

Sept. 5, 1950

W. L. MORRISON

2,521,081

DRIER

Filed Aug. 16, 1946

3 Sheets-Sheet 1

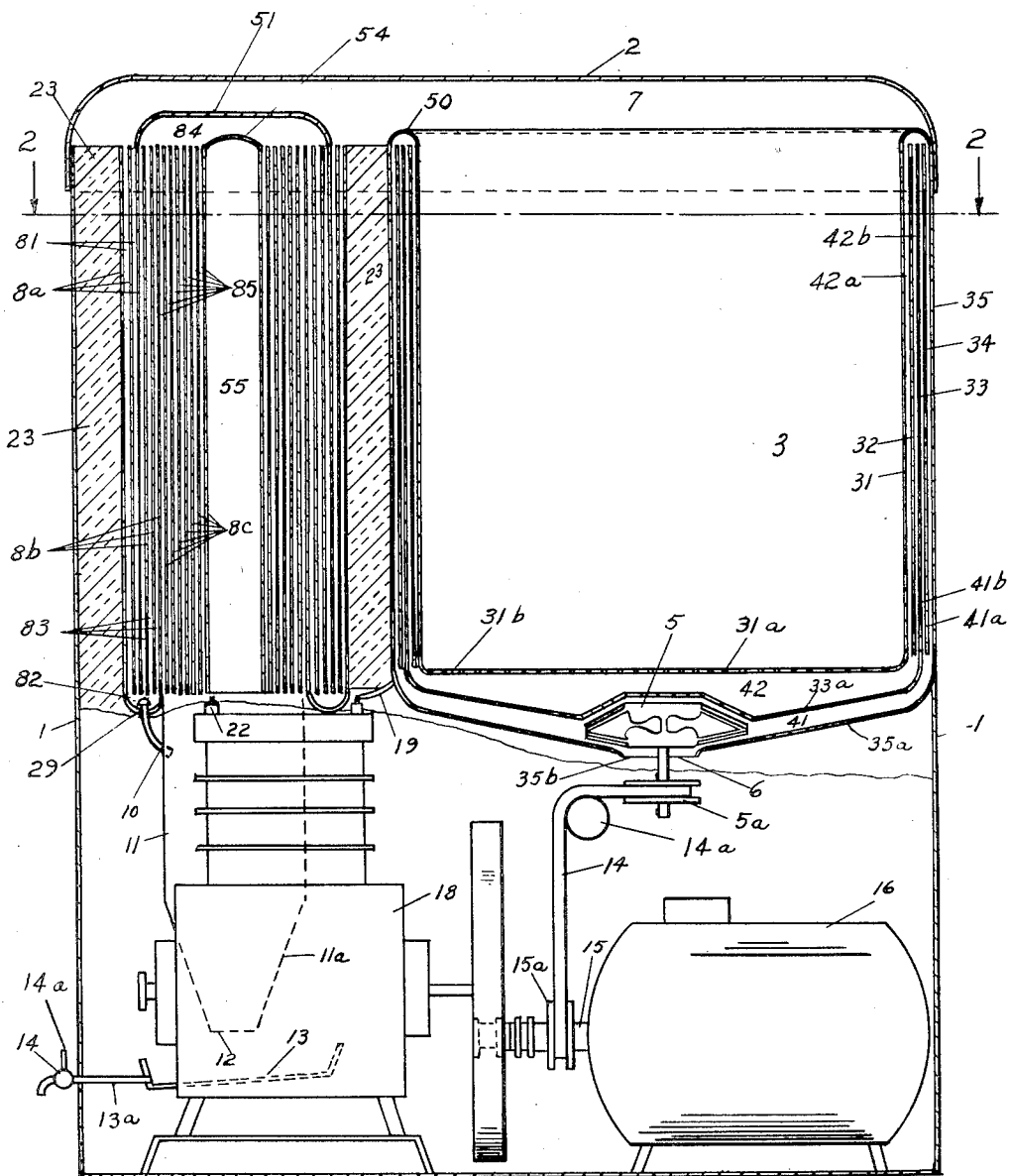


Fig. 1

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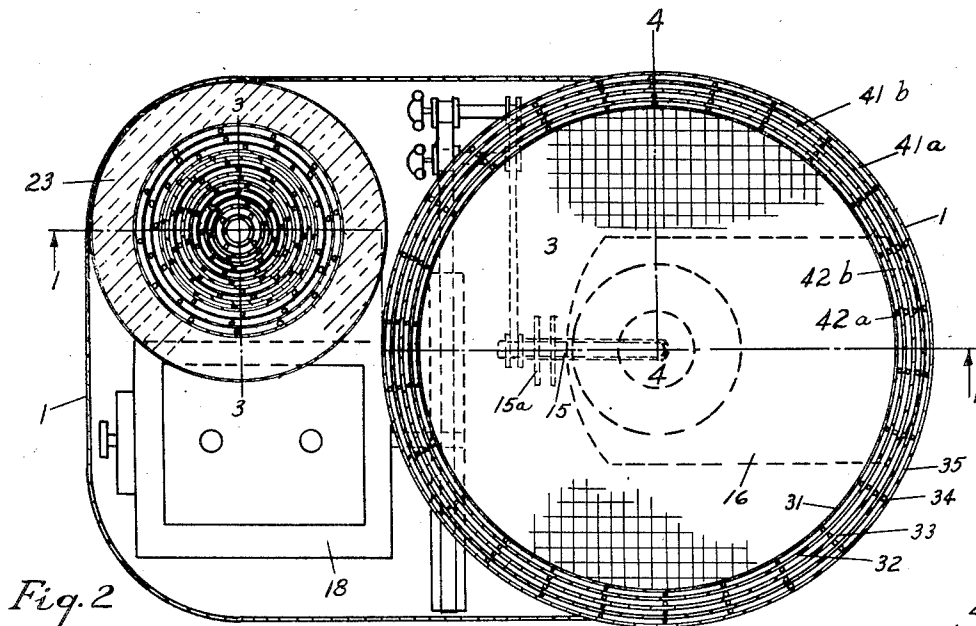


Fig. 2

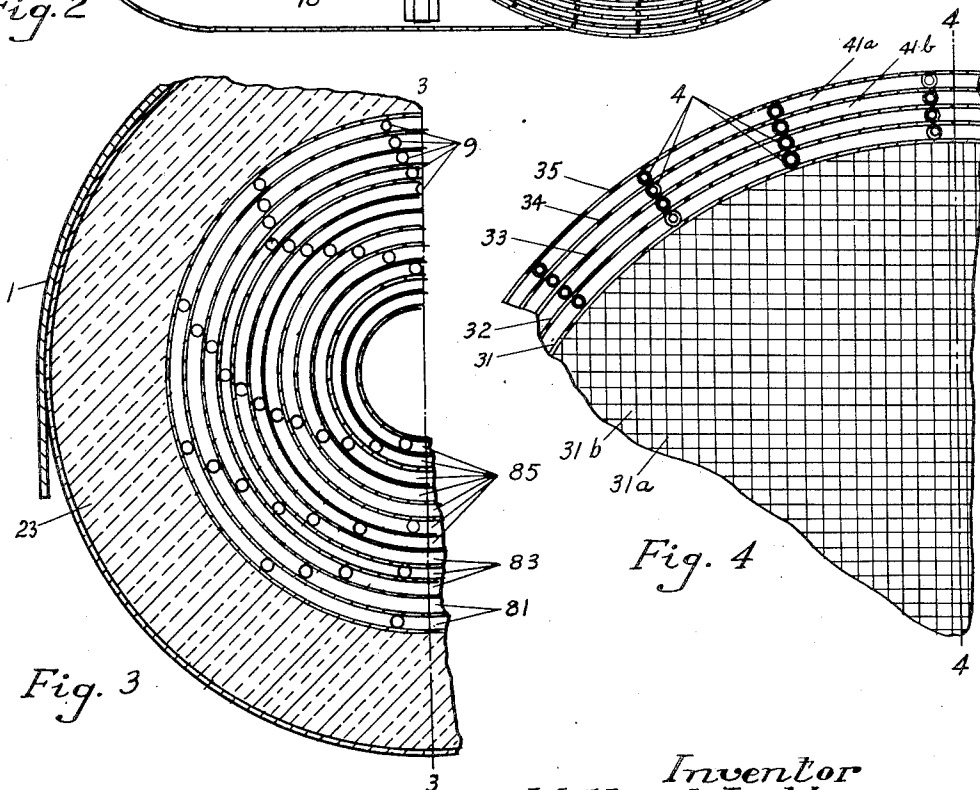


Fig. 3

Fig. 4

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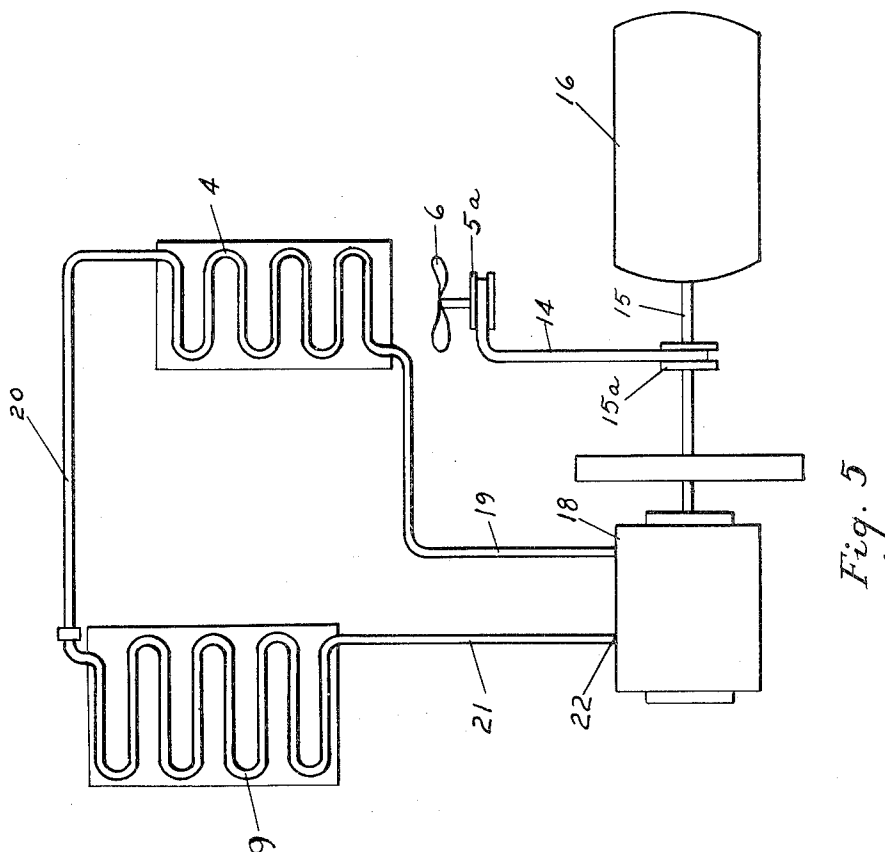
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UNITED STATES PATENT OFFICE

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DRIER

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5 Claims. (Cl. 34-77)

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My invention relates to a drier, and has for one purpose to provide a drier in which I employ the condenser and the evaporator of a refrigeration system in which a volatile refrigerant is cycled.

Another purpose is to provide a drier in which the articles to be dried are placed in a drying zone, and are there subjected to above atmospheric air pressure.

Another purpose is to provide an electrically operated drier system in which a minimum of electrical energy is employed.

Another purpose is to decrease the wear in the fabric being dried which ordinarily results from tumbling fabrics against surfaces.

Another purpose is to effect complete drying at a temperature which will be perfectly safe for delicate fabrics.

Another purpose is to provide an electrically operated drying assembly which does not necessitate special house wiring such as 220 current.

Another purpose is to employ an air circuit that is heated and cooled alternately.

Another purpose is to provide a drying cycle in which the dry, hot air used to abstract moisture from clothes and the like, now moisture laden, is later dried by dropping the temperature below its dew point, the air is then re-used in closed circuit.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

Fig. 1 is a front view, the upper part in section taken on the line 1-1 of Fig. 2 and the lower part in elevation with the front wall removed;

Fig. 2 is a horizontal section on the line 2-2 of Fig. 1;

Fig. 3 is an enlargement of a part of Fig. 2; and

Fig. 4 is an enlargement of another part of Fig. 2.

Figure 5 is a diagrammatic showing of the apparatus.

Like parts are indicated by like symbols throughout the specification and drawings. 1 represents an outer housing, and 2 a cover which fits over the entire housing. The space to hold the articles to be dried is indicated at 3. This space 3 is surrounded by the condenser of a refrigerating circuit, herein shown as of the conventional motor, condenser type. The condenser of such is shown as composed of 5 cylindrical sheets, 31, 32, 33, 34, and 35. These sheets are of a metal having high heat conductive characteristics, such as copper. As

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shown in Fig. 4, which is an enlargement of part of Fig. 3, the individual cylindrical sheets have therebetween tubes, 4, through which the refrigerant flows, and in which condensation takes place. The space between the sheets and about the tubes constitutes air passage space.

The bottom of the cylinder 31 is closed by a mesh or porous portion 31a, through which warmed air may pass into the space 3. The center cylinder 33, is shown as extending inwardly, at its bottom, to form a closed bottom portion 33a, which acts as a closure or upper partition for the fan 5. The outer cylinder 35 is shown as extending inwardly at its lower edge, to form the bottom portion 35a. It partially closes the bottom of the fan 5, but is provided with a generally cylindrical aperture 35b, generally concentric on the axis of the fan 5. The open space thus provided, illustrated at 6, permits the entry of air, in response to rotation of any suitable fan 5. The fan may be driven by any suitable means, for example, by a belt 14 driving from a pulley 15a on a motor shaft 15 of the motor 16. The belt 14 is shown as passing around an idler or idlers 14a, to the fan pulley 5a. Thus, in the normal use of the device, air is delivered upwardly between the cylinders 33 and 35 and about opposite sides of the intermediate cylinder 34. This air then moves downwardly, being confined by the top closure ring 50 and passes between the cylinders 31 and 33 and about opposite sides of the intermediate cylinder 32. The air therefrom flows upwardly through the porous or mesh bottom portion 31a, and from there through the clothes or material being dried. It may be understood that the air, as it flowed through the various cylinders of the condenser structure, abstracted heat from the condensing refrigerant. The dry, hot air thus provided is effective to abstract moisture from the material being dried in the space 3. This air, with the load of moisture it picks up from the drying material then flows downwardly through the evaporator component, shown at the left side of the Figs. 1 and 2. The evaporator structure, as shown in Fig. 3, also includes a plurality of cylinders of heat conductive material. I have, for example, illustrated a plurality of cylinders arranged, as shown in Fig. 3 in three groups, the outer cylinders 8a, the intermediate, 8b, and the inner cylinders 8c. The cylinders are separated by the tubes or ducts 9 of the evaporator component of the herein described cycle. The moist air, flowing over and around the partition 51, flows downwardly between the outer cylinders 8a. Thereafter, con-

finished by the bottom partition 29, the cooling air flows upwardly between and about the intermediate cylinders 8b. Thereafter the air flows downwardly between and about the inner cylinders 8c and downwardly through the air discharge duct 11 which determines in a downward funnel 11a and a bottom aperture, aligned with the receiving gutter 13. Any suitable top partition 54 may be employed to prevent air from flowing through the central space 55. It should be understood that as the air flows about and is cooled by the evaporator coil or ducts, its falling temperature causes condensation of the moisture picked up from the drying clothes. Some of the moisture gathers in the closure or gutter 82 from which it flows through any suitable duct 10. The duct 10 may terminate within the air passage 11. The moisture given up by the air as it flows through the evaporator unit is all received by the gutter 13 and may be drawn off by any suitable discharge duct 13a and controlled, for example, by the valve 14 and any suitable handle element 14a.

It should be understood that I illustrate a motor compressor 18, driven by the motor 16 by any suitable intermediate drive, whereas I thus show a motor-compressor unit, it should be understood that any other means for cycling the refrigerant may be employed.

In describing my system generally, it would thus be observed that, I provide a compressor 18 which delivers the compressed refrigerant through any suitable duct 19, to the tubes or condenser coils 4 associated with the cylinders which surround the drying zone 3. The condenser component of the system is thus used to heat the air, which is circulated, for example, by the fan 5, and driven through the clothes to be dried. The fan may be employed to subject the drying clothes to air pressure which may substantially exceed atmospheric pressure. The air circulates in a closed circuit, within the outer housing 1, passing from the drying zone 3, through the space 7, beneath the cover 2, to the evaporator unit where the moisture is abstracted. The heat necessary for the vaporization of the water dried from the clothes is supplied by the highside of condenser of the refrigeration system.

The fan 5 moves the air through the passage defined between the various cylinders, where it is warmed by the tubes 4.

Whereas, in Figs. 1 and 2, I do not illustrate the condenser and evaporator coils, it should be understood that as shown in the enlargement in Fig. 3 and Fig. 4, they are intended to be present, the showing, it will be understood, to be generally diagrammatic, the entire circuit being indicated diagrammatically in the cycling diagram, Fig. 5.

It will be realized that whereas I have described and explained a practical and operative device, nevertheless, many changes may be made in size, shape, number, and disposition of parts without departing from the spirit of my invention. I therefore wish my descriptions and drawings to be taken as in a broad sense illustrative and diagrammatic, rather than as limiting me to my own specific showing.

The use and operation of my invention are as follows:

Clothes driers as they are made at present necessitate special electrical wiring of 220 volts in a house, in order to safely carry the heavy demand. They create a humid atmosphere in the laundry because of the warm moist air that must escape into it. My invention alleviates these

undesirable qualities and, in addition, provides a means of drying that will not harm delicate fabrics or rayons.

My clothes drier is constructed to run on the regular 110 volt household current and will operate with a current consumption consistent with 110 volt current.

I make use of four circuits: air, heat, refrigerant and partial moisture. However the air and moisture circuit are inter-related and so are the heat and refrigerant circuits.

The air circuit is actuated by the fan 5, which causes cold air with low moisture content to flow through the condenser of the refrigeration circuit, composed of tubes 4 between the walls of cylinders 31, 32, 33, 34 and 35. The fan drives this warm air through the clothes in space 3 so that by the time the air reaches the space 7 below the cover 2, it has lost some of its heat and has picked up considerable moisture from the clothes. The warm moist air then travels at high velocity through the evaporator of the refrigeration circuit, traveling down in spaces 81 between the outer cylinders 8a turning at 82 and traveling up through spaces 83 of the middle group of cylinders 8b and turning at space 84 to travel down again through spaces 85 between the innermost group of cylinders 8c. This elongated course between the refrigerant tubes 9 reduces the temperature of the air below the dew point thus condensing the moisture from the air. The air having lost its moisture and at low temperature repeats its circuit.

In the refrigerating circuit the compressor 18 receives the refrigerant vapor from the evaporator tubes 9 containing the heat which has been accumulated by the evaporation of the refrigerant. The refrigerant is compressed considerably in the compressor and the heat of compression and that due to the loss in the compressors, is added to the heat of the evaporator and these superheated gases are piped through the passage 19 into the condenser tubes 4 where the heat is transferred to the air from the fan. The heat of the compressed refrigerant having been transferred to the air in the refrigerant condenser, the condensed liquid is then conducted in the tube 20, through restriction, to the evaporator tubes 9. The refrigerant in the evaporator tubes 9 reduces the temperature of the surrounding air and the refrigerant empties into manifold 21 and travels back to the compressor at 22 and from there repeats the cycle.

The heat is carried with the refrigerant from the compressor to the condenser tubes 4 of the refrigerant cycle. It transfers to the air which is driven by the fan through the clothes in space 3. There is a partial loss of heat in evaporating the moisture out of the clothes. The heat left in the air transfers to the refrigerant in the tubes 9, the evaporator of the refrigerant circuit, thereby causing the refrigerant to evaporate. The heat travels with the refrigerant vapor to the compressor and thus begins its cycle again.

The moisture forms an incomplete cycle, beginning in the clothes to be dried and ending in the drain pan 13 from where it drains off through the faucet 14. The moisture is withdrawn from the clothes by evaporation into the relatively dry, hot air and is carried as vapor in the spaces between the walls of the refrigerant evaporator.

Due to the extreme reduction of temperature in the evaporation of the refrigerant cycle the moisture condenses on the walls of the cylinders

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in groups 8a, 8b, and 8c. The condensation of moisture that occurs in the passages 81 drains into space 82 from where the water valve 29 allows it to escape into tube 10 and connect with pipe 11. The condensation of moisture that occurs in the passage 85 drops down through the pipe 11 and tapered end section 11a to opening 12. From opening 12 the water drains off into drain pan 13. The end section 11a of pipe 11 is tapered so as to control the air flow.

I claim:

1. In a drier, a housing, a receptacle therein open at the top and having a perforate bottom, a plurality of spaced heating walls surrounding the receptacle, adapted to support and enclose the condenser of a refrigerating system and arranged to define a tortuous heating air passage about the receptacle, discharging through the perforate bottom, a chamber within the housing, adapted to contain the compressor and motor of the refrigerating system, a fan in the chamber, means for operating it, an air conduit leading from the fan to the receiving end of the air passage about the receptacle, a plurality of closely spaced cooling walls within the housing, adapted to support and enclose the evaporator of the refrigerating system, and arranged to define a tortuous cooling air passage, an air passage between the open top of the receptacle and one end of the cooling passage, the other end of the cooling passage discharging into the chamber containing the compressor, means for withdrawing water of condensation deposited on the cooling walls from the housing, independent of air circulation.

2. In a drier, a housing, a fixed receptacle therein open at the top and having a perforate bottom, a plurality of spaced heating walls surrounding the receptacle and arranged to define a tortuous heating air passage about the receptacle, discharging through the perforate bottom, means for heating the walls and the receptacle, a plurality of closely spaced cooling walls within the housing arranged to define a tortuous cooling air passage, and means for cooling the walls and passage, an air passage joining the open top of the receptacle and one end of the cooling air passage, means for joining the other end of the cooling air passage and the perforate bottom of the receptacle, and means for recirculating air through the closed circuit thus defined, means for withdrawing water of condensation deposited on the walls of the cooling passage from the system independent of the air circulation.

3. In a drier, a housing, a fixed receptacle therein open at the top and having a perforate bottom, a plurality of spaced heating walls surrounding the receptacle, adapted to support and enclose the condenser of a refrigerating system and arranged to define a tortuous heating air passage about the receptacle, discharging through the perforate bottom, a chamber within the housing, adapted to contain the compressor and motor of the refrigerating system, a fan in the chamber, means for operating it, an air conduit leading from the fan to the receiving end of the air passage about the receptacle, a plurality of closely spaced cooling walls within the housing, adapted

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to support and enclose the evaporator of the refrigerating system, and arranged to define a tortuous cooling air passage, an air passage between the open top of the receptacle and one end of the cooling passage, the other end of the cooling passage discharging into the chamber containing the compressor, means for withdrawing water of condensation deposited on the cooling walls from the housing, independent of air circulation.

4. In a drier, a vertically disposed receptacle having a perforate bottom and an open top, a plurality of heating walls spaced one outside the other, extending about the receptacle and defining a tortuous air heating passage thereabout, means for heating said walls and passage, a plurality of cooling walls spaced from and insulated from the heating passage, defining a tortuous air cooling passage, and means for cooling the cooling walls, an air chamber beneath the perforate bottom communicating with one end of the heating passage, a fan and an air passage between it and the other end of the heating passage, an air passage connecting one end of the cooling passage with the open end of the receptacle, and an air passage between the other end of the cooling passage and the intake side of the fan, means for operating the fan to recirculate the air in closed circuit in series through the heating passage, the receptacle and the cooling passage.

5. In a drier, a vertically disposed, fixed receptacle having a perforate bottom and an open top, a plurality of heating walls spaced one outside the other, extending about the receptacle and defining a tortuous air heating passage thereabout, means for heating said walls and passage, a plurality of cooling walls spaced from and insulated from the heating passage, defining a tortuous air cooling passage, and means for cooling the cooling walls, an air chamber beneath the perforate bottom communicating with one end of the heating passage, a fan and an air passage between it and the other end of the heating passage, an air passage connecting one end of the cooling passage with the open end of the receptacle, and an air passage between the other end of the cooling passage and the intake side of the fan, means for operating the fan to recirculate the air in closed circuit in series through the heating passage, the receptacle and the cooling passage.

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