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HEATER FOR LIVESTOCK WATERING TANKS

Filed Jan. 9, 1953

FIG. 1

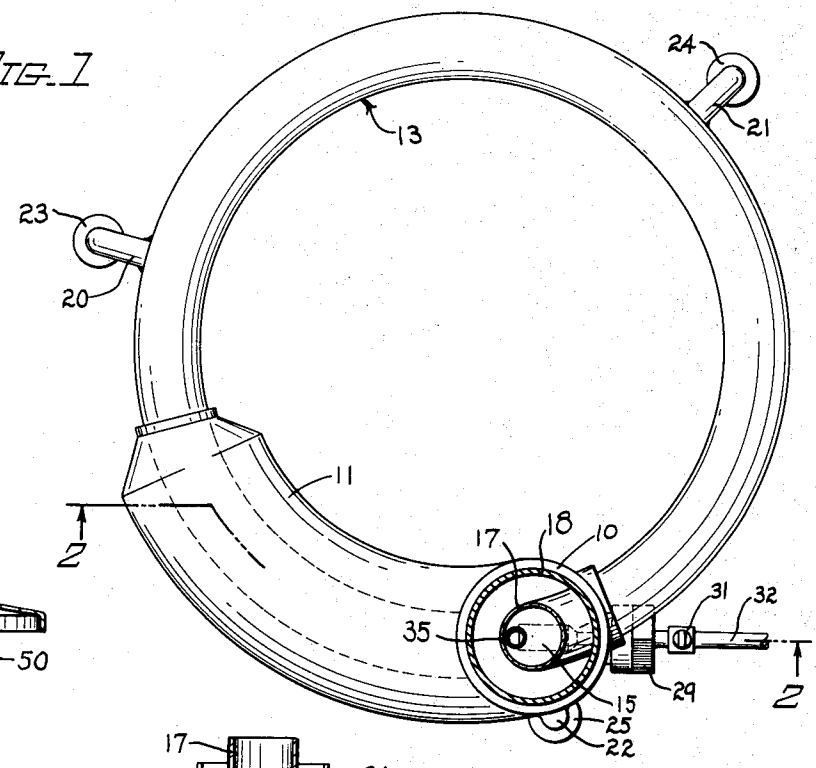


FIG. 3

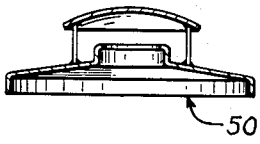
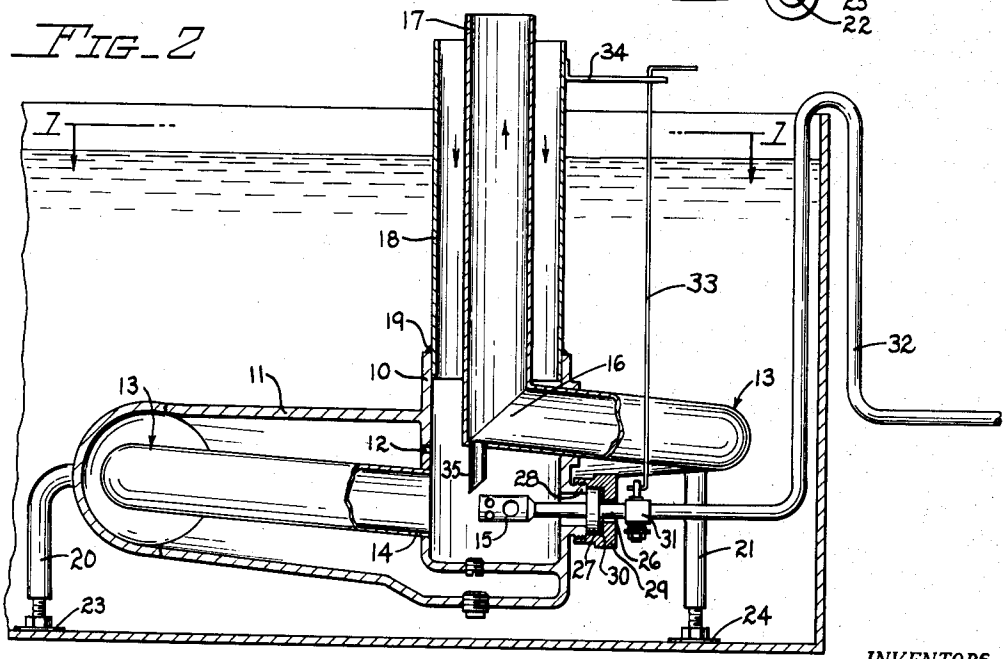


FIG. 2



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HEATER FOR LIVESTOCK WATERING TANKS

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2 Claims. (Cl. 126—360)

This invention relates generally to heaters and more particularly to a flame type heater adapted to be partially submerged in liquid in a reservoir to maintain the temperature of the liquid within a desired range.

It is a primary object of the invention to provide an immersed flue type heater capable of transferring approximately 90% of the heat produced by the flame directly to the liquid in which the flue is immersed, thus largely eliminating heat losses, and affording lower fuel consumption.

Another important object is to provide an immersion heater in which flame extinguishing trouble due to water from condensation is eliminated by partially jacketing the flue, collecting condensate in the jacket, converting the condensate to steam, and discharging the steam along with products of combustion.

Still another object is to provide a unitary heater which may be set bodily in a stock watering tank, for instance, and which requires no modification of the tank, or any physical attachment thereto, and which may therefore be easily removed from the tank for storage purposes.

As a further feature, the invention includes a burner which is constructed as an independent unit, and may thus be easily removed for servicing purposes.

The invention will be more clearly understood when the following description is read in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of a heater embodying the invention with parts in section, the section being taken along the line 1—1 of Fig. 2;

Fig. 2 is a side sectional view taken along the line 2—2 of Fig. 1, and shows the heater installed in a water tank; and

Fig. 3 is a sectional view through a rain cap used in connection with the heater.

Referring to the drawing by reference numerals, **10** designates a combustion chamber and burner well, which in the illustrated embodiment is shown integral with a laterally extending flue jacket **11**. The chamber **10** is closed at its lower end and open at its upper end, and communicates with the interior of jacket **11** through a small vent hole **12**.

A substantially annular, tubular, gently inclined flue **13** has its lower end **14** rigidly secured in a wall of chamber **10**, as by welding, and openly communicates with the interior of the chamber. A torch type high velocity burner **15** is supported from an opposite wall of chamber **10**, and is positioned centrally to project a flame directly into the lower end **14** of the flue. The upper end **16** of annular flue **13** projects through the wall of chamber **10** and terminates centrally therein, directly above burner **15**. A vertical flue extension **17** has its lower end in direct communication with the upper end **16** of the flue, inside the upper end of chamber **10**, a larger diameter vertical stack **18** concentrically surrounds flue extension **17**, and has its lower end in sealed communication with the open upper end of chamber **10**.

The seal is accomplished as by welding annularly, as indicated by the numeral **19**.

The entire heater thus far described is unitary in construction, and can be lifted and transported as a unit. It is supported on legs **20**, **21**, and **22**, the upper ends of legs **20** and **21** being welded to flue **13**, and the upper end of leg **22** being welded to the wall of chamber **10**. These legs have threaded bores in their lower ends to respectively receive leveling screws **23**, **24**, and **25**. A rain-cap **50**, as shown in Fig. 3, is provided.

Burner **15** includes an attached fuel intake pipe **26** which rigidly carries a concentric annular flange **27**. The wall of chamber **10** is provided with an integral, centrally bored, exteriorly threaded boss **28**. The bore in boss **28** is large enough to admit burner **15**. Flange **27** seats on the outer end of boss **28**, and a packing gland nut **29** compresses packing **30** against the outer surface of flange **27** to make a water tight seal, and to hold the burner assembly in position in the chamber **10**. A fuel control valve **31** connects burner pipe **26** to fuel pipe **32**. A valve control rod **33** has its lower end connected to the valve, and its upper end rotatably supported in a bracket **34** which is welded or otherwise secured to stack **18**.

As will be seen from both Figs. 1 and 2, jacket **11** extends outward from chamber **10** and surrounds approximately one fourth of the length of annular flue **13**, adjacent its lower end. The outer end of jacket **11** is preferably reduced in size and is welded to flue **13** to seal that end of the jacket. It will be noted that jacket **11** also extends beneath the lower end of chamber **10**. Jacket **11** thus creates a dead air space around a considerable portion of the flue adjacent the burner, and also beneath the burner chamber. This prevents the liquid being heated from coming in direct contact with the jacketed portions of the heater, and thus greatly reduces or eliminates the formation of condensate on the jacketed parts. In addition, the jacketing of these parts allows them to attain a much higher temperature than they could possibly attain when in direct contact with the liquid in the tank. This higher temperature is utilized to completely solve the condensate problem, as will be explained in connection with the operation of the heater.

The surrounding of the flue extension **17** with the stack **18** serves two purposes. In the first place stack **18** serves as a jacket for the discharge end of the flue. The flue thus attains a much higher temperature than it would otherwise attain, and this high temperature greatly aids in the exhaust of combustion gases from the flue.

Secondly, the proximity of the open ends of the stack **18** and extension **17**, combined with their relative free flow areas, serves to eliminate flame blow outs which occur in the ordinary heater as a result of momentary reverse air flow through the flue caused by gusts of wind. The free flow area through which air may pass to the burner chamber around extension **17** and the extension supporting end **16** of the flue should be at least equal to or slightly greater than the minimum free flow area through the flue and its extension. When this relationship exists, air flowing downward through the stack **18** as a result of a wind gust creates a pressure at the burner location within chamber **10** which is equal to or slightly greater than any back pressure which may be caused in the flue as a result of air from the same wind gust attempting to enter and pass downward through the upper end of extension **17**. By substantially balancing these two pressures reverse air flow through flue **13** is positively prevented, and by eliminating reverse air flow through the flue, flame blow-outs are eliminated. This arrangement is so effective that the burner flame of this heater continues to burn steadily in winds and wind gusts

of 70 miles per hour, and without any cap or wind deflector on the upper ends of either the flue or stack.

Operation

Referring to Fig. 2 it will be seen that a small diameter pipe **35** is secured in a vertical position to the lower end of extension **17** and communicates with the interior of the flue at that point. The lower end of pipe **35** is cut off at an angle, as shown, to serve as a gas scoop, and it is located adjacent and immediately above the combustion end of burner **15**, and its scoop end faces the burner.

When valve **31** is opened gas passes from the combustion end of the burner, and a portion of the discharged gas is picked up by the scoop and passes upward into the lower end of extension **17**. A lighted match is dropped into the extension. The scooped gas immediately ignites and the flame travels downward through pipe **35** to the burner, thus lighting the burner.

Condensate which forms at any point inside flue **13** runs downward toward the jacketed end of the flue. The high temperature of this jacketed portion of the flue immediately flashes all flue condensate into steam, and the steam passes out of the flue along with exhaust gases.

Condensate which forms inside chamber **10** is also quickly converted into steam by the high temperature of the jacketed bottom of this chamber. Condensate which forms inside jacket **11** is also converted into steam by both flue and chamber heat, and the steam passes through vent **12**, and to the atmosphere through flue **13**. It will thus be seen that condensate is disposed of as quickly as it forms, and condensate cannot, therefore, possibly accumulate in the bottom of the burner chamber **10** and extinguish the burner flame.

From the above description, it will be understood that this invention eliminates the two greatest defects in previously designed flame type immersion heaters, namely, flame blow-outs due to wind and gusts, and the extinguishing of the flame due to accumulation of condensate.

Having described the invention with sufficient clarity to enable those familiar with this art to construct and use it, we claim:

1. In an immersion heater which has a liquid tight burner chamber, a burner therein adapted to operate at a level below the surface of the liquid to be heated, and a heat transfer flue communicating with the chamber to receive heat from the burner and projecting exteriorly of the chamber into the liquid to be heated, the improvement which comprises a protective liquid tight jacket encasing a portion of the flue from the burner chamber outward along the flue and preventing direct liquid contact with the encased portion of the flue, said jacket also encasing and protecting at least a portion of the wall of said burner chamber from direct contact with the liquid in which the heater is submerged

2. The heater described in claim 1 in which the jacket is of a cross sectional size and shape to provide an airspace adjacent the encased portions of the flue and burner chamber between their respective outer wall surfaces and the inner wall surface of the jacket.

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