

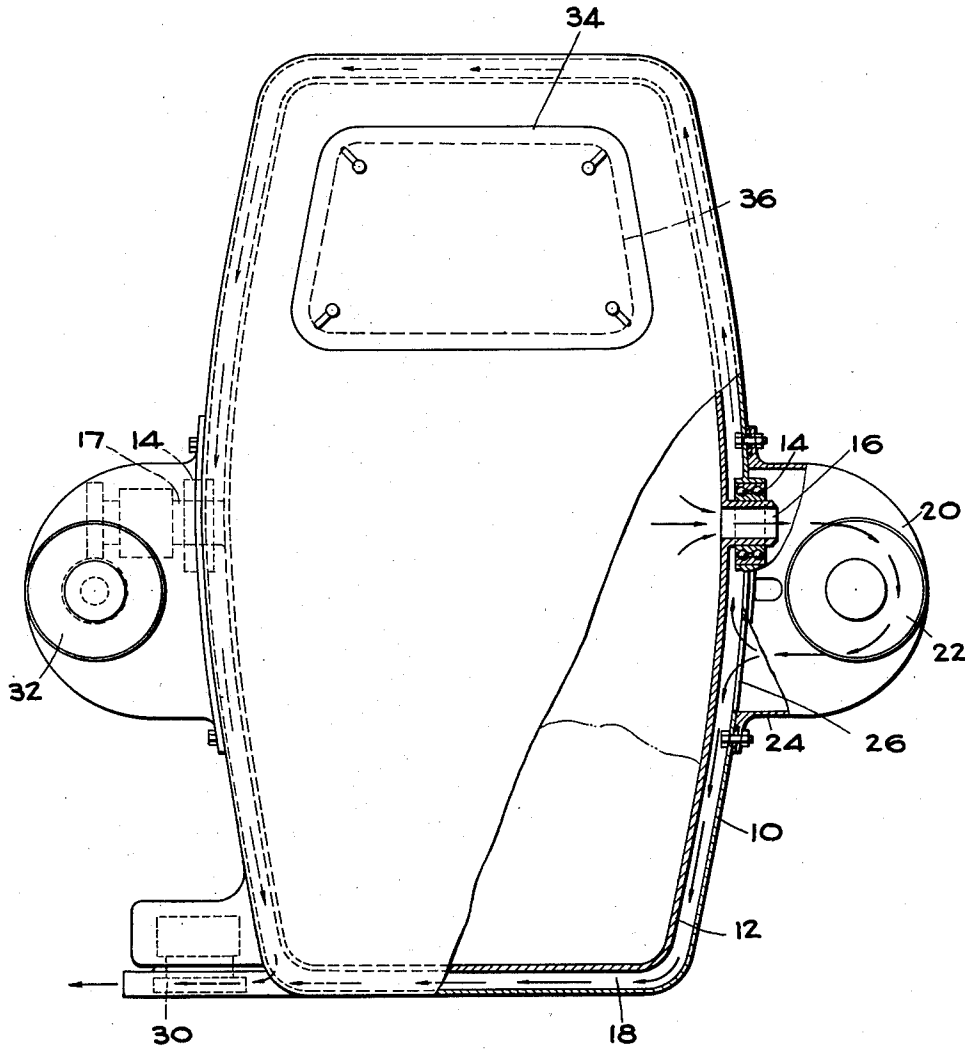
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VACUUM ROTARY DRUM DRIER HAVING MEANS TO COMPRESS EVACUATED VAPORS

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VACUUM ROTARY DRUM DRIER HAVING MEANS TO COMPRESS EVACUATED VAPORS

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This invention relates to an evaporating or drying method and means, and provides an improved drying principle which may be employed, for example, in clothes driers for home laundry drying purposes, and for other special applications.

One of the objects of the invention is to provide an improved drier principle and mechanism which is adapted to function with optimum results under minimum heating conditions. Another object of the invention is to provide an improved drying device which is particularly suitable for installation and operation at locations where supplies of externally generated heat are unavailable. Another object of the invention is to provide an improved heat recycling method and means in material driers and the like. Another more specific object of the invention is to provide an improved dryer device which avoids discharge of large quantities of water vapor to the atmosphere externally of the apparatus. Another object of the invention is to provide an improved drier device of the character described such as requires minimum power and heat energy absorption for optimum operation thereof.

Another more specific object of the invention is to provide an improved clothes drier device such as is particularly suitable for use as a home laundry drying unit. Other objects and advantages of the invention will appear from the specification hereinafter.

In the drawing:

Fig. 1 is an elevation, with portions broken away to show interior mechanism, of a device of the invention such as is designed specifically for home laundry drying purposes.

The drying device is illustrated in the drawing to comprise an outer drum-shaped casing 10 interiorly of which is mounted a clothes carrying drum 12 by means of trunnion bearings 14—14 which are carried by the casing 10 to support stub shaft portions 16—17 of the drum 12. Whereas in the drawing the casing 10 and the drum 12 are illustrated to be approximately barrel-shaped in front section, it will be understood that they may be of any other desirable sectional form while being circular in side elevation and so relatively dimensioned that the drum 12 is free to rotate upon the trunnion bearings 14—14 interiorly of the casing 10 while a vapor space 18 is disposed therebetween.

In the specific arrangement illustrated the stub shaft portion 16 is arranged to be hollow and to provide open communication between the interior of the drum 12 and the interior of a casing

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20 which provides the inlet conduit to a vapor displacement device of the impeller pump type as indicated generally at 22. The outlet port of the pump 22 discharges into an outer casing portion 24 which leads the vapor discharge from the pump 22 through perforated portions 26—26 of the casing wall into the space 18 surrounding the inner drum 12.

A second air exhaust pump or fan is provided as indicated at 30; the intake port thereof being arranged in open communication with the space 18 interiorly of the casing 10 and exteriorly of the drum 12; and separate power supply motors and control devices will be provided for selective operation of the pumps 22—30. Also, any suitable power supply device such as a motor which is indicated generally at 32 will be arranged in geared relation with the inner drum 12 as through connection with the stub shaft portion 17 thereof; and suitable control for the power supply device 32 will be provided whereby the drum 12 may be caused to rotate in conjunction with the drying operation as will be explained hereinafter. Hand holes will be provided through registering side wall portions of the casing 10 and the drum 12 and are provided with detachable cover plates such as are indicated generally at 34—36; whereby laundry or other materials to be dried may be loaded and unloaded at times from the inner drum 10 while the loading holes in the drum 10 and the casing 12 may be kept vapor-sealed during drying operations.

In operation, the materials to be dried such as "damp-dried" laundry or the like, will first be disposed within the drum 12 and the loading doors then closed and sealed against atmosphere leakage. The motor 32 is then started so as to rotate the drum 12. The pump 30 is then started so as to evacuate as much air as possible from the interior of the drum 12 and from the space 18 between the drum and the casing 10 so as to eliminate as much air as possible from the heat recycling system. Actually, this air elimination step of the process will require only a relatively slight displacement operation, and therefore the pump 30 may be of relatively low capacity.

The pump 22 is next started and is driven at a more substantial rate of displacement compared to the operation of the pump 30. For example, assuming a supply of laundry to be loaded into the drum 12 at a temperature of about 60° F., the pump 22 may be effectively operated at such rate as to reduce the pressure within the drum 12 to something in the neighborhood of 1/4 lb. per square inch while increasing the pressure within

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the space 18 between the drum 12 and the casing 10 to approximately $\frac{3}{4}$ lb. per square inch. Thus, the pressure within the drum 12 is reduced while the pressure in the space 18 is increased so that the water in the atmosphere within the space 18 will condense at a higher temperature than the water in the atmosphere within the drum 12. Upon attainment of a substantially stable condition of recycling operation, the temperature within the space 18 will perhaps reach 90° F. The condensate thereupon gives up the latent heat of vaporization to the walls of the drum 12, thereby rendering this heat available for transfer through the drum walls into the materials being dried, thereby aiding in evaporation of the moisture remaining therein. Upon attainment of a substantially stable heat recycling operation the heat radiating from the outer surfaces of the casing 10 will be replaced by the heat which is contributed to the system as an incident to the compressing operation of the pump 22; and the pump 30 thereupon needs only to be operated at sufficient rate to continue to eliminate any air that leaks into the system and to remove therefrom the water condensate.

Continued rotation of the drum 12 throughout the operation of the mechanism functions to agitate and churn the material to be dried thereby facilitating vapor escape from the material and exposure of all surfaces of the material to contact with the drum walls so as to provide optimum heat exchange from the drum walls to the material.

It is estimated that operation of the pump 22 at such rate as to consume $\frac{1}{2}$ H. P., for example in connection with an average size home laundry drier installation, could produce a vapor displacement rate of approximately 200 cu. ft. per minute at a pressure differential of about $\frac{1}{2}$ lb. per square inch. This pressure differential would permit the vapor to condense in space 18 at approximately 30° F. higher than the interior of the drum 12. This temperature differential will allow the energy liberated by the condensing vapor to flow through the wall 12 and assist in the further vaporization of the liquid in the clothes.

Incident to its compressing action the $\frac{1}{2}$ H. P. applied to pump 22 will also add about 14 b. t. u. of energy per minute to the system which will tend to raise the temperature of the entire system until the heat loss from casing 10 equals this energy being added. This temperature drift will not interfere with the operation of the drier as the temperature differential will still remain. It is estimated that a satisfactory drying effect at substantially room temperature would be provided simply upon operation of pump 22 without pump 30, but such an arrangement would require from 5 to 10 times as much power. It is also estimated that a satisfactory drying effect at elevated temperatures (about 212° F.) would be provided simply upon operation of pump 22, but such a device would necessitate the expenditure of enough energy to heat the system to this elevated temperature.

Thus, it will be appreciated that the invention provides a novel heat recycling drying operation through functioning of a mechanism which may be constructed for example for home laundry drying purposes in such form as to be of extreme structural simplicity and mechanical practicality. Such mechanisms will be adapted to produce any desired degree of drying of damp clothing at rapid rate while maintaining the clothing

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at substantially normal room temperatures throughout the entire operation, thereby avoiding subjecting the clothing to high temperature conditions such as harm certain fine fabrics. Also, particular features and advantages of the invention are that the total power consumed is relatively insignificant, and that no source of heat other than operation of the compressor 22 is required. Thus, effective drying operation is provided without the use of steam or gas flame or other external heat applications, thereby rendering the mechanism of the invention mechanically simple and operable wherever any suitable source of power for rotating the drum and driving the pumps may be available.

Also, it will be appreciated that due to the condensation action within the space 18 the only discharge through the pump 30 into the atmosphere externally of the machine will comprise a small amount of air and a trickle of water such as may be easily disposed. Therefore, the machine is particularly adapted for example to be provided in the form of a clothes drier set up for operation in the average home. The motive power for the devices 22—30—32 may be readily obtained by plugging an extension cord into the usual house lighting circuit wall receptacle; and throughout the drying operation there will be no clouds of steam or other undesirable discharges from the machine. Another particular advantage of the machine of the invention when employed as a home laundry dryer is that it is adapted to receive clothing coming directly from a cold rinsing operation, and to thoroughly dry such clothing without requiring heating thereof to higher than room temperatures. Therefore, the need for handling of the clothing in extra hot water rinses or the like is eliminated.

Thus, it will be appreciated that the method of the invention involves an effective recycling of the heat initially within the system in such manner as to provide an improved vaporization of moisture initially within the material to be dried, and discharge of such moisture from the system in the form of water condensate; and that the entire operation is performed without the application of externally generated heat except as provided as an incident to the compressor operation. It will of course be understood that where—as the invention has been illustrated and described herein by way of example more particularly in connection with a means for drying laundry, possible application of the invention is not so limited and that various changes may be made in the mechanism illustrated and described herein by way of example more particularly in connection with a means for drying laundry, possible application of the invention is not so limited and that various changes may be made in the mechanism illustrated and described herein without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A laundry drier comprising an airtight outer casing and an airtight inner casing disposed within the outer casing, means mounting said inner casing for movement to cause agitation of a load of laundry therein, said casings having laundry loading ports at registering positions and airtight closures for said ports, the space within said outer casing exteriorly of said inner casing defining a vapor space, a pump having its intake port in open communication with said vapor space and arranged to discharge into the atmosphere exteriorly of said outer casing, and a sec-

ond pump having its intake port in open communication with the interior of said inner casing and arranged to discharge into said vapor space.

2. A laundry drier comprising an airtight outer casing and an airtight inner casing disposed within the outer casing, means mounting said inner casing for movement to cause agitation of a load of laundry therein, the space within said outer casing exteriorly of said inner casing defining a vapor space, a pump having its intake port in open communication with said vapor space and arranged to discharge into the atmosphere exteriorly of said outer casing, and a second pump having its intake port in open communication with the interior of said inner casing and arranged to discharge into said vapor space.

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