Aug. 1, 1933. A. R. STEVENSON, JR 1,920,769

REFRIGERATED BURNER NOZZLE

Filed Nov. 22, 1930

Fig. 1.

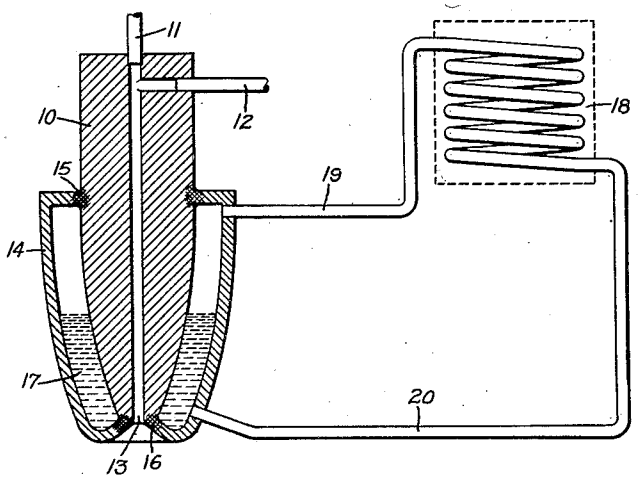
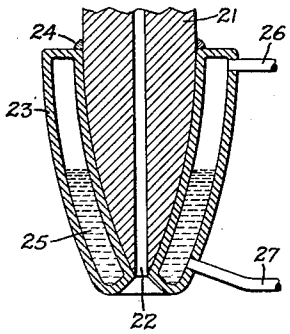


Fig. 2.



Inventor:
Alexander R. Stevenson Jr.,
by Charles V. Mullen
His Attorney.

Patented Aug. 1, 1933

1,920,769

UNITED STATES PATENT OFFICE

1,920,769

REFRIGERATED BURNER NOZZLE

Alexander R. Stevenson, Jr., Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York

Application November 22, 1930. Serial No. 497,519

5 Claims. (Cl. 158—73)

My invention relates to nozzles employed in apparatus for burning fluid fuels and is particularly advantageous in connection with oil burner nozzles for spraying oil into the combustion chamber of an oil burner.

It has been found that due to the temperature of combustion in an oil burner the nozzle of the oil burner is affected by the heat to such an extent that the oil sprayed thereby tends to break down as it reaches the nozzle tip just before it is sprayed into the furnace. This results in a coating of sticky substance at the orifice which eventually carbonizes and seriously interferes with the passage of oil from the nozzle, resulting in a poor flame and one that is unsteady. The oil leaving the nozzle also tends to cling thereto around the orifice and when the burner is shut down the end of the nozzle is wet with oil. The nozzle is usually hot due to the heat of combustion and tends to cake the wet oil thereon. Upon successive operations of the burner, the caked oil continues to grow and becomes a serious detriment to efficient and proper operation of the burner. In extreme cases the nozzle may become so clogged as to shut off the oil flow completely. This makes it necessary to constantly clean the ordinary oil burner nozzle.

Water cooling systems heretofore used require the water to be constantly circulated and replenished in the system and it is entirely possible for the water coils to be burned due to lack of water. There is also the possibility of scale forming within the coils and thus retarding or choking the free flow of water in the cooling system. Water cooling systems must be controlled to care for the intensity of the flame it being entirely possible for the nozzle to become heated more rapidly than the heat is carried away since the temperature of the water will rise if the rate of flow is inadequate. The boiling point of water is above the most efficient temperature at which the nozzle should operate and hence to maintain the nozzle at a proper temperature it is vitally important that proper circulation be provided.

Hence it is the principal object of my invention to provide an oil burner nozzle construction in which high working temepratures and the resulting carbon formation at the orifice are prevented.

More particularly, it is an object of my invention to provide a self-contained automatic cooling system for an oil burner nozzle to obtain low working temperatures thereof.

Another object of my invention is to provide an automatic cooling system for an oil burner nozzle in which there are no moving parts and in which it is unnecessary to replenish the cooling medium.

Other objects will appear hereinafter.

Briefly, my invention comprises an oil burner nozzle which is surrounded by means of a contacting jacket or casing at the lower end thereof which is exposed to the flame. This casing is highly exhausted and a liquid having a low boiling point, such for example as alcohol or turpentine, is introduced therein. If the air were not exhausted from the casing, since it is in a closed system, as heat is absorbed during combustion, the air within the casing would be heated as well as the cooling fluid. This, of course, would increase the surface pressure on the cooling liquid thereby raising the boiling point. A high boiling point would render the cooling device less effective in maintaining the nozzle at a temperature below the carbonization temperature of the fuel. Due to the high vacuum within the casing however, the surface pressure on the liquid is very small reducing the normal low boiling point of the liquid thereby making it possible to obtain a very low temperature of the jacket and the nozzle thus maintaining the nozzle at a temperature below the carbonization temperature of the fuel. Connected to the jacket or casing is a refrigerating condenser. When the oil burner is operated the liquid upon boiling vaporizes and carries heat from the jacket and nozzle to the condenser, which is preferably placed in the path of the combustion air supplied to the burner and in which the heat is given off by the vapor, the vapor condensed and the resulting liquid returned to the jacket proper. In this way the temperature of the nozzle is maintained relatively low, substantially at the boiling point of the liquid, and in practice it is possible to keep the nozzle at a temperature of about 70 degrees C. instead of around 110 to 125 degrees C. as is common in most burners. This refrigerating scheme completely eliminates the difficulties hereinbefore mentioned.

In the drawing, Fig. 1 shows one embodiment of my invention wherein the casing is welded to the nozzle and Fig. 2 shows a modification of the casing used in my invention.

Referring specifically to the drawing, the nozzle 10 is provided with an orifice 13 into which extend the pipes or conduits 11 for air under pressure, and 12 for leading the oil to the nozzle. An aspirating effect is caused by the arrangement of the air and oil conduits and the

oil and air are sprayed from the orifice 13 into the oil burner furnace. Surrounding the nozzle proper is the jacket or casing 14 which is welded to the nozzle as indicated at 15 and 16. The interior of this jacket is exhausted and a liquid with a low boiling point, such as alcohol or turpentine, is introduced into the jacket partially filling the same. Leading from the top portion of the jacket is the conduit 19 which leads the vapors from the jacket to the condenser 18 when the liquid 17 within the jacket boils and vaporizes. The condenser 18 absorbs the heat from the vapors and condenses the same, returning the liquid to the jacket 14 by means of the return conduit 20. The condenser 18 is placed in a position where it will not be exposed to radiant heat.

In Fig. 2 is shown a modification of the jacket member. In this case the nozzle 21 is provided with an orifice 22 through which the oil and air mixture is vaporized. The jacket 23 is a self-contained unit and can be slipped over the oil burner nozzle and welded thereto as at 24, or fastened by any other suitable means. The casing 23 is exhausted and a liquid 25 with a low boiling point is introduced to partially fill the interior thereof. Conduits 26 and 27 lead the vapor from the casing to the condenser (not shown) and return it to the casing in a liquid form. It will be understood, of course, that the operation is the same in both cases.

The operation of the device is as follows: When the oil and air spray is ignited the products of combustion tend to raise the temperature of the nozzle 10. The heat which is absorbed by the casing 14 and the nozzle 10 is absorbed by the liquid within the casing and causes a boiling thereof, it of course being understood that the temperature of the nozzle and casing is thereby maintained at substantially the boiling temperature of the liquid within the evacuated casing. As the vapor caused by the boiling rises within the casing the vapors are led off by means of the conduit 19 to the condenser 18. The condenser 18 may be cooled by any suitable means and absorbs the heat in the vapors, thereby cooling them and causing them to assume a liquid form. The liquid is then returned to the bottom of the casing by means of the return conduit 20. In this way the heat absorbed by the vapors is carried away from the nozzle and dissipated by means of a condenser which may be located at a point a distance from the nozzle. This condenser may be placed in the air blast which is furnished to provide the necessary air for combustion of the oil flame, by means of the air duct indicated by dotted lines in Fig. 1.

It is of course understotod that the operation which takes place in the modification shown in Fig. 2 is identical to that which takes place in the embodiment shown in Fig. 1.

It will thus be seen that the temperature of the oil burner nozzle under ordinary circumstances will be maintained at substantially the boiling temperature of the liquid within the casing. Thus by maintaining the oil burner nozzle at a low working temperature carbonization is prevented at the tip with its resultant erratic operation of the nozzle. The cooling apparatus is automatic, self contained, has no moving parts, and it is unnecessary to replenish the cooling medium used.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use, and I, therefore, aim to cover by the appended claims all of the modifications within the true spirit and scope of my invention.

What I claim as new and desire to protect by Letters Patent of the United States is:—

1. In a combustion furnace, a nozzle having an opening for introducing fuel into the furnace, a cooling device for said nozzle, including a sealed annular container surrounding the nozzle and partially filled with a vaporizable liquid in heat-conducting relation with the nozzle adjacent said opening, and a condenser disposed above the level of said liquid in the path of the combustion air for the furnace to be cooled thereby and communicating with said container for condensing the liquid vaporized in said container.

2. In an oil burner furnace, a nozzle having an opening for introducing fuel oil into the furnace, a cooling device for said nozzle including a sealed annular container surrounding the nozzle for maintaining a liquid having a boiling point below the carbonization temperature of the fuel oil in heat-conducting relation with the nozzle adjacent said opening, and a condenser for vaporized fluid communicating with said casing and disposed above the level of liquid in the path of the combustion air for the burner.

3. In a self-cooled oil burner nozzle mechanism, a nozzle having a restricted opening through the tip thereof for supplying fuel to an oil burner, an automatic cooling device for said nozzle for preventing carbonization of fuel at said tip, said cooling device comprising a casing partially filled with a liquid having a boiling point below the carbonization temperature of the fuel oil and engaging said nozzle for maintaining said liquid in heat-conducting relation with the tip of the nozzle, said casing being exhausted whereby the surface pressure on said liquid is reduced to maintain the boiling point of said liquid below the carbonization temperature of said fuel when heat of combustion is absorbed from said nozzle during operating conditions of said nozzle, and means associated with said casing for condensing said vapor and returning the condensed vapor to the liquid in heat-conducting relation with said tip to maintain it at a low operating temperature, said condensing means being disposed to be cooled by a stream of combustion air to the burner.

4. In a self-cooled oil burner nozzle mechanism, a nozzle having a restricted opening through the tip thereof for supplying fuel to an oil burner, an automatic cooling device for said nozzle for preventing carbonization of fuel at said tip, said cooling device comprising a casing partially filled with a liquid having a boiling point below the carbonization temperature of the fuel oil and engaging said nozzle for maintaining said liquid in heat-conducting relation with the tip of the nozzle, said casing being exhausted to lower the surface pressure on said liquid to maintain the boiling point of said liquid below the carbonization temperature of said fuel when said liquid is vaporized upon absorbing the heat of combustion from said nozzle during operating conditions of said nozzle, and a condenser having a conduit connected to said casing above the

level of the liquid in said casing for conducting vapors to said condenser, and a second conduit connecting said condenser and said casing below the level of the liquid in said casing for returning the condensed vapor to the liquid in heat-conducting relation with said tip to maintain it at a low operating temperature, said condenser being disposed to be cooled by a stream of combustion air to the burner.

5. In a self-cooled oil burner nozzle mechanism, a nozzle having a restricted opening through the tip thereof for supplying fuel to a burner, an automatic cooling device for said nozzle for preventing carbonization of fuel at said tip, said cooling device comprising a casing adapted to be inserted over and engage the exterior of the nozzle and extending below the tip thereof to act as a heat shield therefor, said casing being provided with an opening therethrough concentric with the opening in said nozzle and partially filled with a liquid having a boiling point below the carbonization temperature of the fuel oil, said liquid being maintained in heat-conducting relation with the tip of said nozzle, said casing being exhausted to lower the surface pressure on said liquid to maintain the boiling point of said liquid below the carbonization temperature of said fuel when the heat of combustion is absorbed from said burner nozzle during combustion conditions, and a condenser having conduits connected to said casing above and below the level of the liquid in said casing for condensing the vapor formed during operation of said burner and returning the condensed vapor to the liquid in heat-conducting relation with the tip of the nozzle, said condenser being disposed to be cooled by a stream of combustion air for the oil burner.

ALEXANDER R. STEVENSON.