June 11, 1940. A. V. RITTS ET AL 2,204,051

IMMERSION BURNER

Filed July 2, 1938

Fig. 1.

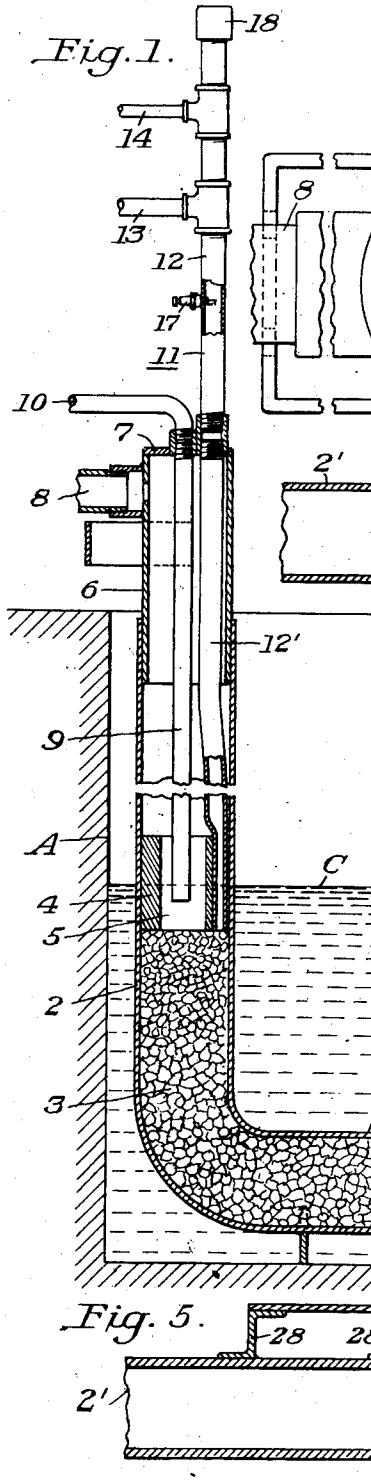


Fig. 3.

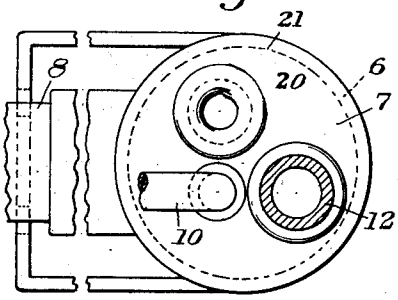


Fig. 4.

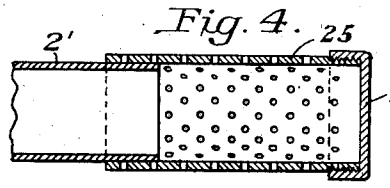
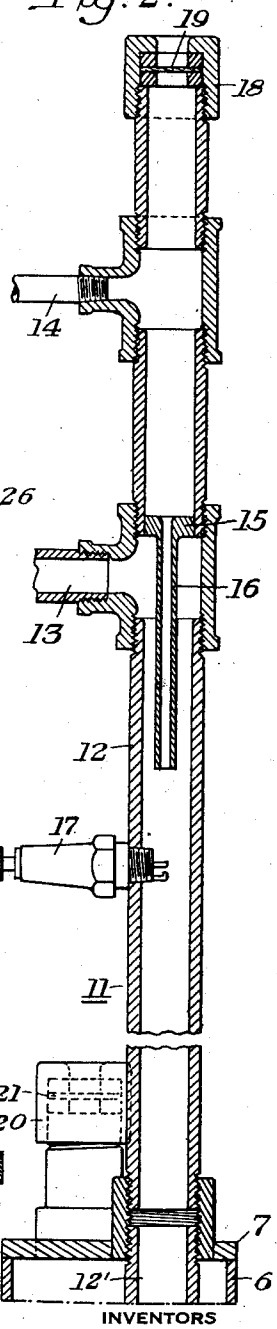


Fig. 5.

Fig. 2.



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IMMERSION BURNER

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Application July 2, 1938, Serial No. 217,198

5 Claims. (Cl. 126—360)

This invention relates to a fuel burning device and is for a fuel burning device to be operated in a liquid bath for heating and agitating the bath.

In certain industrial operations, as for example in metal pickling baths, the acid bath is kept at an elevated temperature and some degree of agitation is ordinarily desired. One common method of heating and agitating such baths is to discharge steam into the bath below the surface, the steam serving to both heat and agitate the liquid. This has certain disadvantages, however, in that it not only requires a boiler or steam plant and a line from the boiler to the tank, but the condensation of steam in the bath during a day's run is such as to considerably dilute the bath. The tanks are sometimes directly fired, but such installations are costly and do not produce the desired agitation in the bath.

According to the present invention, there is provided a burner which can be lowered directly into a pickling or other bath. Combustion takes place under the surface of the liquid and the gases of combustion are discharged into the liquid, thereby producing agitation. Any desired number of burners can be used in a tank. The tanks themselves can be of simple construction, and no provision has to be made for any boiler plant and no dilution of the liquid occurs.

The invention may be readily understood by reference to the accompanying drawing which illustrates certain embodiments of the invention and in which

Figure 1 represents a vertical section through a burner, the view showing the burner immersed in a liquid bath;

Figure 2 is a detailed view on a larger scale of the upper portion of the apparatus shown in Figure 1, the view being a vertical section;

Figure 3 is a top plan view of the apparatus shown in Figure 1;

Figure 4 is a detailed view showing in section a modified outlet at the end of the combustion chamber;

Figure 5 is a view similar to Figure 4 of another modification for the combustion gas outlet.

In the drawing, A designates a tank and B indicates liquid within the tank, and C designates the liquid level.

The burner comprises a combustion chamber, preferably in the form of a tube 2. For use in a relatively shallow tank, the tube 2 is preferably L shaped with a horizontally extending portion 2' at the bottom thereof, but the length and shape of the combustion chamber may be varied according to the depth of the fluid in the tank and according to various other factors. The combustion chamber is filled with tightly packed lumps of sillimanite or other refractory lumps, the lumps being large enough so that the burning gases may pass through the interstices between them. This mass of tightly packed lumps of refractory material is designated 3. At the top of the combustion chamber is a burner member 4 having an orifice 5 through which air is conducted into the combustion chamber. A pipe 6 is telescoped into the pipe 2 above the liquid level. This pipe is closed at its top by a plate 7. Air under pressure is supplied to the interior of the pipe 6 through an air supply pipe 8. A fuel pipe 9 extends from the cover plate 7 down into the orifice 5 and terminates above the refractory bed 3. It preferably terminates below the liquid level C. The concentric gas and air pipes provide a burner. Gas is supplied to the tube 9 through a gas supply pipe 10. Air and gas flowing to the burner may be controlled by any suitable regulating device to maintain the proper proportions of air and gas, such regulating device being well known in the art and forming no part of the present invention. Mounted on the cover 7 to one side of the pipe 9 is a long flame pilot burner designated generally as 11 and comprising a tube 12 having an air supply opening into it at 13. Above the air supply opening 13 is a gas supply pipe 14. Between the air and gas inlets is a plug 15 carrying a long tubular extension 16 projecting into the tube 11 well below the air intake pipe 13. Mounted in the tube 12 is a spark plug 17 for igniting the air and gas mixture in the tube 11. Extending downwardly from the tube 12 and forming in effect a continuation thereof, is a flame tube 12' that terminates at the lower end of the burner block 4. The pilot burner 11 as so constructed will project a long flame down through the flame tube 12' into the refractory mass immediately adjacent the end of the burner block. A gas-tight peep hole is preferably provided at the top of the burner 11, this peep hole comprising a cap 18 in which is a glass or window 19. The cover 7 is also provided with a nipple to which is secured a peep hole comprising a cap 20 with a glass 21, the construction being similar to that shown for the peep hole 18—19 at the top of the pilot burner.

The lower end of the combustion chamber may be provided with various types of terminals for discharging the gases of combustion into the liquid. In Figure 1 the end of the combustion

chamber is illustrated as having a tubular extension 22 which is perforated and through which gases of combustion escape into the liquid. In some cases, where it is desired to regulate the turbulence produced by the discharge of gases, there may be provided in addition to the plate 22, a vertical tube 23 leading from the interior of the combustion chamber or the interior of the terminal portion of the combustion chamber to a point above the liquid level C. This pipe is preferably provided with some means through which the volume of gas escaping through it directly to atmosphere may be controlled. We have shown a simple form of butterfly valve located in the pipe 23 above the liquid level for accomplishing such regulation, but it will be understood that various other arrangements including interchangeable orifice plates may be substituted. A perforated plate 22*a* may be located in the combustion chamber to hold the refractory material in place and provide an open chamber from which the pipes 22 and 23 lead.

In the operation of the burner, air is turned into the pipe 8. This blows the liquid out of the combustion chamber and after the liquid has been forced out of the combustion chamber, air and gas are turned into the pilot burner and the mixture is lighted, causing a flame to be discharged into the combustion chamber at the end of the burner 4. Gas is then turned into the burner pipe 10 and the mixture coming from the burner is lighted. This mixture burns in the combustion chamber and by reason of the presence of the refractory material, a relatively large volume of fuel and air can be efficiently burned in a relatively small chamber. The gases from the combustion chamber discharge through the openings in the plate 22*a* into the liquid. If the by-pass pipe 23 is provided, some of the gases of combustion may escape through the pipe 23 to lessen the volume of gases discharged into the liquid and thereby reduces the turbulence. The peep holes 18—19 and 20—21 enable the operator to observe if the device is working properly.

In lieu of a plate such as the plate 22*a* which discharges the gases endwise into the fluid, the combustion chamber may have a terminal portion as shown in Figure 4 where there is a perforated extension 25 having a closed end 26. With this arrangement the gases of combustion are discharged in all directions around the extension 25. This form of terminal can be used in conjunction with the by-pass tube 23 as described in connection with Figure 1.

In Figure 5 there is illustrated another form of gas discharge terminal which is designed especially for use in very shallow baths. With this form of device, the end of the combustion chamber 2' is closed by a perforated cap 27. Secured to the chamber by supporting members 28 is a flat plate 29, the level of which is preferably just awash of the liquid in the bath. This plate diffuses the escaping gases and prevents too violent a bubbling in a shallow bath. This arrangement may, of course, be used in conjunction with by-pass pipe 23 as shown in Figure 1.

Where the burner is to be used in an acid bath, the combustion chamber 2 is preferably formed of a material which is resistant to attack by the acid. For example, this tube may be formed of lead. When it is formed of lead it is important that the combustion zone begin below the surface of the liquid, in order that the lead in the combustion zone will be liquid cooled and therefore will not be melted. Likewise, the joint between the lead tube and the upper tube 6 is located at the remote point from the burner so that any low melting temperature solder which is used to join the lead to the tube 6 will not be close enough to the flame to be affected by the heat.

The invention provides an immersion burner which can be set into a pickling or other bath to directly heat the liquid within the bath and to simultaneously agitate it. It provides a compact construction and one which can be used with safety. It may be shut down at night and lighted up in the morning without removing it from the liquid. It can be operated at a high rate of combustion when the bath is being heated up and the rate of combustion can thereafter be reduced merely to maintain the temperature of the bath after the bath has reached a predetermined temperature.

While we have illustrated and described certain specific embodiments of our invention, it will be understood that this is by way of illustration and that the invention may be otherwise embodied and various changes and modifications may be made in the combinations illustrated within the scope of the following claims. The term immersion burner as used herein is intended to define only that type of burner which is operated below the level of a bath in which the burner is immersed and wherein the combustion chamber communicates with the bath below the liquid level so that combustion occurs in actual contact with the liquid.

We claim:

1. An immersion burner for the direct heating of liquids comprising a combustion chamber constructed for immersion in a liquid bath, said combustion chamber comprising a metal shell having a refractory mass therein with interstices through the refractory mass through which burning gases may permeate, a burner opening into the combustion chamber, means for supplying air and gas to the burner, said combustion chamber having an opening therein in that portion thereof which is most remote from the burner, which opening is below the normal liquid level of the bath when the burner is immersed, and a pipe also leading from the combustion chamber in that portion which is most remote from the burner to a point above the liquid level of said bath, the location of said opening and pipe being such that the gases and combustion products travel the length of the refractory mass and through the greater portion of the length of the combustion chamber before being discharged.

2. An immersion burner for the direct heating of liquids comprising a combustion chamber constructed for immersion in a liquid bath, said combustion chamber comprising a metal shell having a refractory mass therein with interstices through the refractory mass through which burning gases may permeate, a burner opening into the combustion chamber, means for supplying air and gas to the burner, said combustion chamber having an opening therein in that portion thereof which is most remote from the burner which opening is below the normal liquid level of the bath when the burner is immersed, a pipe also leading from the combustion chamber in that portion which is most remote from the burner to a point above the liquid level of said bath, and variable means for controlling the flow of combustion gases through

said pipe and vary the proportion of gases that enter the liquid bath.

3. An immersion burner for the direct heating of liquids comprising a combustion chamber in the form of a tubular shell with imperforate walls, the combustion chamber being packed with lumps of refractory material, a burner at one end of the combustion chamber, means for supplying air and fuel to the burner, the said shell at that end portion which is most remote from the burner being provided with an opening through which gases of combustion may escape directly into the bath in which the burner is immersed, the opening being below the level of the liquid in which the combustion chamber is constructed to be immersed, the portion of the combustion chamber remote from the burner also having a vent pipe leading therefrom upwardly to a point above the level of the liquid in which the burner is immersed.

4. An immersion burner of the class described having a combustion chamber adapted to operate beneath the surface of the liquid, a terminal portion for the combustion chamber opening directly into the fluid in which the chamber is immersed, said portion also having a pipe extending upwardly a height sufficient to rise above the surface of the liquid.

5. An immersion burner of the class described having a combustion chamber adapted to operate beneath the surface of the liquid, a terminal portion for the combustion chamber opening directly into the fluid in which the chamber is immersed, said portion also having a pipe extending upwardly a height sufficient to rise above the surface of the liquid, and means for regulating the amount of combustion gas discharged into the fluid and discharged above the fluid.

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