(No Model.)

E. ABSHAGEN.

ELECTRIC HEATER.

No. 436,864. Patented Sept. 23, 1890.

Fig. 2.

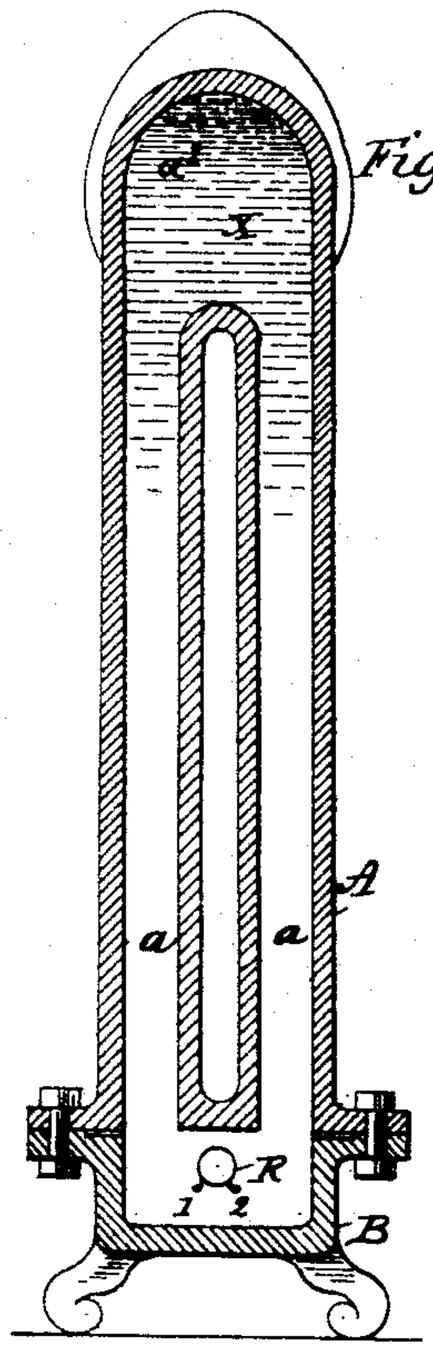


Fig. 1.

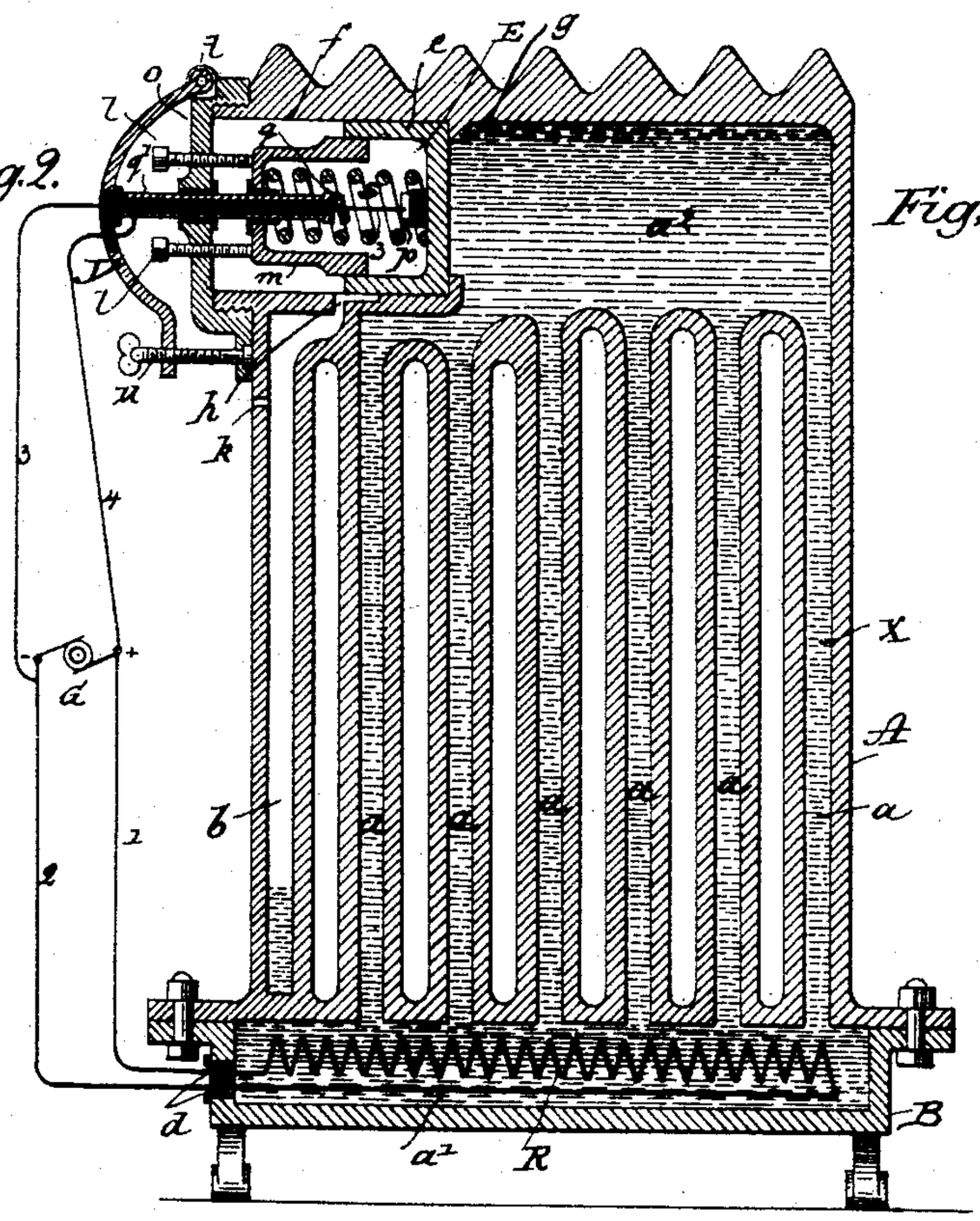


Fig. 3.

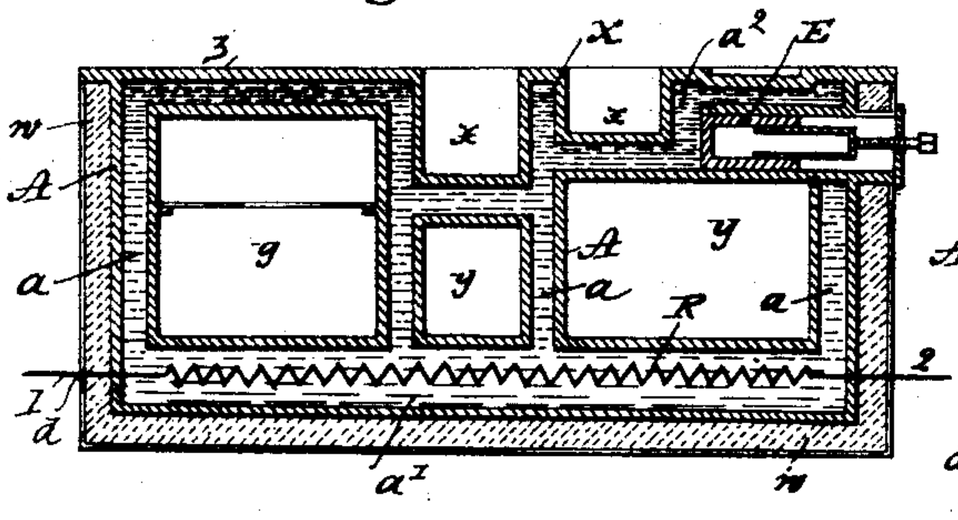
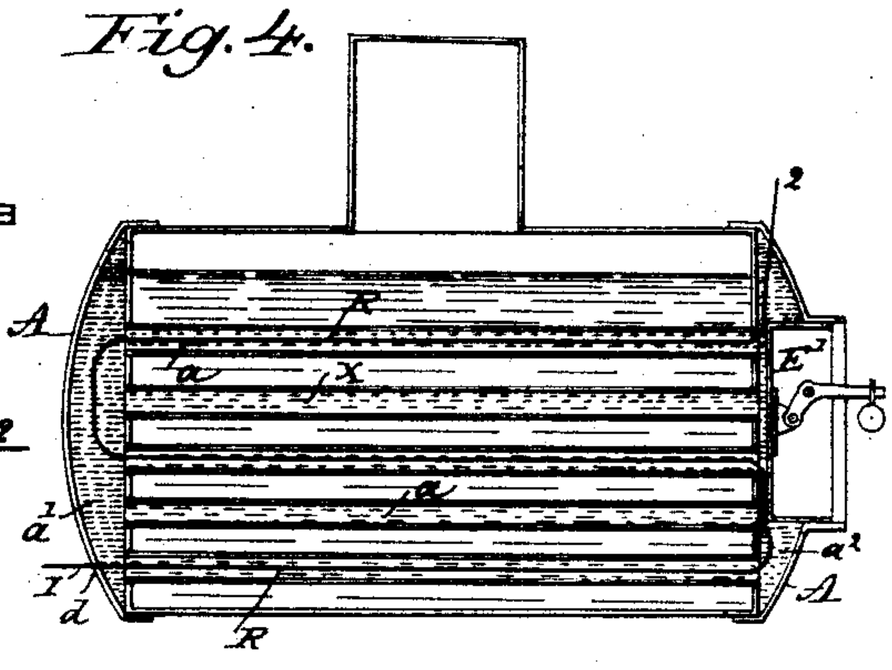


Fig. 4.



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UNITED STATES PATENT OFFICE.

ERNEST ABSHAGEN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF FIVE-EIGHTHS TO ALFRED W. BREWERTON, GEORGE M. CLARK, HENRY M. HUBBARD, AND WILLIAM H. HUBBARD, ALL OF SAME PLACE.

ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 436,864, dated September 23, 1890.

Application filed May 14, 1890. Serial No. 351,770. (No model.)

To all whom it may concern:

Be it known that I, ERNEST ABSHAGEN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Electric Heater, of which the following is a specification.

My invention relates to improvements in electric heaters in which one or a series of resistances is placed in the circuit of an electric current operated in conjunction with a surrounding non-conductive heat-retaining material; and the objects of my improvements are, first, to provide the resistance with a non-conductive material of a fluid and oily substance—such as sperm-oil, linseed-oil, cotton-oil, lard, &c.—which fluid material, unlike others heretofore employed for this purpose, will always be in close contact with the resistance-piece either when hot or cold, and not shrink away by expansion or contraction, as is the case in other apparatuses for like purposes where earthy or mineral non-conductors—like powdered clay, soapstone, plaster-of-paris, &c.—are employed; second, to afford facilities of taking up and retaining the heat generated by the resistance-piece in large quantities and at a higher temperature than is heretofore accomplished. As whale-oil will boil at a temperature of 630° Fahrenheit, my metal heating apparatus, incasing this fluid at a temperature somewhat below its boiling-point, will radiate considerably more heat than is heretofore accomplished by any radiator, whether electric, steam, or hot-water fed, and as no steam is generated below such a boiling-point no precautions against internal pressure other than that caused by the expansion of the oil is needed to guard against, thereby avoiding all dangers of explosion and necessitating but a comparatively light and inexpensive heating apparatus; third, to regulate the amount of heat required for each heater by shunting automatically the current which supplies the electric energy by means of an arrangement in the form of a governor set in operation by the heat developed in the oil and acting through the expansive force of this fluid against an expansion-governor, which latter stands in connection with a shunt or rheostat of any approved form, whereby the amount of current supplied to the resistance-piece will be automatically regulated and the heat radiating from such electric heater will be maintained at an even temperature. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal vertical view of my electric heater in the shape of a radiator. Fig. 2 is a cross-sectional view of the same. Fig. 3 shows my appliance attached to a cooking-stove, and Fig. 4 illustrates my electric heater as used in connection with a steam-boiler.

Similar letters refer to similar parts throughout the several views.

The casing A, which forms the radiator proper, is bolted to its base B. As is usual with radiators, the upper part A is subdivided into a number of compartments *a a a* for the purpose of giving as much radiating-surface as possible. All these compartments *a a*, except *b*, stand in communication with the lower compartment *a'* in the base B and are filled entirely with whale-oil or other oily fluids. The electric wire 1, coming from the electric generator G, of any known form, is introduced at *d* into the lower compartment *a'* of the base B and suspended within said compartment *a'*, and connected therewith is the resistance-coil R, while the return-wire 2 will leave the base B preferably at or near the same place *d* where wire 1 enters, and by returning to the generator G completes the circuit. It will be readily seen that in case the resistance-coil R is of proper size to the line-wire 1 and to the electric current supplied by the latter, according to the well-known "Joule's" law of resistance, a proportionate amount of heat will be generated in the resistance-coil R, which, being surrounded by oil, will be prevented from fusing and transfer such heat to the body of oil within the heater. The heat will gradually rise into the upper compartments *a a* and rapidly be heated throughout the radiator, which latter in the usual manner will radiate such heat in proportion to its heating-surface. The ratio of expansion of oil being well known, I have made provi-

sions for giving to the radiator an additional space into which the enlarged bulk of the heated and expanded oil may flow without subjecting the walls of the radiator to any inward pressure. For this purpose I establish communication between all of the upper compartments *a a*, as shown at a^2, and by providing an expansion-governor E at or near this point the oil, even if unequally expanded in any of the intermediate compartments *a a* or the lower and upper spaces *a' a²*, may have free access to said governor E. The governor consists of a piston *e*, which fits snugly into the piston-cylinder *f*, which latter forms part of the upper compartment a^2 and is normally held in the position shown in drawing Fig. 1 against the stop *g* by means of a spring *s*. It will readily be seen that the expansive force of the oil will gradually compress the spring *s* by pushing the piston *e* outwardly and thereby offer more space for the enlarged bulk of the oil when heated, while at the same time in the cooling of the oil the spring *s* will push the piston again inwardly toward the stop *g*, and thereby prevent the formation of any air-space in the radiator, my object being to have the oil in contact with all parts of the radiator-casing and to prevent the formation of steam and vapor in such air-spaces. At *h* is shown an overflow leading into the overflow-pipe *b*, heretofore mentioned, which latter has communication with the outer air by means of the air-vent *k*. Should, by reason of unforeseen causes, by too rapid heating of the oil or failure of shunting off the current, as will be described hereinafter, the internal pressure become too great, then the piston E will pass the overflow *h* and a sufficient amount of oil will flow off into the pipe *b* and relieve the internal pressure.

In order to regulate the resistance of spring *s*, I employ a number of set-screws *l l*, which operate against the cap-piece *m*, against the inner side of which one end of the spring *s* rests, by means of which the tension of said spring *s* may be regulated so as to be equal to the expansive force of the oil and to work in unison therewith.

An outer head *o* is screwed or otherwise fastened to the casing of a^2, through which the screws *l l* pass.

It is apparent that instead of a spring *s*, as shown in Fig. 1 of the drawings, any other form of mechanical resistance can be used here for this purpose, such as a lever pivoted to the casing of cylinder *f*, one end of such lever bearing against the inner side of piston E, while the other end is weighted by means of a sliding ball, as illustrated at E' in Fig. 4.

In order to regulate the heat supplied by means of the resistance-coil R to the surrounding oil, I have provided the piston E at *p* with an insulated contact-point, and I carry a wire 3 of low resistance to the electric generator G, while another adjustable spring contact-point *q* enters the head *o* and cap *m*, properly insulated from the same and connected by wire 4 to the generator G. If now the heat supplied to the resistance-coil R has expanded the oil within the radiator sufficiently far, and where it is deemed advisable to shut off any further supply of electric energy to the wires 1 and 2, then the piston E, carrying the contact-point *p*, has advanced far enough by means of the propelling force exerted against it from the expanded oil to come in close contact with the contact-point *q*, and will thereby short-circuit the current and relieve the resistance-coil R of any further action. The oil being heated now to such an extent as I deem it necessary, will radiate through its casing for a long time without receiving a fresh reheating, but as soon as sufficiently cooled off its bulk will try to contract to its former capacity. As soon as this takes place the spring *s* or its equivalent will force the piston E inwardly and thereby break contact between *p* and *q* and close the circuit 1 R 2 G and supply a fresh electric current to the resistance-piece R. By this means it is possible to maintain the same temperature within the radiator.

In order to regulate the amount of heat which it is desirable to reach by the radiator, I have shown in Fig. 1 an adjustment J, which, hinged at *t* to the cylinder-head *o*, will press inwardly the contact-rod *q'* by means of the swivel-headed adjustment-screw *u*, and thereby bring the point *q* nearer toward the contact-point *p* and lessen the distance to be traveled by the cylinder-piston E, which conversely will not permit the temperature of the oil to rise to its full extent by short-circuiting the current supplied to the resistance R at a time when the oil has received a less quantity of heat from R, and thereby has not expanded to the maximum point to which this radiator has been set or tested.

Any well-known device for short-circuiting the current or diminishing the strength of the same gradually, as by means of a rheostat or rheocord, may be employed in conjunction with the forward and backward motion of my expansion-governor.

One or a number of such heaters may be placed in connection with a main line, receiving electrical energy from the same source or generator, and these electrical heaters may be wired either in series or in multiple arc.

Fig. 3 shows my invention as adapted for a cooking-range, in which A is the surrounding casing; X, the oil surrounding the different compartments where heat is needed for cooking purposes, such as at *x* for boiling, at *y* for roasting or baking, and at *z* for cake-frying. *n* is a non-heat-conducting insulator—as mineral wool, asbestus, &c.—placed at such parts where it is desirable not to radiate outwardly, but to concentrate the heat inwardly. E is the expansion-governor, and R the resistance-piece.

Fig. 4 shows my invention as adapted for raising steam in boilers without the use of a furnace or grate fire. The tubes *a a* are con-

nected at either end of the boiler with a head-compartment $a' a^2$, filled with oil X. Through one or a number of tubes is strung the resistance-piece R and imparts the heat embodied in the oil to the surrounding water of the boiler. As oil is a good electrical non-conductor, the current supplied to the different forms of my electrical heaters will not be grounded or give any electrical shock to the touch of the metal casing.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric heat-generator, a resistance-piece covered with a non-conductive fluid—such as oil, lard, or its equivalent—substantially as shown.

2. In ar electric heat-generator, a resistance-piece covered with oil and combined with heat-reservoirs, substantially as described.

3. In an electric heater, a closed vessel within which a resistance-piece is sustained, covered with an oily fluid, said resistance-piece being in circuit with a generator of electricity, substantially as set forth.

4. In an electric heater, a resistance-piece, being in continuous contact with an oily fluid, substantially as described.

5. The combination, in an electric heater, of a metallic box or case with a heat-retaining material in the form of an oily fluid in said box or case and an electrical resistance-piece covered by said oily fluid, the resistance-piece being placed in circuit with a generator of electricity, and an expansion-governor arranged to operate in such a manner as to remove automatically all internal pressure from the heater caused by the expansion of the heated oil within said heater, as herein set forth and described.

6. In an electrical heater, a casing containing an oily fluid and surrounding an electrical resistance-piece, which latter is in circuit with an electrical generator, an automatic expansion-governor operated by the expansion and contraction of the hot and cold oil within said heater, and an electrical shunt operated by the expansion-governor and so arranged as to withdraw at any certain point the electrical current from the resistance-piece within the heater by short-circuiting the current automatically at certain stages of the temperature of the oil within the heater, as herein set forth and described.

7. In an electrical heater, the casing A, containing the oily fluid X, the resistance-piece R, placed within the circuit of a generator of electricity, which resistance-piece is surrounded by said oily fluid X, and the expansion-governor E, actuated upon by the force exerted by the expansion of the heated oily fluid X and pressing the same outwardly, and thereby preventing an internal pressure against the inner sides of the heater, in combination with an adjustable shunt p q, so arranged that as soon as the limit of the desired expansion of the oil and the corresponding temperature of the same has been reached the energizing-current supplied to the resistance-piece R will be automatically shunted off and any further supply of heat to the radiator withdrawn and reinstated again in the resistance-piece automatically as soon as the oil commences to contract by breaking the shunt-circuit and closing the resistance-circuit, as herein set forth and described.

8. In an electrical heater, a case A, containing the oily fluid X, and one or a series of resistances R, which latter are in circuit with an electric generator, in combination with an expansion-governor operated by the action of the expanded oily fluid when heated, and an overflow pipe or reservoir d, connected with the main oil-reservoir by means of an overflow-passage h, which is automatically opened by said expansion-governor for the purpose of relieving the main reservoir of a part of its bulk to prevent any internal pressure caused by the expansion of the heated oil within the heater, as and for the purpose herein described.

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