

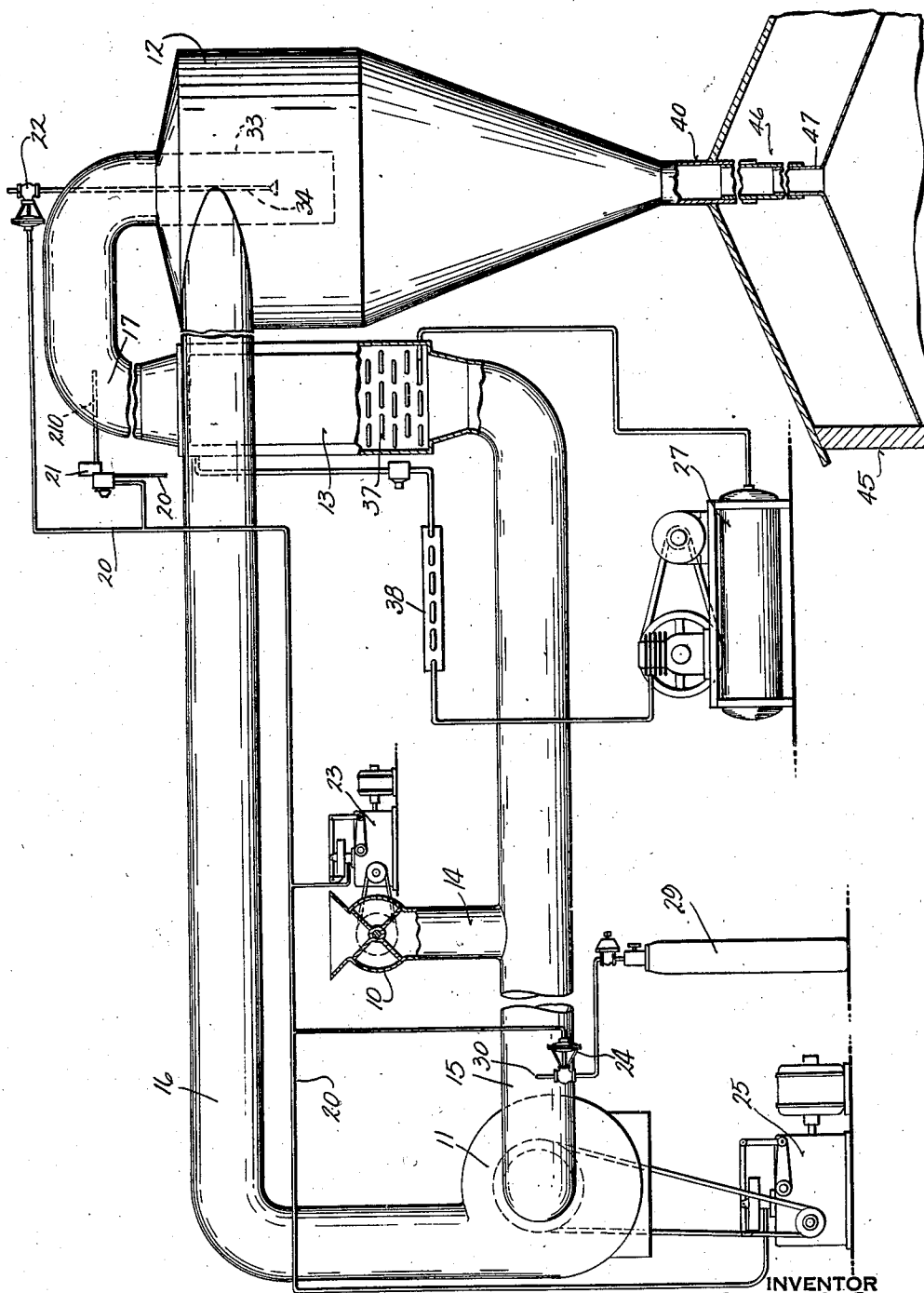
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ART OF PRESERVING ELEMENTS OF ORGANIC MATERIALS

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ART OF PRESERVING ELEMENTS OF
ORGANIC MATERIALS

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12 Claims. (Cl. 99—8)

This invention pertains to improvements in the art of preserving valuable elements of organic materials in dry storage. The present invention is an improvement on the device disclosed in my application Serial No. 311,639, filed December 29, 1939, now Patent 2,266,292, granted December 16, 1941.

In common with the objects stated in the above identified application and in my application No. 231,110, filed September 26, 1938, now Patent 2,241,654, granted May 13, 1941, an important object of the present invention is to provide an improved method of packing and storing herbageous stock food or the like with a minimum loss of vitamin A or carotene content, as well as with substantially no loss of color. As taught in my prior applications, extraction of heat from organic materials prior to storage, together with the retention of the material at temperatures below 60 degrees F. during the storage period, results in a substantial retention of the vitamin content thereof.

Loss of vitamin content is due to oxidation and oxidation is accelerated by heat. However, some oxidation occurs even at low temperatures, and it is the object of the present invention to substantially eliminate this oxidation by removal of oxygen from the material just prior to sacking and storage thereof and the substitution therefor of an inert gas such as CO₂.

A further object of the invention resides in the provision of an improved method, and apparatus for carrying out the method, of introducing an inert or non-oxydizing gas into the material to be stored, preferably during the chilling process, whereby the air is largely replaced by said gas and the inert gas is retained with the material when packed to prohibit subsequent absorption of air during storage.

It is a further object of the invention to provide means for drawing off air which has been replaced by inert gas prior to packaging and storage of the material.

It is a still further object of the invention to provide a circulating apparatus from which the air content of finely divided material may be withdrawn and replaced by an inert gas, while the material and gas are being circulated in an otherwise closed cycle of turbulent movement, said apparatus is provided with means whereby the amount of inert gas introduced therein is automatically controlled in accordance with the quantity of material circulated there-through.

A further object of the invention is to provide a closed cycle of circulation in which air

replaced by inert gas is expelled therefrom, with a minimum loss of inert gas.

Other objects and advantages of the present invention will become apparent to those skilled in the art upon examination of the specification and claims appended thereto.

The drawing discloses apparatus in which a stream of finely divided material entrained in air and inert gas is driven or drawn by a blower 11 through a closed passage comprising conduit 15, blower 11, conduit 16, separator 12, conduit 17, and through chilling unit 13 back to conduit 15. A suitable metering device or rotary valve 10 is provided to measure the quantity of comminuted stock foods or the like delivered through conduit 14 into the circulation passage.

The chilling unit 13 is preferably arranged vertically to minimize the possibility of dust lodging therein.

A tank of compressed gas 29, such as CO₂ is piped to a nozzle 30, located within conduit 15 or at some other convenient point within the circuit. The passage of gas from tank 29 through nozzle 30 is controllable by valve 24, preferably of the type operated by diaphragm flexion, in response to temperature-pressure changes within the circuit at a remote point therefrom as hereinafter described. The speed of the blower unit 11, as well as the rate at which material is fed into the circuit through metering device 10, may be controllable through a temperature responsive regulator 21 which has a heat responsive element 210 disposed within conduit 17. Pneumatically controlled regulating devices 23 and 25 may regulate the speed of feed intake device 10, and blower 11 through control unit 21, located in a pipe line 20 leading from a source of pneumatic energy. Nozzle control valve 24 is responsive to the same temperature changes within conduit 17 by reason of its being connected to the pneumatic pipe line 20.

As stated in my Patent 2,266,292, the controls are so designed that an increase in gaseous temperature within conduit 17 results in a decrease in the rate at which material is fed into the system as well as a decrease in the speed of blower 11. Conversely, a lowering of the temperature of gas within conduit 17 results in an automatic increase in feed rate and blower speed. In this manner the device is adapted to operate in a manner whereby the refrigerating unit 37 will at all times sufficiently lower the temperature of the material being treated to effect efficient preservation in subsequent storage.

Due to the varying rate at which material is

introduced into the circuit it would not be economical to introduce the inert gas at a constant rate. I have found, however, that the ideal rate of gas introduction through nozzle 30 is a function of both the feed intake rate and the blower speed. Hence, I employ a properly designed pneumatic valve 24, coupled to the common pneumatic control line 20, to automatically regulate gaseous flow through nozzle 30 and maintain a substantially peak efficiency at all times, thereby effecting maximum economy of this gas during operation of the device.

A substantial quantity of air is necessarily introduced into the system with the material entering the system through conduit 14. To avoid pressure buildup within the system, this air must be withdrawn or expelled therefrom and it is, of course, desirable that a minimum of the inert gas be withdrawn or expelled with the air. The solid material and air which enter the system through conduit 14 commingle with the gaseous stream of inert gas and air which is circulating therethrough. Hence, as the material is conveyed through conduit 15, conveyor 11 and conduit 16 to the separator 12, it is commingled with both air and inert gas.

Therefore, I employ a separator 12 of sufficient size to allow the heavier inert gas and the entrained solids to separate from the air by centrifugal force as well as by gravity. To expedite the separation, the upper portion of the chamber is preferably made cylindrical, pipe 16 being preferably tangentially disposed in relation to the periphery of the cylindrical portion. A descending vortex is developed within the separator housing to effect separation in a well known manner, the vortex reversing at a point spaced from discharge spout 40 to ascend centrifugally of the separator into the outlet discharge conduit 33. Separator 12 serves a dual function—firstly, the solid material entrained in the gaseous stream is substantially separated therefrom whereby gravity pulls the separated material into that portion of the separator adjacent discharge spout 40. Secondly, the inert gas being heavier than the air is effectively separated therefrom initially by centrifugal forces set up within the device and thence by gravity. The relatively light air will accumulate at low pressure areas within the cycle and to prevent pressure buildup within the system, I withdraw this air through a suitable conduit 34 leading from one such low pressure area within the separator through a relief valve, into the atmosphere or into a vacuum chamber if desired. It is immaterial whether this conduit 34 discharges into the atmosphere or into the vacuum chamber, since the pressure within the pressure chamber will be above atmospheric pressure under ordinary conditions of use. While I prefer to locate conduit 34 in the center of separator outlet pipe 33, it may be disposed at the top of the separator at a point just outside outlet 33 and between 90 and 270 degrees distant from inlet conduit 16.

As stated, a low pressure relief valve 22 is provided in that portion of conduit 34 extending outside the separator. Because the amount of air introduced into the circuit varies substantially with the amount of material metered therein, the amount of air which must be withdrawn through outlet 34 to prevent pressure buildup is a function of the feed rate. To obtain automatic control of the rate at which air is bled from the system, low pressure relief valve 22 is also of

the pneumatic type and is connected to the line 20. Hence, it is controlled through regulator 21 in response to temperature changes within the conduit 17, as is the feed rate, the blower speed, and the rate of admission of the inert gas.

The solid material separated from the pneumatic stream within separator 12 is substantially free of air, the air having been replaced by inert gas, and to prevent the escape of the inert gas during sacking and storage, I propose that if the material is to be sacked it should be packaged or sacked in asphalt lined burlap bags or multiple layer paper bags which are practically air tight. A small amount of the inert gas will, therefore, be packed with the material and it is highly probable that a small amount of the gas will escape through conduit 34 along with the air being withdrawn from the system. Because the pressure within the system is greater than atmospheric pressure, the only air introduced therein is that which commingles with the material being fed through conduit 14. I have found that for a given material the amount of air contained therein is relatively fixed, and hence it follows that, barring leaks in the apparatus, the amount of inert gas delivered through nozzle 30 into the passage way is a direct function of the amount or comminuted organic material metered through conduit 14.

For example, alfalfa meal, which may be treated by the device, weighs approximately forty pounds per cubic foot. A ton of this material will, therefore, occupy fifty cubic feet. Assuming ten percent of this volume is air, an eighty percent dilution or replacement of the trapped air can be effected with four cubic feet of CO₂ which is equal to a half pound of CO₂ at atmospheric pressure at 32 degrees F. Assuming CO₂ gas costs 10 cents per pound, cost of treating alfalfa meal amounts to only 5 cents per ton.

It is apparent that the introduction of inert gas through valve 24 as well as the withdrawal of replaced air from separator 12 through valve 22 may be manually controlled or that some other type of automatic control other than the pneumatic type illustrated may be employed without departing from the spirit and scope of this invention.

Instead of packaging the material in a sack, it may be stored in a silo-like receiver such as that shown at 45. As a convenient means of preventing the dilution of the atmosphere of carbon dioxide accompanying the material into the silo 45, I prefer to provide the discharge spout 40 of the separator 12 with a telescopic extension pipe 46 comprising separable sections, the lowermost section 47 of which carries a float in the form of an inverted funnel beneath which the material delivered from the separator into the silo packs, to gradually raise the funnel as the silo fills. This arrangement tends to confine in the material in the silo the atmosphere of carbon dioxide entrained with such material and to prevent said atmosphere of carbon dioxide from dilution by the air of the silo.

Even if air is used, rather than carbon dioxide as the chilling material, it is still desirable to prevent the dilution of the chilled air by such warm air as may be in the silo when the air is introduced. Accordingly, the silo filling arrangement using the inverted funnel as herein disclosed is useful whenever any gas, carbon dioxide or otherwise, in which storage material is entrained is to be protected against dilution

during the filling of a container with such material.

It is probably not possible to remove all of the air from the treated material in the apparatus above described, nor is the removal of all of the air necessary to substantially retard oxidation during storage. Experiments have taught that the removal and replacement by inert gas of approximately 75 or 80 percent of the air in stock food and the like, together with a substantial lowering of the temperature thereof prior to storage, prevents substantially all loss of vitamin content during extended periods of storage. The fact that the material is packed tightly in the silo, bags or other container further aids in excluding air and protecting the material against oxidation. In general, the larger the container, the easier it will be to substantially replace the air with the substituted atmosphere of inert gas. Hence, the silo type container is ordinarily to be preferred to the sack.

I claim:

1. A method of preparing a finely divided organic material for storage, consisting in commingling the material with a stream of relatively cool non-oxidizing fluid and maintaining the stream in continuous circulation from the point of commingling to a point of separation, introducing inert gas into the stream to replace air introduced therein with the material and regulating both the rate of material feed into the stream and the rate at which inert gas is introduced into the stream in a predetermined correspondence with temperature changes of the stream at a point remote from the point of material introduction, and separating the material from the stream and from the inert gas which is not interstitially contained by the material.

2. A method of preserving finely divided organic material, consisting in circulating in a closed path a chilled stream of non-oxidizing and inert gas, metering the material and air commingled therewith into the chilled stream of non-oxidizing gas, separating the material and inert gas from the air after the material has been substantially chilled, removing the air from said path, and packing the material and some of the inert gas which has commingled therewith in an air excluding receptacle whereby to prevent deterioration of the material through oxidation during extended periods of storage.

3. A process of cooling organic material preparatory to storage thereof comprising the introduction of said material and entrained air into a pre-cooled circulating fluid stream of non-oxidizing fluid, guiding the stream along a definite path to a point of separation, introducing inert gas into the stream to be commingled with the material therein, controlling the introduction of gas in correspondence with the volume of material being introduced, displacing and separating a volume of air from the material equivalent to the volume of gas so introduced, and removing the material from the circulating stream and packaging it while protecting it from exposure to air.

4. A continuous process of preparing finely divided food material for storage, consisting in maintaining a confined circulating current of inert gas, continuously feeding the food material into said circulating current at one stage while separating air therefrom at another stage, removing the material from the circulating current after such air separation, and feeding inert

gas into said current to compensate for losses in the removed material.

5. A method of preserving organic material consisting in commingling the material and the air entrained therein with a confined stream of non-oxidizing gas, maintaining the stream in circulation from the point of commingling to a point of separation, separately removing the air and the material from the stream, and packaging the material.

6. A method of preparing finely divided organic material for storage consisting in introducing the material and air commingled therewith into a stream of inert gas, directing the stream and the material entrained therein into a separator to remove a substantial portion of the air therefrom, said air removal being controllable in response to temperature changes occurring in the stream at a point spaced from the point of introduction of the material.

7. A device of the character described having in closed circuit relation, a cooling chamber, a blower, and a separator, a quantity of dry gas within the circuit, means for introducing an inert gas into the circuit from an outside source, means for metering finely divided material into the gas during its passage from the air cooler into the separator, and temperature responsive means within the circuit and spaced from said metering means to control both the rate of material delivery and the rate of inert gas introduction into the system in accordance with temperature changes in the circuit.

8. Apparatus for treating organic material comprising a closed circuit conduit having a blower and a separator in the circuit in spaced relation, means for metering an inert gas into the circuit to be circulated therethrough by the blower, means for introducing material therein, an outlet passageway extending from a point outside the separator to a low pressure point therein and provided with means for the control of the gas therethrough, and temperature responsive means extending into the conduit and connected with the outlet passage, control means whereby air outlet from the separator is controlled in response to temperature changes occurring in the circulating gas.

9. A method of preserving organic material consisting in commingling the material and the air entrained therein with a stream of non-oxidizing gas confined to circulate in a closed circuit path, continuously introducing material into the stream to be entrained therein and carried from the point of commingling to a point of separation, separately removing the air and the material from the stream, introducing gas to replace the air and gas removed from the stream and packaging the material while excluding air therefrom.

10. The combination with a blower having a suction pipe provided with refrigerating means, a feed pipe for finely divided material leading to the suction pipe between the refrigerating means and the blower, a metering valve operatively connected with the feed pipe, a separating chamber, an outlet duct leading from the blower to the separating chamber, a return duct leading from a separating chamber to the suction pipe, means provided in the upper portion of the separating chamber for the removal of air therefrom and means positioned in the lowermost portion of the chamber for removal of solid material, and temperature responsive means disposed within the return duct and operatively connected with the

air removal means whereby air removal from the separator is controlled in response to temperature changes within the return duct.

11. The combination with a blower having a suction pipe provided with refrigerating means, means for feeding divided material into the suction pipe between the refrigerating means and the blower, said material feeding means including means for excluding air from the material fed, a separating chamber, an outlet duct leading from the blower to the separating chamber, a return duct leading from a separating chamber to the suction pipe, means provided in the upper portion of the separating chamber for the removal of air therefrom and means positioned in the lowermost portion of the chamber for removal of solid material, and temperature responsive means disposed within the return duct and operatively connected with the air removal

means whereby air removal from the separator is controlled in response to temperature changes within the return duct.

12. A device of the character described having in closed circuit relation, a cooling chamber, a blower, and a separator, a quantity of dry gas within the circuit, means for introducing an inert gas into the circuit from an outside source, means for feeding finely divided food into the gas during its passage from the air cooler into the separator, said feeding means including means for excluding air from the material fed into the gas, and temperature responsive means within the circuit and spaced from said metering means to control both the rate of food delivery and the rate of inert gas introduction into the system in accordance with temperature changes in the circuit.

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