Title: EXTRACTING ESSENTIAL OILS AND VOLATILE WATER

Abstract: A system and method are provided for extracting essential oils and volatile water from organic material. The system comprises a gas passage arranged and configured for passing a gas from a condenser to a pump, the pump for pumping the gas to a heating unit for heating the gas. The system further comprises a container for containing the material, the container being configured for allowing contact between the heated gas and the material so as to produce a vapor. The system further comprises a condenser being configured to cool the vapor to a condensation point so as to produce a condensed liquid, wherein the condenser comprises a chamber arranged and configured for providing the gas to the gas passage. The system further comprises a separating unit in liquid communication with the condenser to collect the condensed liquid and separate the essential oils and volatile water.
Description

Title of Invention: EXTRACTING ESSENTIAL OILS AND VOLATILE WATER

Technical Field

[0001] The invention relates to a system and a method for extracting essential oils and volatile water from organic material.

Background Art

[0002] Essential oils and volatile water of an organic material may have several industrial and health applications. For example, they may be used in perfumes, cosmetics, soaps and other products such as flavoring food and drink, and for adding scents to incense and household cleaning products. Essential oils and volatile water may have other applications including medical applications such as skin treatments or remedies for cancer and other diseases. Essential oils and volatile water are generally extracted by distillation, often by using steam. Steam distillation generally involves boiling water to produce steam and then bubbling the steam through a material.

[0003] CN103740468 A describes a steam distillation aromatic essential oil equipment. The equipment comprises a distillation kettle, a complex distillation column, a goose neck pipe, a cooler and an oil-water separator, wherein a double-layer hollow steam coil pipe is horizontally and fixedly arranged at the bottom in the kettle body of the distillation kettle; the inner pipe of the double-layer hollow steam coil pipe is connected with steam outlet pipes which are distributed annularly and are communicated with the inner pipe of the double-layer hollow steam coil pipe and penetrate through the outer pipe of the double-layer hollow steam coil pipe in a liquid sealing way.

Summary of Invention

[0004] It would be advantageous to have a system or method for a more effective extracting of essential oils and volatile water from organic material.

[0005] To better address this concern, a first aspect of the invention provides a system for extracting essential oils and volatile water from organic material, the system comprising: a gas passage arranged and configured for passing a gas from a condenser to a pump, a pump for receiving the gas from the gas passage and pumping the gas to a heating unit, a heating unit configured to receive the gas from the pump and heat the gas to generate a heated gas, a container for containing the material, the container having an inlet and an outlet, the inlet being coupled to the heating unit for receiving the heated gas, the container being configured for allowing contact between the heated gas and the material so as to produce a vapor, a condenser coupled to the outlet of the container to receive the vapor and the heated gas, the condenser being configured to
cool the vapor to a condensation point so as to produce a condensed liquid, wherein the condenser comprises a chamber arranged and configured for providing the gas to the gas passage, a separating unit in liquid communication with the condenser to collect the condensed liquid and separate the essential oils and volatile water.

The above measures involve a gas passage arranged and configured for passing a gas from a condenser to a pump. The gas passage may be, for example, a pipe. The passage may be directly or indirectly connected to the pump and to the condenser.

The above measures further involve a pump for receiving gas from the gas passage and pumping the gas to a heating unit. The pump may be any pump suitable for pumping a gas. For example the pump may be an air pump.

The above measures further involve a heating unit configured to receive the gas from the pump and heat the gas to generate a heated gas. The heating unit may be, for example, a heat exchanger. The heat exchanger may be any type of heat exchanger suitable for heating a gas, for example a double pipe heat exchanger or a shell and tube heat exchanger, etc.

The above measures further involve a container for containing the material. The container may be, for example, a vessel made of suitable metal or glass.

The above measures further involve a condenser having a chamber for providing the gas to the gas passage. The condenser may be a shell and tube. The condenser may comprise a gas separator to efficiently separate the gas from the volatile.

The above measures further involve a separating unit in liquid communication with the condenser to separate and remove the essential oils and volatile water from the condensed liquid. The separating unite may be any separating apparatuses suitable for separating water and oil. For example, the separating unit may be a pressure vessel or a centrifugal water-oil separator, etc.

The invention is based on the insight that raw organic materials, such as herbs and plant materials, themselves often have nearly 70-90 percent of water. Such water content is sufficient to evaporate volatile components of the raw materials. Therefore, there may be no need and it may not be energy efficient to boil water of an external water source to produce steam flow for use in an extraction processes as it is common in distillation-based essential oils and distilled water extraction devices and methods. Furthermore, when contacting the material, the steam is generally mixed with the vapor of the material which may influence a quality of the extracted volatile water or essential oil. Moreover, extra energy is generally wasted in a condensing unit to separate the essential oil from the mixture of steam and material vapor. It is an insight of the inventor that it is more effective and efficient to provide a system wherein a heated gas is pumped and circulated within the system. As such, the system may be a closed system with a circulating gas compared to an open energy wasting steam
system. It is noted that pressure and temperature may be accurately regulated at
different places in the system which may enhance the efficiency of the system and
quality of the essential oil product.

[0013] Optionally, the system further comprises an evaporator, the evaporator being
arranged and configured for receiving the volatile water from the separating unit,
producing water vapor and supplying the water vapor to the inlet of the container. The
evaporator may perform evaporation function based on a thermal, mechanical and/or
electromechanical process. Humidify the heating gas may increase a medium mass
transfer effectiveness. This is advantageous in enhancing efficiency of the system and
reducing energy consumption. The volatile water may be supplied to the evaporator
with a mechanical pressurizing system e.g. a water pump or using gravitational force.

[0014] Optionally, the system further comprises a fluid source containing a fluid and the
evaporator is further arranged and configured for receiving the fluid from the fluid
source, producing a supplementary vapor from the fluid and supplying the sup-
plementary vapor to the inlet of the container. Humidify the heating gas may increase a
medium mass transfer effectiveness. This is advantageous in enhancing efficiency of
the system and reducing energy consumption. The fluid may be supplied to the
evaporator with a mechanical pressurizing system e.g. a water pump or using gravita-
tional force. The fluid is selected from one or more of a group comprising water and
a volatile solvent.

[0015] Optionally, the heating unit is configured to heat the gas up to 500 degree Celsius.

[0016] Optionally, the heating unit is configured to heat the gas to a first temperature and
then to a second temperature, the first temperature being greater than the second tem-
perature.

[0017] Optionally, the first temperature is less than 250 degree Celsius and the second tem-
perature is greater than 50 degree Celsius.

[0018] Optionally, the pump is configured to adjust a pressure of the gas and thereby adjust
a pressure of the container in a range between -250 mbar to 500 mbar.

[0019] Optionally, the system further comprises a compressor being coupled to at least one
of the pump and the container, and being in an adjustable gas communication with the
at least one of the pump and the container so as to regulate a pressure of the gas in the
gas container.

[0020] Optionally, the separating unit comprises a first vessel for collecting the essential oils
and a second vessel for collecting the volatile water.

[0021] Optionally, the gas is selected from at least one from a group of air, deoxygenated
air, Helium or Nitrogen.

[0022] Optionally, the container comprises a mesh plate arranged in the container to hold the
material and, a cap for opening and closing the container, the cap being movably
arranged at a top of the container.

[0023] Optionally, the system further comprises a linkage system arranged and configured for enabling a rotation of the container about a pivot point coupled to a base of the container such that the container rotates from a vertical direction towards a horizontal direction, the linkage system having a first member and a second member, the first member being joint to the second member and the pivot point, the second member being joint to the cap, wherein a rotation of the first member results in movement of the second member and thereby simultaneously rotates the container and opens the cap.

[0024] In a further aspect of the invention, a method is provided for extracting essential oils and volatile water from organic material, the method comprising, receiving gas from a gas passage, pumping the gas to a heating unit, heating the gas to generate a heated gas, contacting the heated gas with the material so as to produce a vapor, cooling the vapor to a condensation point so as to produce a condensed liquid, providing the gas to the gas passage, collecting the condensed liquid and separating the essential oils and volatile water.

[0025] It will be appreciated by those skilled in the art that two or more of the above-mentioned embodiments, implementations, methods, and/or aspects of the invention may be combined in any way deemed useful.

[0026] Modifications and variations of the system, which correspond to the described modifications and variations of the system, can be carried out by a person skilled in the art on the basis of the present description.

**Brief Description of Drawings**

[0027] These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiments described hereinafter. In the drawings,

**Fig.1**

[0028] [fig.1] shows a system for obtaining essential oils and volatile water from organic material.

**Fig.2**

[0029] [fig.2] shows a system for obtaining essential oils and volatile water from organic material.

**Fig.3**

[0030] [fig.3] shows a system for obtaining essential oils and volatile water from organic material.

**Fig.4a**

[0031] [fig.4a] shows a container in a vertical position with a cap at the top of the container.

**Fig.4b**
[0032]  [fig.4b] shows a container being rotated and opened via a linkage system.

Fig.5

[0033]  [fig.5] shows a method for obtaining essential oils and volatile water from organic material.

**Description of Embodiments**

[0034]  Fig. 1 shows a system 10 for obtaining essential oils and volatile water from organic material. The system comprises a gas passage 011 arranged and configured for passing a gas 01 from a condenser 015 to a pump 012. The system 10 further comprises a pump 012 for receiving the gas from the gas passage and pumping the gas to a heating unit. The system 10 further comprises a heating unit 013 configured to receive the gas 01 from the pump 012 and heat the gas 01 to generate a heated gas 03. The system 10 further comprises a container 014 for containing the material, the container 014 having an inlet and an outlet, the inlet being coupled to the heating unit 013 for receiving the heated gas 03, the container being configured for allowing contact between the heated gas 03 and the material so as to produce a vapor 04. The system 10 further comprises a condenser 015 coupled to the outlet of the container 014 to receive the vapor 04 and the heated gas 03, the condenser 015 being configured to cool the vapor 04 to a condensation point so as to produce a condensed liquid 05; wherein the condenser 015 comprises a chamber arranged and configured for providing the gas 01 to the gas passage 011. The system 10 further comprises a separating unit 016 in liquid communication with the condenser 015 to collect the condensed liquid 05 and separate the essential oils and volatile water. It is noted that the heated gas 03 is the gas 01 which is heated by the heating unit 013.

[0035]  Fig. 2 shows a system 50 for obtaining essential oils and volatile water from organic material 058. The system 50 comprises a gas passage 052, a pump 054, a heat exchanger 056, a container 060, a condenser 064 with a chamber 065 and a separator 066. The container 060 may comprise an opening 061 for loading and unloading of the material 058. The container 060 may further comprise a mesh plate 070 at a bottom of the container 060 to hold the materials 058. The container 060 may be wrapped with a heating jacket or similar means to maintain its temperature or to heat the material inside the container in an efficient manner. A wall of the container 060 may be heated with any kind of heat source such as solar energy, electric power and/or with a flow of a heating fluid. The container 060 may comprise a heat source inside the container to further heat the material. The heat source inside the container 060 may comprise Ohmic heating element or an infrared, ultrasound or a microwave generator.

[0036]  The system 50 may comprise a plurality of pipe lines, e.g. pipe lines 55, 57, 62, to connect components of the system 50. The system 50 may further comprise a plurality
of valves 059, 067, 031, 032, 038, 049, 041, 045, 058, 049, to open and close different pipe lines of the system 50. The system 50 may further comprise valves, for example, to regulate the pressure inside the container 060, condenser 064 and at a suction line of the pump 054. The condenser 064 may comprise inlet 072 and an outlet 073 for allowing a flow of a cooling fluid. The gas 053 may flow in the gas passage 052 from an opening of the chamber 065 of the condenser 064 to a suction line of the pump 054. The system 50 may further comprise measuring means such as pressure gauges, temperature sensors and humidity sensors to control an extraction process.

Fig. 3 shows a system 300 for obtaining essential oils and volatile water from organic material. The system 300 comprises a container 360, a condenser 364, a separator 368, a first vessel for essential oils 366, a second vessel for volatile water 339, an evaporator 344, an air pump 354 and a heat exchanger 356. The system 300 further comprises a plurality of valves 331, 332, 338, 340, 341, 342, 345, 348, 349, 358 being arranged and configured to open, close and/or partially open different pipe lines of the system 300. The system 300 further comprises a separator 368 being arranged and configured for receiving condensed materials 333 from the condenser 364, and to separate the condensed materials 333 into essential oils 330 and volatile water 337. The separator 368 is designed so as to equalize the pressure using a pipeline 336. The system 300 further comprises an essential oil vessel 366. The vessel 366 receives essential oils from the separator 368. The system 300 further comprises a volatile water vessel 339 arranged and configured for receiving the volatile water 337 from the separator 368, being emptied from pipe line 371, and optionally supply water for evaporator 344 using a pipe line 363. The system 300 further comprises an evaporator 344, the evaporator 344 being arranged and configured for receiving volatile water from the volatile water vessel 339 or for receiving pure water from an external water supply 351, for producing water vapor, and supplying the water vapor to an inlet of the heat exchanger 356, wherein the heating unit 356 is configured to receive the gas from the pump 354 and supply the heated gas 357 to the container 360. The system 300 further comprises a one way check valve 346 to block a reverse gas flow from the heat exchanger 356 into the evaporator 344. The system 300 further comprises a pipe line 347 to circulate the gas-vapor mixture between the container 360 and the heat exchanger 356 to cook the plant materials efficiently. The system 300 further comprises pipe lines 362, 347, 369, 335, 333, 330, 337, 334, 353, 355, 357, 351, 343, 363, 371, to connect different parts of the system 300. The system 300 further comprises a condenser 364 comprising an inlet 372 and outlet 373 for coolant fluid, an inlet 369 to receive gas-vapor mixture from container 360 and outlets 333 and 335 for condensates and dehumidified gas respectively. The condenser 364 receives the volatile vapors 362, 369 from container 360 and condenses the volatile materials 333.
The condenser 364 may comprise of a gas separator (not shown) to efficiently separate volatile materials from a vapor-gas mixture. The system 300 further comprises a passage 335 to receive the dehumidified gas from the condenser 364. The system 300 further comprises a gas pump 354 to circulate the gas and/or gas-vapor mixture. The system 300 further comprises a container 30, the container comprising a space for organic material, a mesh plate (not shown) to keep plant material, an inlet to receive heated gas 357 from heat exchanger 356 and an outlet to send the gas-vapor mixture to a recycling line 347 for further cooking and/or to the condenser 367 to produce volatile material 333.

Fig. 4a shows a container 405 in a vertical position with a cap 401 at the top of the container 405. Fig. 4b shows the container 405 being rotated and opened via a linkage system 410. The linkage system 410 arranged and configured for enabling a rotation of the container 405 about a pivot point 440 coupled to a base of the container 405 such that the container 405 rotates from a vertical direction towards a horizontal direction, the linkage system 410 having a first member 420 and a second member 430, the first member 420 being joint to the second member 430 and the pivot point 440, the second member 430 being joint to the cap 401, wherein a rotation of the first member 420 results in movement of the second member 430 and thereby simultaneously rotates the container 405 and opens the cap 401. It is noted that the second member 430 of the linkage system 410 may further comprise a mechanism (not shown) for enabling it to be shorten so as to fasten and seal the cap 401 of the container 405. Additionally, the linkage system 410 may be equipped with a hydraulic and/or electric actuator (not shown) to automatically perform a rotation of the container 405.

It is also noted that it may be advantageous to increase gas pressure in the container. This may improve efficiency of the system. The system described above may further comprise a compressor to pressurize the gas. The compressor may be arranged and configured to receive the gas from the pump and supply the pressurized gas to the container so as to increase the gas pressure in the container.

It is further noted that the system described above may further comprise a pipe line to connect a top of the container to a pump suction line avoiding the humid gas flow into the condenser. Such arrangement may be configured such that a cooking step is accomplished and the material releases its essential oils before a condensation step begins.

It is further noted that the condenser may be cooled with coolant water, coolant air or with other cooling systems such as any kind of heat pumps.

It is noted that the system may comprise a control unit, controllable proportional valves and sensors to automatically control process parameters e.g. temperature, pressure, flow, humidity, etc.
It is noted that the system is arranged and configured to receive essential components from essential oil vessel and/or volatile water vessel and perform some additional distillation and chromatographic steps to separate the components of essential oils and/or volatile materials.

Fig. 5 shows a method 500 for obtaining essential oils and volatile water from organic material. The method 500 comprises receiving 510 gas from a gas passage, pumping 520 the gas to a heating unit, heating 530 the gas to generate a heated gas, contacting 540 the heated gas with the material so as to produce a vapor, cooling 550 the vapor to a condensation point so as to produce a condensed liquid, providing 560 the gas to the gas passage and separating 570 the essential oils and volatile water.

It is noted that the method described above may further comprise and optional step for circulating the gas-vapor mixture so as to cook the organic material. The method may further comprise an optional step whereby the gas is humidified with volatile water or with any pure water.

It is noted that the method described above may be configured so as to process the materials in various combinations of steps involving processing in lower temperatures, higher temperatures, lower pressures and higher pressures e.g. processing at a first step in a higher temperature and a higher pressure and then processing at a second step in a lower temperature and a lower pressure. Optionally, the method may involve reducing the pressure inside the container to reduce the boiling point of water and essential oils. Optionally, the method may involve increasing the pressure inside the container to effectively cook the material and split the texture of material. Optionally, the method may involve extracting essential oils from organic materials in atmospheric pressure. Optionally, the method may involve using a secondary volatile solvent e.g. acetone, hexane or ethyl acetate to efficiently extract the essential materials from organic materials.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or stages other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. In the device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.
Claims

[Claim 1] A system (10) for extracting essential oils and volatile water from organic material, the system (10) comprising:
- a gas passage (011) arranged and configured for passing a gas (01) from a condenser (015) to a pump (012);
- a pump (012) for receiving the gas (01) from the gas passage (011) and pumping the gas (01) to a heating unit (013);
- a heating unit (013) configured to receive the gas (01) from the pump (012) and heat the gas (01) to generate a heated gas (03);
- a container (014) for containing the material, the container having an inlet and an outlet, the inlet being coupled to the heating unit (013) for receiving the heated gas (03), the container (014) being configured for allowing contact between the heated gas (03) and the material so as to produce a vapor (04);
- a condenser (015) coupled to the outlet of the container (014) to receive the vapor (04) and the heated gas (03), the condenser (015) being configured to cool the vapor (04) to a condensation point so as to produce a condensed liquid (05), wherein the condenser (015) comprises a chamber arranged and configured for receiving the heated gas (03) and providing the gas (01) to the gas passage (011);
- a separating unit (016) in liquid communication with the condenser (015) to collect the condensed liquid and separate the essential oils and volatile water.

[Claim 2] The system according to claim 1, wherein the system further comprises an evaporator, the evaporator being arranged and configured for:
- receiving the volatile water from the separating unit;
- producing water vapor; and
- supplying the water vapor to the inlet of the container.

[Claim 3] The system according to claim 1, wherein the system further comprises an evaporator, the evaporator being arranged and configured for:
- receiving volatile water from the separating unit;
- producing water vapor; and
- supplying the water vapor to an inlet of the heating unit;
wherein the heating unit is further configured to receive the water vapor from the pump and supply the water vapor to the container.

[Claim 4] The system according to claims 2 or 3, wherein the system further comprises a fluid source containing a fluid and the evaporator is further
arranged and configured for:
- receiving the fluid from the fluid source;
- producing a supplementary vapor from the fluid; and
- supplying the supplementary vapor to the inlet of the container.

[Claim 5] The system according to claim 4, wherein the fluid is selected from one or more of a group comprising water and a volatile solvent.

[Claim 6] The system according to any of preceding claims, wherein the heating unit is configured to heat the gas to a temperature up to 500 degree Celsius.

[Claim 7] The system according to any of preceding claims, wherein the heating unit is configured to heat the gas to a first temperature and then to a second temperature, the first temperature being greater than the second temperature.

[Claim 8] The system according to claim 7, wherein the first temperature is less than 250 degree Celsius and the second temperature is greater than 50 degree Celsius.

[Claim 9] The system according to any of the preceding claims, wherein the pump is configured to regulate a pressure of the gas and thereby regulate a pressure of the container in a range between -250 mbar to 500 mbar.

[Claim 10] The system according to any of the preceding claims, wherein the system further comprises a compressor being coupled to at least one of the pump and the container, and being in an adjustable gas communication with the at least one of the pump and the container so as to regulate a pressure of the gas in the gas container.

[Claim 11] The system according to any of the preceding claims, wherein the separating unit comprises a first vessel for collecting the essential oils and a second vessel for collecting the volatile water.

[Claim 12] The system according to any of the preceding claims, wherein the gas is selected from at least one from a group of air, deoxygenated air, Helium or Nitrogen.

[Claim 13] The system according to any of the preceding claims, wherein the container comprises:
- a mesh plate arranged in the container to hold the material; and
- a cap for opening and closing the container, the cap being movably arranged at a top of the container.

[Claim 14] The system according to claim 13, wherein the system further comprises a linkage system arranged and configured for enabling a
rotation of the container about a pivot point coupled to a base of the container such that the container rotates from a vertical direction towards a horizontal direction, the linkage system having a first member and a second member, the first member being joint to the second member and the pivot point, the second member being joint to the cap, wherein a rotation of the first member results in movement of the second member and thereby simultaneously rotates the container and opens the cap.

[Claim 15] A method (500) for extracting essential oils and volatile water from organic material, the method (500) comprising:
- receiving (510) gas from a gas passage;
- pumping (520) the gas to a heating unit;
- heating (530) the gas to generate a heated gas;
- contacting (540) the heated gas with the material so as to produce a vapor;
- cooling (550) the vapor to a condensation point so as to produce a condensed liquid;
- providing (560) the gas to the gas passage; and
- separating (570) the essential oils and volatile water.
# INTERNATIONAL SEARCH REPORT

**International application No**

PCT/IB2015/055055

## A. CLASSIFICATION OF SUBJECT MATTER

**INV.** C11B9/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

## C. 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>GB 176 104 A (FRANCIS LAWRY USHER; EDWARD PARR METCALFE) 27 February 1922 (1922-02-27) cl aims; figures</td>
<td>1-15</td>
</tr>
<tr>
<td>X</td>
<td>CN 201 770 692 U (HONGFANG AROMATIC MATERIAL KUNSHAN CO LTD) 23 March 2011 (2011-03-23) cl aims; figures</td>
<td>1-15</td>
</tr>
<tr>
<td>A</td>
<td>CN 103 740 468 A (GUO YONGLAI) 23 April 2014 (2014-04-23) cl ted in the application the whole document</td>
<td>1-15</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 application or patent 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 invention

*O* document relating to an oral disclosure, use, exhibition or other means

*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 when the document is taken alone

*Y* document of particular relevance; the claimed invention cannot be considered novel or 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

*Z* document member of the same patent family

Further documents are listed in the continuation of Box C. X See patent family annex.

Date of the actual completion of the international search

22 February 2016

Date of mailing of the international search report

02/03/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentboulevard 2 NL - 2280 HV Rijswijk

Tel: (+52-70) 360-2040,  
Fax: (+52-70) 360-3046

Authorized officer

Vernier, Frederic
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB 176104</td>
<td>A</td>
<td>27-02-1922</td>
<td>NON E</td>
</tr>
<tr>
<td>CN 201770692</td>
<td>U</td>
<td>23-03-2011</td>
<td>CN 102212419 19 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CN 201770692 U 23-03-2011</td>
</tr>
<tr>
<td>CN 103740468</td>
<td>A</td>
<td>23-04-2014</td>
<td>NON E</td>
</tr>
</tbody>
</table>