May 10, 1932. E. A. DOWNEY 1,858,003

HEATER

Filed March 6, 1931

Fig. 1.

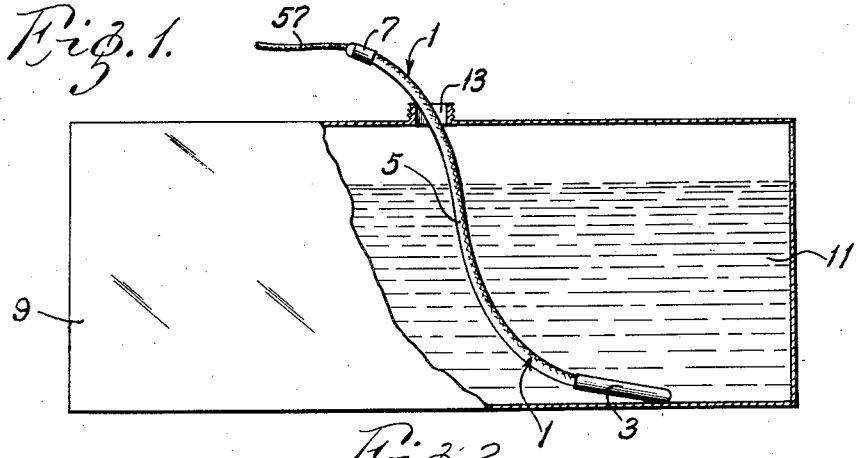


Fig. 2.

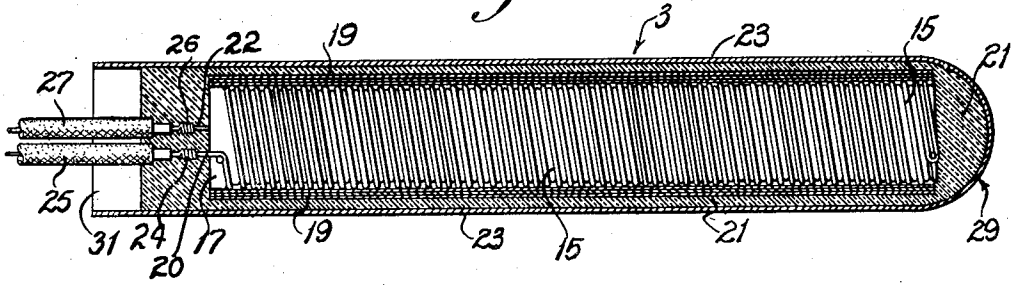
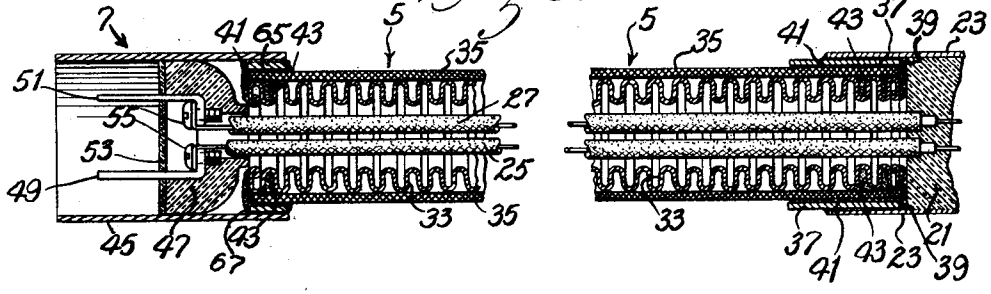


Fig. 3.



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UNITED STATES PATENT OFFICE

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HEATER

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This invention relates to heaters, and with regard to certain more specific features, to electric heaters.

Among the several objects of the invention may be noted the provision of an electric heating unit adapted to be immersed in a liquid to be heated; the provision of a heater of the class described which is unaffected by the liquid in which it is immersed and which is flexible enough to be effectively introduced into containers through relatively small openings and the provision of apparatus of the class described which is relatively simple to manufacture and operate. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structure hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated several of various possible embodiments of the invention,

Fig. 1 shows a heater embodying the invention immersed in the liquid of a tank;

Fig. 2 is a detail sectional view of a part of the heating element of Fig. 1; and

Fig. 3 is a detailed sectional view of certain flexible sheathing of the heater, showing a method of joining the sheathing to end pieces of the heater.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

In Fig. 1 there is shown a heating device 1 which comprises a heating element 3, an electrical connection 7, and a sheath 5 connecting said connector 7 and element 3. The heater is inserted in a tank 9 through an opening 13, and into a liquid 11 contained within the tank. It is often necessary to heat such liquids, as for instance, lubricating oils before they are applicable for use in an engine. This is particularly true of airplane engines which at present require operation for a considerable length of time, in order to heat the lubricating oil carried in the tank of the airplane before the plane can "take-off". At present this heating is accomplished by running the engine which passes the oil, in the oil tank, through the engine to heat it. This, however, is time consuming, and is deleterious to the engine inasmuch as cold oil does not properly flow to supply oil to all parts of the engine. Furthermore, this heating consumes a considerable amount of gasoline and time.

There are numerous other instances in which it is desirable to heat inflammable liquid in a tank, without applying heat to the outside thereof and without effecting a fire hazard. This is true in oil rooms of industrial plants which are subjected to varying temperature conditions which may carry the oil below the temperature at which it is efficient.

My heater as shown in Fig. 1 is designed to accomplish such heating of oil tanks by immersing an electric heating element in the liquid and supplying electrical energy thereto, from a battery, or from a suitable generator.

Referring now more particularly to Fig. 2 which illustrates in detail the heating element 3, there is shown at numeral 23 a cover formed from a metal such as brass or the like, having a preferably rounded and closed end 29, and an open end 31, to be sealed as hereinafter described. An insulating core 17 placed within the cover 23 carries a wire wound heating coil 15 formed of any suitable wire having an appreciable resistance, such as iron, nickel, nichrome or the like. The choice of the wire, and the amount used being governed by the amount of resistance required to supply the amount of heat required. The present heating coil comprises a 750 watt, 110 volts coil. It is to be understood, however, that this is by way of example only, and that the invention is in no way limited as to the type or size of heating coil. Around the core 17, outside the coil 15, are wound sheets of mica or like insulating material 19. Between the mica 19 and the cover 23 there is placed an electrical insulating material 21 which has proper heat conducting characteristics, and which

may be inserted in a liquid condition, to solidify after properly surrounding the mica layer 21. As shown in Fig. 2 the core 17, with the winding 15 and the mica layer 19, is preferably centered in the cover 23 and held in place by the cement 21.

Leads 20 and 22 of the coil 15 are joined to leads 25 and 27, to be described, this being done at connections 24 and 26. The connections between the leads 25 and 27, and 20 and 22, are made prior to the positioning of the core 17 in the cover 23 with the cement 21, which cement surrounds the connections.

The rounded end 29 of the cover 23 permits of easier entry of the heater into cramped quarters. The layer of cement 21 between the mica 19 and the cover 23 should be thin enough not to appreciably interfere with the heat transfer, and sufficiently thick to give protection between the cover 23 and the coil 15. The core 17 may be formed from suitable non-conducting and heat resisting material such as one having a lava base.

Referring now more particularly to Fig. 3, there is shown at numeral 5 the sheath for protecting the leads 25 and 27 which connect the heating element 3 to the electrical connector 7. The sheath 5 comprises an inner metallic lining 33 which is in the form of a continuous, flexible bellows. The bellows 33 are of a conventional construction and may be of a helical construction, or may be formed by annular convolutions as shown in Fig. 3. The advantage of the bellows 33 is found in the fact that such a structure is flexible, but has no packed joints wherein, when the heating element is in hot condition, carbonization of the oil and consequent impairment of the flexibility feature might take place. The term "bellows" as used herein is intended to cover analogous structures which are flexible but present no packed joints.

The outer layer or armor of the sheath 5 comprises a wire braid which, like the lining 33, is of a flexible nature. The braid 35 is sufficiently stiff to prevent the sheath 5 from being twisted or bent to the extent that the limit or elasticity of the bellows 33 is reached. The braid 35 is made sufficiently tight to entirely prevent twisting and bending action. Thus the braid 35 prevents the bellows 33 from being stretched or compressed, bent or twisted beyond its elastic limit but permits sufficient action of this nature to provide flexibility.

As shown in Fig. 3, the sheath 5 carries therein the leads 25 and 27 from the coil 15. These leads are insulated by both a non-conducting and heat-resisting insulator, and are capable of carrying all of the current which the coil 15 may take.

The sheath 5 positively protects the leads 25 and 27 from the liquid 11 in which the leads or sheath 5 may be immersed, inasmuch as it comprises metal which is entirely impervious to liquids such as oil.

In order to positively prevent leakage between the sheath 5 and the heating element 3, the sheath 5 is connected to the heating element 3 in the following manner:

Starting with the element 3 in its finished condition as shown in Fig. 2, and with the sheath 5 removed therefrom, and the electrical connector 7 also removed from the sheath 5, a sleeve or ring 37 is slipped over the end of the sleeve 5 shown in Fig. 3. The sleeve 37 is soldered or analogously joined to the braid 35, solder 41 being used in the present example. A lower edge 39 of the sleeve 37 is likewise joined to the bellows 33 by the solder 41. It is to be noted that the braid 35 is not continued to the extreme edge of the bellows 33, thereby allowing the edge 39 of the sleeve 37 to be soldered or otherwise joined to the bellows 33. The sleeve 37 is of such dimensions that it is adapted to fit closely into the opening 31 of the cover 23. The sleeve 37 is now positioned in the opening 31 and soldered or likewise joined to the cover 23. It is thus seen that a fluid tight connection is made between the sheath 5 and the element 3 because a continuous metallic connection results from the joint, and this fluid tightness may be traced from the bellows 33, through the solder 41, the sleeve 37 and the solder 41 to the cover 23.

The sleeve 37 serves as an intermediate medium between the braid 35 and the cover 23 insuring a more fluid-tight and stronger joint.

Prior to positioning the leads 37 on the sheath 5, it is desirable that the ends of the braid 35 be soldered or otherwise joined to the ends of the bellows 33 as shown at numerals 43. This soldering of the ends insures a more rigid joint between the bellows 33 and the sleeve 37.

With the sheath 5 in position in the cover 23, and the leads 25 and 27 strung through the sheath, the electrical connector 7 is connected to the sheath 5 as follows:

A sleeve 65 is placed over the braid 35 of the sheath and soldered thereto, the end 67 of the sleeve substantially aligning with ends of the bellows and braid. The end 67 is now soldered to the bellows 33 by a layer of solder 41. The cylindrical metal tube 45, which comprises the outer cover of the connector 7 and which has an inside diameter slightly larger than the outer diameter of the sleeve 65, is now slipped over the sleeve 65 and soldered or otherwise joined thereto as shown in Fig. 3. It is pointed out that the insulating base 47, carrying the terminals 49 and 51, may or may not be in place at this stage. As in the joint between the sheath 5 and the cover

23, the cover braid 35 of the sheath 5 does not extend to the extreme end of the sheath 5.

The insulating base 47 is now positioned in the cover or cylinder 45 with the terminal posts 49 and 51 positioned as is shown in Fig. 3. The leads 25 and 27 are respectively joined to the posts 49 and 51 by the screws 55. Thus it is impossible for the base 47 to be removed from the cover 45 while the leads 25 and 27 are joined thereto, inasmuch as the leads 25 and 27 are fastened in a reasonably taut position.

An insulating cover 53 is slipped over the posts 49 and 51 and rests on the base 47, protecting the screws 55 and the interior of the bellows 33 from any foreign material.

The cover 45 extends appreciably beyond the posts 49 and 51 and protects them from being bent out of alignment.

Thus a substantially fluid-tight joint has been provided between the outside of the connector 45 and the bellows 33. Inasmuch as this portion of the heater 1 is not subject to immersion in the liquid to be heated, the inside of the connector 7 is not made liquid tight.

To operate the heater, it is plugged into a line 57 which is in communication with a source of current such as a supply line from a generator, or a battery, this being by way of the connector 7. The heating element 3 is dropped through a hole 13 in a tank 9, and by reason of the flexible sheath 5 may be positioned at various points within the tank 9. The current supplied to the heating element 3 is converted into heat which is transferred to the liquid 11. The liquid 11 cannot come in contact with either the coil 15, or the leads 25 and 27, which are sealed within their respective covers.

It is to be understood that the invention is not limited to the form of the connector 7 or the heating element 3 as shown in the drawings. The heating element 3 may be constructed in any suitable manner which will provide a liquid proof insulating protection for a coil 15. The connector 7 may comprise a base with a set of terminal posts, the base being supported by the leads 25 and 27. In most instances, however, it is advisable to use a construction similar to that shown in Fig. 3.

An advantage of the heater is the ease with which it may be applied to any tank or the like, containing the liquid to be heated. Furthermore, a heater has been provided which is compact and portable and which is adapted to heat liquid directly rather than through the walls of the container. Further, by applying my heater to oil tanks of airplanes or the like, the necessity for a long warming up period of the engine is eliminated.

The heater 1 may be permanently installed in a tank and thermostatically controlled so as to always keep the oil therein above a predetermined minimum temperature.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A heater comprising an electrically operable heating element, electrical leads running to said element, a sheath covering said leads, said sheath comprising a metallic bellows, said bellows being joined to said element with a fluid tight joint whereby said leads are sheathed by a fluid-tight, flexible construction.

2. A portable heater comprising an electrically operable heating element, electrical leads running to said element, a flexible sheath covering said leads, said sheath having an inner metallic bellows lining and an outer wire braid lining, said sheath being joined to said element in a fluid tight joint, an electrical connector terminating the other ends of said leads, and said connector also being joined to said sheath.

3. A portable heater comprising an electrically operable heating element, electrical leads running to said element, a sheath covering said leads, said sheath having an inner metallic bellows lining and an outer wire braid lining, said braid being adapted to limit the bending and/or twisting of said bellows lining but permitting of substantial flexibility, said sheath being joined to said element by a fluid tight joint whereby said leads are sheathed by a substantially fluid tight construction.

In testimony whereof, I have signed my name to this specification this 3rd day of March, 1931.

EDWARD A. DOWNEY.