

W. L. MAXSON
APPARATUS FOR COOLING UNDER ULTRA VIOLET
RADIATION AND VACUUM CONDITIONS
Filed July 13, 1944 3

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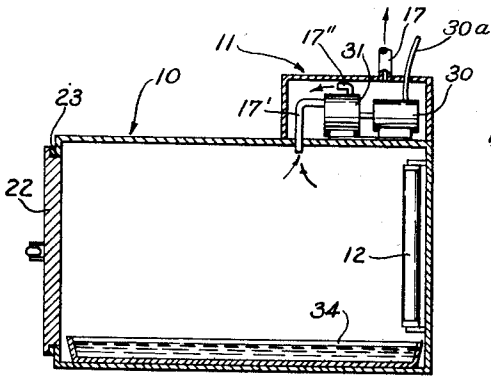


Fig. 1

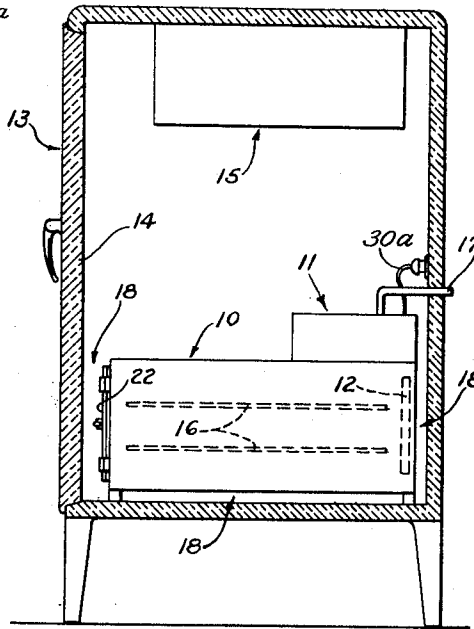


Fig. 2

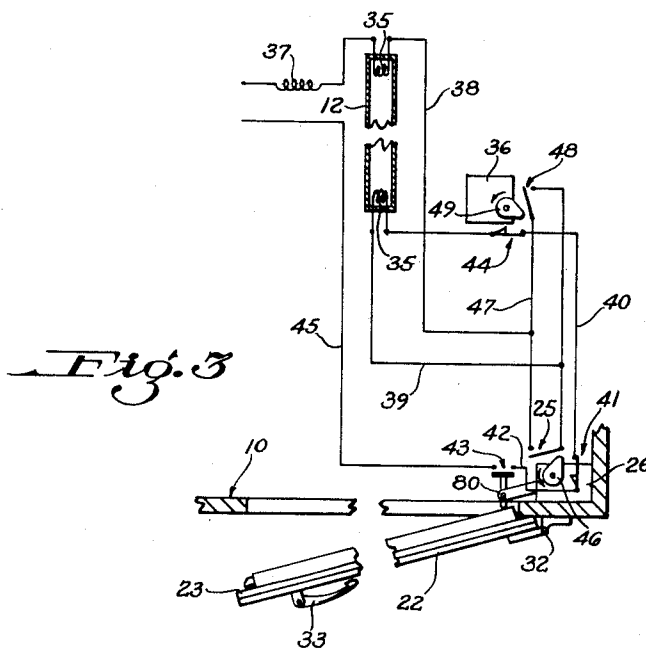


Fig. 3

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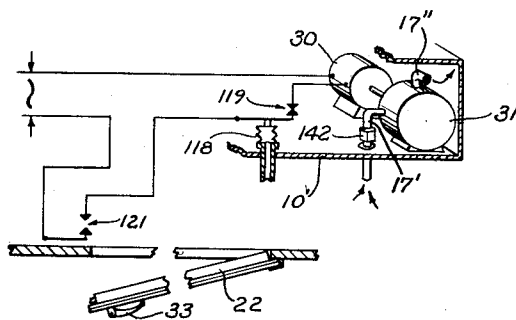


Fig. 4

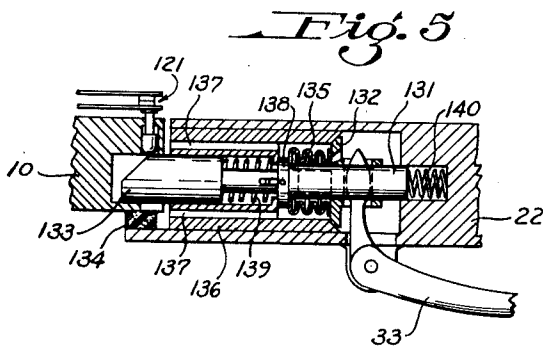


Fig. 5

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3 Sheets-Sheet 3

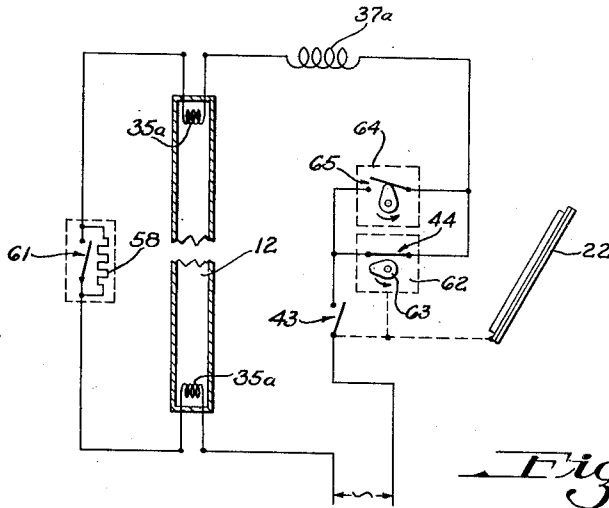


Fig. 6

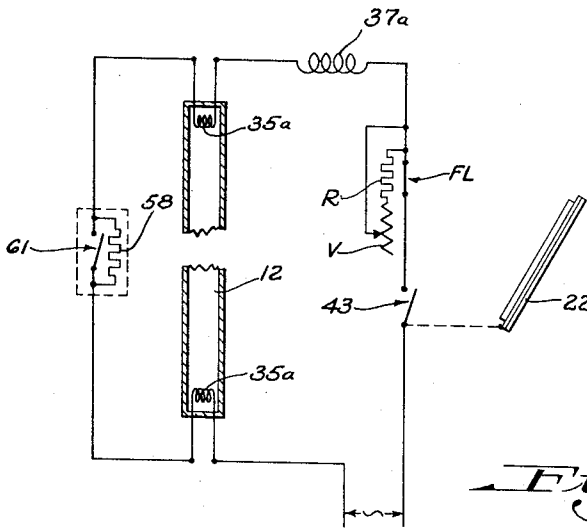


Fig. 7

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UNITED STATES PATENT OFFICE

2,425,816

APPARATUS FOR COOLING UNDER ULTRA-VIOLET RADIATION AND VACUUM CONDITIONS

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Application July 13, 1944, Serial No. 544,785

6 Claims. (Cl. 62—89)

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This invention relates to a method of and apparatus for storage and preservation of perishable materials such as foods.

This application is an improvement on the apparatus and method disclosed in my application, Serial No. 534,902 and in addition to the evacuated refrigerated chamber disclosed in that application, in this invention I provide a germicidal lamp to sterilize the material stored within the chamber.

It is well known that four of the basic factors affecting storage of perishable materials, such as food, are bacteria, molds, dehydration and oxidation or respiration.

In the prior application I provide means for preventing dehydration and oxidation, inhibit the action of bacteria by refrigeration, and reduce the tendency of molds to form by the combined action of refrigeration and evacuation of oxygen contained in the air.

It is an object of the present invention to provide substantially complete protection to perishable materials by treating them with a combination of ultra violet light, refrigeration, removing the oxygen from the chamber by evacuation, and providing the proper humidity.

Another object of the invention is to provide an apparatus for preservation of perishable material by removing oxygen from the chamber in which it is stored and sterilizing the material by ultra violet light.

Other and incidental objects of the invention will be apparent from the reading of the following specification and from the inspection of the accompanying drawings in which:

Figure 1 is a vertical cross section of the storage chamber, which may be placed in a refrigerator;

Figure 2 is a vertical cross section of a refrigerator with a storage compartment mounted therein;

Figure 3 is a horizontal cross section of the storage compartment indicating the wiring diagram of the ultra violet lamp;

Figure 4 is a schematic diagram of the electrical connections of the vacuum pump;

Figure 5 is a longitudinal section of one type of latch for the door of the unit;

Figure 6 is a schematic diagram of a modification of the wiring of the ultra violet light source including a thermostatic switch to start the arc; and

Figure 7 is a schematic diagram of a modification of Figure 6 showing means thermostatically to control the periods of operation of the ultra violet source.

Referring first to Figure 1, the storage compartment is generally indicated at 10. This chamber is appropriately constructed so as to withstand the vacuum therein to approximately the

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vapor pressure of water at the temperature at which the materials are to be preserved. The chamber 10 is provided with a door 22 which is sealed to the chamber by resilient member 23.

The door is provided with the usual hinges 32 and latch 33, Fig. 3. A vacuum pump 31 for evacuating the chamber is provided. This is preferably driven by an electric motor 30 controlled as hereinafter described. The motor 30 is housed in an enclosure 11. Electrical conductors are led into the enclosure 11 through a conduit 30a. The pipe 17 is provided so that air exhausted from the chamber may be carried to the exterior of the refrigerator, Fig. 2. In the chamber there is provided an appropriate source of ultra violet light 12 in such a position that its rays are directed to all of the comestibles stored therein.

An appropriate container 34 is provided for water to maintain the proper humidity in the chamber and to catch condensed moisture therein.

This chamber may be mounted in a refrigerator as shown in Figure 2 in which 13 generally indicates the refrigerator, provided with a door 14 and a unit 15 to control the temperature thereof.

This chamber may be removable as shown or may be constructed as a unit integral with the refrigerator. This chamber is preferably spaced away from the refrigerator walls as indicated at 18 so that the cool air may circulate around all sides of the chamber in order to provide conductive refrigeration through the walls of the container, in contradistinction to the usual refrigeration by convection of currents of air. The chamber may be provided with shelves 16 of such material that they will conduct heat from the material stored thereon to the conductive walls of the chamber.

In Figure 4 the upper surface of the storage unit is indicated at 10' and mounted thereon is the motor 30 connected to a vacuum pump 31. The vacuum pump is connected to the interior of the storage unit through an appropriate pipe 17' and exhausts to the air through a second pipe 17. The motor and the pump are separated from the interior of the refrigerator by an appropriate heat insulating layer. The vacuum pump 31 may be either directly connected to the exterior atmosphere, or it may exhaust into the enclosure 11 through a pipe 17 and the exhaust be carried to the exterior atmosphere by a pipe 17, as indicated in Figure 2. The latter construction has the advantage that the motor is cooled by the air exhausted from the compartment 10. In order to control the air pressure in the compartment 10, a pressure responsive means 118 is provided. This means controls the contacts 119, and when a sufficiently low pressure in the unit 10 is reached, these contacts are opened and the motor 30 is turned off. An appropriate check

valve 142 is provided to retain the vacuum in the compartment 10.

The door 22 must be capable of sealing the unit 10 sufficiently securely to maintain the vacuum therein but at the same time it must be capable of being readily opened. In the opening process it must be able to turn off the vacuum pump and break the vacuum. In order to accomplish this, I have devised novel securing means and a vacuum breaking means for the door 22. Referring to Figure 5, the door 22 is secured against the body of the unit 10 with an airtight seal by the gasket 134 extending completely around the door 22. The door is latched in its closed condition by a bolt 133 sliding into an appropriate aperture in the portion 10. This bolt 133 may be opened by the handle 33 which operates a slide 131 connected to the bolt 133 as will be hereinafter described. In order to break the vacuum so that the door 22 may be opened, the slide 131 is provided with a valve member 132 which cooperates with a barrel member or sleeve 136 which is installed in a vacuum tight manner in the door 22. When the handle 33 is rotated clockwise, the member 131 will be moved to the right against the pressure of the spring 140. The valve 132 will be lifted from the barrel 136 and air will be permitted to enter the body of the unit through the apertures 137.

The valve 132 is connected to the member 131 through a longitudinally expansible metal tube 135 so that after the valve 132 is sealed the member 131 and the latch 133 may be moved forward by the springs 138 and 140 until the member 138 is firmly seated. When the door is closed and the member 138 is seated, the latch 133 extends past spring contacts 121, and closes the circuit through the motor 30 again evacuating the storage unit. Conversely, when the door 22 is to be opened, the handle 33 is rotated clockwise, the latch 133 is withdrawn, the contacts 121 are separated, turning off the motor 30 and the vacuum pump 31, and the valve 132 is then raised permitting the entrance of air to the compartment and permitting the opening of the door 22.

The lamp 12 shown is one of the many types of ultra violet sources. Any other suitable source such as a mercury vapor arc enclosed in suitable glass and having an auxiliary unit containing transformers and reactors, or rectifiers, or suitably enclosed incandescent carbon filaments may be used. One suitable mercury vapor lamp employing an ordinary fluorescent light fixture and auxiliaries is marketed by the General Electric Company under the trade name "Uviarc."

The lamp shown in Figure 3 is one type of ultra violet sterilizing lamp. This lamp 12 includes a tube of a glass, capable of transmitting ultra violet light, and enclosing vapors which are rendered radiating by the passage of electric current therethrough. The starting electrodes 35 of the lamp are formed of coil heating elements analogous to the filaments of electric light bulbs. The lamp may be started by connecting the terminal of one of the electrodes to a conductor of a 110 volt circuit and the terminal of the other electrode through a ballast reactance 37 to the other terminal of the 110 volt circuit. When the two terminals of the electrodes are bridged by a conductor, a heating current will flow through each of the electrodes in series and the lamp will light on breaking of the bridging connection. The current will then flow from one electrode to the other through vapor in the lamp.

To insure that the sterilizing lamp will not burn

when door 22 is opened, that the lamp will burn for a desired interval immediately after closing the door, and that the light will burn for desired periods of time at desired intervals independently of its activation by the door, a time delay device 26, an interval timer 36 and suitable electrical connections are provided.

When the door is opened, the starting of the lamp is prevented by a switch 43 which interrupts the supply circuit when the door 22 is open, and completes the circuit when the door is closed. On the closing of the door the switch 43 is closed and the time delay device 26 is started by the operation of the arm 30 connected to the operating pin of the switch 43. The cam of the time delay device 26 operates in a counter-clockwise direction, first closing the switch 25. Thereupon the electrodes 35 are heated by the flow of current in the circuit extending through the reactor 37, the upper electrode 35, the conductor 38, the switch 25, the conductor 39, lower electrode 35, switch 44, conductor 40, switch 41, conductor 42, switch 43 and conductor 45.

It should be noted that the time delay device 26 and the interval timer 36 each operates two switches 25 and 41, and 43 and 44, respectively, of which the starting switch 25 or 43 is closed for a brief interval and the stopping switch 41 or 44, respectively, is opened for a brief interval, in sequence. These results may be accomplished in different known fashions, as will be readily understood by those versed in the art, the drawings being intended merely to show diagrammatically the principle of operation of the device.

After an interval sufficient to heat the electrodes 35, the cam 46 of the time delay device permits the switch 25 to open, thereby opening the shunt circuit around the tube 12. Opening of the circuit will, because of the reactor 37, cause a momentary high potential to be established across the tube 12, which establishes an arc across the electrodes. The circuit then includes the reactor 37, upper and lower electrodes 35, the switch 44, the conductor 40, the switch 41, the conductor 42, switch 43 and conductor 45. After the lamp has been on for the required time, determined by the time delay device 26, the cam 46 opens switch 41 and extinguishes the lamp.

The interval timer 36 operates independently of the time delay device 26. The starting switch for the interval timer is indicated at 48 and operates in the same general manner as the switch 25 in the time delay device. The cam of the interval timer 36 is likewise indicated as operating in a counter-clockwise direction. When the switch 48 is closed, the starting circuit is completed through the reactor 37, the upper electrode 35, conductor 47, switch 48, conductor 39, lower electrode 35, switch 44, conductor 40, switch 41, conductor 42, switch 43 and the conductor 45. After an interval sufficient to heat the electrodes, the cam 49 of the interval timer permits the switch 48 to open, and the current then flows through the circuit including the reactor 37, upper and lower electrodes 35, switch 44, conductor 40, switch 41, conductor 42, switch 43, and conductor 45, as before. The arc is extinguished when the cam 49 opens the switch 44, or when the switch 43 is opened by opening the door.

As before mentioned, the period of closure of the switches 25 and 43 is of sufficient duration to heat the electrodes 35 to the point where the vapor contained in the tube 34 can carry the current. The opening and closing of switches 41 and 44, however, occurs very quickly and

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there is, therefore, no detrimental interaction between the controlling means. The period of opening of the switches 41 and 44 should be great enough to permit the heated electrodes 35 to cool enough so that the arc will not immediately be reestablished on their reclosure.

The operation of the device of my invention may now be summarized briefly as follows: When the door of chamber 10 is opened by means of handle 33, the vacuum in the chamber is broken by the opening of valve 132, and the vacuum pump 31 is rendered inoperative by the opening of contacts 121. Upon reclosing of the door after, for example, a comestible article has been placed in the chamber 10, the bolt 33 latches the door in sealing position and the vacuum pump is rendered operative by closing of contacts 121. The vacuum pump continues to operate until the desired degree of vacuum is obtained, at which point the bellows 118 stop further operation of the pump by opening of contacts 119. In the meantime, the ultraviolet light source 12 has also commenced to function. When the door 22 was closed, switch 43 was closed and the arm 80 started operation of the time delay device 26, the cam 46 of this device serving to close switch 25, so that with both switches 43 and 25 closed, the circuit for heating the electrodes 35 is established for the proper interval of time to permit the electrodes 35 to heat. At the end of this interval of time, switch 25 reopens due to the action of the cam 46, and through the action of the reactor 37 a high voltage is produced starting the operation of the tube 12. This operation now continues for a desired period of time, the duration of this period being governed by the interval of time required by the cam 46 to continue its counter-clockwise rotation to the point at which it opens switch 41. When this switch is opened, the tube 12 ceases to act. This interval is arbitrarily chosen to be of such duration that under normal conditions the air within the chamber and the exterior of the comestibles contained therein have been sterilized to a desired degree. Cam 46, however, continues its rotation until switch 41 again closes, but the tube 12 does not become reenergized by closing of switch 41, by reason of the fact that electrodes 35 have cooled off sufficiently to prevent the reestablishment of the circuit of the arc between electrodes 35, even though 110 volts potential is applied across these electrodes. Moreover, the starting circuit of the tube is open at contact 25, for the reason that the cam 46 of the time delay device 26 ceases its rotation upon its return to the starting position indicated in Fig. 3.

The purpose of interval timer 36 is to set the tube 12 into operation intermittently for given periods of time to bring about reesterilization of the contents. The timer 36 rotates its cam 49 continuously in counterclockwise direction. When the cam closes the switch 48 the starting circuit of tube 12 is completed, causing the tube to commence operation. When the cam reaches contact 44 and opens the same, the operation of the tube is interrupted. It remains so interrupted until the contact 48 is again reclosed.

The circuits of the present invention, therefore, serve to bring about operation of the ultraviolet radiation, both at the time of closing of the door of the chamber and at regular intervals thereafter. It will be understood, of course, that the durations of these intervals and of the periods of energization of the tube may be made such as desired.

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It will be noted that whenever the door 22 stands open, contact 43 remains open so that lamp 12 is prevented from operating. The timers 36 and 26 may be driven by clockwork or by electric motors connected to the lighting circuit.

Instead of employing the cam operating timers illustrated, bi-metallic strips may be substituted, controlled by resistance wire through which flows a portion of the current which actuates the lamp 12.

Figures 6 and 7 show modifications of the circuit using such bi-metallic strips controlled by resistance elements. In Figure 6 the switch 43 is controlled by the door as in Figure 3 and the time delay device 62 functions in the same manner as the time delay device 26 in Figure 3, and the interval timer 64 performs the same function as the interval timer 36. The important difference in the operation of this circuit as distinguished from the circuit in Figure 3 is the manner of establishing the arc across tube 12. In this case the electrodes 35a are connected to a switch 61 around which is shunted resistor 58. When the circuit is closed by the closing of the door and the consequent closing of the switch 43, current flows through a resistor 58 which closes the bi-metallic switch 61. Closing of switch 61 shunts out the resistor 58 which thereupon becomes cool and allows the switch 61 to open again. When the switch 61 opens, the reactor 37a causes an arc to be established across the electrodes 35a and the lamp continues to burn until extinguished by the interruption of the supply circuit by the switch 44. The resistance 58 is so high in relation to the voltage drop across the arc that after the arc is established there is no appreciable current through the resistor 58 and therefore the switch 61 does not close again.

The cam 63 in the timer 62 rotates three-quarters of a revolution until the switch 44 is held open where it remains until the door is again opened. Thereafter the lamp 12 continues to function under the control of the interval timer 64 controlling switch 65. The switch 61 functions in the manner above described upon each operation of switch 65.

In the circuit shown in Figure 7, a thermostatic switch FL is substituted for both the time delay device 62 and the interval timer 64, the circuit otherwise remaining the same. In this modification the thermostatic switch FL is controlled by a resistor R in the same manner as in the well known thermostatic lamp flashers. When the switch 43 is opened no current passes through the resistor R and the switch FL is closed. When the switch 43 is closed, current passes through the resistor R, through the choke 37a, through the resistor 58, etc. The switch 61 establishes the arc as before to cause actuation of the tube 12. Resistor R, meanwhile, heats the bi-metallic strip in the switch FL at a rate dependent on the desired length of the period of actuation of the tube 12. When the strip is sufficiently heated it opens the circuit to cause the operation of the tube 12 to be stopped. The length of time required for the switch FL to be opened is dependent on the setting of the adjustable contact on the resistor V in series with the resistor R. When switch FL opens, the tube 12 and the resistor R are deenergized, the switch FL cools to a closed attitude, and the cycle is repeated.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments

shown, but what I desire to cover by Letters Patent is set forth in the appended claims.

I claim:

1. A storage chamber adapted to be refrigerated including a removable airtight box capable of withstanding external air pressure, a door for sealing said box, means mounted on the box for evacuating said box to a predetermined low pressure, means for producing ultra violet light within said box, and humidifying means within said box.

2. A storage chamber adapted to be refrigerated including a removable airtight thermally conductive box capable of withstanding external air pressure, a door for sealing said box, means mounted on the box for evacuating said box to a predetermined low pressure, means for producing ultra violet light within said box, and humidifying means within said box.

3. A storage chamber adapted to be refrigerated including a removable airtight thermally conductive box capable of withstanding external air pressure, a door for sealing said box, means mounted on the box for evacuating said box to a predetermined low pressure, means mounted on the box for producing ultra violet light within said box, humidifying means within said box, and thermally conductive shelves within said box connected to the walls thereof.

4. In combination, a refrigerator, a removable airtight thermally conductive box therein capable of withstanding external air pressure, a door for sealing said box, means mounted on the box for evacuating said box to a predetermined low pressure, means for producing ultra violet light within said box, and humidifying means within said box.

5. In combination, a refrigerator, a removable airtight thermally conductive box therein capable of withstanding external air pressure, a door for sealing said box, means mounted on the box for

evacuating said box to a predetermined low pressure, means for producing ultra violet light within said box, humidifying means within said box, and means for controlling the source of ultra violet radiation.

6. In combination, a refrigerator, a removable airtight thermally conductive box therein capable of withstanding external air pressure, a door for sealing said box, means mounted on the box for evacuating said box to a predetermined low pressure, means for producing ultra violet light within said box, and means on the box for controlling the source of ultra violet radiation including a switch adapted to be operated by the door of said chamber for turning off said source when the door is open, an interval timer switch connected between the door switch and said source to turn said source on at regular intervals for regular times, and a time delay switch connected in series with the door operated switch and in parallel with the interval timer to turn said source on for a limited time immediately after closing of the door.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,107,763	Potter	Feb. 8, 1938
2,109,002	Warren	Feb. 22, 1938
2,145,196	Biggs	Jan. 24, 1939
2,263,456	Darcy	Nov. 18, 1941
2,246,676	Hainsworth	June 24, 1941
2,234,254	Hull	Mar. 11, 1941

FOREIGN PATENTS

Number	Country	Date
521,040	Germany	Mar. 18, 1931