

# United States Patent

[11] 3,574,953

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[21] Appl. No. 800,903  
[22] Filed Feb. 20, 1969  
[45] Patented Apr. 13, 1971  
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[32] Priority Sept. 24, 1968  
[33] Great Britain  
[31] 45284/68

[56]

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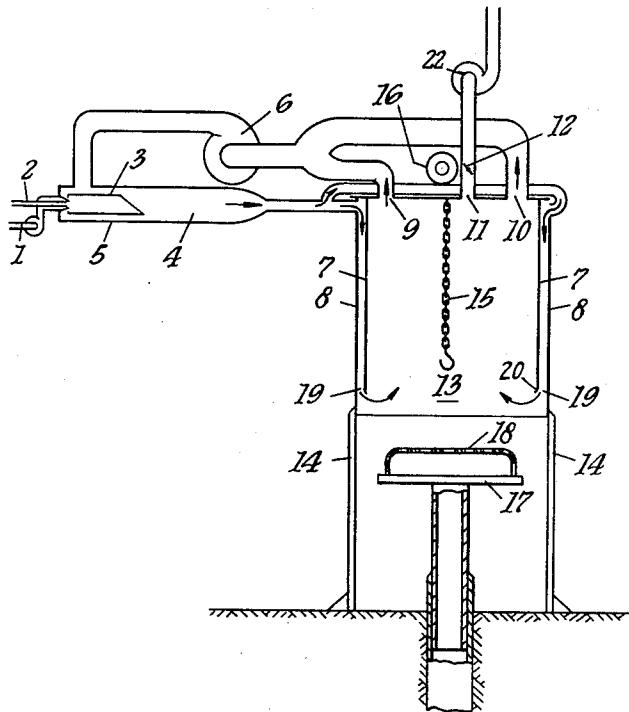
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[54] DRYING AND CURING OVENS  
3 Claims, 1 Drawing Fig.

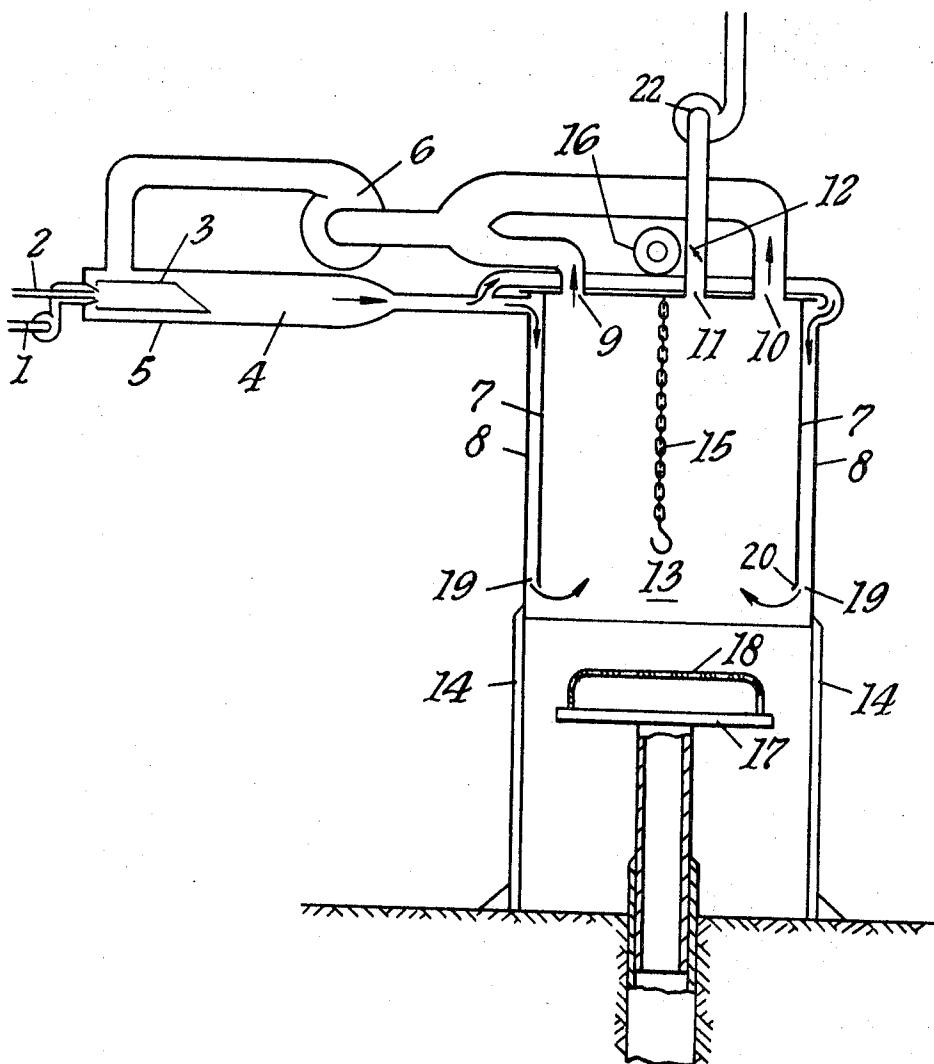
[52] U.S. Cl. .... 34/219  
[51] Int. Cl. .... F26b 19/00  
[50] Field of Search. .... 34/219,  
220, 222, 223, 224, 225, 236, 212; 118/64, 65;  
263/6, 40

**ABSTRACT:** In a drying and curing oven heated air is introduced through the lower open end of a drying compartment and rises and makes intimate contact with an article supported in said compartment, and used air is exhausted through one or more ducts extending from a closed top of the compartment. If desired, the exhausted used air is discharged to a burner for heating incoming drying air and is recirculated with the latter to said drying compartment.



Patented April 13, 1971

3,574,953



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AGENT 5

## DRYING AND CURING OVENS

## BACKGROUND OF THE INVENTION

This invention relates to drying and curing ovens which effect rapid and uniform solvent evaporation and curing of varnish films, particularly on hollow or irregularly shaped objects.

When drying and curing varnishes, lacquers and the like it is customary to apply heat in order to evaporate the solvent and cure the binder medium as rapidly as possible. This can be effected in static ovens or horizontal drying tunnels, which have the following attendant disadvantages:

When ovens are employed, opening of doors to permit entry of the varnished object causes loss of heat and consequent time lag before the oven re-attains equilibrium temperature. Heat transfer to the object to be dried is slow if natural convection is employed. When forced circulation is employed heat transfer is improved but is frequently irregular, as, particularly when the object is hollow, certain sections of it may remain exposed to high air velocities, while others remain in relatively becalmed zones. This can give rise to uneven evaporation of the solvent and nonuniform rates of cure of the varnish medium. Furthermore, drainage of the varnish prior to setting can give rise to uneven film formation.

In particular, when drying and curing varnished electrical parts which may consist of annularly disposed wire coils, the use of such ovens give rise to slow, uneven cure and, if the annular part is positioned in a horizontal stream of heated air so that the stream flows both through and around the part, drainage during the solvent evaporation stage leads to excessive thickening of the varnish along the lower sections, with consequent risk of blistering, solvent trapping and undercure.

It has been found that rapid, uniform heating of objects coated with varnishes and lacquers can be achieved by means of an oven as hereinafter described.

Furthermore, the rate of entry of objects into the oven can be controlled in order progressively to flash evaporate most of the solvent in the coating of the objects as they enter the oven, thereby ensuring uniform cure of the varnish medium and avoiding building up a dangerous concentration of solvent vapor within the oven.

## SUMMARY OF THE INVENTION

Broadly, according to the present invention a drying and curing oven for varnish or lacquer coated articles comprises an inverted compartment of any desired cross-sectional shape through which heated air is circulated by entry into the heating compartment via a space around all or part of the periphery of the base and wherein exhaustion is effected via one or more ducts located on the top of said compartment.

According to a preferred embodiment, the base of the oven is open and circulation, temperature, and venting conditions are balanced so that articles or objects may be progressively raised into the oven compartment without that balance being disturbed. Where the heating source for the air is by direct combustion, ventilation by means of convection ducting or fan also located in the top of the oven, in addition to recirculation of the heated air, may be incorporated in order to compensate for the entry and expansion of gaseous combustion products.

## BRIEF DESCRIPTION OF THE DRAWINGS

The single view illustrated is a vertical section through an oven of an embodiment of the invention in which direct combustion is employed as the heating medium.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawing, a mixture of air from impeller 1, and diesel fuel from pipe 2 is ignited in tube 3 so that the flame emerges into the venturi chamber 4 where it meets the stream of circulating air from an annular space 5 impelled by fan 6. The mixture of heated air and combustion products is

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introduced into the bottom of an oven 13 after passing down a space or duct 19 formed between the inner and outer walls 7 and 8 of said oven. This mixture is withdrawn by said fan 6 from one, or preferably two or more exit ports 9 and 10 in the top wall of the oven and continuously recirculated. In order to compensate for air and combustion products emerging from the tube 3, additional ducting 11 incorporating an exhaust fan 22 is also incorporated in the top of the oven chamber. This ducting also incorporates an adjustable damper 12 or the like, in order to control the rate of ventilation and thereby facilitate achieving a state of balance at the open base of the oven 13. The oven 13 is supported by suitable means, such as legs 14 above the floor to permit entry of the objects to be heated. Objects may be either hoisted into the oven by means of a chain 15 or chains winched at 16 from above the oven roof, or raised into the oven by mechanical, pneumatic or hydraulic means, for example by a hydraulically operated and elevated table 17. When objects are raised into the oven, it is important that they are supported in such a manner, such as by a slatted frame 18, that the circulation of the heated air is not impeded. Alternatively, the raisable tackle itself may be of open construction.

Although the heated air may be introduced into the oven chamber by exterior ducting this is not desirable, on the grounds of thermal efficiency. Entry countercurrently by way of the space between the exterior and interior walls 7 and 8 is preferred. This space may completely surround the interior vertical wall 7 or it may be limited to spaces between opposite exterior and interior walls. Likewise, if the oven chamber is of circular section, the space may be annular or confined to the peripheries of opposite sectors. The object of the venturi chamber 4 is to prevent interference with the flame when direct heating is employed, for example by creating back pressure or blowing the flame out. The design of the venturi chamber 4 may be varied according, for example, to the position of the fan.

In order to minimize turbulence of air at the base of the oven 13, deflector rims 20 or louvers are incorporated along the periphery of the orifice of the duct 19 at the inlet edge of the inner wall of the oven. In order to facilitate control of the flow of the heated air, and consequently a balance at 13, adjustable dampers as at 12 may be incorporated into the spaces between the interior and exterior oven walls 7 and 8. It should be understood that for thermal efficiency the oven and circulatory ducting should be adequately lagged.

I claim:

1. A drying or curing oven for varnish or lacquer coated articles comprising, in combination:

a. a compartment having

1. double upright walls, the inner one of said walls bounding an oven chamber downwardly open to atmosphere surrounding the oven, the outer and inner walls defining therebetween first duct means for supplying a gas to said chamber, said duct means having orifice means extending about the downwardly directed open side of said chamber for discharging the supplied gas, and
2. to top wall upwardly bounding said chamber;
- b. second duct means extending from said top wall and communicating with said chamber for exhausting gas from the same;
- c. deflecting means along said inner wall adjacent said orifice for deflecting said supplied gas and for thereby minimizing turbulence at said open side;
- d. damper means in one of said duct means for controlling the flow of gas through said chamber between said first and second duct means and for thereby achieving a state of balance in the gas at said open side;
- e. heating means for heating the gas supplied by said first duct means; and
- f. recirculating means for returning a portion of the exhausted gas to said chamber.

2. An oven as set forth in claim 1, further comprising raising means for raising said coated objects into said chamber through said open side.

3. An oven as set forth in claim 2, wherein said orifice is substantially annular about said open side.