casings to form a water jacket, a fuel injection pipe extending longitudinally through the water jacket and welded to the end plates, said inner casing defining a chamber, a fuel injection pipe mounted in the chamber and hingedly connected to the rear end plate of the water jacket, and means for angularly adjusting the last named fuel injection pipe in the chamber.

2. A burner unit comprising inner and outer vertically elongated tubular casings, an end plate welded to and connecting each of the front and rear ends respectively of the inner and outer casings to form a water jacket, a gas injection pipe extending longitudinally through the water jacket and welded to the end plates, said inner casing defining a chamber, a liquid fuel injection pipe mounted in the chamber and hinged to the rear end plate of the water jacket, a roller pivoted for swinging movement in the chamber for engaging the liquid fuel injection pipe, and a reciprocating actuating bar having an inclined track formed thereon for engaging the roller for angularly adjusting the liquid fuel injection pipe.

3. A burner unit comprising inner and outer vertically elongated tubular casings, an end plate welded to and connecting each of the front and rear ends respectively of the inner and outer casings to form a water jacket, a gas injection pipe extending longitudinally through the water jacket and welded to the end plates, a vertically elongated chamber formed by the inner casing extending longitudinally through the central portion of the water jacket, a liquid fuel injection pipe mounted in the chamber and hingedly connected to the rear end of the water jacket, a burner tip at the forward end of the liquid fuel injection pipe in the chamber, a grooved roller mounted for swinging vertical movement in the intermediate portion of the chamber for engaging the liquid fuel injection pipe, and a longitudinally adjustable actuating bar in the chamber having an inclined track formed at one end for engaging the grooved roller for vertically adjusting the liquid fuel injection pipe.

4. The combination with a furnace of the class described having a combustion chamber, of a burner unit extending into the combustion chamber, comprising a vertically elongated tubular water jacket having inner and outer side walls connected together by end walls adapted to be inserted in the furnace wall in a fixed position, a chamber within the water jacket, a gas injection pipe extending longitudinally in the water jacket and welded to the end walls, a liquid fuel injection pipe extending into the chamber in the tubular water jacket having a hinged connection at its rear end to the rear end wall of the water jacket, a burner tip at the front end of the liquid fuel injection pipe, an anchor bar welded to the inner wall of the vertically elongated tubular water jacket, a pair of links pivoted at their lower ends to the anchor bar, a grooved roller pivoted to the opposite ends of the pair of links for engaging and supporting the liquid fuel injection pipe in the tubular water jacket, an inclined track for engaging the grooved roller, and means for sliding the inclined track longitudinally to angularly adjust the burner tip in relation to the tubular water jacket.

5. In combination, with a furnace of the class described having a combustion chamber, of a burner unit extending into the combustion chamber, comprising a vertically elongated tubular water jacket having inner and outer side walls connected together by end walls adapted to be inserted in the furnace wall in a fixed position, a chamber within the water jacket, a liquid fuel injection pipe extending into the chamber within the tubular water jacket having a hinged connection at its rear end to the rear end wall of the water jacket, a burner tip at the front end of the liquid fuel injection pipe, an anchor bar welded to the inner surface of the inner wall of the vertically elongated tubular water jacket, a pair of links pivoted at their lower ends to the anchor bar, a grooved roller pivoted to the opposite ends of the pair of links for engaging and supporting the liquid fuel injection pipe in the tubular water jacket, an actuating bar having an inclined track at one end for engaging the grooved roller, means for sliding the actuating bar to move the inclined track longitudinally to angularly adjust the burner tip in relation to the tubular water jacket, and means for holding the actuating bar in its adjusted position.

6. A burner unit comprising inner and outer tubular casings, an end plate welded to and connecting each of the front and rear ends respectively of the inner and outer casings to form a water jacket for the burner, said inner casing defining a chamber, a fuel injection pipe mounted in the chamber having its rear end attached by means of a hinged connection to the rear end plate of the water jacket, and pivoted swinging means mounted in the chamber for supporting and laterally adjusting the forward end of the fuel injection pipe in the chamber.

7. A burner unit comprising inner and outer vertically elongated tubular casings, an end plate welded to and connecting each of the front and rear ends respectively of the inner and outer casings to form a water jacket, said inner casing defining a chamber, a liquid fuel injection pipe mounted in the chamber having its rear end attached by means of a hinged connection to the rear end of the burner unit, a roller pivoted for swinging movement in the chamber for engaging and supporting the forward end of the liquid fuel injection pipe, and a reciprocating actuating bar mounted in the chamber having an inclined track formed thereon for engaging the roller for angularly adjusting the forward end of the liquid fuel injection pipe.

8. A burner unit comprising inner and outer casings, an end plate welded to and connecting each of the front and rear ends respectively of the inner and outer casings to form a water jacket, said inner casing defining a chamber, a gas injection pipe extending longitudinally through the water jacket and end plates and welded to said end plates, a liquid fuel injection pipe mounted in the chamber having its rear end attached by means of a hinged connection to the rear end plate of the water jacket, and means mounted in the chamber for adjusting the forward end of the liquid fuel injection pipe in relation to the gas injection pipe.

EDWARD C. NEWBURG.