

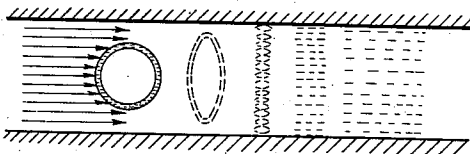
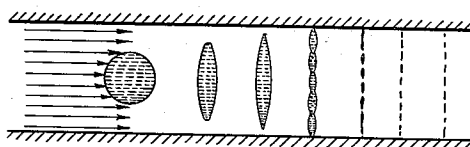
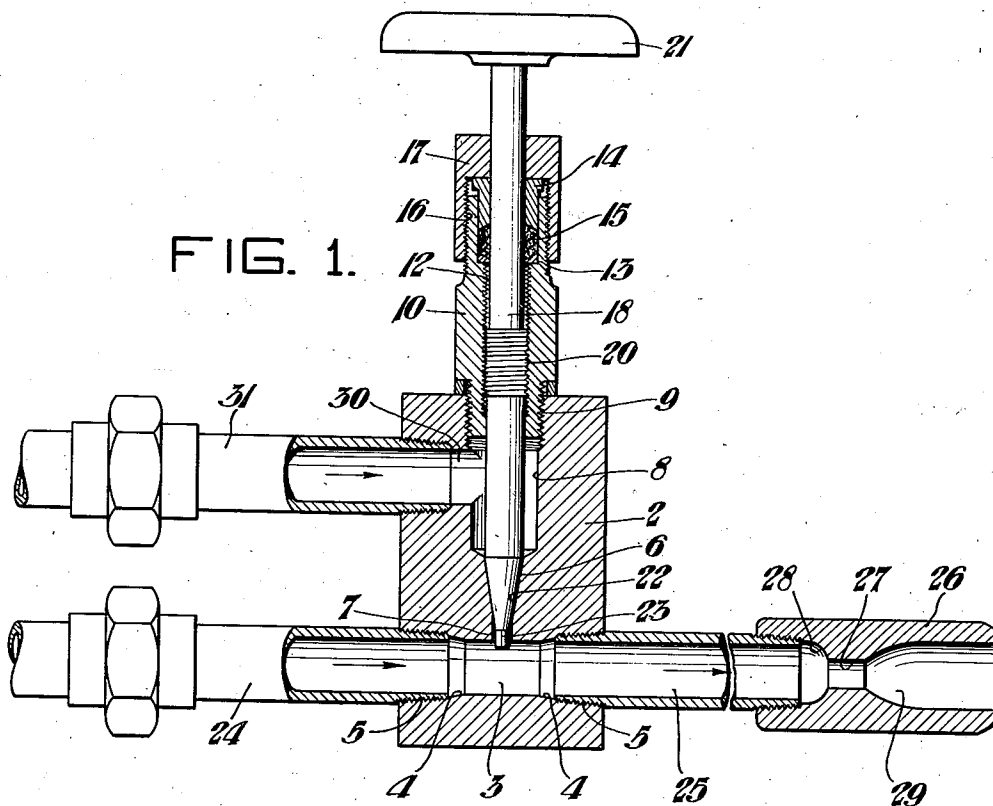
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LIQUID FUEL BURNER

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LIQUID FUEL BURNER

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9 Claims. (Cl. 299-140)

This invention relates to liquid fuel burners, and particularly to an improved mixing and atomizing device for use in connection therewith.

This application is a continuation-in-part of my copending application, Serial No. 177,099, filed November 29, 1937.

In heating furnaces, such as used for heating steel billets and the like, it is desirable to provide a heat which is clean, uniform, continuous and which can be dependably controlled as to its intensity. In order to produce such a heat it is necessary to provide both a suitable fuel and an efficient burner for burning the fuel. Coal-tar has a low flash point, a high calorific value and has been found, when liquefied, to be a good heating medium for such furnaces. It is also inexpensive and, due to its heat value, is a very desirable liquid fuel.

Various types of atomizers have been suggested and used in connection with burners for burning liquid fuel, such as liquefied coal-tar, as is well known to those skilled in the art. Most of the atomizers heretofore suggested and used introduced the fuel into the mixing chamber of the atomizer in a solid globule, that is, in a solid mass. Such a solid globule or mass of fuel was oftentimes not sufficiently broken up by the impinging flow of steam or air which is usually used to atomize the fuel and consequently, the atomizer parts of the burner and the nozzle became clogged after a short period of use, which greatly reduces the efficiency of the burner. Also, the fuel inlet into the atomizing chamber often became clogged. This clogging, of course, not only required frequent periodical cleaning of the burner parts and nozzles, but often necessitated the replacement thereof which was inconvenient as well as expensive. Furthermore, such atomizers consumed an excessive amount of fuel for the reason that the fuel was not completely atomized when it left the nozzle and consequently was not burned, thereby resulting in waste of fuel.

In the atomizer of the present invention, all of the above disadvantages have been eliminated and there is provided an atomizer in which the liquid fuel is introduced into the mixing chamber thereof in a thin-walled hollow body which is easily and readily broken up so that the liquid fuel is completely atomized when it leaves the burner nozzle.

Accordingly, it is one of the objects of the present invention to provide an atomizer for liquid fuel burners which will effectively and efficiently break up the fuel as it enters therein so as to prevent clogging of the atomizer and the burner

parts thereby providing a liquid fuel burner which can be used indefinitely without cleaning.

It is another object of this invention to provide an atomizer for liquid fuel burners which is simple and inexpensive in its construction, and at the same time, one which is easily and conveniently controlled.

It is a further object of the invention to provide an atomizer for liquid fuel burners which completely and thoroughly atomizes and vaporizes the fuel, thus saving the amount of fuel used and at the same time, increasing the efficiency of the burner.

Various other objects and advantages of my invention will more fully appear in the course of the following specification, and will be particularly pointed out in the appended claims.

In the accompanying drawing, I have shown, for the purpose of illustration, one embodiment which my invention may assume in practice.

In the drawing:

Figure 1 is a longitudinal section through the improved atomizer and liquid fuel burner of my invention;

Figure 2 is a diagrammatic view showing theoretically how a solid globule of fuel is broken up in other atomizers heretofore suggested and used; and,

Figure 3 is a similar view showing theoretically how the hollow thin-walled globule of fuel is broken up and atomized in the atomizer of my invention.

Referring more particularly to the drawing, the improved atomizer of my invention comprises a body member or block 2 having a longitudinally extending cylindrical-shaped centrally located mixing chamber 3, in the form of a Venturi throat, extending therethrough and being outwardly relieved at 4 at each end, with the outwardly relieved portion terminating in relatively larger cylindrical-shaped inner threaded portions 5 at each end thereof. In one side of the block, centrally of and perpendicular to the mixing chamber 3 therein, there is disposed an inwardly smoothly tapered liquid fuel passageway 6 terminating inwardly in a relatively short straight and cylindrical-shaped smooth passageway 7 communicating with the mixing chamber 3. The tapered passageway 6 terminates outwardly in a cylindrical-shaped fuel passageway 8, which has its outer end interiorly threaded as at 9.

There is disposed in the threaded portion 9 of the block 2, a valve-body member 10 having an inner threaded portion 12 which is out-

wardly relieved at its outer end so as to provide a chamber 13 which is adapted to house a packing-seat member 14 and a packing 15. The upper end of the valve-body member 10 is also provided with an outer threaded portion 16 which is adapted to receive a gland-nut 17 which, when tightened down on the packing-seat member and packing, will prevent the escape-ment of liquid fuel from this end of the valve.

There is positioned in the valve-body 10, a valve-stem 18 having a threaded portion 20 arranged therein intermediate the length thereof which cooperates with the inner threaded portion 12 of the valve-body 10, and having a hand-wheel 21 arranged on its outer end to actuate the same to control the flow of the liquefied fuel into the mixing chamber as will hereinafter be described. On the inner end of the valve-stem 18 there is arranged a tapered portion 22 corresponding to the taper of the passageway 6 in the body member or block 2, which terminates preferably in a relatively small cylindrical portion 23 arranged on the extreme inner end of the valve stem, although it may terminate in a pointed end in some instances, if desired. The cylindrical portion 23 has a slightly smaller diameter than the cylindrical-shaped passageway 7 in the block, with which it cooperates, and preferably extends a slight distance into the mixing chamber 3, as shown in Figure 1 of the drawing, in order to aid in preventing the clogging of the liquefied fuel in the passageway 7.

One of the threaded portions 5 of the mixing chamber 3 in the block 2 is adapted to be connected to the end of a steam supply pipe line 24. It is preferable that the cross-sectional area of the mixing chamber 3 be less than the inner cross-sectional area of this steam supply line 24 so that the velocity of the steam is increased at this point to hasten and thoroughly atomize the liquid fuel, as well as to carry away the atomized fuel. There is connected to the opposite threaded portion a delivery connection consisting of a short length of pipe 25 having an inner diameter preferably larger than that of the mixing chamber 3. There is disposed on the outer end of the delivery pipe 25 a nozzle 26 having a throat 27 smaller than that of the mixing chamber 3. This nozzle preferably has a centrally disposed smooth-surfaced throat 27, being outwardly relieved at its fuel-entering side by a cup-shaped chamber 28 and at its delivering side by an outwardly relieved delivering chamber 29.

There is also arranged in the side of the body member 2, a liquid fuel inlet passageway 30 which communicates inwardly into the fuel passageway 8. There is connected to the fuel inlet passageway 30 a suitable liquid fuel supply pipe 31.

In the atomizer of my invention, it will be seen that the liquid fuel enters the body member 2 through the passageway 30 and flows downwardly in the passageway 8 between the valve-stem 18 and the inner wall block through the tapered passageway 6 around the tapered portion 22 of the valve-stem therein, and through the cylindrical-shaped passageway 7 around the cylindrical end portion 23 of the valve-stem into the mixing chamber or Venturi throat 3. It will be seen that the liquid enters the mixing chamber in the form of a cylindrical-shaped hollow globule. That is, the liquid fuel enters therewith in the form of a cylindrical hollow body having a relatively thin wall due to the relative-

ly small clearance between the cylindrical end portion 23 of the valve stem and the cylindrical passageway 7 in the block.

Thus, it will be seen that as the relatively thin-walled body of liquid fuel enters the mixing chamber, it is readily broken up and initially atomized by the impinging flow of steam passing therethrough as is schematically shown in Figure 3 of the drawing. That is to say, the thin-walled body of fuel is initially atomized in the Venturi throat or mixing chamber 3 due to the high velocity of the high pressure steam passing axially therethrough. The initially atomized fuel then is forced from the mixing chamber into the larger delivery pipe 25 wherein the velocity of the same is reduced and the pressure increased thereby vaporizing the fuel. The vaporized fuel is then forced through the small throat 27 of the nozzle at an increased velocity and a low pressure whereby the fuel is delivered from the nozzle completely and thoroughly vaporized.

It will be understood that the liquid fuel passageway 7 can be kept clean at all times so as to prevent the clogging thereof by manipulating the valve-stem 18 back and forth therein, which will effectively remove any solidified fuel or foreign particles therefrom.

As a result of my invention, it will be seen that there is provided an atomizer in which the liquid fuel is thoroughly and completely vaporized thereby preventing the clogging of any of the parts of the atomizer and liquid fuel burner assembly, and at the same time, a large bodied soft flame of medium heat will be delivered from the nozzle.

While I have in this application specifically shown and described an embodiment of my invention, it will be understood that this embodiment is merely for the purpose of illustration and description, and that various other forms may be devised within the scope of the invention, as defined in the appended claims.

I claim:

1. Apparatus for vaporizing liquid fuels including, in combination, a longitudinally extending cylindrical-shaped mixing chamber having a central portion of a constant diameter throughout its length and being outwardly relieved at each end thereof, an inwardly tapered liquid fuel passageway communicating with the central portion of said mixing chamber substantially perpendicular thereto for introducing a relatively thin body flow of liquid fuel thereinto, a valve stem having a similarly shaped tapered end portion for controlling the flow of the liquid fuel through said passageway into said mixing chamber, means arranged at one end of said mixing chamber for introducing a fluid under pressure thereinto and therethrough axially thereof, whereby the relatively thin body of liquid fuel is effectively broken up and atomized by the impact thereof with the fluid due to the relatively high velocity thereof as the same is delivered continuously into said mixing chamber, means arranged at the opposite end of said mixing chamber concentric therewith providing a relatively long chamber having a constant inner diameter slightly larger than the inner diameter of the central portion of the mixing chamber for delivering the atomized fuel therefrom, whereby the same expands and is vaporized at a reduced velocity, means arranged beyond said last mentioned means concentric therewith and having a throat diameter less than the inner diameter of the central portion of said

mixing chamber whereby said vaporized fuel is confined as it is delivered thereto so as to increase the velocity thereof, said last mentioned means having means associated therewith beyond the throat portion thereof whereby the vaporized fuel is delivered from the throat and expands so as to be delivered therefrom thoroughly and completely vaporized.

2. An atomizer of the class described including, in combination, a body member having a Venturi throat arranged therein consisting of a longitudinally extending cylindrical-shaped portion having substantially a constant diameter throughout its length and being outwardly relieved at each end thereof, a passageway arranged in said body member substantially centrally of said cylindrical-shaped portion and substantially perpendicular thereto for introducing a liquid fuel thereinto, means for controlling the amount of liquid fuel entering said cylindrical-shaped portion, means arranged at one end of said body member for introducing a fluid under pressure into and through said Venturi throat axially thereof whereby the liquid fuel will be atomized by the impact of the high pressure fluid therewith, and means arranged at the opposite end of said body member and said Venturi throat for delivering the atomized fuel therefrom.

3. An atomizer of the class described as defined in claim 2, wherein the passageway for introducing the liquid fuel into the cylindrical-shaped portion of the Venturi throat and means for controlling the amount of liquid fuel entering therethrough consists of an inwardly tapered liquid fuel passageway terminating in a relatively short straight smooth cylindrical portion, and a valve stem having a similarly shaped tapered end portion which cooperates therewith to control the amount of liquid fuel entering the cylindrical-shaped portion of the Venturi throat with the extreme outer end of the tapered end portion of said valve stem extending through the straight smooth cylindrical portion of the passageway and a slight distance into the cylindrical-shaped portion of the Venturi throat.

4. An atomizer of the class described including, in combination, a body member having a Venturi throat arranged therein, a passageway arranged in said body member substantially perpendicular to the axis of said Venturi throat for introducing a liquid fuel thereinto, a valve stem having a tapered portion arranged thereon adjacent the end thereof which is disposed in said liquid fuel passageway for controlling the amount of liquid fuel entering the Venturi throat, said valve stem having the extreme outer end thereof extending into and disposed in said Venturi throat, means arranged at one end of said body member and said Venturi throat for introducing a fluid under pressure into and through the Venturi throat axially thereof whereby the liquid fuel will be atomized by the impact of the high pressure fluid therewith, and means arranged at the opposite end of said body member and said Venturi throat for delivering the atomized fuel therefrom.

5. An atomizer of the class described including, in combination, a body member having a Venturi throat therein consisting of a longitudinally extending cylindrical-shaped portion having substantially a constant diameter throughout its length and being outwardly relieved at each end thereof, a tapered passageway arranged in said

body member intermediate the length of said cylindrical-shaped portion and substantially perpendicular thereto for introducing a liquid fuel thereinto, a valve stem having a tapered portion arranged thereon adjacent the end thereof which is disposed in said liquid fuel passageway for controlling the amount of liquid fuel entering said cylindrical-shaped portion, said valve stem having the extreme outer end thereof extending into and disposed in the cylindrical-shaped portion of said Venturi throat, means arranged at one end of said body member for introducing a fluid under pressure into and through said Venturi throat axially thereof whereby the liquid fuel will be completely atomized by the impact of the high pressure fluid therewith, and means arranged at the opposite end of said body member and said Venturi throat for delivering the atomized fuel therefrom.

6. An atomizer of the class described as defined in claim 5, wherein the tapered portion of the valve stem cooperates with the tapered fluid passageway for introducing a controllable relatively thin body of the liquid fuel into the Venturi throat whereby the fluid under pressure as it passes into and through the Venturi throat readily and effectively breaks up the thin body of liquid fuel and atomizes the same.

7. An atomizer of the class described including, in combination, a body member having a Venturi throat therein, a passageway arranged intermediate the length of said Venturi throat communicating therewith and being substantially perpendicular to the axis thereof for introducing a liquid fuel thereinto, a valve stem arranged in said passageway with the end thereof extending into the Venturi throat and being slightly smaller than the passageway for controlling the flow of the liquid fuel into said Venturi throat, said valve stem and passageway adapted to cooperate with each other and being constructed and arranged so that a hollow body of liquid fuel will be introduced into the Venturi throat, means arranged at one end of said Venturi throat for introducing a fluid under pressure into and through the same axially thereof whereby the liquid fuel will be atomized by the impact of the high pressure fluid therewith, and means arranged at the opposite end of said Venturi throat for delivering the atomized fuel therefrom.

8. An atomizer of the class described including, in combination, a body member having a Venturi throat arranged therein, a cylindrical-shaped passageway arranged intermediate the length of said Venturi throat communicating therewith and being substantially perpendicular to the axis thereof for introducing a liquid fuel thereinto, a valve-stem arranged in said passageway having a straight cylindrical-shaped end with the diameter thereof being slightly smaller than that of the cylindrical-shaped fuel passageway and extending into and disposed in said Venturi throat for controlling the flow of the liquid fuel thereinto, said cylindrical-shaped end of said valve-stem and said cylindrical-shaped fuel passageway adapted to cooperate with each other so that a relatively thin-walled hollow body of liquid fuel will be introduced into the Venturi throat, means arranged at one end of said Venturi throat for introducing a fluid under pressure into and through the same axially thereof whereby the liquid fuel will be atomized by the impact of the high pressure fluid therewith, and means arranged at the opposite end of said Ven-

turi throat for delivering the atomized fuel therefrom.

9. An atomizer of the class described including, in combination, a body member having a Venturi throat arranged therein, a tapered passageway arranged intermediate the length of said Venturi throat terminating inwardly in a straight cylindrical-shaped passageway which communicates with said Venturi throat and being substantially perpendicular to the axis thereof for introducing a liquid fuel thereinto, a valve-stem arranged in said passageway having a tapered end portion corresponding with the taper of said liquid fuel passageway terminating in a relatively straight cylindrical-shaped end extending into and disposed in said Venturi

throat for controlling the flow of the liquid fuel thereinto, said cylindrical-shaped end of said valve-stem and said cylindrical-shaped fuel passageway adapted to cooperate with each other so that a relatively thin-walled hollow body of liquid fuel will be introduced into the Venturi throat, means arranged at one end of said Venturi throat for introducing a fluid under pressure into and through the same axially thereof whereby the liquid fuel will be atomized by the impact of the high pressure fluid therewith, and means arranged at the opposite end of said Venturi throat for delivering the atomized fuel therefrom.

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