

Oct. 13, 1970

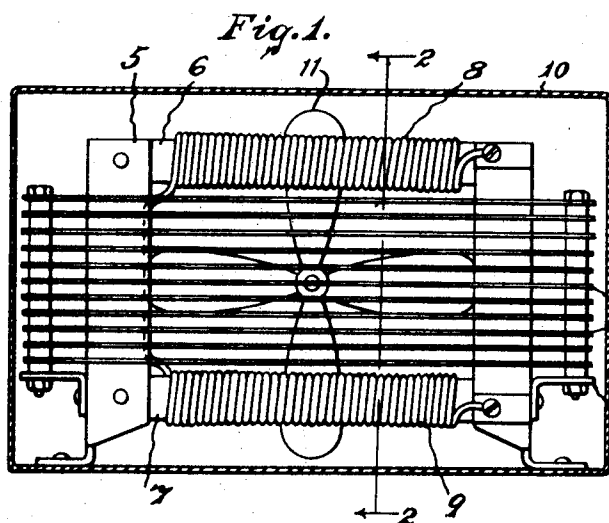
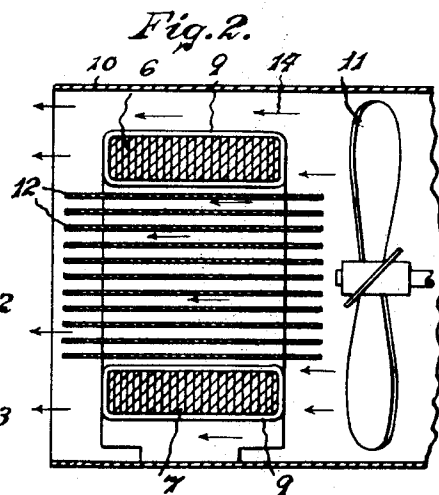
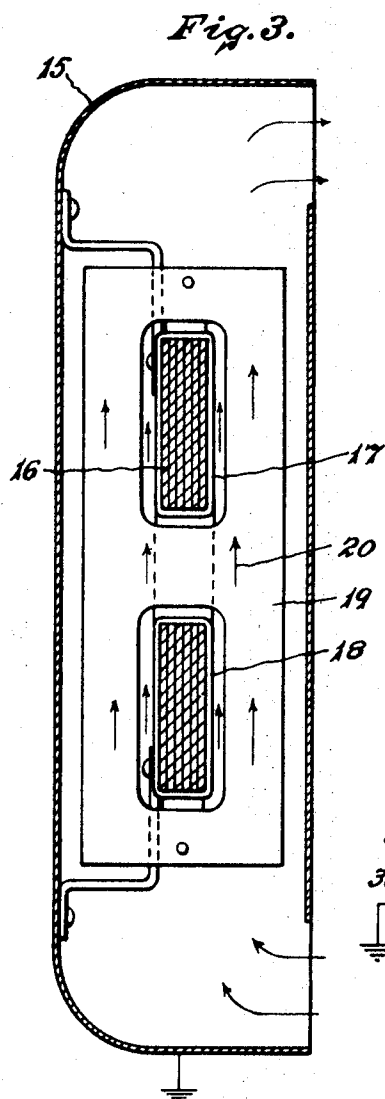
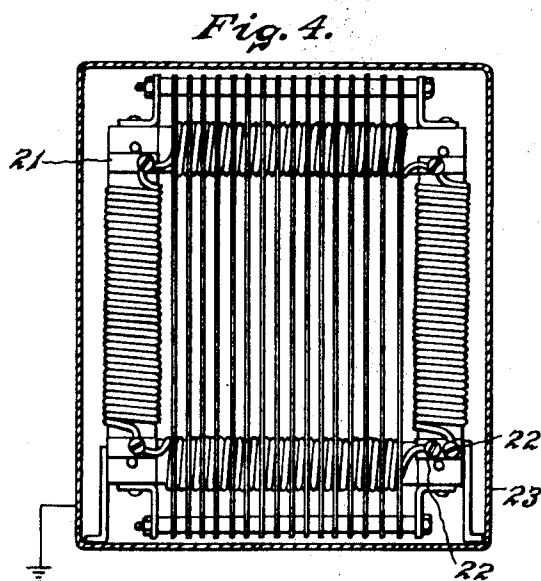
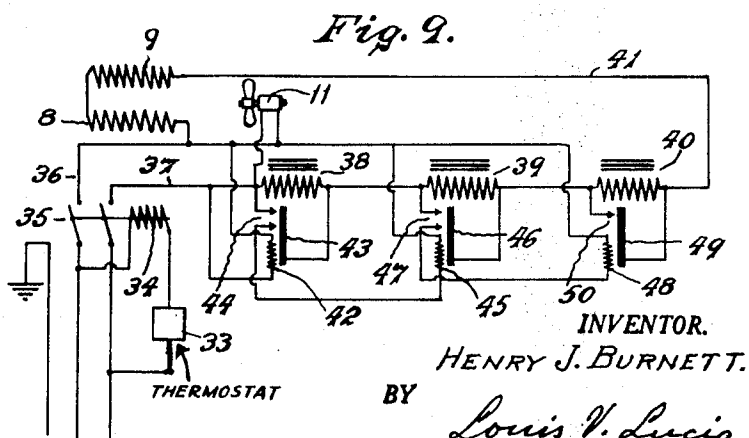
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3,534,197

INDUCTION GAS HEATER

Filed June 1, 1966

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

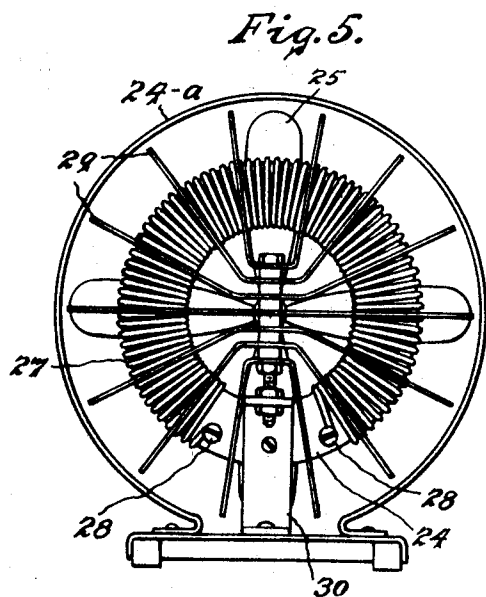
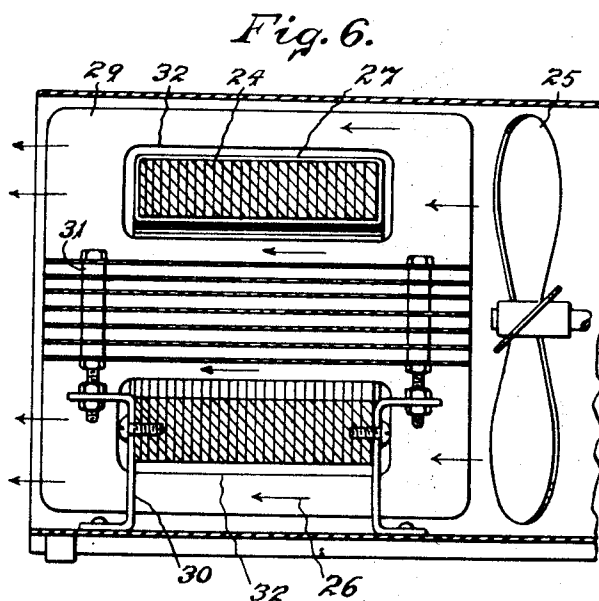


Fig. 7.

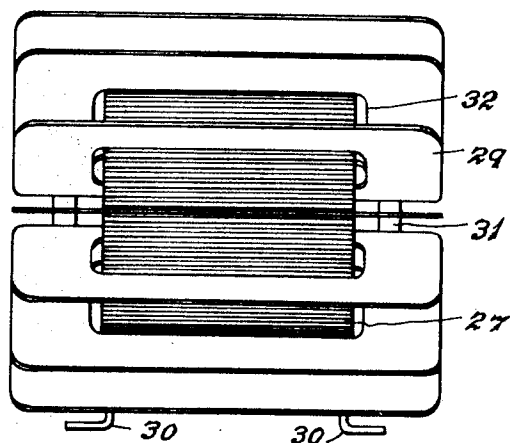
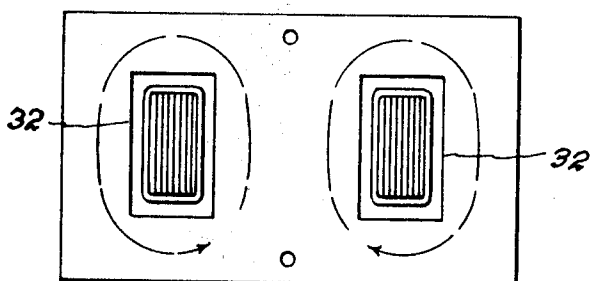


Fig. 8.



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3,534,197

INDUCTION GAS HEATER

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1 Claim

ABSTRACT OF THE DISCLOSURE

An electric induction heater for heating gasses has at least one primary coil wound as a single layer on a magnetic core of either rectangular or toroidal configuration. A plurality of metallic, nonmagnetic fins surround the core. The fins each have a pair of holes therethrough through which spaced portions of the core extend. The fins are mounted in such manner as to be spaced from and thereby electrically insulated from the core and primary coil. The fins act as short-circuited secondaries so that heat is generated by induced current at two places in each fin when the primary coil is energized. The heater is mounted in a casing through which gas to be heated is circulated. Circuit means are provided whereby power is applied gradually to the heater so as to prevent a sudden overload of the electric supply line.

It is an object of this invention to provide an electric heater which is shock proof, explosion proof, free of electrical leakage and safe to use in the presence of inflammable gas or other highly combustible material. Another object is to provide such a heater wherein no part of the heater will attain a temperature high enough to become incandescent so that it will not ignite any material coming into contact therewith. In carrying out my invention I employ an iron core having a current carrying coil, which is preferably wound around said core in a single layer and insulated therefrom, and a series of heating fins associated with said coil and insulated therefrom as hereinafter described.

A further object is to provide such a heater wherein the current carrying element thereof is so disposed that heat may be readily transferred therefrom by an air current and thereby kept at a safe temperature which is also comfortable to the touch.

In order to cause the total transfer of heat from said coil and fins, a flow of air is provided for said heater and the said core is preferably rectangular in cross section and the conductor wire of the primary coil is wound around the core in a single layer and in the direction of the air flow so that the major portion of said wire is exposed to the said air flow.

The fins are also disposed edgewise to the air flow and spaced apart to facilitate the transfer of heat therefrom.

Further objects and advantages of this invention will be more clearly understood from the following description and the accompanying drawings in which:

FIG. 1 is a plan view of an electric heater embodying my present invention.

FIG. 2 is a sectional side view thereof on line 2—2 of FIG. 1.

FIG. 3 is a sectional side view of a modified form of said heater.

FIG. 4 is a sectional front view of a further modification thereof.

FIG. 5 is a sectional front view on line 5—5 of FIG. 6, showing a further modification of my improved electric heater using a toroid type coil.

FIG. 6 is a sectional side view thereof.

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FIG. 7 is a side view of said toroid type coil and associated fin assembly.

FIG. 8 is a plan view of a fin, such as used in said heater, illustrating the theoretical path of the electric currents in said fin.

FIG. 9 is a diagrammatic view of a preferred electric circuit for said heater.

As illustrated in FIGS. 1 and 2 of the drawing, the numeral 5 denotes a core frame having a plurality of cross sectionally oblong core portions 6 and 7 about which are wound insulated primary coils 8 and 9 of conductor wire in such a manner that the major portion of said wire is disposed upon the exterior of said core portions. Said heater is contained within a casing 10 and said major portion of the coil wire is exposed to a current of air within said casing that is provided by a fan 11, or by other air moving means such as a central blower system.

It will be noted that the said primary coils are wound around the core in a single layer and so that each winding thereof is disposed lengthwise to the flow of the air current to facilitate the transfer of the heat which is generated by resistance in said coils.

To complete the electrical circuit for said heater, I provide a series of fins 12 which are exposed edgewise to said air current. Said fins being constructed of thin nonferrous metal and so mounted that they are spaced apart, to permit the flow of the air current therebetween for transferring heat therefrom, and mounted upon the core 5 by the mounting brackets 13 which support said fins on a geometrical center with relation to said coils.

In the operation of said heater, when the alternating current is applied to the primary coils 8 and 9, which are connected in series, a magnetic flux will be produced in the core 5. Said magnetic flux will induce the current to flow in the short circuited paths in the fins 12, indicated by the arrows in FIG. 8, and cause said induced current to heat said fins. Therefore, since heat is produced by resistance in the coils and by induction in the fins, said heater could rightfully be called a combination resistance and induction heater.

The air current supplied by the fan 11 and moving in the direction indicated by the arrows 14, will transfer the heat from said core and fins, thereby keeping said heater relatively cool and below a temperature which could cause explosion or ignition of inflammable material or be uncomfortable to the touch at the exterior of the casing. At the same time allowing said heater to produce a relatively large amount of heat in the air current.

As shown in FIG. 3, my invention may be adapted for use in a convection type heater 15 wherein the core 16 is constructed in a flat form and hung within the casing of said heater so that the major portion of the coils 17 and 18, which are wound around said core, and the fins 19 will be disposed in the direction of flow of the air current within said heater, indicated by the arrows 20, which are caused by convection.

FIG. 4 shows another form of my invention wherein the core 21 has four coils wound thereon in series and ending in terminals 22—22 and the heating unit is mounted within an air duct 23 of a central heating system. This type of heater is particularly adapted for a higher electric voltage.

In the form illustrated in FIGS. 5, 6 and 7, the core 24 is constructed in the form of a tubular toroid that is mounted within a coaxial shell 24-a and disposed lengthwise to the axis thereof in the direction of an air current provided by the fan 25 and indicated by the arrows 26.

A single coil 27 having terminals 28—28 is wound on said toroid so that the major portion thereof is exposed to said air current and cooled thereby. A series of fins

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29 are mounted around said toroid and also disposed in the direction of said air current to be cooled thereby. Said fins being mounted upon brackets 30 by means of spacers 31 and bent to radiate from the axis of said toroid as clearly illustrated in FIGS. 5 and 7.

It will be noted that in all of the forms of said heater shown, each of the fins has a pair of holes 32—32 through which the core passes so that said fins completely surround the core in two places. The said openings are substantially larger than the core and the fins are thereby well air-insulated from the current carrying primary coil so that no current leakage or contact of any kind between the heat fins and the power carrying primary coil can occur. Also, since said fins become heated by the induced alternating current, said air-insulation will protect the current carrying coils against damage from contact with said fins. By having the said fins of non-magnetic material, magnetic forces which would cause vibration and hum are minimized. Also, by supporting the fins with a two point suspension on a geometrical center, the induced electrical current is prevented from traveling through undesirable paths, such as through the mounting bolts and other parts of the heater.

It will be further understood from the illustration shown in FIG. 8 that by having the core pass through the two spaced holes 32—32 in the heating fin, the paths of the induced current flow in said fins, indicated by the arrows, are short circuited so that heat is generated in two places in said fins and, since the current is divided between the number of fins and paths provided in the heater, a very low voltage exists in each fin and this renders possible a high degree of safety in the heater.

As shown in FIG. 9, my improved heater is preferably connected in an electric circuit which will prevent the full load of the electric current from being applied thereto all at once and permit said load to be applied gradually in small amounts so to prevent a sudden overload on the electric supply line. Said circuit preferably includes a thermostat 33 which controls a relay 34 to operate a main switch 35. When said switch is closed, it will fully energize the fan 11 through the conductors 36 and 37 and partly energize the coils 8 and 9 through the conductors 36, 37, and the resistances 38, 39 and 40, which are preferably in the form of choke coils, and the conductor 41. The closing of said main switch will also cause energization of the coil 42 to heat the thermal bar 43 and thereby close the thermal switch 44 to shunt the resistance coil 38 and thereby increase the load on the heating coils 8 and 9. The closing of the thermal switch

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44 will also energize the next coil 45 to heat the thermal bar 46 and thereby close the thermal switch 47 to shunt the resistance coil 39 and further increase the load on the heating coils 7 and 8. The closing of the thermal switch 47 will then energize the coil 48 to heat the thermal bar 49 and close the switch 50 and shunt the last resistance coil 40 and thereby complete the application of the full load of the electric current to the coils 7 and 8. It will therefore be understood that by my novel electric circuit, a heavy electric load may be applied to a heater in installments and thereby eliminating an undesirable full load surge on the power line and the necessity of having oversized electrical conductors and other heavy duty equipment.

I claim:

1. In an electric heater, a magnetic core including a plurality of bar portions, primary coils wound around said bar portions and connected in series, a plurality of spaced flat fins surrounding said coils and spaced therefrom, leg members secured to said core, said leg members having portions thereof bent to support said fins, a post secured to each of said bent portions and supporting said fins, and spacers surrounding said posts and spacing the fins.

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219—10.51, 370, 375, 511; 317—132; 336—61