Sept. 1, 1936. W. L. LONG 2,052,983

HEATING AND DRYING APPARATUS

Original Filed Feb. 20, 1933 2 Sheets-Sheet 1

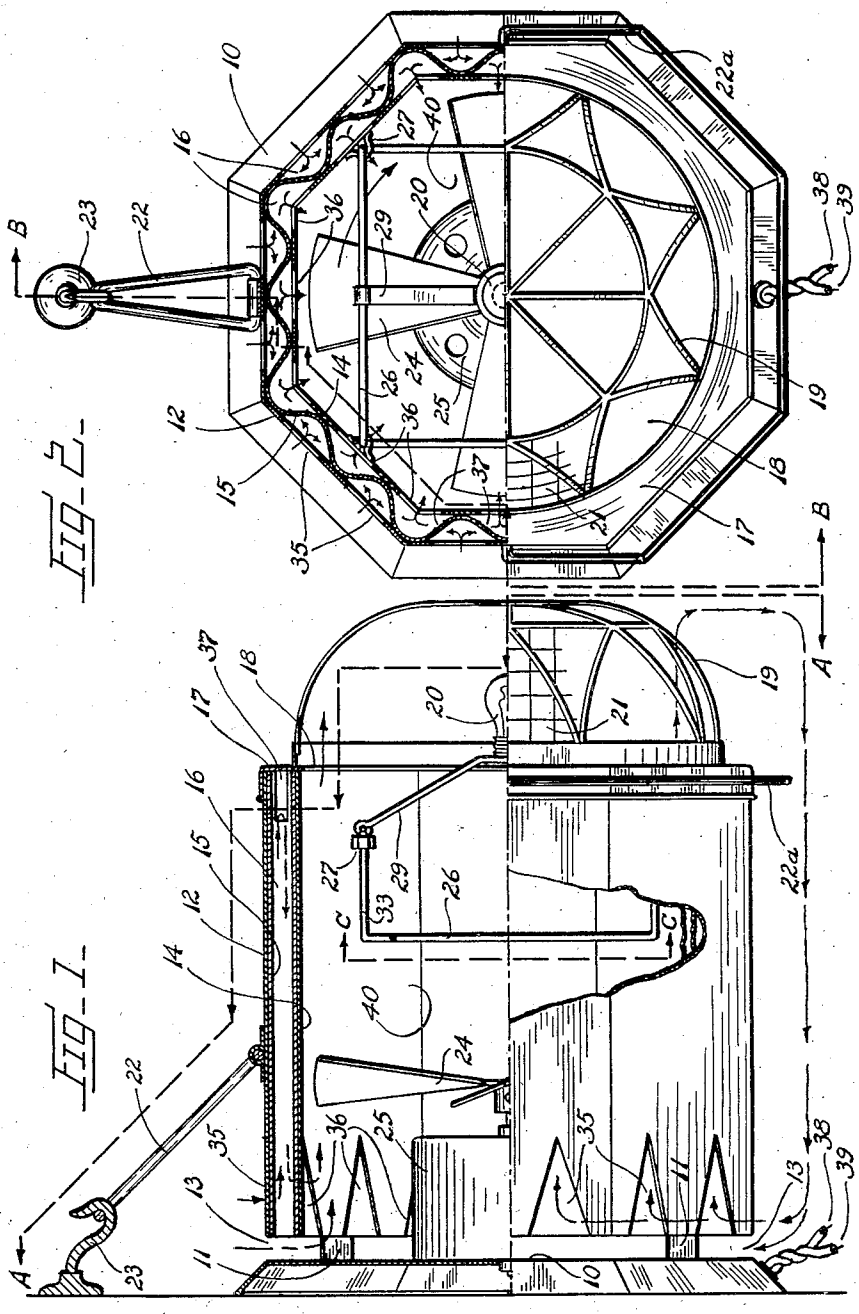


FIG. 2.

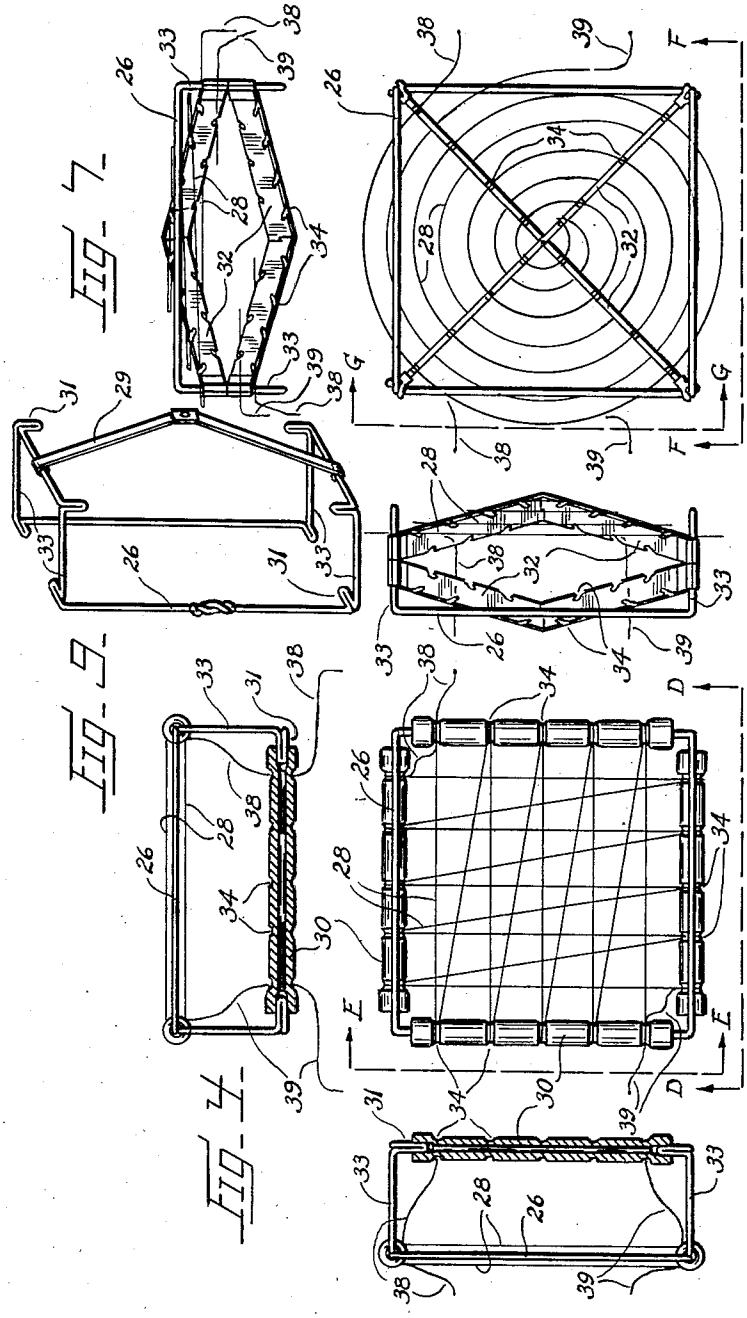
FIG. 1.

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HEATING AND DRYING APPARATUS

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HEATING AND DRYING APPARATUS

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Renewed December 4, 1935

20 Claims. (Cl. 219—39)

This invention relates to heating and drying apparatus and more particularly to the continuous improvements made in the device covered by Patent No. 1,694,351 which has been further perfected since its issue on December 4th, 1928.

The object of these improvements has been to facilitate and increase the flow of the circulated medium through the apparatus with less motor power required to operate the fan and less friction in the wall channels employed to preheat the medium in the manner that exhaust steam is utilized. This object has been accomplished by reducing the number of channels and by diverting only a portion of the medium through the channels while the remainder feeds direct to the inlet side of the blast fan.

Another objective which has been attained by this invention is that greater heating efficiency is accomplished by spreading or extending the heating unit across and around the blast chamber so that the fan forces the medium between the individual element wires instead of passing only along the side of the heat radiating unit. This extension of the heating unit over a larger area has been obtained by crisscrossing the element wire in different planes and by a spiral winding of the wire on spaced insulator bars as indicated. In fact the positioning of the heating wires in the direct path of the blast fan and concentric therewith warms the medium so effectively that the preheating channels may be reduced to a minimum and for some uses be entirely eliminated without the tubular wall of the blast chamber becoming overheated. This condition applies where the fan moves sufficient medium through the webbed or spiral matted heating area to carry away the heat units fast enough to prevent superheating of the element wires.

A further object of the invention has been to provide an apparatus which will operate effectively either in a horizontal or vertical position and of such size and shape that it may be hung from a wall or set on either its side or end and still function properly.

Other essential features and advantages of my invention will be apparent from the following detailed description in which reference is made to the accompanying drawings wherein a preferred embodiment of the invention is fully shown.

In the drawings;

Fig. 1 is a half side view and a half section of the apparatus taken on section line B—B of Fig. 2.

Fig. 2 is a half end view and half section taken on line A—A of Fig. 1.

Fig. 3 is a plan view of the yoke construction taken on line C—C of Fig. 1.

Fig. 4 is a view from line D—D of Fig. 3.

Fig. 5 is a view from line E—E of Fig. 3.

Fig. 6 is a plan view of an alternate yoke construction taken on line C—C of Fig. 1.

Fig. 7 is a view from line F—F of Fig. 6.

Fig. 8 is a view from line G—G of Fig. 6.

Fig. 9 is an isometric view of the yoke construction employed in Fig. 3.

Referring to the drawings; 10 designates a base or end closure member to which is attached adjustable legs or strap supports 11 that sustain in desired relation to the base a tubular wall member 12 which is shown octagonal in plan. An inlet space 13 is indicated between the closure 10 and wall member 12. An inner tubular wall of similar contour to member 12 and of less diameter is indicated by 14. Between the members 12 and 14 is shown an intermediate fluted or corrugated member 15 that acts as a separator to maintain the wall members 12 and 14 concentric and also divides the space into distinct channels 16 which are thirty-two in number in this particular illustration. A closure member 17 fits one end of the channels 16 and has a central opening 18 that is approximately the same size as the area confined by the inner tubular wall 14. A wire guard or perforated grill member 19 over the opening 18 is shown in semi-spherical form to provide space for a pilot light 20, though it is optional whether the opening 18 has a raised or flat protecting member. A wire screen 21 may be employed as an additional protection for the interior mechanism when the apparatus is placed to operate vertically. 22 indicates a hinged link or ring by which the device is shown hung horizontally from a wall hook 23, while 22a is wire handle.

The blast fan 24 which circulates the medium through the apparatus is propelled by a motor 25 shown attached to the end member 10 concentric with the tubular wall 14. A spring wire or strap yoke member 26 is located above or in front of the fan 24 and may be secured to wall 14 by clips 27. One form of this yoke member which supports the heating unit 28 is shown isometrically in Fig. 9. The pilot light may be supported by an insulated strap 29 carried by the yoke 26. Hollow porcelain insulator bars 30 are shown sprung between pivots 31 on the yoke 26 or asbestos straps 32 may be employed diagonally and clevised to the legs 33 of the

yoke 26. Each type of insulator is provided with notches 34 to properly space the element wires of heating unit 28 which are wound around or through the notches.

The tubular wall members 12 and 14 are provided with openings 35 and 36 respectively positioned in staggered relation as indicated in Fig. 2. The intermediate crimped member 13 has communicating openings 37 at the opposite end from the openings 35 and 36 which insure free circulation between the separate channels 16. Electric power is supplied to the apparatus thru wires 38 and 39 which connect with the motor 25, the heating unit 28 and the pilot light 29 within the elongated blast chamber 40 confined by the tubular wall 14.

In the operation of the device the following sequence of action occurs as each novel feature performs its separate function and all combine to accomplish the purpose of the invention.

When current is supplied to the motor 25, heating unit 28 and pilot light 29, the blast fan 24 is set in motion and the resistance to passage of the current heats the element wires 28. A partial vacuum is created on the inlet side of the fan which causes a draft thru the space 13 provided between the end member 10 and wall member 14. The area of this space has a definite relation to the velocity and pitch of the fan which may be calculated and tested to draw a proper percentage of the circulated medium thru the channels 17 by means of the openings 35, 36 and 37. The back and forth movement of a portion of the circulated medium preheats the same thru contact with the channels adjacent to the wall member 14 which is heated thru radiation from the wires 28.

The mixing of the preheated medium with that which is drawn direct to the fan raises the average temperature of the circulated medium before the same passes between the element wires. This method insures that the wall member 12 will remain cool.

It is evident that for some purposes sufficient medium may be drawn thru an enlargement of the inlet space 13 to provide the exact amount of draft past the hot area surrounding the wires 28 to absorb the total heat units generated without loss by radiation thru the tubular wall 14 or injury to the element from overheating, and under these conditions the insulating members 12 and 15 may be eliminated without diminishing the efficiency of the device.

The circulated medium is forced by the fan thru the blast chamber 40 confined by the tubular wall 14 where it comes into direct contact with the element wires 28 which are suspended concentric therein and at the opposite end of the chamber from the blast fan. It will be evident that greater heating efficiency is obtained by circulating the medium between and around the separate wires, which are suspended in either a spiral mat or cross webbed formation, than is attained by the former method of passing the medium along the sides of an element wound on a single central insulator support.

The warmed medium after passing thru the area surrounding the element wires of the heating unit is expelled thru the wire or perforated grill guard surmounting the opening 18 at the outlet end of chamber 40 and is again drawn in thru the draft inlet space 13 after its heat has been diffused. This cyclic expansion and contraction of the circulated medium by temperature change thru either a closed or an open circuit is continuous and tends to approach a smaller change in volume as the inlet and outlet temperatures become more equalized.

By virtue of the novel construction devised to support in a widely extended manner the element wires comprising the heating unit over the cross area of the blast chamber, it will be apparent that the circulated medium will be forced to pass directly into contact with all sides of the separated heating wires which are hot enough to destroy any germs carried by the medium. This construction comprises a fourway extended spring wire or metal strap yoke member into which may be sprung the insulating bars on which the separate series of element wiring circuits have been wound before insertion into the yoke. This method is adaptable to either round or flat insulators which may be crossed diagonally with end clevises sprung between opposite legs of the yoke. A spiral winding of the element wires is preferred for the wire can be brought closer to the walls of the blast chamber and so provide greater heating area thru which the circulated medium must pass in its circuit.

While the form of mechanism herein shown and described constitutes the preferred construction of this invention, it is understood that various changes and revisions may be made in the size, shape, capacity, proportion and arrangement of parts and elements without departing from the spirit and scope of the invention.

I claim:

1. A heating and drying apparatus utilizing cyclic expansion and contraction of a medium, including a tubular chamber, a blast circulation mechanism and a yoked multiple-plane heat providing unit located within the chamber so that the circulated medium discharges directly from the chamber, immediately following its passage thru the heating unit, the yoking means including a wire frame.

2. A heating and drying apparatus employing cyclic expansion and contraction of a circulated medium, comprising an elongated blast chamber, means for providing forced circulation at one end of the chamber and a series of yoked heating units in the opposite end; closure members providing inlet and outlet openings to the chamber, located in such manner that the circulated medium is forced directly from the chamber, immediately following its passage thru the heated area, the yoking means including a wire frame.

3. A heating and drying apparatus providing blast circulation of a heated medium, including a fan mechanism, a yoke and an expanded heating unit yoked in opposite ends of a tubular chamber and concentric therewith; closure members providing inlet and outlet openings in respective ends of the chamber; said openings being arranged to compel the circulated medium to discharge directly from the chamber, subsequent to its passage thru the heated area, the yoking means including a wire frame.

4. A heating and drying apparatus, including blast circulation of a contractable and expansible medium, comprising a circulating means located in one end of an elongated chamber and a yoked heating means in the opposite end, each being concentric with the chamber and so positioned that the circulated medium is forced directly from the apparatus immediately after its passage thru the heating means, the yoking means including a wire frame.

5. A heating and drying apparatus, compris-

ing an elongated chamber; a motor propelled blast fan centrally positioned in the suction end of said chamber and a multiple heating unit supported by a yoke member in the opposite discharge end concentric with the fan; a closure member providing limited inlet to the chamber near the fan and a perforated grill member protecting the heated outlet end of said chamber.

6. A heating and drying apparatus comprising a tubular chamber including a laterally supported multiple-plane yoke member in one end and a centrally located blast fan in the opposite end concentric with the yoke; a heating unit comprising elements wired in parallel suspended crosswise from said yoke; a closure member providing restricted inlet to the chamber near the fan and a wire grill member secured over the outlet opening from said chamber.

7. A heating and drying apparatus comprising, a tubular wall inclosing a blast chamber; an offset closure member adjustably secured to said wall providing a limitable intake to the chamber; a centrally positioned yoke supporting a plurality of spaced elements of a heating unit within the outlet end of said chamber and a motor propelled fan located at the closure end concentric with the chamber to provide forced discharge of the medium from the apparatus, immediately after its circulation thru the heating unit.

8. A heating and drying apparatus comprising, an elongated wall member incasing a circulation chamber; a closure member adjustably secured to said wall member providing a limitable intake to the chamber; a multiple-plane yoke member supporting a plurality of spaced elements of a heating unit centrally positioned directly within the outlet end of said chamber and a blast fan located near the closure member and concentric with the chamber to provide forced discharge of the circulated medium from the chamber.

9. A heating and drying apparatus comprising, a circulation chamber including an adjustable end closure member for restricting the inlet to said chamber; a motor driven fan centrally secured to said closure member and a spring yoke member suspended in said chamber opposite of the fan and concentric therewith; a plurality of insulator bars demountably secured to the yoke, providing spaced support for the spiral winding of a heating unit, inside a perforated outlet end to said chamber.

10. A heating and drying apparatus comprising an elongated blast chamber, including inlet and outlet closure members; means for circulating a medium located in the inlet portion of the chamber and a heating means in the opposite outlet end, positioned transversely of the chamber axis and concentric therewith; said heating means including an extended arrangement of element wires supported in multiple planes and opposite directions by a plurality of insulator bars detachably secured to a yoke member extending crosswise of the chamber.

11. In a heating and drying apparatus; an elongated chamber inclosed by a tubular member; end closures providing inlet and outlet means for circulation of a medium thru said chamber; a motor driven fan centrally positioned at the inlet end of the chamber and a multiple-plane yoke member positioned in the outlet end at right angles to the longitudinal axis of the chamber and concentric therewith.

12. In a heating and drying apparatus; a tubular member inclosing a blast chamber; end closures providing inlet and outlet openings for circulation of a medium thru the chamber; a blast fan centrally positioned at the inlet end of the chamber and means for propelling the same; a multiple plane yoke member secured in the outlet end opposite the fan, at right angles to the longitudinal axis of the chamber and concentric therewith; said yoke furnishing directional support for pairs of insulator bars providing a spacing means for a crosswise winding of the heating element.

13. In a heating and drying apparatus; an elongated chamber housing a circulating mechanism in the inlet end and a heating unit in the opposite outlet end of said chamber; closure members providing respectively inlet and outlet openings for circulation thru the apparatus; said blast mechanism and heating unit being located concentric with and at opposite ends of the longitudinal axis of the chamber and the plane of the heating unit at right angles to said axis.

14. In a heating and drying apparatus; a tubular chamber housing a motor driven fan at the inlet end and a heating means in the opposite outlet end of the chamber; closure members providing inlet and outlet means for blast circulation thru the apparatus; said heating means comprising a yoke member consisting of two parallel U shaped sections forming a cube frame and held in such position by two straight parallel sections connecting the corresponding lateral legs of the U sections; and pairs of insulator bars clevised or dowelled to the yoke in different planes and directions to provide spaced winding support for a series of heating units.

15. In a heating and drying apparatus; a closure member providing adjustable inlet means to an elongated circulation chamber; a perforated closure means at the opposite end providing outlet openings from said chamber; a yoke member situated near the outlet openings and at right angles to the chamber axis, comprising supporting means for a multiple series of element wires suspended in separate planes from said yoke and arranged to form a crossed web or spiral mat heating unit in the direct path of a medium circulated by a motor driven fan positioned within the inlet portion of said chamber.

16. In a heating and drying apparatus; a closure member providing adjustable inlet means to a tubular chamber; a perforated outlet means enclosing the opposite end of said chamber, providing protection for a pilot light operatable with the motor and heating unit; a yoke member positioned near the outlet and within the chamber at right angles to its axis, comprising a supporting arrangement for a multiple series of element wires suspended in multiple planes on said yoke to form an expanded web or mat heating surface transverse of the chamber and in the direct circuit of the medium circulated by a blast fan located near the inlet end of said chamber; a ring member secured to the exterior of the chamber providing means for horizontal suspension of the apparatus from a vertical surface and a handle providing vertical suspension means.

17. In a heating and drying apparatus; two concentric tubular members of different diameters providing, an elongated inner circulation chamber; a series of equally spaced channels surrounding said chamber between the tubular members and parallel with their axis; an end closure member positioned to provide inlet means

to the chamber and to the said channels; the opposite end of the channels having a closure member and the circulation chamber a perforated outlet means; a blast fan located within said chamber at the inlet end thereof and means for driving said fan; a series of staggered openings in the tubular members at the inlet side of the fan providing an inlet and an outlet to alternate channels; openings connecting the channels at the opposite end of the chamber and a heating unit arranged transversely within the outlet portion of the chamber at a point substantially axial of the nested parallel channels.

18. In a heating and drying apparatus; a tubular member positioned concentrically within a larger member of similar contour, providing a blast chamber; nested channels located between the tubular members surrounding the chamber and parallel with its axis; a closure member restricting the intake to said chamber; openings into the channels at opposite ends thereof providing circulation thru the same into the blast chamber; a power propelled fan situated in the chamber near the openings to said channels and a transversely positioned heating unit in the other end of the chamber substantially axial of the nested channels.

19. In a heating and drying apparatus; concentric tubular members inclosing an elongated chamber; a series of nested channels between the tubular members parallel with the chamber axis; an end closure spaced from the tubular members to provide inlet means to the chamber; means for closing the opposite end of the channels surrounding the open outlet of said chamber; a power propelled blast fan located within the inlet end of the chamber; staggered openings in the tubular members at the inlet end of the chamber providing openings into alternate channels; openings between the channels at the opposite end of the same and a heating unit arranged within the outlet portion of the tubular chamber at a point substantially axial of the nested channels.

20. In a heating and drying apparatus; concentric tubular members providing a blast chamber; an intermediate member forming nested channels surrounding the chamber parallel with its axis; closure means for limiting the inlet opening at one end of the chamber and means for closing the end of each channel at the outlet end of said chamber; inlet and outlet openings in the inner and outer tubular members respectively at the inlet end of the chamber; said openings being positioned in staggered relation to provide one opening to each channel at one end and communicating openings between the channels inside the tubular members at their opposite ends; a blast fan located in the inlet end of the chamber and a heating unit in the opposite end concentric with the chamber axis.

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