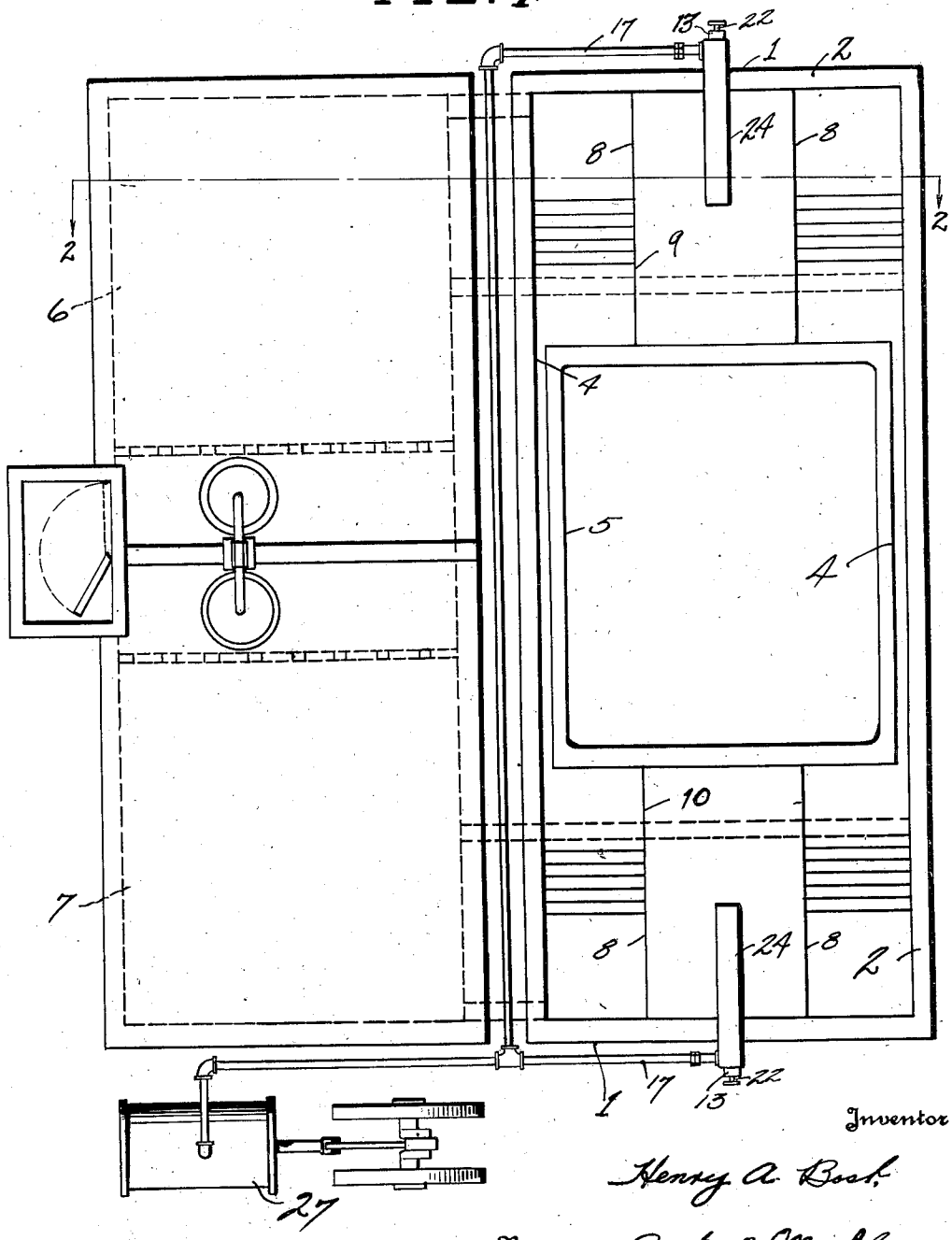
Nov. 5, 1935. H. A. BOST 2,020,047

METHOD FOR BURNING LIQUID FUEL

Filed Feb. 24, 1930 3 Sheets-Sheet 1

FIG. 1.



Inventor

Henry A. Bost.

By Justin W. Macklin.

Attorney

Nov. 5, 1935. H. A. BOST 2,020,047

METHOD FOR BURNING LIQUID FUEL

Filed Feb. 24, 1930 3 Sheets-Sheet 2

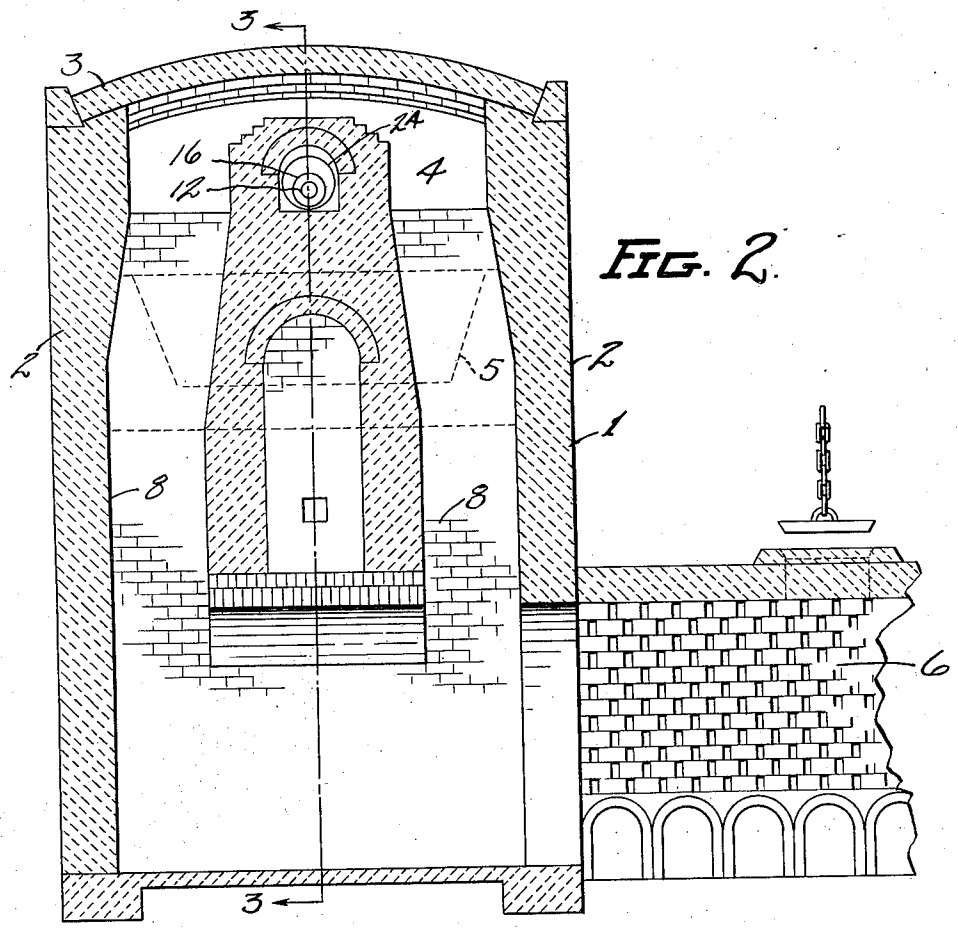


FIG. 2.

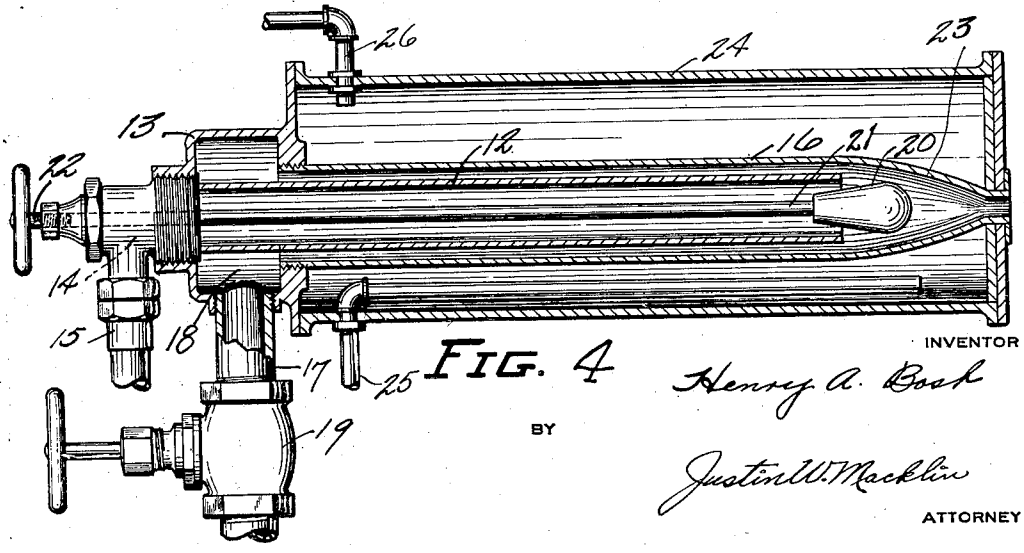


FIG. 4

INVENTOR

Henry A. Bost

BY

Justin W. Macklin

ATTORNEY

Nov. 5, 1935. H. A. BOST 2,020,047

METHOD FOR BURNING LIQUID FUEL

Filed Feb. 24, 1930 3 Sheets-Sheet 3

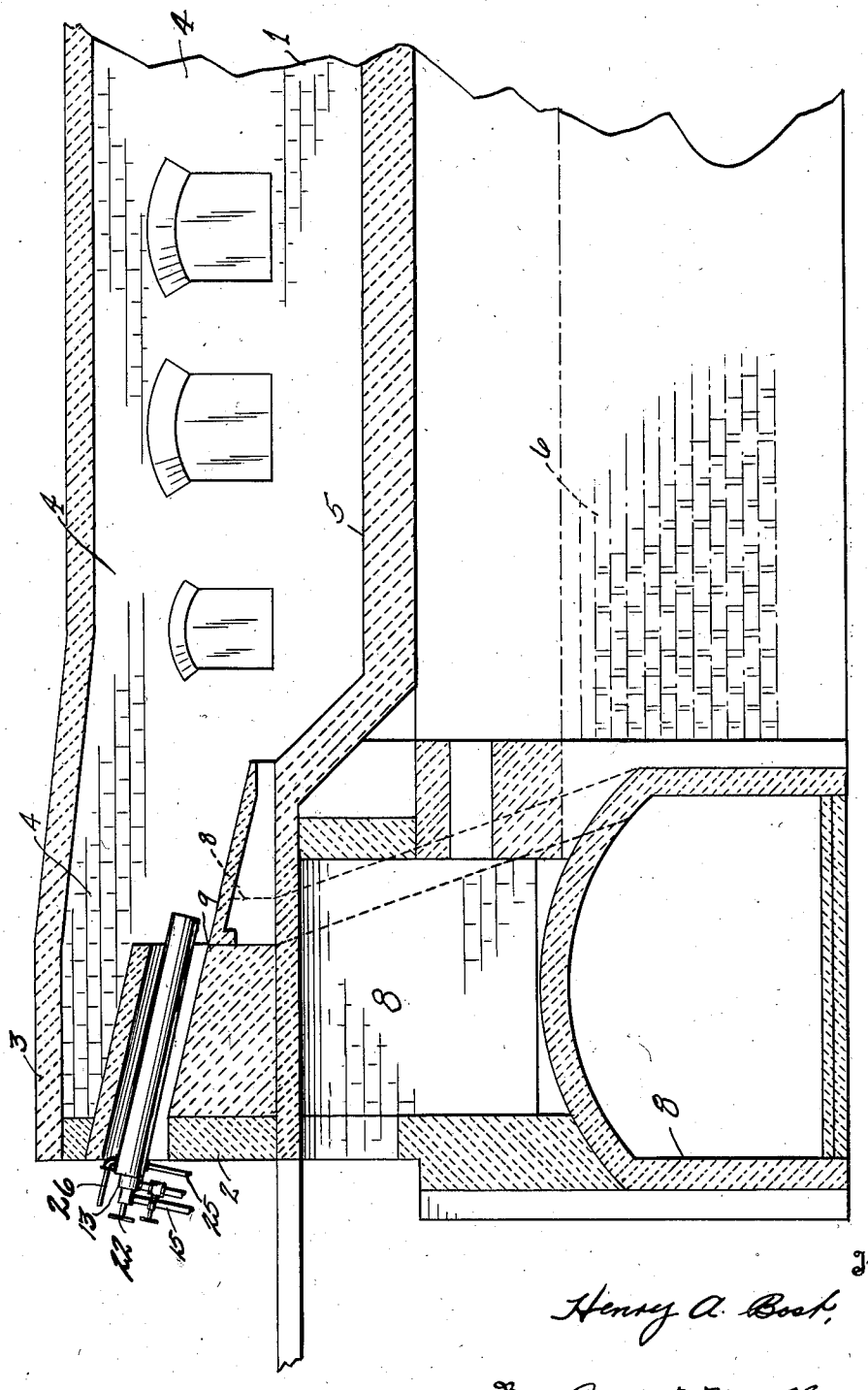


FIG. 3.

Inventor

Henry A. Bost.

By Justin W. Macklin.

Attorney

Patented Nov. 5, 1935

2,020,047

UNITED STATES PATENT OFFICE

2,020,047

METHOD FOR BURNING LIQUID FUEL

Henry A. Bost, Euclid, Ohio, assignor to The Otis Steel Company, Cleveland, Ohio, a corporation of Ohio

Application February 24, 1930, Serial No. 430,703

3 Claims. (Cl. 158—117.5)

This invention relates to a method for effectively cheapening the cost of using fuels and increasing the efficiency thereof, permitting the use of crude or low grade oils in open hearth steel furnaces and the like.

In order to obtain efficient combustion of low grade or cheap oils it is necessary first to vaporize them completely. Heretofore the practice has been to atomize oil or tar with air under pressure sufficient to spray the oil into the combustion chamber of a furnace, where the radiant heat of the furnace raised the temperature of the mixture to vaporize the oil. This method has proven unsatisfactory in that complete vaporization has not been obtained, and consequently combustion has been inefficient. The large volume of relatively cool air necessarily introduced into the furnace tends to reduce the temperature therein. Likewise, vaporization is retarded, due to the fact that the oil globules are suspended in air which first must be heated before the temperature of the oil is raised sufficiently to cause it to vaporize and ignite. Consequently in open hearth furnaces, part of the mixture does not burn completely while passing over the bath and is still burning in the open brick work in the discharge passage leading from the furnace. Incomplete combustion results and causes carbonaceous deposits on the open brick or checker work, subjecting it to excessive heat in some places and choking the air passages in other places.

This incomplete combustion is partially overcome by using higher grade oils, but such prove expensive in that the oil costs more per unit volume and contains less heat units per volume than the low grade oils.

Primarily therefore, an object of my invention is to reduce heating costs by providing a method for the efficient combustion of cheap low grade oils, while another object of my invention is to obtain a constant and easily controlled heat most effectively applied.

Another object of my invention is to obtain these results and eliminate the difficulties heretofore encountered by the use of inexpensive and easily obtainable equipment and without changing the furnace structure.

Still another object of my invention is to atomize crude or low grade oils with a combustible gas in such proportions and under such conditions that I accomplish the above objects.

Other objects of my invention will become apparent from the following specification in which the illustrative structure shown in the drawings is indicated by the use of reference numerals.

The method contemplated by my invention includes the use of a combustible gas under pressure to atomize the oil and carry it into the combustion chamber of the furnace. Further, my method includes properly proportioning the amounts of oil and gas and controlling the pressures thereof so that efficient and complete combustion is made possible.

For the purpose of illustration, I shall describe the application of my method to heating open hearth furnaces.

In the drawings—

Fig. 1 is a top plan view of an open hearth furnace equipped with oil burning apparatus adapted for carrying out the method of my invention, the roof being omitted for clearness of illustration.

Fig. 2 is a partial cross sectional view of the furnace taken on the plane designated by the line 2—2 in Fig. 1.

Fig. 3 is a longitudinal sectional view taken on a plane indicated by the line 3—3 of Fig. 2.

Fig. 4 is a longitudinal sectional view of an oil atomizing gun used in carrying out the method of my invention.

Referring to the drawings, 1 indicates an open hearth furnace of the recuperative reversible type. As illustrated, the furnace has the usual refractory walls 2 and roof 3 forming a combustion chamber 4, the bottom of which contains a crucible 5 for the metal bath.

Checker work chambers 6 and 7 communicating with the heating chamber through suitable passages such as 8 are provided for preheating the incoming air before it enters the combustion chamber and for recuperating the heat from the products of combustion as they pass out of the combustion chamber.

In operation the combustion chamber is heated alternately from opposite ends, the direction of flow of the air and products of combustion through the checker work being correspondingly alternated so that each checker work in turn heats the incoming air for an interval and then is heated by the products of combustion.

The furnace is first heated to a temperature sufficient to cause the fuel to ignite as it is introduced thereinto. Liquid fuels, such as oil, are then sprayed into the combustion chamber by suitable oil guns, mounted centrally of the bath in the end walls of the chamber 4, operating alternately as described. These oil guns are preferably extended over ramps such as 9 and 10,

which slope from the end walls down to the surface of the bath, protecting the guns and causing the burning products from the guns to be directed onto the bath surface. They may be mounted so that the flame can be directed where desired.

For carrying out the method of my invention I find it satisfactory to use an oil gun, such as illustrated in Fig. 4. The gun includes an oil nozzle 12 mounted in a suitable head 13, having a passage 14 interconnecting with the nozzle 12. Oil is introduced into the nozzle 12 through the passage 14 from a suitable conduit 15, the amount and pressure of the oil so introduced being regulated by a suitable valve.

Surrounding and spaced from the oil nozzle and extending a short distance beyond the discharge end thereof is a gas nozzle 16. This nozzle likewise may be carried in the head 13 and communicates with a conduit 17 by means of the passageway 18 in the head. A valve 19 is provided to regulate the volume and pressure of gas introduced into the nozzle 16. Gas under pressure is supplied to the nozzle 16 from a suitable source such as the compressor 27, capable of supplying the desired quantity of gas at a pressure of from 60 to 90 pounds per square inch.

A deflector 20, which may be carried by a shaft 21 mounted in the head 13 of the gun is movable axially of the oil nozzle by a screw 22 to control the volume and deflection of the oil stream issuing therefrom. The gas nozzle is contracted at its discharge end 23, so that the gas and oil are commingled and intimately mixed, and the pressure thereof transformed into velocity as the mixture is driven from the gun.

The gun is protected by a suitable water jacket 24, through which water is circulated, by introducing it at the front end near the bottom through a conduit 25 and discharging it at the top near the rear end through a conduit 26.

Experience has proven that the use of relatively expensive fuel or illuminating gas under a pressure of from 40 to 80 pounds and a cheap crude oil under pressure of from 110 to 140 pounds sprayed from such a gun in proper proportions will heat a furnace efficiently at a cost materially below that heretofore possible.

The pressures and proportions used may be varied, depending upon the quality of gas and oil used and the temperature and the shape of flame desired. To insure a regular and constant flow of oil and gas, however, the oil pressure should be greater than that of the gas at the orifice of the oil nozzle in the burner. As the mixture passes into the heated combustion chamber of the furnace, the gas ignites quickly and burns, adding its heat to the bath and rapidly heating the oil suspended therein. Since the oil and gas are in intimate contact, part of the heat of the burning gas completely vaporizes the oil and, aided by a forcible stream of preheated air supplied to the combustion chamber of the furnace, insures complete combustion of the fuel before it leaves the bath.

In carrying out my process by such an apparatus, I have effected very marked savings in the cost per ton of reducing steel.

I claim:

1. The method of burning liquid fuel in furnaces, which includes atomizing the fuel under high pressure by and with a combustible gas under high pressure at one velocity, transforming the pressure of said atomized mixture into a higher velocity and directing the mixture into a space heated sufficiently to ignite the gas in the presence of air, whereby the liquid fuel is quickly vaporized and burned.

2. The method of burning oil which includes intimately intermixing the oil under high pressure with an inflammable gas under high pressure at one velocity, transforming said pressures into a higher velocity, directing the mixture to desired points, igniting the gas while the oil is suspended therein and in the presence of air, whereby the oil is rapidly transformed into gas, and igniting and burning the resultant gas and air mixture.

3. A method of burning liquid fuel in a furnace, comprising delivering heavy oil under high pressure into a mixing chamber having a comparatively restricted discharge orifice, delivering inflammable gas under somewhat lesser pressure into the mixing chamber to mix with and effectually atomize the oil, discharging the mixture from the mixing chamber first into the presence of heated air and then into a body of air heated to sufficiently high temperature to cause the gas and oil to be ignited and burned.

HENRY A. BOST.