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E. L. GRUPP
ELECTRIC FLUID HEATER

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2 Sheets-Sheet 1

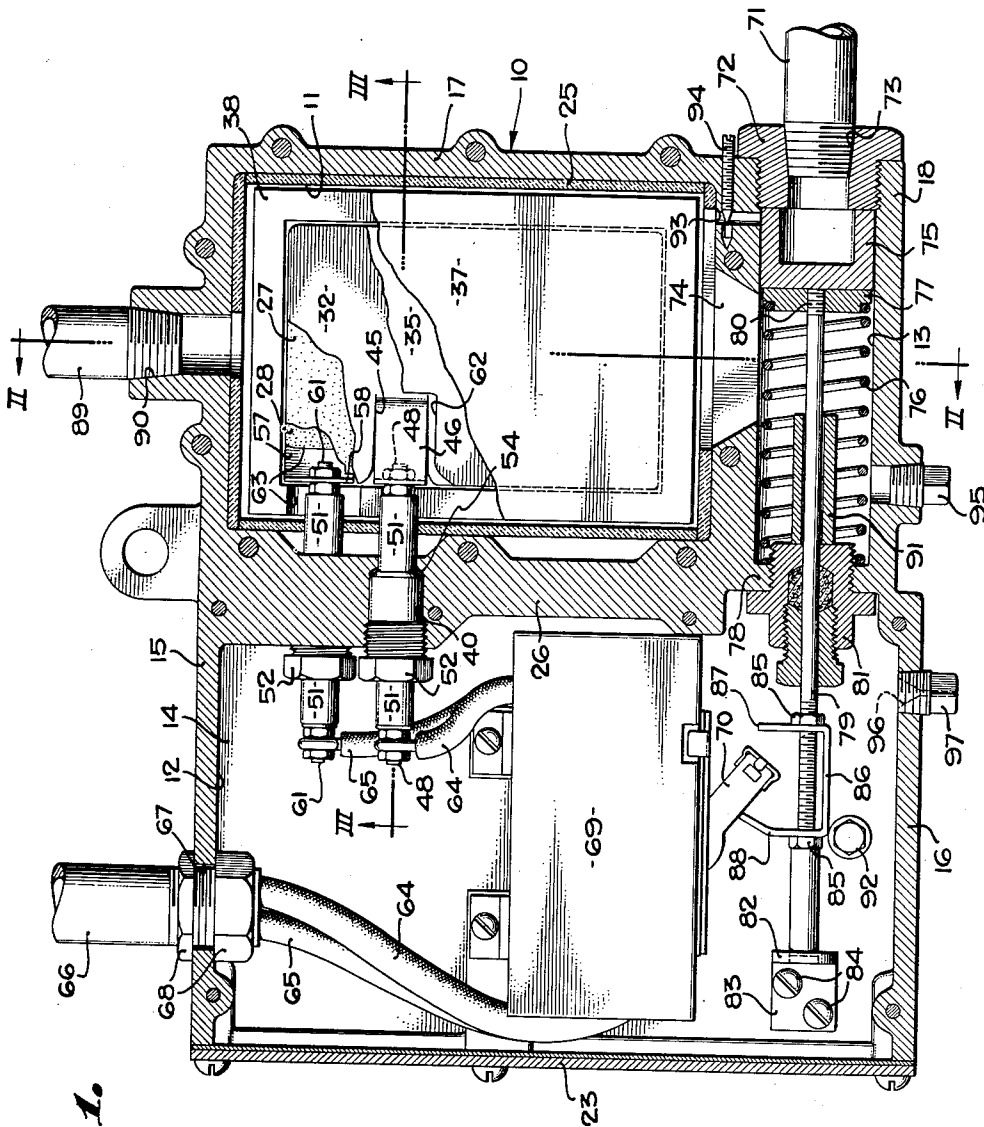


Fig. 1.

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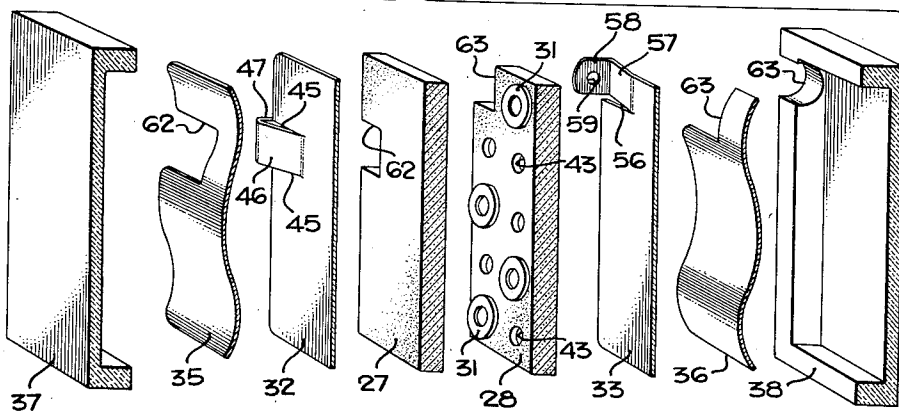
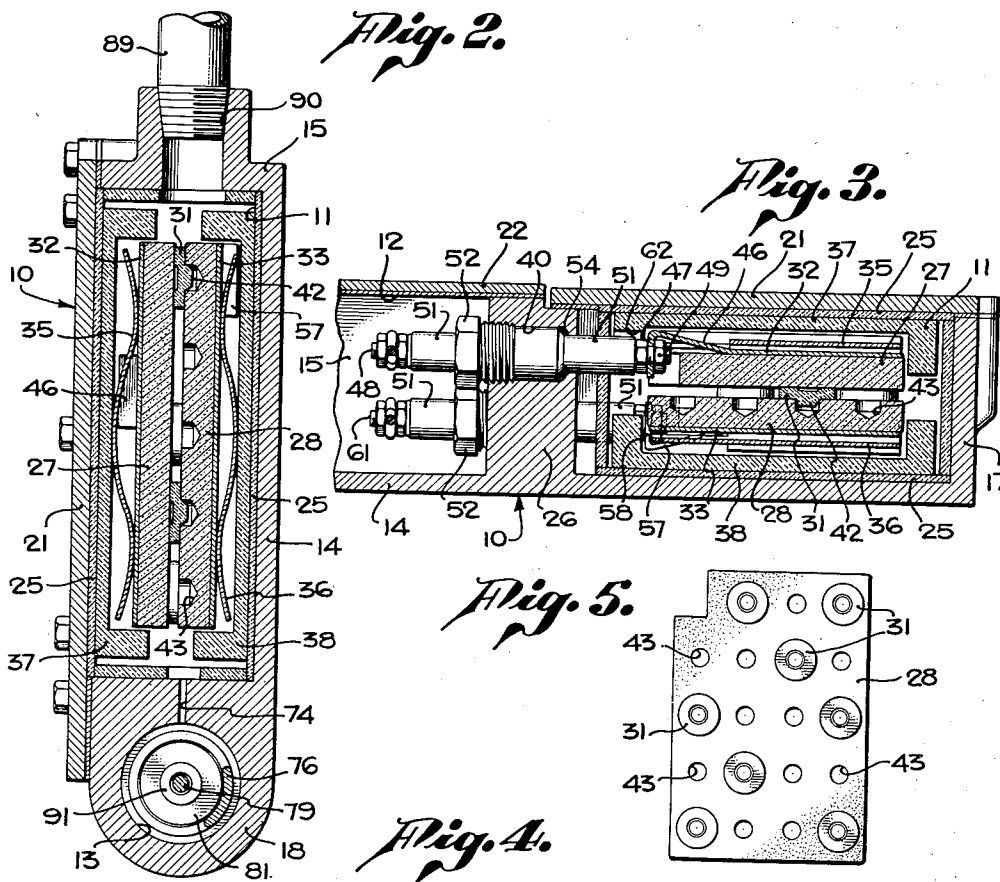
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2 Sheets-Sheet 2



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ELECTRIC FLUID HEATER

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8 Claims. (Cl. 219-40)

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This invention relates to an electric fluid heater, and more particularly but not necessarily to an electric water heater.

All of the electrical water heaters known to me are objectionable in that the electrical ground loss is greater than that permitted by the underwriters in some districts. Also they do not provide for heating water of different conductive characteristics. Particularly, heaters which use the water as resistance to conduct the current between the electrodes and heat the water by subjecting it to the electrolytic action of the current do not provide means for varying the effective area of the electrodes to compensate for the different mineral content of water to be heated.

It is therefore a primary object of this invention to provide an electric water heater that will overcome the above difficulties.

Another object is to provide an electric water heater wherein the casing containing the heating elements and other parts is insulated in such a manner as to reduce the electrical ground loss from the unit to a minimum and thereby render the heater safe for use in any location where such a heater is desired.

Another object is to provide in a heater having the above characteristics novel electrodes adjustable for varying the distance between the electrodes and adjustable for varying the effective area of the electrodes in order to obtain the proper electrolytic action on waters of different mineral contents.

A further object is to provide a heater of novel construction and arrangement of parts that will be durable, efficient in operation and comparatively cheap to manufacture.

A still further object is to provide a heater in which the heating element is energized in response to the supply of water to the heater and deenergized when the supply of water to the heater is stopped.

The above and other objects will be made apparent throughout the further description of the invention when taken in connection with the accompanying drawings, wherein like reference characters refer to like parts. It is to be distinctly understood that the drawings are not a definition of the invention but merely illustrate one form by means of which the invention may be effectuated.

In the drawings:

Fig. 1 is a front elevational view having the cover removed, partly in section, and with certain parts broken away in order to disclose details of the invention.

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Fig. 2 is a sectional view taken along the line II—II of Fig. 1.

Fig. 3 is a sectional view taken along the line III—III of Fig. 1.

Fig. 4 is a vertical section of an exploded view of a heating unit embodying the invention.

Fig. 5 is an elevational view of an electrode embodied in the invention.

Referring to the drawings, the present heater may include a housing or casing, represented in its entirety by 10. The housing provides a heating unit compartment 11, a switch compartment 12, and a cylinder 13. In the construction of the housing 10, the back 14, top 15, bottom 16, one side 17, and the walls 18 of the cylinder 13 may be cast, molded, or otherwise formed to provide an integral structure. The front of the housing may consist of a cover plate 21 for the heating unit compartment 11 and a cover plate 22 for the switch compartment 12. The cover plate 22 terminates at its outer end in an inwardly extending flange 23, the latter forming the other end of the housing 10.

One of the important features of the invention is the provision of suitable insulation of the housing in order to reduce the electrical ground loss of the heating unit to a minimum. I have found by experiment that effective insulation for this purpose may be obtained by constructing the housing of aluminum or brass and providing the housing with a high dielectric coating of phenolic resinoid. A suitable insulating compound for this purpose consisting of a phenolic resinoid is known to the trade as "Heresite." I have also discovered that a coating of phenolic resinoid of one mil thickness when properly applied to aluminum or brass is effective for properly insulating a voltage as high as 1800 volts. The housing is sprayed both internally and externally with phenolic resinoid to provide a coating of the desired thickness, after which time the coating is baked. The baking may be at 220° F. for a period of twenty-four hours, or at 500° F. for ten minutes. Phenolic resinoid coating has high thermal shock resistance and is tasteless and odorless.

The compartments 11 and 12 of the housing are separated by a vertical transverse partition 26. The partition 26 is integral with the back 14, top 15, and bottom 16 of the housing 10 and is provided with a phenolic coating the same as above described. The interior of the heating unit compartment 11 is further lined with an insulation strip 25 of phenolic material having a thickness of $\frac{3}{8}$ of an inch. The heating unit consists

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of a pair of plate-like carbon electrodes 27 and 28 spaced apart by spacer members 31, a pair of contact plates 32 and 33 adapted to lie flat against the opposing faces of electrodes 27 and 28, respectively, a pair of curved or arcuate shaped spring members 35 and 36, and a split, ceramic casing composed of two parts 37 and 38. The arcuate shaped spring member 35 is disposed between casing part 37 and contact plate 32, while spring member 36 is disposed between casing member 38 and contact plate 33. It can now be understood that when the ceramic casing parts 37 and 38 are urged toward one another by the cover 21, the spring members 35 and 36 will be compressed and urge their respective adjacent contact plates 32 and 33 into contact with the respective opposing faces of electrodes 27 and 28, the electrodes 27 and 28 being held in spaced relation by spacer members 31. The spacer members 31 are made of suitable insulating material and are preferably round and present flat, annular faces on each of their sides, one of their sides being provided with a centrally disposed lug or projection 42, adapted to engage corresponding openings 43 provided in the inner face of one of the electrodes. Spacer members 31 of different thickness may be provided for adjusting the spacing between the electrodes and the required number of spacer members may be inserted between the electrodes to provide the desired effective area of the electrodes. By the use of spacer members of different thickness to adjust the spacing between the electrodes, and by increasing or decreasing the effective area of the electrode by varying the number of spacer members between the electrodes, the heater may be easily and quickly converted for proper heating of waters of different mineral content.

The contact plate 32 is slit at 45 to form a terminal strip 46. The terminal strip 46 terminates in an inwardly extending tab 47 having an opening therein for receiving one end of a terminal 48 and is fixed thereto by any suitable means, such as the threaded means shown at 49. The terminal 48 extends through an opening 40 in the partition 26 and is suitably insulated therefrom by a porcelain cover 51. The terminal 48 and cover 51 are preferably formed integral with each other and a threaded means 52 may also be formed integral with cover 51 in order to make a fluid-tight unit. The opening 40 may be internally threaded and counterbored to form an annular beveled shoulder to cooperate with the beveled inner end of the threaded means 52 and a copper washer inserted therebetween as shown at 54 to insure a water-tight connection.

The contact plate 33 is slit adjacent its top at 56 to form a terminal strip 57. The terminal strip 57 terminates in an inwardly extending tab 58 having an opening 59 therein for receiving one end of a terminal 61. The terminal 61 is mounted through an opening in the partition 26, insulated therefrom, and forming a water-tight connection therewith in the same manner as that described in connection with terminal 48.

In order to provide space within the heating unit compartment 11 for the tab 47, terminal 48 and their threaded connecting means 49, the part 37 of the ceramic casing, spring member 35 and electrode 27 are recessed, as shown at 62. Space is likewise provided within the compartment 11 for tab 58, terminal 61 and their associated threaded connecting means 49 by recesses in ceramic casing part 38, spring member 36 and electrode 28, as shown at 63.

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The ends of terminals 48 and 61 within the switch compartment are electrically connected to a source of current by conductors 64 and 65 respectively. The conductors enter the switch compartment by way of a conduit 66 extending into an opening 67 provided in the top 15 of the housing 10. The end of the conduit may be rigidly fixed to the top 15 by means of the threaded connection 68. Interposed within the electrical circuit, comprising the conductors 64 and 65, is a switch or circuit breaker 69 having a switch arm 70 for actuating the switch in the usual manner.

It will be noted from Figs. 2 and 4 that the present device differs from prior constructions in three principal characteristics. First, the spring members 35 and 36 contact plates 32 and 33 and electrodes 27 and 28 are spring-held within the casings 37 and 38 in what may be termed floating therewithin. This permits expansion and contraction of the springs 35 and 36 and contact plates 32 and 33 without exerting undue stress on the electrodes 27 and 28 and thereby prevents the usual cracking and distorting of the latter. Second, the positioning of the contact plates 32 and 33 between their respective springs and electrodes protects electrodes 27 and 28 from friction due to relative movement of the springs 35 and 36, thereby greatly lengthening the life of the electrodes 27 and 28. Third, the particular fabrication of the heating unit whereby spacer members of a selected area and thickness may be employed in such numbers as may be required for varying the distance between the electrodes for varying the effective area of said electrodes. Moreover, the present heating unit may be readily disassembled for inspection, replacement of any one element or repair, and quickly and readily reassembled into a compact, effective unit.

In the present invention it is desired to actuate the switch for energizing the heating unit in response to the water supplied to the heating unit and to deenergize the heating unit when the supply of water is cut off from the heating unit. To this end, water is supplied to the unit by way of an inlet pipe 71 connected to the outer end of cylinder 13. The outer end of cylinder 13 is internally threaded for receiving an externally threaded nipple 72, the latter having an internally threaded bore 73 for receiving the threaded end of pipe 71. The cylinder 13 is connected with the heating compartment 11 by way of a slot or elongated passageway 74 provided through the top of the wall of the cylinder 13. For actuating the switch 69 to energize or deenergize the heating unit in response to demand for hot water from the heating unit, a piston 75 is provided within the cylinder bore 13. The piston 75 is biased by a spring 76 toward its outermost position in the cylinder, at which position its outer face rests against the inner face of nipple 72. The piston 75 is preferably of the full-floating type and a spring-retaining cap 77 is placed against the inner face of the piston 75 for engaging the outer end of coil spring 76. The other end of coil spring 76 engages the inner closed end 78 of the cylinder 13. The closed end 78 of the cylinder may be a continuation of the partition 26.

The spring-retaining cap 77 is provided with a central threaded opening for receiving the threaded end of a switch-actuating rod 79, as shown at 80. The rod 79 extends axially through the cylinder 13, packing gland 81, provided in the

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rear end 78 of cylinder 13, into the switch compartment 12, and terminates in a guide 82 carried by a bracket 83 fixed to the back 14 of the housing 10 by any suitable means, such as screws 84. A portion of rod 79 within the switch compartment and immediately below the switch arm 70 is threaded to receive two adjusting nuts 85 spaced apart. Between the nuts 85 there is positioned on the shaft 79 a member 86 formed to provide a pair of spaced, upstanding arms 87 and 88 between which the end of switch arm 70 extends.

It can now be understood that when water is supplied to the cylinder 13 by way of intake pipe 71, the force of the water will urge the piston 75 against the tension of the spring 76 inwardly sufficiently to permit the passage of water from the cylinder 13 through the passageway 74 into the heating unit. Since piston 75 is appreciably shorter than passageway 74, water pressures on opposite sides of the piston readily balance each other, and the piston quickly responds to drop in pressure in chamber 11 when faucets in line 89 are opened.

As the piston is moved inwardly, the rod 79 will also move accordingly and cause the member 87 to move the switch arm 70 into close position and energize the heating unit. The heated water passes out the top of the heater by way of outlet pipe 89 connected with the top of the housing 10, as shown at 90. Upon cutting off the water supply to the cylinder 13, the spring 76 will urge the spring-retaining cap 77 and piston 75 to their outermost positions and since the rod 79 is fixed to the cap 77, the rod will be moved to the right and cause member 88 to move the switch arm 70 to break the circuit and deenergize the heating unit. It is to be understood in connection with the above explanation, that a faucet or faucets may be located in line 89 and water is continually present within the heater. When a faucet in line 89 is opened, pressure within the heater (and within bore 13) is reduced, causing line pressure in supply pipe 71 to move piston 75 and supply a stream of water to the heater.

A tubular stop member 91 may be carried by the inner face of the gland member 81 for limiting the inner travel of the spring cap and piston. Also a roller support or guide 92 may be provided in the switch compartment for contact with the bottom of member 86 for assisting in the support and guiding of the rod 79.

In order to equalize and compensate for the differential pressures between the interior of the cylinder and the heating unit when piston 75 reaches closed position, there is provided a by-pass 93 adjacent the inner end of nipple 72. An adjusting screw 94 may be provided in the housing and connect the by-pass 93 for adjusting the same. The rear end of the piston 75 may be beveled or provided with recesses for connecting the interior of the intake pipe 71 with the by-pass 93 when the piston 75 is in closed position.

In the bottom of the wall of the cylinder 13 there is provided a drain plug 95 for draining the heating unit and cylinder during cold weather when the heater is not in use. Also there is provided a trap 96 in the bottom of the switch compartment for catching any leakage from the gland 81, the trap 96 being provided with a plug 97 for draining the trap.

Accordingly there is provided an electric heater for water or other fluids that is so constructed and insulated as to insure a minimum electric

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ground loss, which can be adjusted for the proper heating of liquids containing different mineral content and which is compact, durable, efficient, inexpensive to operate and comparatively cheap to manufacture.

While only one form of the invention has been illustrated and described, it will now be apparent to those skilled in the art that certain changes, additions, omissions, and substitutions may be made in the exemplary form shown without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A fluid heater including: a housing; a partition in said housing forming two compartments; a cylinder in said housing; an electric switch in one of said compartments; a heating unit in the other of said compartments, said heating unit comprising a pair of electrodes; means for biasing said electrodes toward one another; and means for retaining said electrodes at a desired distance apart, said biasing means being supported in floating relation to the first named compartment; an electric conductor connecting said switch and said heating unit; means for connecting a source of current to said switch; a piston in said cylinder; a fluid inlet and a fluid outlet connected with said heating unit compartment; means actuated by said piston in response to fluid pressure in said inlet for actuating said switch, and an adjustable port connecting said inlet with said other compartment for equalizing the pressure therebetween.

2. An electrically energized instantaneous water heater including: an outer metallic housing; a compartment in said housing; an inlet bore in the housing near one end of said compartment; a port connecting said bore and compartment; an outlet port in the housing in communication with the other end of the compartment; a pair of opposing, dielectric casings in the compartment; an electrode plate in each casing; spring means between each casing and its electrode urging said electrodes toward each other; and removable spacer means between said electrodes and attached thereto, the said electrode plates and spring means being supported in floating relation with said casings.

3. An electrically energized instantaneous-type water heater, comprising: an outer metallic relatively flat housing provided with a transverse partition dividing said housing into a switch compartment and a heating compartment, a piston bore in the bottom of the housing, an inlet port into the end of the piston bore, a lateral passageway from the piston bore in communication with one side of the heating compartment, an outlet port in the top of the housing opposing the lateral passageway, a spring-biased piston in the bore, said piston normally closing the inlet port, and a pair of flat electrodes in spaced relation in the heating compartment and between said lateral passageway and outlet port; at least one of said electrodes being provided with a series of recesses, and removable spacer means arranged to be held in said recesses of one electrode and contact the opposite electrode to limit the effective surface area of said electrodes.

4. In a fluid heater the combination of: a housing including a back, top, bottom and sides and an open front; a removable closure for the front of the housing to form a compartment therein; a fluid inlet into the bottom of the housing and a fluid outlet in the top of the housing

and in communication with the compartment; a ceramic casing within the compartment; a pair of imperforate electrodes in said casing; spring means biasing the electrodes towards each other and means for maintaining the electrodes in a predetermined, spaced, relation comprising a plurality of spacer members carried by one of said electrodes, said spacer members being removable to vary the effective surface area of the electrodes.

5. In a fluid heater the combination of: a housing provided with a transverse partition forming two compartments in said housing; a switch means positioned in one of said compartments; a cylinder formed in the wall of the housing below the second compartment; a fluid inlet into one end of the cylinder; a port communicating the side of the cylinder with the second compartment; a piston in the cylinder, said piston being spring biased to normally close the fluid inlet; an adjustable pressure equalizing passageway between the second compartment and said cylinder, normally closed by said piston, said passageway communicating with the cylinder between the fluid inlet and port; a heating unit in the second compartment and connected to the switch means and means actuated by the piston in response to fluid pressure in the inlet for actuating the switch.

6. A fluid heater of the character stated in claim 5 wherein the heating unit comprises a pair of imperforate electrodes, spring means biasing the electrodes towards each other; and means for maintaining the electrodes in predetermined, spaced relation comprising a plurality of spacer members carried by one of said electrodes and in contact with the other electrode.

7. An electrically energized, instantaneous, water heater comprising: an outer metallic housing provided with a partition dividing said housing into two compartments; a switch in one of said compartments; an inlet bore in the housing near one end of the second compartment; a port connecting said bore and compartment; an

outlet port in the housing in communication with the other end of said compartment; a pair of opposing dielectric casings in the compartment; an electrode plate in each casing, said electrode plates being in parallel, opposing relation; spring means between each casing and its electrode urging said electrodes towards each other; and removable spacer means between said electrodes and attached thereto, the said electrodes and spring means being supported in floating relation with respect to said casings; and piston means in operative relation to said port arranged to actuate the switch in response to fluid pressure in the inlet bore.

8. In an electrically energized, fluid heater the provision of: a pair of flat, imperforate electrodes in parallel relation and selective means for variably spacing said electrodes at a predetermined distance, said means including a series of recesses in one of the opposing faces of said electrodes and spacer members extending thereinto and contacting the opposing electrode face, said spacer members being removable to vary the effective surface area of the electrodes.

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