P. H. BARDILL.

HEATING TRANSFORMER.

APPLICATION FILED MAR. 1, 1921.

1,409,647.

Patented Mar. 14, 1922.

Fig. 1.

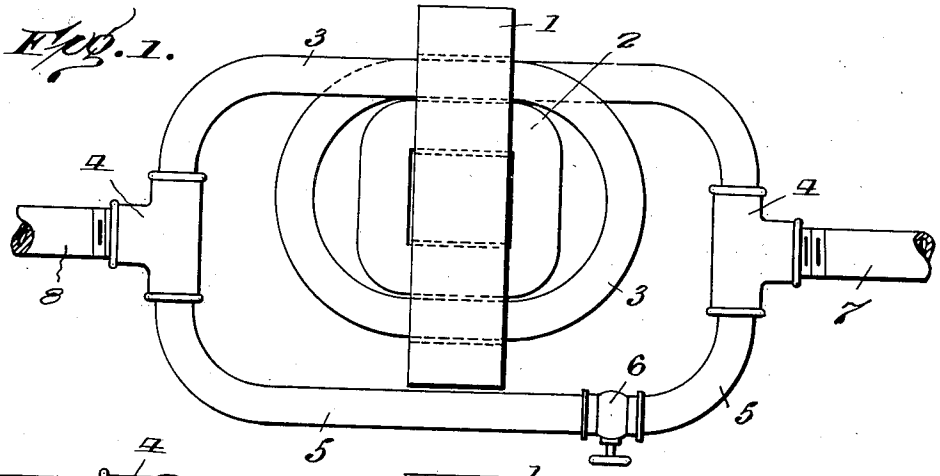


Fig. 2.

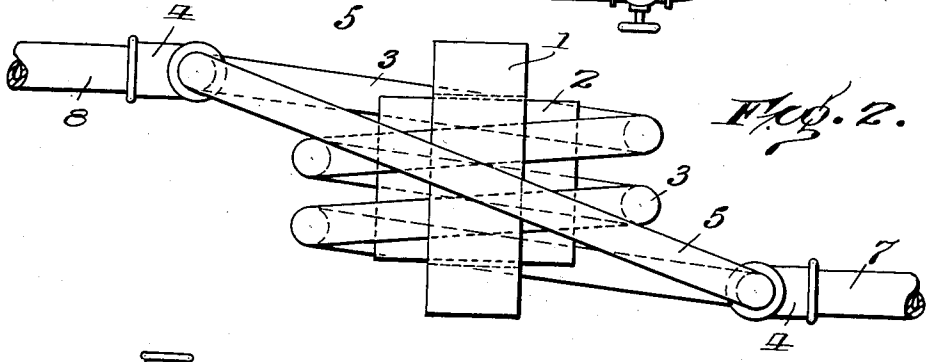
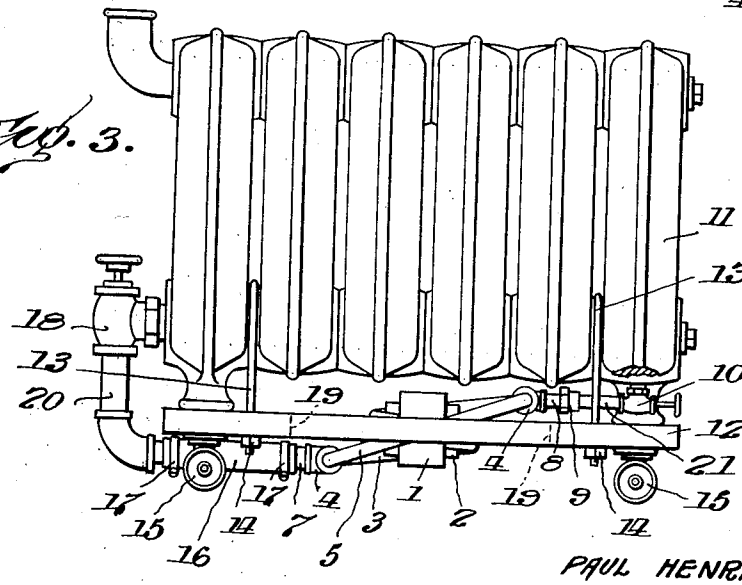


Fig. 3.



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HEATING TRANSFORMER.

1,409,647. Specification of Letters Patent. Patented Mar. 14, 1922.

Application filed March 1, 1921. Serial No. 448,758.

To all whom it may concern:

Be it known that I, PAUL HENRY BARDILL, a citizen of the United States, residing at Dubuque, in the county of Dubuque and State of Iowa, have invented certain new and useful Improvements in Heating Transformers, of which the following is a specification.

This invention relates generally, to transformers, and more specifically to transformers of the type wherein the secondary output is utilized to heat a fluid, which in certain cases further serves as a source of heat.

An object of my invention is to provide a transformer particularly adapted for heating fluids.

A further object is to provide a transformer having a tubular short-circuited secondary winding forming a continuous passage for fluid, whereby every portion of the said winding is effective in heating fluid, no solid short-circuiting conductor being embodied therein, a higher heating efficiency being thus attained.

A specific object of the invention is to provide a portable electrically heated hot-water radiator.

Other objects and advantages of my invention will be evident upon reference to the following specification, descriptive of one embodiment of the invention, and the accompanying drawing, wherein;

Fig. 1 is a diagrammatic top view of a heating transformer,

Fig. 2 is a front view of the same, and

Fig. 3 represents, on a reduced scale, a transformer of this type applied to a radiator.

Similar reference characters in all the figures represent like parts.

Referring first to Figures 1 and 2, the transformer comprises the usual core, 1, and primary coil, 2, adapted to be connected in the usual way to a source of alternating or pulsating current of commercial or other suitable voltage, it being understood that a suitable switch will be provided to connect or disconnect the transformer and the source of current. All these elements are old and well known and not part of my invention. The secondary of the transformer comprises any suitable number of turns of metallic tubing, 3, which may be copper, aluminum, iron, etc., as determined by the nature of the fluid to be heated, appearance, expense, etc., it being understood that in general, a metal not chemically acted on by the fluid will be selected. When a metal of inferior conductivity is used, such as iron or brass, etc., the cross section of metal in the tube may be correspondingly increased to secure the same approximate heating effect, $\frac{E^2}{R}$. When iron is used, additional heat may be produced by hysteresis. The tube may be coated inside with any suitable material to resist the chemical action of the fluid being heated, and may be insulated or not on its exterior, as preferred in any particular case.

I have found it desirable to make any necessary joints in this tube or pipe by means of welding or soldering instead of relying on the pipe threads alone, as leaks may develop otherwise. In the present embodiment I show the two ends of the secondary tubular winding connected to the T's 4, 4. To close or short-circuit the secondary winding, I provide a tube 5, which may be of the same nature or different nature from the tube 3, but in the embodiment shown has the same size as the tube 3. If tubes 3 and 5 are made of different metals or of different metallic cross-sectional areas, their heating effects may be made suitable for any desired uses. For instance, suppose that it be desired to produce approximately equal heating effects in tubes 3 and 5. This means that equal powers should be consumed in the two tubes, or, in other words, they should be equal in resistance. This equality is readily obtained by providing tubes of the same bore but of different wall-thickness, or of different metal, or by a combination of both. However, it may be desirable to make tubes 3 and 5 of different bore, so as to provide not only equal electrical resistances, but also equal frictional resistances to the fluid flow, so that the fluid entering from pipe 7 may be equally heated in the two tubes 3 and 5 until it leaves at pipe 8. As ordinarily preferred, however, both tubes 3 and 5 are of the same size and material, hence tube 5 has, due to its shortness and straightness, much less resistance, both electrical and frictional, than tube 3. The consequence of this is that the fluid in tube 3 will become hotter than that in tube 5, and a fluid circulation will result through these two tubes. A valve 6, (Fig. 1, not shown in

Fig. 2, to avoid complicating the drawing) may be provided to assist in controlling this circulation, and thus serves to control the temperature of the circulating fluid. This valve 6 is preferably of the type usual in hot-water radiators, namely, one that does not entirely shut off the flow when in its "off" position, so that there thus may not accidentally be an entire stoppage of flow, resulting in over-heating of the tube. The valve 6 of course has no appreciable effect on the electrical resistance of the tube 5, since it is itself of metal and of negligible resistance.

While the transformer is suitable for heating any fluid, this term being used in its general sense, to embrace both liquids and gases, by merely connecting the fluid container to the inlet 7 and the outlet 8, and is peculiarly suited for heating inflammable or otherwise dangerous chemical fluids, due to the absence of flame and accurate heat control possible, as well as the possibility of exclusion of the atmosphere or introduction of other inert or active atmosphere, or conditions of pressure or vacuum, I prefer to employ it in connection with a portable radiator of the hot-water type, as shown in Fig. 3. The radiator 11 is mounted on a base 12, to which it is secured by the U-bolts 13 and nuts 14. The base 12 is mounted on rollers or casters 15 so as to be readily portable, so that it may be rolled from room to room as needed, for instance to supplement stationary heating apparatus or even to constitute the sole source of heat. The transformer, comprising elements 1, 2, 3, 4, and 5, is mounted in any suitable way in the base 12, which is cut out as shown by the dotted lines 19, 19, to receive it. The inlet pipe 7 is connected by means of the rubber hose section, 16, and hose clamps 17, 17, to the outlet pipe 20 of the radiator, through the valve 18. The outlet pipe 8 of the transformer is connected by means of union 9 to the inlet pipe 21 of the radiator, through a valve 10. The chief purpose of the rubber hose section 16 is to insulate the radiator from one terminal of the secondary, so that it does not form part of a closed circuit, thus avoiding electrolysis, corrosion, formation of gas, etc. Additional advantages are that the rubber serves to take up strains due to differential expansion of the radiator and the connected tubular secondary, and also that it serves to deaden vibration or humming of the transformer, and the transmission of this to the radiator.

If desired, any suitable thermostatic or other regulator may be employed to keep the radiator or other fluid container at the desired temperature, for instance, as shown in the U. S. patent to Ludwick, 1,193,404, of Aug. 1, 1916. It will be understood that while I has disclosed one form which my invention may assume, the same is susceptible of numerous other embodiments, and the invention is, therefore, not to be understood as confined to any specific form otherwise than it is defined in the following claims:

1. A fluid heating transformer which has a tubular secondary winding, independent of the transformer core, short-circuited by a tubular short-circuiting connector.

2. A fluid heating transformer which has a tubular secondary winding, independent of the transformer core, short-circuited by a tubular short-circuiting connector, said connector forming a continuous closed conduit with the tubular secondary.

3. A fluid heating transformer which has a tubular secondary winding, independent of the transformer core, short-circuited by a tubular short-circuiting connector, said connector forming a continuous closed conduit with the tubular secondary, and a valve interposed in the said closed conduit.

4. A fluid heating transformer which has a substantially helical tubular secondary, and a tubular short-circuiting connector connected to the ends of said secondary, whereby in the normal position of the transformer said connector is inclined, to assist in producing circulation of fluid through the same by convection.

5. A fluid heating transformer which has a substantially helical tubular secondary, a tubular short-circuiting connector connected to the ends of said secondary, whereby in the normal position of the transformer said connector is inclined, to assist in producing circulation of fluid through the same by convection, and a radiator also connected to the ends of the secondary in fluid conducting relation thereto.

6. A fluid heating transformer which has a substantially helical tubular secondary, a tubular short-circuiting connector connected to the ends of said secondary, whereby in the normal position of the transformer said connector is inclined, to assist in producing circulation of fluid through the same by convection, and a radiator also connected to the ends of the secondary in fluid conducting relation thereto, and an insulating element interposed between the radiator and the secondary whereby the radiator does not form a closed portion of the electrical circuit of the secondary.

In testimony whereof I affix my signature.

PAUL HENRY BARDILL.