

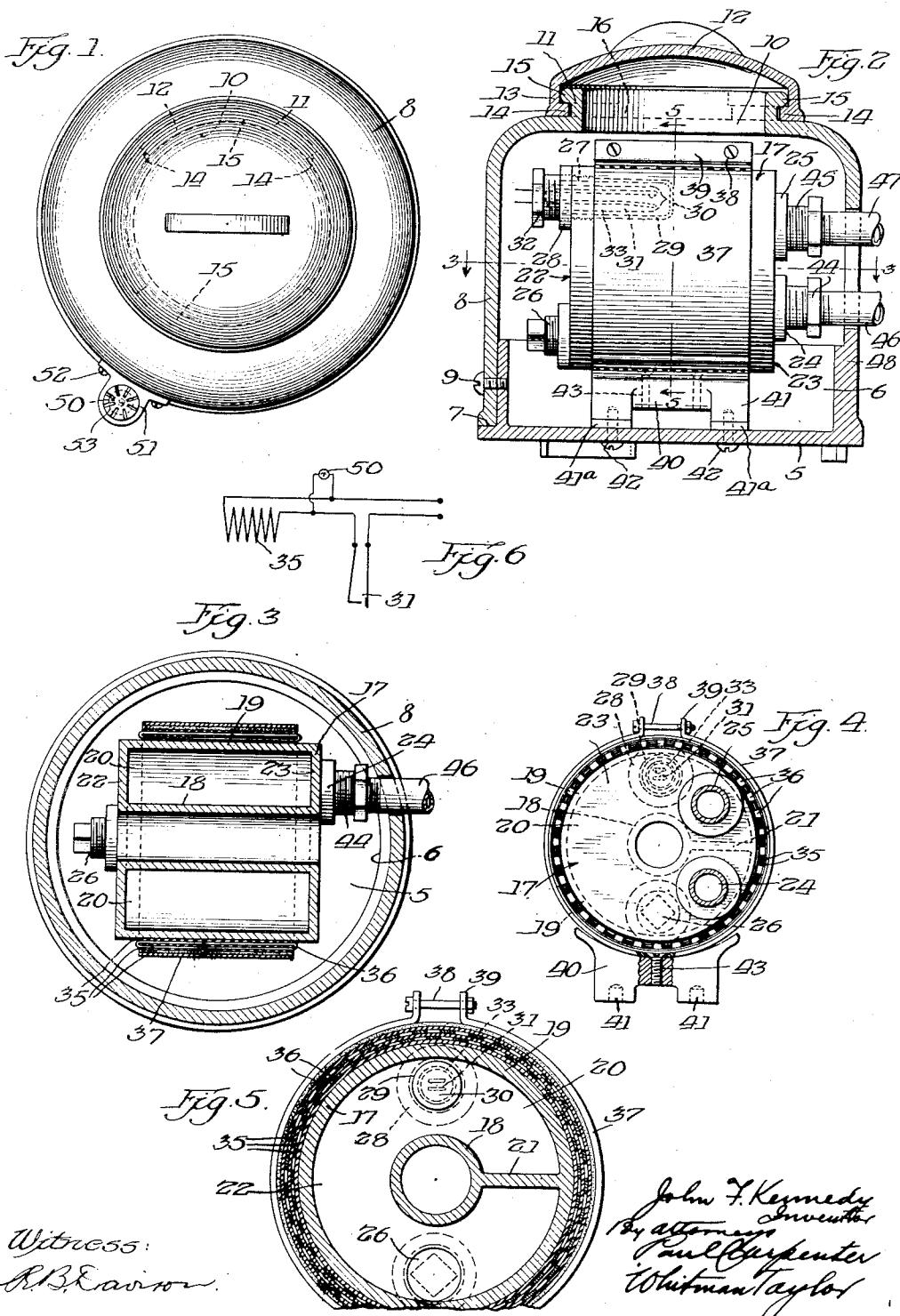
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FLUID HEATER

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FLUID HEATER

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This invention relates in general to heating apparatus and more particularly to improvements in fluid heaters and control and signalling means therefor.

5 While the invention is illustrated and more particularly described for use as a pre-heater for liquid fuel, such as oil, it will be understood that it may be adapted for other analogous purposes and, therefore, finds a wide field of utility.

10 In the conventional type of oil burner, due to the deposit of oil particles in the valves, burner nozzles and the like, the kind of oil which may be employed in a given burner is dependent upon the ability of the burner to convey and consume 15 the oil with efficient combustion, and when oil is supplied to the conventional oil burner, care must be taken that the viscosity of the oil be maintained at a proper point, that is to say the gravity, as it is termed, of the oil must be such as to readily and efficiently pass the burner and 20 be consumed thereby. This requires that in a given oil burner a certain grade of oil be employed which has, of course, a certain price on the open market. Inasmuch as the oil is supplied at whatever temperature it may be in the 25 supply tank, usually from 60 to 65° F., it will be seen that the normal viscosity of the oil is relatively high and that, under these conditions, a greater load is placed on any fuel pump which may be employed for supplying the oil, and, 30 furthermore, that the viscosity of the oil at the burner being relatively high cuts down the efficiency of the burner.

I have discovered that by pre-heating the oil, 35 regardless of what grade it may be within the normal range usually employed, after it is extracted from the tank and before it reaches the furnace, the efficiency of the burner is markedly increased, and, as well, the amount of oil consumed is reduced, on the one hand, and a lower 40 gravity, that is to say, higher viscosity oil at the outset may be employed, thus reducing the cost of heating. Furthermore, frequent cleaning of the furnace, and other auxiliary parts thereof, is 45 not required, inasmuch as the pre-heated relatively heavy particles of oil burn more readily and without the production of carbon deposits. Another feature is that the ignition of the oil for burning is greatly facilitated and makes for 50 greater certainty of operation.

The principal objects and advantages of the present invention reside in the provision of an improved fluid heater which is a compact, durable and unitary structure which has no moving 55 parts which can get out of adjustment and

wherein the fluid to be heated is caused to flow through a circuitous path in contact with a heat-conducting wall; the provision of an improved fluid heater of the character referred to which 5 may be, as a unit, installed in the fluid supply line, such, for example, as the fuel oil supply pipe of an oil burner or the like, or for other similar installations; the provision of an improved fluid heater of the character referred to 10 which includes automatically operating means for controlling the temperature of the fluid passed through the heater, together with novel visual signalling means for indicating when the heater 15 is in operation; the provision of an improved fluid heater of the character referred to wherein the heating chamber or shell is characterized by the absence of joints in the walls, thereof, thus eliminating the danger of leaks, blow-outs and the like; and the provision of an improved heating 20 device of the character referred to which may be installed in a conventional oil-burning system without material alterations in the system and without any alterations in the oil burner itself.

The foregoing and such other objects and advantages as may appear or be pointed out as this description proceeds are attained in the structural embodiment of the invention shown in the accompanying drawing, in which:

Figure 1 is a top plan view of the device of 30 this invention;

Figure 2 is a vertical, sectional view, the heating element being shown in elevation;

Figure 3 is a horizontal, sectional view, taken on the line 3—3 of Figure 2 looking in the direction 35 indicated by the arrows;

Figure 4 is an end elevational view of the heating unit and casing shown in Figure 2, viewed from the aspect of the right-hand side thereof in said Figure 2; 40

Figure 5 is a vertical, sectional view of the device taken on the line 5—5 of Figure 2 looking in the direction indicated by the arrows; and

Figure 6 is a diagrammatic illustration of one convenient circuit arrangement. 45

Referring now more particularly to the drawing, and first to Figures 1, 2, and 3, I provide a housing including a base 5 preferably substantially circular and provided with an upstanding annular flange 6 of somewhat less diameter than 50 the diameter of the base 5, to afford an annular shoulder 7.

The housing also includes a hood comprising a cylindrical wall 8 which is adapted to fit over the flange 6 and seat upon the shoulder 7. Any 55

suitable means may be employed for securing the hood in position, such, for example, as a series of screws, only one of which is shown and indicated at 9.

5 The top of the hood is provided with an opening 10 bordered by an annular flange 11 to which is applied a closing cap 12. The cap 12 has a flange 13 provided with inwardly extending arcuate portions 14 which engage beneath complementary shoulders 15 on the flange 11 so as to provide retaining means for the cap. The shoulders 15 are interrupted, as indicated at 16, and the cap is applied with its arcuate portions 14 entering the space between the shoulders 15 and 16, and then said cap is rotated for locking it in closed position.

The heating device comprises, as best shown in Figures 2 to 5, a casing or shell 17 of heat-conducting material. This shell is preferably 20 formed of a casting, inasmuch as by forming the same of a casting, there is no opportunity for leaks to occur. This shell or casing includes the inner and outer cylindrical walls 18 and 19 spaced from each other to form a cylindrical passageway 25 20, a partition 21 being provided therein and extending from the inner cylindrical wall 18 to the outer cylindrical wall 19, as best shown in Figures 4 and 5.

The casing or shell further includes the end 30 walls 22 and 23, thus forming a unitary and compact casting which is not subject to leaks.

The passageway 20 is provided with inlet and outlet ports formed at the points 24 and 25 in one of the end walls, in the present instance the end wall 23, the inlet 24 being located on one side of the partition 21, and the outlet 25 being located on the other side of the partition 21. Thus, fluid entering the inlet, in order to reach the outlet, must flow around through the arcuate 40 or cylindrical passageway 20 in contact with the outer cylindrical wall 19 thereof.

In the opposite wall 22, I provide an opening closed by a clean-out plug 26, this clean-out plug being preferably located at the bottom of the 45 casing 17 when the same is installed in operative position so that sediment may be readily removed therefrom. It will be understood that the outlet 25 is preferably located above the partition 21, for two reasons, namely, that the oil will naturally tend to rise as it is heated, and sediment, therefore, will drop to the bottom of the casing away from the outlet 25, and, furthermore, the outlet is adjacent to thermostatic control means which I will now proceed to describe.

55 In the end wall 22 and above the cylindrical wall 18, I provide a threaded hole 27 into which is introduced a nipple 28 which carries an extending casing 29 having a closed end 30 lying in the passageway 20. This casing 29 serves to support a thermally responsive element such as a thermostat carried by a threaded plug 32 engaging the nipple 28. The thermostat is of a conventional form mounted in a vacuum tube 33 for eliminating the effects of sparking, and is 65 connected electrically to the heating element hereinafter described.

It will be observed that the thermostat is placed in the casing adjacent to the outlet 25 and thus, as fluid, such as oil, becomes heated in contact with the wall 19, it passes further in contact with the thermostat casing 29, thus actuating the thermostat in accordance with its set condition to regulate the temperature of the heating element which I will now proceed to describe.

75 The heating element conveniently includes a

relatively flat strip composed of mica insulating layers between which is arranged a conventionally wired resistance designed to become heated when electrically energized. The heating element which I employ is readily obtainable in the 5 open market and is of a flexible character and may be wrapped about the outer wall 19 of the casing in substantially cylindrical form, as best shown in Figures 3, 4, and 5. Thus, the heating element, as there shown, is composed of the alternate layers of insulating material 35 and conductors 36, one of the insulating layers being in contact with the outer surface of the casing wall 19 so that heat is transmitted directly thereto from the heating element. 15

Inasmuch as the heating element must be maintained in intimate contact with the wall 19, I provide a cylindrical metal band 37 which substantially completely encompasses the heating element and is drawn into snug engagement therewith by the provision of bolts 38 passing through the upturned ends 39 of said metallic band 37. 20

I find it convenient to employ in the casing 17 a metal which is highly conductive of heat, such, for example, as brass, and also preferably employ the same kind of metal in the band 37 so that the coefficients of expansion and contraction of the casing and the band are the same, thus preventing springing of the heating element away from the casing and consequent loss of heat units. 30

The casing and heating element and retaining band therefor are mounted on a saddle 40 on the base 5, said saddle being provided with legs 41 into which retaining screws 42 extend, thus fixedly retaining the saddle on the base 5. Between the bottom of the legs 41 and the base 5, I insert heat-insulating washers 41a, as shown in Figure 2. The casing and heating element are retained on the saddle by the provision of screws 43 extending through the band 37 into the saddle, and their ends being threaded into the wall of the saddle 40. 40

The inlet 24 and the outlet 25 are provided with threaded bushings 44 and 45 to which the pipes 46 and 47 are connected, the pipe 46 leading from the supply tank, and the pipe 47 extending to the oil burner or other apparatus. A suitable slotted aperture is provided in the wall 8 of the hood, for the pipes 46 and 47, and a portion of this aperture is closed by the provision of an upstanding abutment 48 cast integrally with the flange 6 of the base 5. 50

It will be understood that when the casing, and its heating element and thermostat are installed 55 in the housing, the latter is filled with heat insulating material such as asbestos wool or the like, thus preventing undue heat radiation therefrom.

For convenience, I provide an electrical circuit such as that shown in Figure 6 in which the heating element is shown at 35 and the thermostat at 31. Across the circuit of the heating element I provide an incandescent lamp as indicated at 50 so that, when the thermostat closes 65 the circuit to energize the heating element, the lamp will be lighted and indicate that the current is being supplied by the thermostat.

One convenient arrangement for the signal lamp is shown in Figure 1 in which a lamp socket 70 and housing 51 is bolted, as indicated at 52, to the hood 8, the lamp being located in a protecting cage 53 so as to be visible and thus render a visual indication as to the flow of electricity to the device. 75

From the foregoing it will be understood that upon relatively cold fuel oil entering the inlet 24 and passing in contact with the heat-conducting wall 18, the oil temperature is raised to a degree materially reducing the viscosity of the oil and thus facilitating its consumption at the burner.

While I do not consider myself as limited in the figures given herein, an example of the operation of the invention is that, where grades of fuel oil commonly designated Numbers 3 and 4 are employed, in instances where a No. 3 oil had to be employed the device of this invention permits of the efficient consumption of No. 4 oil and it will thus be understood that more oil is normally burned when the viscosity is high than when the viscosity is low, and thus my invention permits of the initial use at the tank of a high viscosity oil, the heating device reducing this viscosity and thus increasing the efficiency of the burner and reducing the cost of operation thereof.

The following table graphically shows the advantages of employment of the heating device of this invention:

Heat units and values of typical grades of burning oil

Grade	Baumé gravity	B. t. u.'s per gal.
No. 1.....	38-40	136,887
No. 2.....	32-36	138,926
No. 3.....	28-32	141,790
No. 4.....	24-28	145,612
No. 5.....	18-20	149,484

From the foregoing it will be observed that with the lower gravity of oil, greater heat units are contained therein, thus permitting, with the operation of this invention, the employment of a lower grade of oil at a lower initial cost, but at the same time permitting the consumption of the lower grade of oil which would not otherwise be efficient or practicable.

It will thus be understood that the present invention permits of a saving in liquid fuel costs from 15 to 25%; furnishes a greater number of heat units for the same quantity of oil; makes for a clean-burning fire preventing the collection of carbon deposits; requires no adjustment other than an initial one upon installation; and enhances the ignition point of the oil and requires no alteration in the oil-burning construction itself.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. In a fluid heater, a heat conducting shell or casing having concentric cylindrical walls joined by annular end walls and an interior longitudinal partition, forming a circuitous fluid passageway and provided with an inlet and an outlet, and a heating element surrounding said casing.

2. In a fluid heater, a heat conducting shell or casing having concentric cylindrical walls joined by annular end walls and an interior longitudinal partition, forming a circuitous fluid passageway and provided with an inlet and an outlet, and a heating element applied to said casing adjacent to the path of flow of fluid therethrough surrounding said casing.

3. In a fluid heater, a heat conducting shell or casing having a circuitous passageway provided with an inlet and an outlet, a heating element surrounding said casing, and an adjustable re-

movable retaining member of material having the same coefficient of expansion and contraction as said shell or casing, holding said heating element in close contact with said shell or casing.

4. In a fluid heater, a heat conducting shell or casing having a circuitous passageway provided with an inlet and an outlet, and a heating element surrounding said casing, means controlled by the temperature of the fluid for controlling the energization of said heating element, and means for visibly indicating the duration of such energization.

5. In a fluid heater, a shell or casing having internal and external heat conducting spaced walls connected by end walls and a longitudinal partition affording a circuitous passageway for fluid between said spaced walls, inlet and outlet ports on opposite sides of said partition, and a heating element in contact with and surrounding said external heat conducting wall.

6. In a fluid heater, a shell or casing having internal and external heat conducting spaced walls connected by end walls and a longitudinal partition affording a circuitous passageway for fluid between said spaced walls, inlet and outlet ports on opposite sides of said partition, and an electrical heating element in contact with and surrounding said external heat conducting wall.

7. In a fluid heater, a shell or casing having internal and external heat conducting spaced walls connected by end walls and a partition affording a circuitous passageway for fluid between said spaced walls, inlet and outlet ports on opposite sides of said partition, and an electrical heating element in contact with and surrounding said external heat conducting wall, and thermally actuated means located between said walls for controlling said electrical heating element.

8. In a fluid heater, a shell or casing formed of a single casting of heat conducting material provided with internal and external spaced walls, connected by end walls and a partition, affording a circuitous passageway for fluid between said walls, an inlet port below said partition and an outlet port above said partition, a heating element of elongate form applied to and in contact with said external wall, and means including an element having the same coefficient of expansion and contraction as said casing for clampingly engaging said heating element for retaining it in heat transmitting contact with said external wall.

9. In a fluid heater, a fluid passageway comprising a heat conducting shell or casing having an inlet and an outlet, a heating element surrounding said casing, a supporting base, a saddle thereon for supporting said shell or casing, and a housing mounted on said base independently of said saddle; said shell or casing and said heating element being mounted within said housing in spaced relation thereto and substantially entirely surrounded by said base and said housing.

10. In a fluid heater, a heat conducting shell or casing having a circuitous passageway provided with an inlet and an outlet, and a heating element surrounding said casing, a supporting base, and a saddle thereon for supporting said shell, and heat insulating means between said saddle and said supporting base.

11. In a fluid heater, a shell or casing having internal and external spaced cylindrical walls, end walls, a radial connecting partition, and inlet and outlet ports on opposite sides of and immediately adjacent to said partition so that fluid

entering said casing at said inlet must flow around the space between said cylindrical walls to reach said outlet, and a heating element surrounding and in contact with said casing.

- 5 12. In a fluid heater, a shell or casing having internal and external spaced cylindrical walls, end walls, and a radial connecting partition, inlet and outlet ports on opposite sides of and immediately adjacent to said partition so that fluid
10 entering said casing at said inlet must flow around the space between said cylindrical walls to reach said outlet, a thermostatically controlled heating element surrounding and in contact with said casing and including a flexible electrical
15 conductor, means for holding the heating element against said casing, and a heat insulating housing for said heater.

13. In a fluid heater, a shell or casing having internal and external spaced cylindrical walls,
20 end walls, and a radial connecting partition, inlet and outlet ports on opposite sides of and immediately adjacent to said partition so that fluid entering said casing at said inlet must flow around the space between said cylindrical walls
25 to reach said outlet, a thermostatically controlled heating element surrounding and in contact with said casing and including a flexible electrical conductor, means for holding the heating element against said casing, a heat insulating housing for
30 said heater, and a visual signal on said housing automatically operable to indicate when said heating element is energized.

14. In a fluid heater, a heat conducting shell or casing having a circuitous passageway provided
35 with an inlet and an outlet, and a heating element surrounding said casing, a removable outer housing for said fluid heater, and heat insulating means surrounding said fluid heater within said housing, said housing being provided with an ap-
40 erture and a closure for said aperture whereby said heat insulating means may be introduced into or removed from said housing.

15. In a fluid heater, a heat conducting shell

or casing having a circuitous passageway provided with an inlet and an outlet, and a heating element surrounding said casing, and means controlled by the temperature of the fluid for controlling the energization of said heating element. 5

16. In a device of the character described, in combination, a fluid heater including a heat-conducting shell or casing having a circuitous fluid passageway and provided with an inlet and outlet and a heating element surrounding said
10 casing, a supporting base, a saddle thereon for supporting said fluid heater and a housing mounted on said base in spaced relation to and substantially entirely surrounding said fluid heater, the space between said housing and said heater
15 being filled with removable insulation material and said housing having an aperture provided with a closure to permit the placing or removal of said insulating material.

17. In a fluid heater, a shell or casing formed
20 of a single casting of heat conducting material provided with internal and external spaced walls connected by end walls and a partition, affording a circuitous passageway for fluid, and a heating element surrounding said casing. 25

18. In a fluid heater, a shell or casing formed of a single casting of heat conducting material provided with internal and external spaced walls connected by end walls and a partition, affording a circuitous passageway for fluid, and a heating
30 element applied to said casing adjacent to the path of flow of fluid therethru.

19. In a fluid heater, a shell or casing formed of a single casting of heat conducting material having internal and external spaced cylindrical
35 walls, end walls and a radial connecting partition, inlet and outlet ports on opposite sides of and adjacent to said partition so that fluid entering said casing at said inlet must flow around the space between said cylindrical walls to reach said
40 outlet, and a heating element adjacent to said casing.

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