(54) Title: IMPROVEMENTS RELATING TO THE CONDITIONING OF COMMINUTED MATERIALS

(57) Abstract

The invention provides that tea is handled, after it has been delivered from the tea estates, in containers (tote bins) which are continuously or periodically flushed with an inert gas, such as nitrogen, so that the tea can be stored in a fresh condition until ready to be packaged for sale to the consumer. Blending is enhanced in that large storage bins containing different types of tea and conditioned by the inert gas as described can be operated to discharge respective portions of tea to be blended to provide a desired tea blend. The said blending and purging can be carried out automatically and can be pre-programmed.
FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT Austria
AU Australia
BB Barbados
BE Belgium
BF Burkina Faso
BG Bulgaria
BJ Benin
BR Brazil
CA Canada
CF Central African Republic
CG Congo
CH Switzerland
CI Côte d'Ivoire
CM Cameroon
CS Czechoslovakia
DE* Germany
DK Denmark
ES Spain
FI Finland
FR France
GA Gabon
GB United Kingdom
GN Guinea
GR Greece
HU Hungary
IT Italy
JP Japan
KP Democratic People's Republic of Korea
LU Luxembourg
MC Monaco
MG Madagascar
ML Mali
MN Mongolia
MR Mauritania
MW Malawi
NL Netherlands
NO Norway
PL Poland
RO Romania
SD Sudan
SE Sweden
SN Senegal
SU* Soviet Union
TD Chad
TG Togo
US United States of America

* Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.
Improvements Relating to the Conditioning of Comminuted Materials

This invention relates to the conditioning of comminuted particulate materials of the type used for the production of beverages or food stuffs for human consumption, and in particular concerns the conditioning of tea when in comminuted form as sold directly to the public in packets and tea bags and the like, and to apparatus for storing the tea under inert conditions. Although the invention has particular application to tea, and although reference will be made to hereinafter only to tea in the interests of simplicity of description, the applicants appreciate that perhaps the invention may be applied to other comminuted particulate materials such as coffee, herbs, powdered milk and other powdered materials.

As explained in our co-pending patent application No 9012289.6, the process involved from the picking of tea leaves in the plantation where tea is grown, until the tea is packaged for supply to the consumer, comprises the processing of the leaf into comminuted form at the plantation, and various process steps at the plantation including the drying of the tea. The comminuted and dried tea is then packaged in large transport containers in the form of bags and/or boxes and these bags and/or boxes are shipped from the plantation to the blender and packager who blends different teas to produce the end product which is packaged into the familiar containers and tea bags which are sold on supermarket shelves.

Research which we have conducted has shown that the comminuted tea undergoes an oxidative reaction when left exposed to normal atmosphere, and that this oxidative reaction causes reduction of freshness quality during storage
as mentioned in our said co-pending patent application.

It is therefore, according to our research, desirable that as much as possible, the length of time which the tea, from when it is picked in leaf form, until it is packaged in high barrier hermetically sealed packs, for example as described in our co-pending patent application No 9012289.6, is in contact with the atmosphere, should be as short a period as possible.

A basic inventive concept provides therefore that, as specifically applied to tea, steps should be taken to ensure that from the time the leaf is picked, the tea should suffer minimum exposure to the atmosphere until such times as it is placed in high barrier hermetically sealed packs for sale to the consumer.

As outlined in our said co-pending application, at the plantation it is proposed that the dried and comminuted tea should be placed in high barrier hermetically sealable bags, but it is to be expressed herein, that these bags may be replaced by other high barrier hermetically sealable containers. In the said application certain steps must be taken to prevent contact between oxygen and the tea after the tea has been placed in said high barrier hermetically sealed bags at the plantation, and the means described is that the air should be extracted from the bag and/or the bag should be filled with an inert gas such as nitrogen, and/or the bags should contain an oxygen scavenging device which extracts oxygen from the atmosphere inside the high barrier hermetically sealed bag, or other container. It is proposed that additional or alternative means may in fact comprise the utilisation of an agent which is an antioxidant, by which the tea may be treated prior to insertion in the high barrier hermetically sealed container, or which may be introduced
into the container with the tea. Indeed, it is preferred that any means of preventing the oxidative reaction of the tea during the transit from the plantation until the high barrier hermetically sealed container is eventually opened at the location of the blender, be employed.

Our co-pending patent application No 2228912 discloses that when the tea has been blended, it is packaged in high barrier hermetically sealed packs for sale to the consumer. If deterioration of the tea due to the said oxidation has been prevented until the tea is placed either directly into said high barrier hermetically sealed packs or in tea bags which are placed into said high barrier hermetically sealed packs, and the packs are sealed, then the freshness quality of the tea will be retained, until the pack is opened by the consumer, but it is also desirable that the oxidation reaction should be prevented between the time when the blender receives the high barrier hermetically sealed containers from the plantation and when the tea is finally placed in the high barrier hermetically sealed packs. This requirement is considerable, because usually the blender will prepare tea blends in large batches e.g. of the order of 2 tons, and it may take several days to package such a batch of tea either into bags or other consumer containers so that the blended tea will in fact have a long standing time in the blender's warehouse. If it is exposed to the atmosphere during this period, and has not previously been so exposed, then the said oxidative reaction will occur to the detriment of the freshness quality of the tea. It has not yet been ascertained with sufficient accuracy as to the period during which the tea must be exposed to the atmosphere before the oxidative reaction is sufficient significantly to reduce the freshness quality. Ensuring that there minimum time is between the breaking open of the containers received from the plantation, and the placement of the tea in high barrier
hermetically sealed consumer packs, is therefore of importance to ensure that the consumer receives the freshest possible product.

The present invention seeks to provide a method for meeting the requirement of maintaining of the condition of the tea between opening of the container received from the plantation until placement of the tea in high barrier hermetically sealed consumer packs, and in accordance with the method of the invention, the tea either unblended or blended, is stored in containers from which the air is displaced by means of an inert gas, and the containers are sealed except to the extent that inert gas can be charged continuously or periodically into the container head space and is also capable of escaping therefrom, in order to prevent ingress of air into the container head space.

Preferably, the container is of a type having an outlet in the base thereof, such outlet being controllable by a valve to enable the tea to be discharged therefrom, when it is to be consumed for example by being placed either directly into high barrier hermetically sealed containers for distribution to the consumer, or into tea bags which are subsequently inserted in high barrier hermetically sealed containers for distribution to the consumer.

Each such container preferably is in the nature of what is known as a "tote bin" which is a box like container having a base of frusto-conical or pyramidal form leading to a central outlet pipe containing the said valve. The top of the container is closed but has a removable circular lid which sealingly engages a lid seat. The lid can be removed for the charging of the tea thereinto.

Tote bins are adapted to be used by being supported on gantry
frames located above feed devices for feeding tea discharged from the bins to the machines which portion and package the tea into consumer containers.

Each said tote bin preferably has a purging inlet for the inert gas at the top end thereof, and a purging relief valve which allows the gas inserted through the purging inlet to pass through the purging relief valve. At the top of the bin there may also be a pressure relief valve to relieve pressure inside the bin when it exceeds the first predetermined level, and the top of the bin may furthermore include a burst disc or a second pressure relief valve which is designed to operate at a second and higher predetermined level. The purge valve is preferably designed so that it will allow escape of the purging gas at all times but prevents ingress of air into the head space at times when purging is not taking place.

When the tea is charged into the bin, it is preferably charged into an atmosphere inside the bin which is made up of inert gas. To achieve the flooding of the bin with inert gas, the base of the bin may be provided with inlet devices enabling the charging of inert gas into the base of the bin to flood same and to displace air from the bin. Said flooding inlets may comprise sintered metal plates spaced around the frusto-conical base, and respectively connected to a gas flooding source.

The gas which is used for flooding the bin and for purging preferably is nitrogen but equivalent inert gases may also be used.

The specific embodiment of the invention provides the advantage that the tea is held in tote bins in an inert atmosphere, and furthermore by the purging of the tops of the
bins above the level of tea therein, any contact between the tea and the atmosphere is avoided, or the risk of contact is minimised, and the tea can be stored for long periods under these conditions until use of same is required.

As to the rate or frequency of purging, this may be done on a programmed and timed basis, or alternatively purging can take place on a continuous basis, provided the rate of flow of inert gas through the purging valve is not too high. Although once the tea containers from the estate have been opened and the tea blended, it is unlikely in practice to be more than several days before the tea is eventually packaged in the consumer packs, the present invention also provides an opportunity for a slightly different method of handling tea in that because of the maintenance of the tea in a condition whereby the oxidative reaction is avoided, when tea types are received from the plantation or plantations, the containers from the plantation may be opened immediately, and the tea types stored in large tote bins under the conditions envisaged in the present invention, and tea can be withdrawn from these bins on an on-demand basis to make up any particular blend of tea as may be required. With this arrangement, the tea types may be stored in the respective large tote bins or silos for long periods, without any sacrifice of freshness quality of the tea.

According to another aspect of the invention therefore tea types are maintained in respective containers and from which portions may be withdrawn at will to provide tea blends, and the tea is maintained in such containers in the manner hereinbefore described in order to limit or prevent the said oxidation reaction.

It will be appreciated from the foregoing that the invention has specific application to tea in particular, but it is not
intended that the invention should be limited in particular to tea but that it should also apply to other materials, such as herbs, coffee, which can be handled and treated in similar fashion for similar reasons.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, wherein;

Fig. 1 is a side view illustrating the conventional method of handling comminuted tea;

Fig 2 is a side elevation of a container according to and for use in the method of the present invention;

Fig 3 is a plan view of the container shown in Fig. 2;

Fig 4 is a side view showing utilization of the container of Figs 2 and 3.

Referring to the drawings, the firstly to Fig 1, in a tea blending and packaging factory conventionally comminuted tea is delivered from a conventional storage assembly 16, 18, 20, 22 to be described, to conventional delivery apparatus 10 which propels the tea through for example outlets such as pipes 12, as indicated by arrows 14 to for example a tea bag filling machine or a machine for delivering batches of tea to consumer containers.

The bulk of the tea, which may be in blended form is held suspended in a large fabric container 16 having an outlet 18 leading to an intermediate hopper 20.

The intermediate hopper 20 is provided with a control valve 22 to control the flow of tea from the container 16 to hopper
20 and to the apparatus 10.

The container 16 in being a fabric allows ingress of air into the bulk of the tea, and therefore the oxidative reaction referred to herein can and does take place if the tea has not previously been exposed to the atmosphere and if it is left standing for any length of time which in practise is inevitable. In any event, the apparatus as illustrated in Fig 1 may have down time and the tea may be therefore held in storage in this equipment whilst it is not running. During this time it is exposed to the atmosphere with a possible loss of freshness quality of same as described herein.

In accordance with the present invention, the contact between the atmosphere and the tea is minimised in that the bulk comminuted tea is stored in a storage bin or container (tote bin) of which an embodiment is shown in Fig 2 and 3.

Referring to Fig 2, the storage bin comprises essentially a body having a square section 24 and a pyramid base 26. At the apex of the pyramid of the base there is an outlet 28 which leads to a control valve 30 which can be opened and closed to control the flow of the tea out of the outlet 28 as will be explained hereinafter.

The top of the container 24 is sealed by means of closure plate 32, said closure plate having an inlet aperture 34 which is closed by means of a dished lid 36 having a handle 38. The lid 36 furthermore has locking arms 40,42 which engage in locking plates 44 when the lid is inserted and turned, the arms and plates coming together with a wedging action in order firmly to press the lid 36 into hermetic sealing engagement with the inlet 34.

The plate 32 furthermore is provided a with pressure burst
disc assembly 46 or a second and higher set pressure relief valve.

Additionally, at the top of the container is provided a quick release inlet 48 with check valve for the coupling of the interior of the top of the container to a supply of inert gas such as nitrogen and for preventing loss of internal pressure. Also included is a pressure gauge 50 for reading the pressure of the nitrogen inside the container, and pressure relief valve 52 for releasing excess internal pressure should the need arise.

Additionally, as shown in Fig 3, at the opposite side of the container is a purge release valve 54 which, when nitrogen is being supplied to the top of the container, allows the nitrogen to leak through the purge valve 54 to atmosphere.

At the pyramid base 26 and on the faces thereof are provided sintered metallic purge plates 56 through which inert gas such as nitrogen can be fed by means of conduits 58 connected thereto and located outside the container, said conduits 58 being coupled to a manifold 60 having a quick release coupling 62 with check valve for connection to the supply of inert gas. The manifold preferably comprises a base ring which supports and strengthens the pyramid base 26.

Each of the sides of the box section 24 is provided with a horizontal support rail 64 by which the container can be supported in a suspended fashion on a gantry frame 66 having feet 68. The frame serves also to support the container body which is pressurised, against explosion and bursting, and also has guide channels 70 for receipt of the forks of a fork lift truck, so that the assembly shown Fig 2 can be raised and moved into position as required.
In use the container shown in Figs 2 and 3, it is used as a storage and delivery bin for the comminuted tea, but before the tea is placed therein, nitrogen is flooded through the plates 56 in order to displace all the air from the inside of the container, the lid 36 of course being open during this operation. When the container has been thus flooded, the tea is charged into same. The operations are sequenced so that the high barrier hermetically sealed containers received from the plantation in which the tea is contained are not opened until tea is to be blended and charged into the tote bins. As soon as the tote bin has been filled, the lid 36 is sealed closed and the quick release coupling 62 disconnected. The sealed tote bin may then be transported from the filling station to a dispensing area or more usually to a storage area. In either case, the head space in the container may then be purged with nitrogen supplied through by connecting the quick release coupling to coupling 48, the nitrogen bleeding through the purge valve 54 during this operation. This purging of the head space may take place continuously, or it may be performed at random or fixed intervals under automatic control and it preferably is pre-programmed. The presence of the nitrogen prevents the atmosphere coming into contact with the stored tea. When a stored bin is to be moved to the dispensing area, the quick release connection is de-coupled and the bin moved to the dispensing area, wherein the bin is used as described in relation to Fig. 4.

The tea which is charged into the tote bin may be a blend, or it may be a tea type which is to be blended with other types.

Fig 4 shows how the tote bin of Figs 2 and 3 is used, and it will be seen that it is positioned in place of the fabric sack 16 in the Fig 1 embodiment. The top of the bin can be purged with nitrogen or other inert gas whilst it is in the position shown in Fig 4, or whilst it is generally being
stored as illustrated by Fig 2, but during dispensing, valve 30 is open as is lid 36.

The Fig 4 arrangement will apply mainly where the tea stored in the bin 24, 26 is a blend and is to be directed to the packaging machines, but in the case where the tea is of a particular type to be blended with other types, the bin may be arranged to be coupled to a blending machine along with other similar bins but containing different types of tea so that the blender can extract from each bin as required to produce the appropriate blend. With this arrangement, the bins can be much larger and can store larger quantities of tea types. Blending in this way can be made pre-programmable and automatic.

It can be seen that the invention provides an extremely effective method for preserving the freshness quality of tea and taken in conjunction with the other precautionary measures for maintaining freshness quality i.e. (i) enclosing the tea in high barrier hermetically sealed containers at the plantation, (ii) discharging the tea directly from these containers into bins such as illustrated in Figs 2 and 3 as soon as the plantation containers are opened, and (iii) containing the tea under inert gas conditions until it is inserted in the high barrier hermetically sealed consumer packages, provides an overall system which results in tea freshness quality being maintained to the maximum extent.
CLAIMS

1. A method of preserving tea, wherein steps are taken to ensure that from the time the tea is picked, the tea suffers minimum exposure to the atmosphere until such times as it is placed in high barrier hermetically sealed packs for sale to the consumer.

2. A method of preserving tea, the tea either being unblended or blended, wherein the tea is stored in containers from which the air is displaced by means of an inert gas, and the containers are sealed except to the extent that inert gas can be charged continuously or periodically into the container head space and is also capable of escaping therefrom, in order to prevent ingress of air into the container head space.

3. A method according to claim 2 wherein the container is of a type having an outlet in the base thereof, such outlet being controllable by a valve to enable the tea to be discharged therefrom, when it is to be consumed for example by being placed either directly into high barrier hermetically sealed containers for distribution to the consumer, or into tea bags which are subsequently inserted in high barrier hermetically sealed containers for distribution to the consumer.

4. A method according to claim 3, wherein the or each container is in the nature of what is known as a "tote bin" which is a box like container having a base of frusto-conical or pyramidal form leading to a central outlet pipe containing the said valve.

5. A method according to claim 4, wherein the top of the container is closed but has a removable circular lid which
sealingly engages a lid seat.

6. A method according to claim 5, wherein the lid can be removed for the charging of the tea into the container.

7. A method according to any of claims 4 to 6, wherein the tote bins are adapted to be used by being supported on gantry frames located above feed devices for feeding tea discharged from the bins to the machines which portion and package the tea into consumer containers.

8. A method according to any of claims 4 to 7, wherein the or each tote bin has a purging inlet for the inert gas at the top end thereof, and a purging relief valve which allows the gas inserted through the purging inlet to pass through the purging relief valve.

9. A method according to claim 8, wherein at the top of the bin there is a pressure relief valve to relieve pressure inside the bin when it exceeds the first predetermined level.

10. A method according to claim 9 wherein the top of the bin furthermore includes a burst disc or a second pressure relief valve which is designed to operate at a second and higher predetermined level.

11. A method according to claim 9, wherein the purge valve is designed so that it will allow escape of the purging gas at all times but prevents ingress of air into the head space at times when purging is not taking place.

12. A method according to any of claims 4 to 11, wherein when the tea is charged into the bin, it is charged into an atmosphere inside the bin which is made up of inert gas.
13. A method according to claim 12, wherein to achieve the flooding of the bin with inert gas, the base of the bin is provided with inlet devices enabling the charging of inert gas into the base of the bin to flood same and to displace air from the bin.

14. A method according to claim 13, wherein said flooding inlets comprise sintered metal plates spaced around the frusto-conical base, and respectively connected to a gas flooding source.

15. A method according to claim 12, 13 or 14, wherein the gas which is used for flooding the bin and for purging is nitrogen.

16. A method according to any preceding claim wherein the container is periodically purged, and as to the rate or frequency or purging, this may be done on a programmed and timed basis.

17. A method according to any of claims 1 to 4, wherein purging takes place on a continuous basis.

18. A method of storing tea, wherein tea types are maintained in respective containers and from which portions may be withdrawn at will and mixed to provide tea blends, and the tea is maintained in such containers in the manner according to any one of the preceding claims to limit or prevent the said oxidation reaction.

19. A container for storing tea under inert conditions for use in the method according to any one of the preceding claims.
## INTERNATIONAL SEARCH REPORT

### I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC

<table>
<thead>
<tr>
<th>Int.Cl.</th>
<th>Symbol(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>A23F/06;</td>
</tr>
<tr>
<td></td>
<td>B65D88/74;</td>
</tr>
<tr>
<td></td>
<td>A23L3/3418</td>
</tr>
</tbody>
</table>

### II. FIELDS SEARCHED

**Minimum Documentation Searched**

<table>
<thead>
<tr>
<th>Classification System</th>
<th>Classification Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int.Cl. 5</td>
<td>A23F; B65D; A23L</td>
</tr>
</tbody>
</table>

**Documentation Searched other than Minimum Documentation**

To the extent that such documents are included in the Fields Searched

### III. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of Document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to Claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>WORLD PATENTS INDEX Section Ch, Week 42, 1971 Derwent Publications Ltd., London, GB; Class D, AN 71-67777S &amp; JP,A,46 036 175 (KYOEI SEICHA) 6 July 1968 see abstract</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>WORLD PATENTS INDEX LATEST Section Ch, 1983 Derwent Publications Ltd., London, GB; Class D, AN 83-38742K &amp; SU,A,935 057 (CHAIPROM TEA) 15 June 1982 see abstract</td>
<td>1,2</td>
</tr>
<tr>
<td>X</td>
<td>NL,C,73 625 (A.M.H.BAKE) 16 November 1953 see claims 1-3 see column 1, line 1 – line 38</td>
<td>1,2</td>
</tr>
</tbody>
</table>

*Special categories of cited documents:*

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means by the applicant or patentee
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

### IV. CERTIFICATION

**Date of the Actual Completion of the International Search**

03 FEBRUARY 1992

**Date of Mailing of this International Search Report**

14 FEB 1992

**International Searching Authority**

EUROPEAN PATENT OFFICE

**Signature of Authorized Officer**

Form PCT/ISA/210 (second sheet) (January 1993)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of Document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to Claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US,A,4 535 586 (J.W.EBERLE) 20 August 1985 see claims 1,2 see column 1, line 1 - column 2, line 54 see column 3, line 9 - line 68</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>B.E.RIPP 'Controlled Atmosphere and Fumigation in Grain Storage' 1984 , ELSEVIER , AMSTERDAM, NETHERLANDS see page 523 - page 529 see page 699 - page 701</td>
<td></td>
</tr>
</tbody>
</table>
This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 03/02/92.

<table>
<thead>
<tr>
<th>Patent document</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>NL-C-73625</td>
<td></td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>US-A-4535586</td>
<td>20-08-85</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

For more details about this annex: see Official Journal of the European Patent Office, No. 12/82.