E. W. TUCKER.

LIQUID FUEL BURNING SYSTEM.

APPLICATION FILED AUG. 6, 1909.

996,737.

Patented July 4, 1911.

Fig. 1.

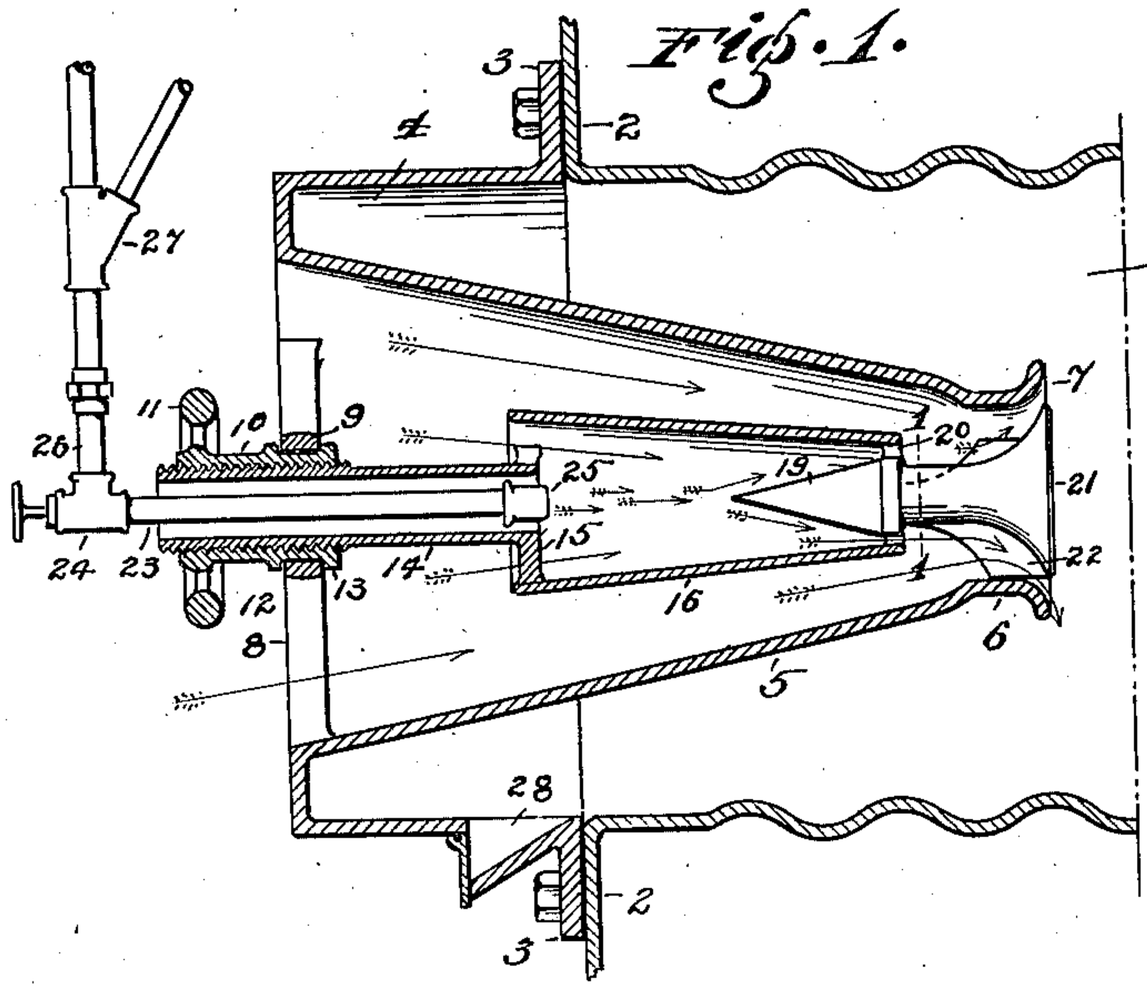


Fig. 3.

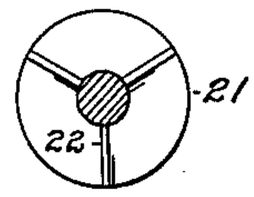


Fig. 2.

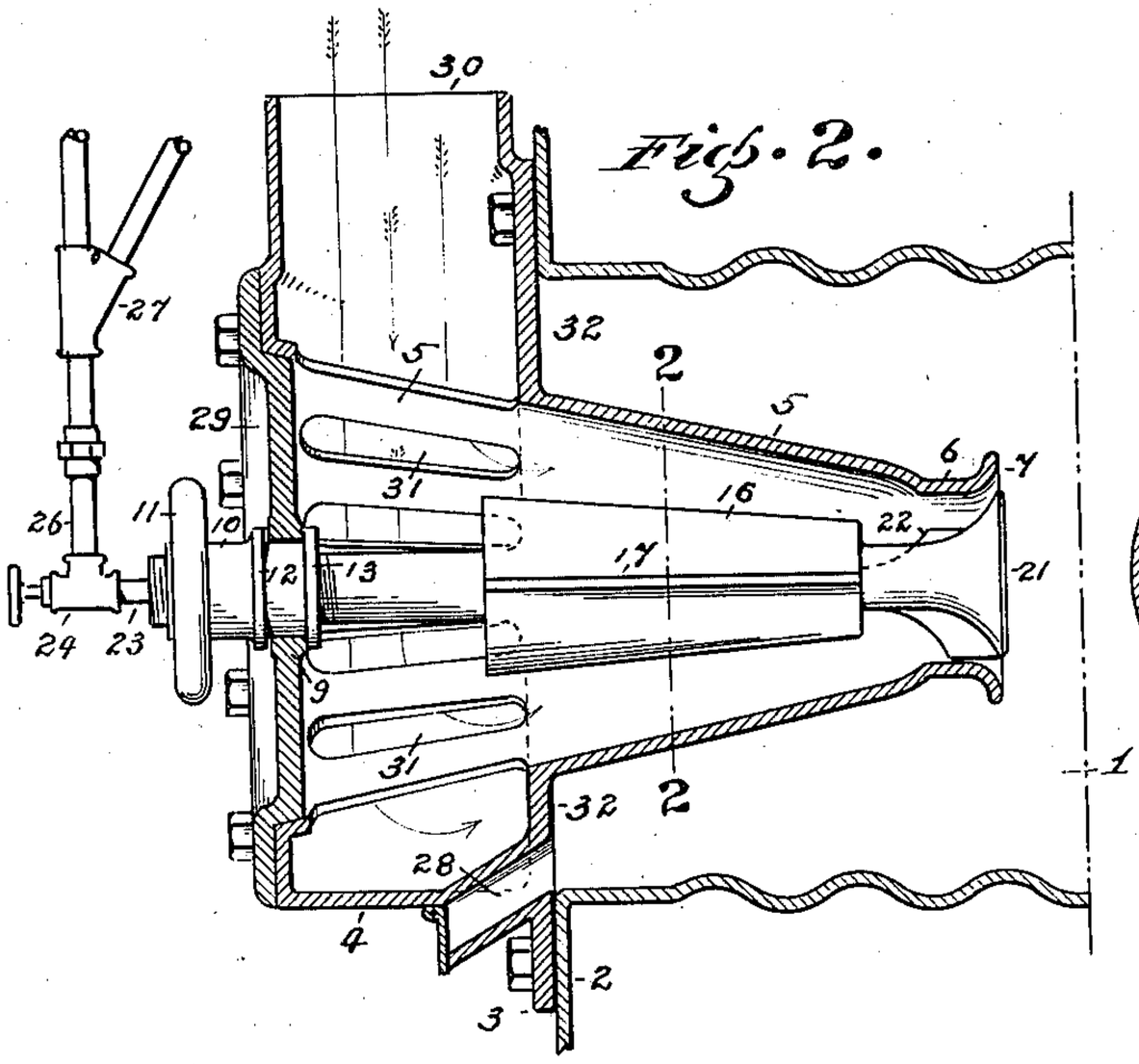
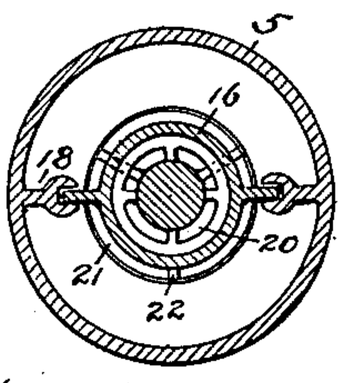


Fig. 4.



WITNESSES:

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LIQUID-FUEL-BURNING SYSTEM.

996,737.

Specification of Letters Patent. **Patented July 4, 1911.**

Application filed August 6, 1909. Serial No. 511,636.

To all whom it may concern:

Be it known that I, EDWIN W. TUCKER, a citizen of the United States, and residing at 818 Page street, in the city of San Francisco, county of San Francisco, and State of California, (post-office address, 256 Spear street,) have invented certain new and useful Improvements in Liquid-Fuel-Burning Systems; and I do hereby declare the following to be a full, clear, and exact description of the said invention, such as will enable others skilled in the art to which it most nearly appertains to make, use, and practice the same.

This invention relates to improvements in liquid fuel burning systems and more particularly to the burner thereof.

The invention consists in the generic combination of the burner mechanism, with the ventilating mechanisms of furnaces; whereby all air admitted to the furnace is compelled to pass through the burning fuel. The burner is understood to define that mechanism which atomizes or delivers the fuel within the furnace in combustible condition, liquid or gaseous. The ventilating mechanism is understood to define all air openings or aerating devices controlling the admission of air to the furnace, or combustion chamber, and does not include the "uptake" or exits from the combustion chamber.

The use of liquid fuel being a comparatively new art it has been common practice to adapt it to the designs of hard fuel furnaces, the error of this becomes apparent on a comparison of the principal characteristics of the two fuels. Hard fuel such as coal requires a fire box, having a horizontal division consisting of grate bars or water tubes according to design. The fuel is introduced into the furnace through a stoke door above the grate bars. An ash pit is provided below the grate bars, and an ash pit door through which air is admitted below the grate bars and compelled to filter through the burning fuel before admission to the combustion chamber above the grate bars. The stoke door may be provided with a regulated ventilator which can be used to promote combustion, but at the expense of the efficiency of the fire. The major portion of the ventilation is through the ash pit door therefore through the burning fuel, obviously to exclude cold air from the combustion chamber.

To merely introduce an oil burner through the stoke door and depend on the ash pit door for ventilation is impracticable because cold air is thus admitted directly into the combustion chamber. The greater the heating surface exposed, the greater the evil of admitting cold air to the combustion chamber, because the cold air rushes against the heating surface causing sudden contraction injurious at once to the structure of the boiler and its heating efficiency. Further, the velocity of the flame issuing from the burner is such that the air sets up a vertical action around the flame insulating it in a measure from the heating surface, its velocity often carries it through the combustion chamber to the uptake before any effective radiation results.

It is essential to proper atomization that the oil fuel and the atomizing agent such as steam or compressed air issue with great initial velocity from the atomizing tip. It is equally essential that sufficient, and no more, air be admitted to the combustion chamber than will properly support combustion therein.

The object of this invention is to promote the combustion of liquid fuel within a combustion chamber, by introducing ventilation in the same manner common to the rational methods necessary to develop the maximum efficiency of other forms of fuel; to wit, by passing the ventilation through the burning fuel.

With this object in view, broadly the invention consists in the generic combination of the liquid fuel burner mechanisms, and the ventilating mechanisms of furnaces.

In the drawings; Figure 1. is a longitudinal cross section illustrating the invention applied to the front of a marine type of internally fired boiler with "natural draft." Fig. 2. is a similar view of the same modified to conform to the use of the common type of "force draft." Fig. 3. is a detailed end elevation in cross section taken on the line 1—1 of Fig. 1. Fig. 4. is a detailed end elevation in cross section taken on the line 2—2 of Fig. 2.

In detail the construction consists of combustion chamber 1 with the flanges 2, which represent the boiler front. Flange 3 of the furnace front is bolted to the boiler front and entirely covers the front of the furnace or that portion through which air can enter the combustion chamber. To attain suffi-

cient length without projecting too far within the combustion chamber, also to conform to the needs of the conventional forced draft mechanisms, the furnace front has the outwardly projecting chamber 4. The furnace front is provided with the inwardly projecting funnel shaped inlet 5 terminating in the constricted nozzle 6 with the bell shaped tip 7. The spider 8 set within the entrance of the inlet 5 is provided with the hub 9.

The adjusting swivel 10 consists of a tubular body provided with a hand wheel 11, the annular flange 12 abutting the outside of the hub 9, and ring 13 secured to the body of the swivel on the inside of said hub, whereby the swivel is secured within the hub and is free to rotate therein. The interior of the tubular body is threaded throughout its length to receive the tube 14 which is provided with an external running thread adapted to engage the said swivel. The inner end of said tube is rigidly secured to the spider 15 across the entrance of the cylindrical atomizing chamber 16.

The exterior of the atomizing chamber is provided with the rib 17 which slides freely in the guides 18 projecting from the inner wall of the inlet 5. The deflecting valve consists of the conical plug 19 concentrically secured within the outlet of the atomizing chamber, leaving the annular spaces 20 for the escape of the fuel. The deflecting bell shaped end 21 is adapted to close the constricted nozzle 6 within which it is guided by the radial guides 22. The function of the deflecting valve is to deflect the fuel issuing from the atomizing chamber, coöperating with the bell shaped tip 7 to cause an annular tulip shaped flame. The volume of the flame is regulated by rotating the swivel 10, which through the connecting mechanism advances or retracts the deflecting valve within the nozzle.

The atomizer consists of the barrel 23 screwed into the T 24 and terminating in the atomizing tip 25 within the atomizing chamber. The fuel is fed to the atomizer through the pipe 26 screwed into the T 24. The atomizing agent such as steam or compressed air is introduced into the fuel pipe at 27. The interior of the atomizer is provided with any suitable mixing devices adapted to cause a splitting up and mixing of the fuel before ejection.

The invention operates as follows: The fuel issues from the atomizer in a highly combustible vapor and is driven against the conical plug 19 and issues through the spaces 20 and impinges upon the deflecting head 21 and issues into the combustion chamber wherein it may be lighted by a torch or taper passed through the hole 28 in the furnace front. The natural suction of the "uptake" combined with the injection suction (due to the shape of the inlet 5 and the velocity of the fuel rushing through the nozzle 6) is sufficient to draw all the air necessary through the inlet 5 and the atomizing chamber to mix with the fuel to support combustion. Passing in with the burning fuel as it does it is impossible for cold air to enter the combustion chamber or impinge against the heating surface.

For forced draft the furnace front is modified as shown in Fig. 2. The solid cover 29 is bolted over the entrance to the inlet 5 in place of the spider 8, this cover is provided at its center with an opening similar to the hub 9 within which the swivel is properly secured. This cover hermetically seals the entrance to the inlet 5. Air is forced through the air pipe 30 into the chamber 4 which is separated from the combustion chamber by the diaphragm 32, from which it escapes through the slots 31 in the wall of the inlet 5 and follows the same course as described in connection with the "natural draft" illustrated in Fig. 1.

The construction shown in the drawings has been specifically described, but it is obvious that various changes to meet special conditions are contemplated within the scope of the invention. Variously shaped burner tips may be substituted to meet conditions. Different forms of atomizers can be used to meet fuel conditions and the pressure of the atomizing force, and the design of the furnace front can be altered to conform to the furnace plan.

Having thus described this invention what is claimed and desired to secure by Letters Patent is:

1. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of an atomizing chamber adjustably mounted in said air chamber, means for supplying fuel to one end of said atomizing chamber, and means carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber.

2. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of an atomizing chamber adjustably mounted in said air chamber, means passing through the inlet of said air chamber for supplying fuel to one end of said atomizing chamber, and means carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber.

3. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of an atomizing chamber adjustably mounted in said air chamber, means for supplying fuel to one end of said atomizing chamber, a valve carried by the opposite end of said atomizing chamber to

regulate the discharge of fuel from the outlet of said air chamber, and means within said atomizing chamber to direct the discharge of fuel toward said valve.

4. The combination with a furnace front having an air chamber provided with an inlet and a bell-shaped outlet, of an atomizing chamber adjustably mounted in said air chamber, means for supplying fuel to one end of said atomizing chamber, and a bell-shaped valve carried by the opposite end of said atomizing chamber to coöperate with the bell-shaped outlet of said air chamber.

5. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of an atomizing chamber adjustably mounted in said air chamber, means for supplying fuel to one end of said atomizing chamber, a valve carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber, and a deflector disposed within said atomizing chamber to direct the discharge of fuel toward said valve.

6. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of an atomizing chamber adjustably mounted in said air chamber, means for supplying fuel to one end of said atomizing chamber, a valve carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber, and a cone-shaped deflector secured within said atomizing chamber to direct the flow of fuel toward said valve.

7. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of a spider disposed in the inlet, an atomizing chamber adjustably mounted in said air chamber, a hub disposed in said spider, a fuel feed pipe passing through said hub and discharging into one end of said atomizing chamber, means mounted in said hub for adjusting the position of said atomizing chamber in said air chamber, and a valve carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber.

8. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of a spider disposed in said inlet, a hub mounted in said spider, an atomizing chamber adjustably mounted in said air chamber, a pipe passing through said hub and discharging in one end of said atomizing chamber, an atomizer passing through said pipe and discharging into said atomizing chamber, means for rotating said hub for adjusting the position of said atomizing chamber within said air chamber, and a valve carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber.

9. The combination with a furnace front having an air chamber provided with an inlet and a bell-shaped outlet, of a spider disposed in said inlet, a hub carried by said spider, an atomizing chamber adjustably mounted in said air chamber, a pipe passing through said hub and discharging into one end of said atomizing chamber, an atomizer passing through said pipe and discharging concentrically of said pipe, means for rotating said hub to adjust said atomizing chamber, and a bell-shaped valve carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber.

10. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of sockets carried by opposite walls of said air chamber; an atomizing chamber provided with flanges to slide in said sockets, means for adjusting the position of said atomizing chamber in said air chamber, means for supplying fuel to one end of said atomizing chamber, a bell-shaped valve carried by the opposite end of said atomizing chamber coöperating with the outlet of said air chamber, and a deflector secured within said atomizing chamber to direct the flow of fuel toward said outlet.

11. The combination with a furnace front having an air chamber provided with an inlet and an outlet, of a spider disposed in said inlet, a hub disposed in said spider, sockets carried by opposite walls of said air chamber, an atomizing chamber in said air chamber provided with flanges disposed in said sockets and a stem passing through said hub, means for rotating said hub to adjust the position of said atomizing chamber in said air chamber, means for supplying fuel to one end of said atomizing chamber, and means carried by the opposite end of said atomizing chamber to regulate the discharge of fuel from the outlet of said air chamber.

In testimony whereof, I have hereunto set my hand July 1909.

EDWIN W. TUCKER.

Witnesses:
E. W. Tucker, Jr.,
M. Kuhl.