



- (51) **International Patent Classification:**
A01F 25/16 (2006.01)
- (21) **International Application Number:**
PCT/MY2015/000104
- (22) **International Filing Date:**
29 December 2015 (29.12.2015)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
PI 2015704769 28 December 2015 (28.12.2015) MY
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- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, OA, RO, RS, RU, RW, SA, SC,

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- (54) Title:** WELL SILO FOR GREEN MATERIALS STORAGE

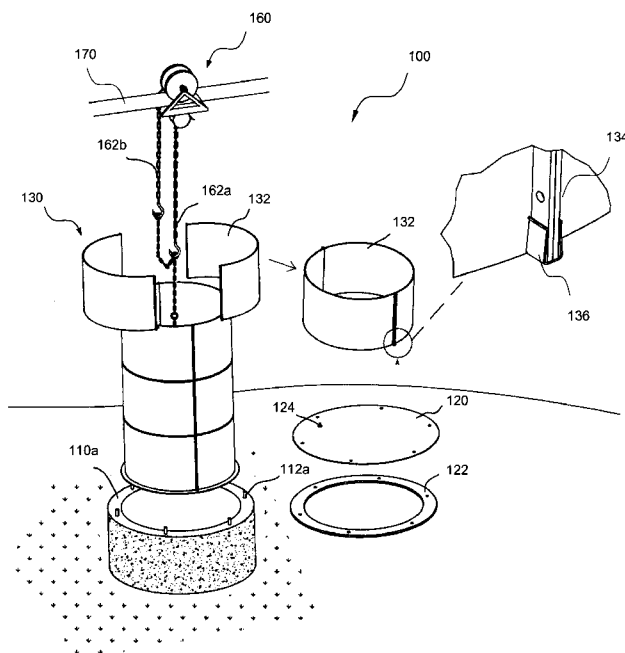


FIG. 1

- (57) Abstract:** An underground well silo (100) includes: an upper unit structure having a concrete wall (110a) with suitable fastening means (112a) to receive an air tight seal lid (120); an intermediate unit structure made of a series of concrete walls (110b) stackably joined to form the depth of the silo; a bottom unit structure having a one end closed concrete wall (110c); wherein green materials are stored in a loading compartment (130) that is made of a series of inner wall plates (132) embedded in the silo (100), said loading compartment (130) is provided with a bottom plate (140) connected to a loop chain (150) such that it can be detachably linked to a loading/unloading mechanism (160) via a hook; and wherein trapped air in the silo (100) is extractable through a one way valve (124) of the air tight seal lid (120) to keep silage in an anaerobic condition.



SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE,

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

WELL SILO FOR GREEN MATERIALS STORAGE

FIELD OF INVENTION

- 5 The present invention relates generally to a well silo for green materials storage; and more particularly to an underground well silo of green materials storage for animal feed.

BACKGROUND OF INVENTION

- 10 Silage is a fermented feed for ruminants such as cattle, sheep and goats that are made from plant materials such as maize and grass. They are usually made in airtight structures by compressing the plant materials to remove air and undergo fermentation by naturally occurring anaerobic bacteria for about 21 days. The conventional silos are usually in the form of plastic containers, trench or tower. Most of these silo types have
- 15 the weakness where the silage cannot be stored for long after opening of the silo due to the entry of air. The entry of air may encourage the growth of aerobic bacteria that may cause decay of the silage.

US 5117593 A discloses an underground storage silo for emergency supplies.

- 20 Accordingly, underground silo for storing emergency supplies includes a cylindrical body portion having a closed bottom and side walls and an open top with a flange around the top, a convex cover configured for mating with said open top and having a flange for mating with the flange of the body portion, and a hatch in the cover for accessing stored supplies. The body portion is preferably made of seamless woven fiberglass. The cover
- 25 includes a lip extending downwardly from the flange for encircling the flange of the body portion. A sealant is provided between the flanges of the cover and body portion to

facilitate a fluid tight seal. By placing the silo underground the lives of emergency supplies are extending due to thermal insulation of the underground location.

Other prior arts such as a Japanese patent JPH02286009A entitled a lifting and
5 transferring device of silage and the like; and a Korean patent KR20120072123A
entitled a method for constructing underground silo, had disclosed a common method of
preserving in well silo. However, it is found that feeds will be easily spoiled or decayed
once they are exposed. Some other type of silo may include PVC drum, trench and
polybag which may not be durably strong for adverse weather conditions. Moreover,
10 typical bunker silo, usually with concrete walls where filled trench is covered with a
plastic tarp to make it airtight. However, it is found that bunker silo may not suitable
because certain amount of feed may still spoil or decay under substantially high
temperature or under the hot sun conditions.

15 In view of these and other shortcomings, it is therefore advantageous to provide a well
silo for green materials storage. Accordingly, the present invention provides an
underground well silo of green materials storage for animal feed that is simple in
construction, relatively inexpensive and yet effective in use. Moreover, the present
invention also provides a well-sealed underground silo where air is able to be extracted,
20 such that to create a vacuum to enable an effective anaerobic condition for ensiling
process.

SUMMARY OF THE INVENTION

The present invention provides an underground well silo for green materials storage. Accordingly, the underground well silo includes: a) an upper unit structure having a concrete wall with suitable fastening means to receive an air tight seal lid; b) an
5 intermediate unit structure made of a series of concrete walls stackably joined to form the depth of the silo; c) bottom unit structure having a one end closed concrete wall; wherein green or crop materials are filled and stored in loading compartment that is made of a series of inner wall plates embedded in the well silo, said loading
10 compartment is further provided with a bottom plate connected to a loop chain such that it can be detachably linked to a loading / unloading mechanism through a hook of mechanical hoist; and wherein trapped air in the well silo is able to be extracted using a vacuum pump through a one way valve of the air tight seal lid so that to maintain silage in an anaerobic condition.

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Accordingly, the well silo is well-sealed and to enable air to be extracted, such that to create a vacuum therein to enable an effective anaerobic condition for encouraging ensiling process.

20 Accordingly, the concrete walls are stackably joined to one another by suitably fastening means, such as bolt and nut to attain a desired depth of the silo. It will be appreciated that a rubber layer is provided in between each of the joint of two concrete walls as a sealant for the joints.

25 Accordingly, the well silo can be an integrated structure instead of sectionally built up, or it can also be varied in any fashions, geometries, shapes or contours depending upon the nature of application and/or usage requirements.

In the preferred exemplary of the present invention, each inner wall plate is equipped with connecting flanges with rubber seal, such that to enable a pair of inner wall plates to be air tightly joined to each other by suitable fastening means or clips.

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Accordingly, the inner wall plate is made of two pieces of fibre glass, or any suitable lightweight, rigid and non-corrosive materials, and to be joined together by using the clips at the top and bottom ends of the inner wall plate.

10 It will be appreciated that the loading compartment can be varied in any fashions, geometries, shapes or contours in corresponding to the well silo depending upon the nature of application and/or usage requirements.

Accordingly, the loading / unloading mechanism enables the bottom plate to be pulled
15 up or down with the green or crop materials.

Accordingly, additional chain hook can be provided at a mechanical host's frame for temporary hanging the loop chain to enable the hook of mechanical hoist to operate with another loop chain to pull up or down the green or crop materials.

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Accordingly, the loading / unloading mechanism is preferably configured at a supporting bar supported by two pillars.

It will be appreciated that the bottom plate can be loaded at the top of the silo during the
25 filing process, so that green or crop materials can be filled and compacted into a pair of inner wall plates.

Accordingly, fully filled inner wall plates of the loading compartment can be lowered down into the well silo so that other pair of inner wall plates of the loading compartment can then be installed; and the same process is continued until the well silo is fully filled with the green or crop materials.

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In the preferred example, the air tight seal lid is installed and tightened onto the concrete wall of the upper unit structure of the well silo by suitable fastening means. Accordingly, the air tight seal lid is provided with a rubber seal layer as a sealant for the joint.

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It will be appreciated that the well-sealed underground well silo has a lower temperature than the atmospheric temperature, such that to prevent feeds from being decayed for extensive preservation. Accordingly, the well silo is capable of maintaining the remaining silage in an anaerobic condition at optimum temperature between 25°C to 35°C for silage materials of 1 tonne, with pH of silage 2.3 – 4.5 at 0 ppm oxygen.

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It should be noted that the remaining or unused silage can be kept in the well silo from being decayed for extensive preservation by simply applying the vacuum pump to extract air that has been entered into silo through the one way valve of the air tight seal lid.

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The present invention consists of several novel features and a combination of parts hereinafter fully described and illustrated in the accompanying description and drawings, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

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BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and
5 thus are not limitative of the present invention, wherein:

FIG. 1 shows an exposed perspective view illustrating in partially exploded and enlarged views of an underground well silo for green materials storage in accordance with the preferred exemplary of present invention;

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FIG. 2 shows a cross-sectional side embedded view with partially enlarged side view and perspective view of the underground well silo for green materials storage according to preferred exemplary of the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EXEMPLARY

The present invention relates to a well silo for green materials storage. Hereinafter, this specification will describe the present invention according to the preferred exemplary of
5 the present invention. However, it is to be understood that limiting the description to the preferred exemplary of the invention is merely to facilitate discussion of the present invention and it is envisioned that those skilled in the art may devise various modifications and equivalents without departing from the scope of the appended claims.

10 The present invention generally provides an underground well silo of green materials storage for animal feed, wherein the well silo is well-sealed and to enable air to be extracted, such that to create a vacuum therein to enable an effective anaerobic condition for encouraging ensiling process. It will be appreciated that the well-sealed underground silo has a lower temperature than the atmospheric temperature, such that
15 to prevent feeds from being decayed for extensive preservation.

The underground well silo of green materials storage for animal feed according to the preferred exemplary of the present invention will now be described in detail with reference to accompanying FIGS. 1 to 2, either individually or in any combination
20 thereof.

Referring to FIGS. 1 and 2, the main structure of a storage facility of green materials for animal feeds is a well silo (100). Accordingly, the well silo (100) generally includes an upper unit structure, intermediate unit structure and a bottom unit structure. By way of
25 example but not limitation, the upper unit structure of the well silo (100) is provided with a concrete wall (110a) having suitable fastening means (112a) to receive an air tight seal lid (120). The intermediate unit structure of the well silo (100) is preferably made of

a series of concrete walls (110b) stackably joined to form the depth of the silo; while the bottom unit structure of the well silo (100) is preferably a one end closed concrete wall (110c). It will be appreciated the concrete walls (110a, 110b and 110c) are preferably stackably joined to one another by suitably fastening means, such as for example, but
5 not limited to, bolt and nut (112b) to attain a desired depth of the silo. Accordingly, a rubber layer (114) is provided in between each of the joint of two concrete walls (110a, 110b, 110c) as a sealant for the joints. It will be appreciated that the well silo (100) may be an integrated structure instead of sectionally built up, or it can also be varied in any fashions, geometries, shapes or contours depending upon the nature of application
10 and/or usage requirements.

In the preferred exemplary of the present invention, green or crop materials are generally filled and stored in loading compartment (130). By way of example but not limitation, the loading compartment (130) is preferably made of a series of inner wall
15 plates (132) to be embedded into the well silo (100). Accordingly, each inner wall plate (132) is preferably equipped with connecting flanges (134) with rubber seal, such that to enable a pair of inner wall plates (132) to be air tightly joined to each other by suitable fastening means or clips (136). By way of example but not limitation, the inner wall plate (132) may be made of two pieces of fibre glass, or any suitable lightweight, rigid and
20 non-corrosive materials, and to be joined together using the clips (136) at the top and bottom ends of the inner wall plate (132). It will be appreciated that the loading compartment (130) may also be varied in any fashions, geometries, shapes or contours in corresponding to the well silo (100) depending upon the nature of application and/or usage requirements.

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In the preferred exemplary, the loading compartment (130) is further provided with a bottom plate (140) located at the bottom of the silo. It will be appreciated that the bottom

plate (140) is preferably connected to a loop chain (150) such that it can be detachably linked to a loading / unloading mechanism (160) through a hook of mechanical hoist (162a). Accordingly, the loading / unloading mechanism (160) enables the bottom plate (140) to be pulled up or down with the green or crop materials. If desired, an additional chain hook (162b) may be provided at a mechanical host's frame for temporary hanging the loop chain (150) to enable the hook of mechanical hoist (162a) to operate with another loop chain (150) to pull up or down the green or crop materials. By way of example but not limitation, the loading / unloading mechanism (160) is preferably configured at a supporting bar (170) supported by two pillars (not shown).

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During the filling process of green or crop materials, the bottom plate (140) will be loaded at the top of the silo so that green or crop materials are being filled and compacted into a pair of inner wall plates (132). The fully filled inner wall plates (132) of the loading compartment (130) will then be lowered down into the well silo (100). Other pair of inner wall plates (132) of the loading compartment (130) will then be installed and the same process will be continued until the well silo (100) is fully filled with the green or crop materials. The air tight seal lid (120) will then be installed and tightened onto the concrete wall (110a) of the upper unit structure of the well silo (100) by suitable fastening means (112a). It should be noted that air tight seal lid (120) is preferably provided with a rubber seal layer (122) as a sealant for the joint.

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By way of example but not limitation, the trapped air in the well silo (100) will be extracted using a vacuum pump through a one way valve (124) of the air tight seal lid (120) so that to maintain silage in an anaerobic condition. It will be appreciated that well silo (100) of the present invention is capable of maintaining the remaining silage in an anaerobic condition at optimum temperature between 25°C to 35°C for silage materials of 1 tonne, with pH of silage 2.3 – 4.5 at 0 ppm oxygen. In the event that the silage is

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ready for collection, the air tight seal lid (120) will be removed and the silage will then be taken out. The remaining or unused silage may still be kept in the silo from being decayed for extensive preservation by simply applied the vacuum pump to extract air that has been entered into silo through the one way valve (124) of the air tight seal lid

5 (120).

It is to be understood that the set forth examples and detailed description are exemplary and explanatory only, and are not restrictive of the invention. As such, the set forth examples and detailed description, including methodology, apparatus, components,

10 materials, temperatures, or any other variable parameters and approaches as described above should not be construed as limiting, but as the best mode contemplated by the inventor for carrying out the invention.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the principle

15 and scope of the invention, and all such modifications as would obvious to one skilled in the art intended to be included within the scope of following claims.

CLAIMS

1. An underground well silo for green materials storage characterized in that the underground well silo (100) includes:

- 5 a) an upper unit structure having a concrete wall (110a) with suitable fastening means (112a) to receive an air tight seal lid (120);
- b) an intermediate unit structure made of a series of concrete walls (110b) stackably joined to form the depth of the silo;
- c) bottom unit structure having a one end closed concrete wall (110c);

10 wherein green or crop materials are filled and stored in loading compartment (130) that is made of a series of inner wall plates (132) embedded in the well silo (100), said loading compartment (130) is further provided with a bottom plate (140) connected to a loop chain (150) such that it can be detachably linked to a loading / unloading mechanism (160) through a hook of mechanical hoist (162a);

15 and wherein trapped air in the well silo (100) is able to be extracted using a vacuum pump through a one way valve (124) of the air tight seal lid (120) so that to maintain silage in an anaerobic condition.

20 2. The underground well silo according to Claim 1, wherein the well silo (100) is well-sealed and to enable air to be extracted, such that to create a vacuum therein to enable an effective anaerobic condition for encouraging ensiling process.

25 3. The underground well silo according to Claim 1, wherein the concrete walls (110a, 110b and 110c) are stackably joined to one another by suitably fastening means, such as bolt and nut (112b) to attain a desired depth of the silo.

4. The underground well silo according to Claim 3, wherein a rubber layer (114) is provided in between each of the joint of two concrete walls (110a, 110b, 110c) as a sealant for the joints.
- 5 5. The underground well silo according to Claim 1, wherein the well silo (100) can be an integrated structure instead of sectionally built up, or it can also be varied in any fashions, geometries, shapes or contours depending upon the nature of application and/or usage requirements.
- 10 6. The underground well silo according to Claim 1, wherein each inner wall plate (132) is equipped with connecting flanges (134) with rubber seal, such that to enable a pair of inner wall plates (132) to be air tightly joined to each other by suitable fastening means or clips (136).
- 15 7. The underground well silo according to Claim 6, wherein the inner wall plate (132) is made of two pieces of fibre glass, or any suitable lightweight, rigid and non-corrosive materials, and to be joined together by using the clips (136) at the top and bottom ends of the inner wall plate (132).
- 20 8. The underground well silo according to Claim 1, wherein the loading compartment (130) can be varied in any fashions, geometries, shapes or contours in corresponding to the well silo (100) depending upon the nature of application and/or usage requirements.
- 25 9. The underground well silo according to Claim 1, wherein the loading / unloading mechanism (160) enables the bottom plate (140) to be pulled up or down with the green or crop materials.

10. The underground well silo according to Claim 9, wherein an additional chain hook (162b) can be provided at a mechanical host's frame for temporary hanging the loop chain (150) to enable the hook of mechanical hoist (162a) to operate with another loop chain (150) to pull up or down the green or crop materials.
11. The underground well silo according to Claim 1, wherein the loading / unloading mechanism (160) is preferably configured at a supporting bar (170) supported by two pillars.
12. The underground well silo according to Claim 1, wherein the bottom plate (140) can be loaded at the top of the silo during the filling process, so that green or crop materials can be filled and compacted into a pair of inner wall plates (132).
13. The underground well silo according to Claim 12, wherein fully filled inner wall plates (132) of the loading compartment (130) can be lowered down into the well silo (100) so that other pair of inner wall plates (132) of the loading compartment (130) can then be installed; and the same process is continued until the well silo (100) is fully filled with the green or crop materials.
14. The underground well silo according to Claim 1, wherein the air tight seal lid (120) is installed and tightened onto the concrete wall (110a) of the upper unit structure of the well silo (100) by suitable fastening means (112a).
15. The underground well silo according to Claim 16, wherein the air tight seal lid (120) is provided with a rubber seal layer (122) as a sealant for the joint.

16. The underground well silo according to Claim 1, wherein the well-sealed underground well silo (100) has a lower temperature than the atmospheric temperature, such that to prevent feeds from being decayed for extensive preservation.

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17. The underground well silo according to Claim 16, wherein the well silo (100) of is capable of maintaining the remaining silage in an anaerobic condition at optimum temperature between 25°C to 35°C for silage materials of 1 tonne, with pH of silage 2.3 – 4.5 at 0 ppm oxygen.

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18. The underground well silo according to Claim 1, wherein the remaining or unused silage can be kept in the well silo (100) from being decayed for extensive preservation by simply applied the vacuum pump to extract air that has been entered into silo through the one way valve (124) of the air tight seal lid (120).

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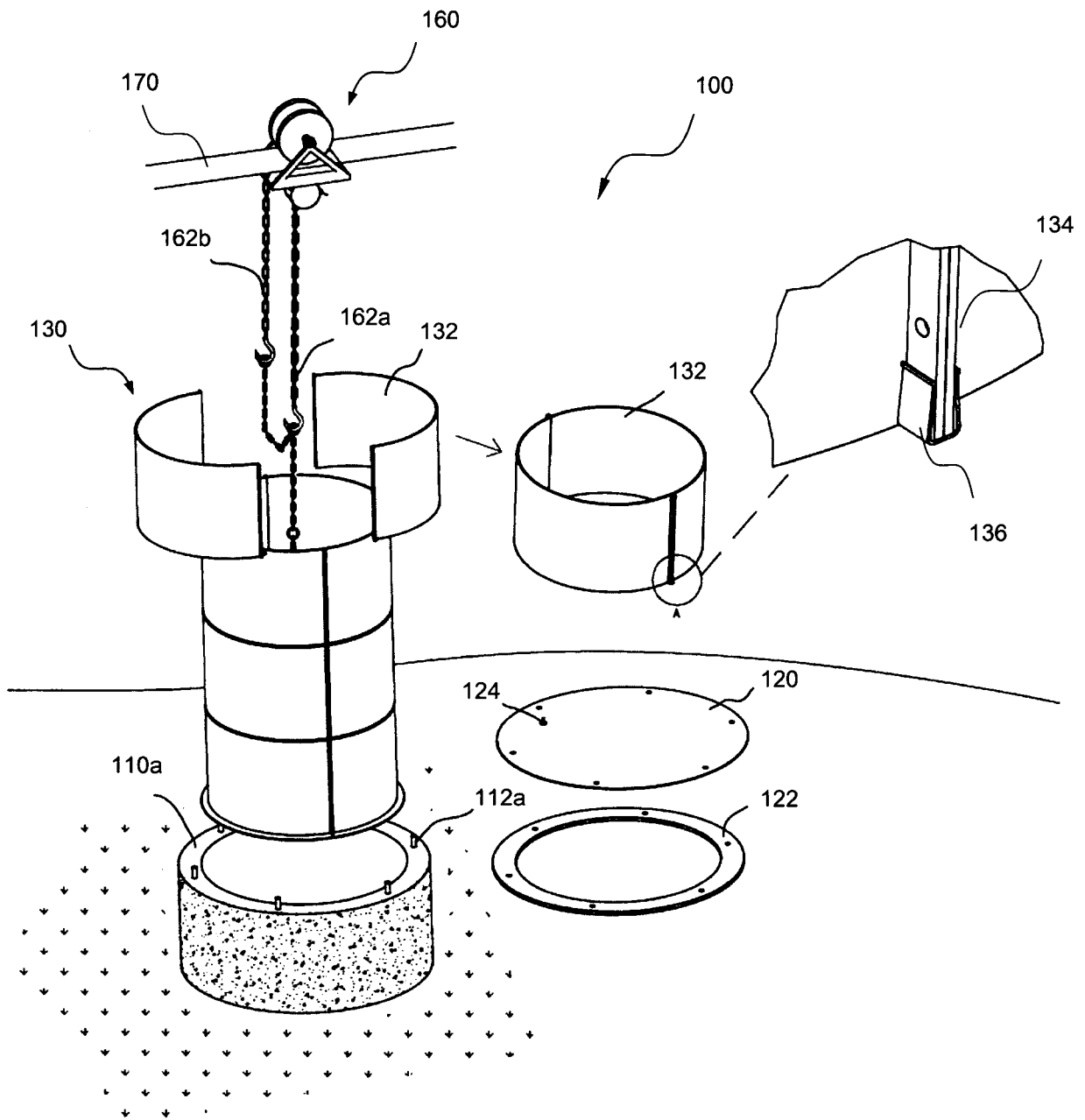


FIG. 1

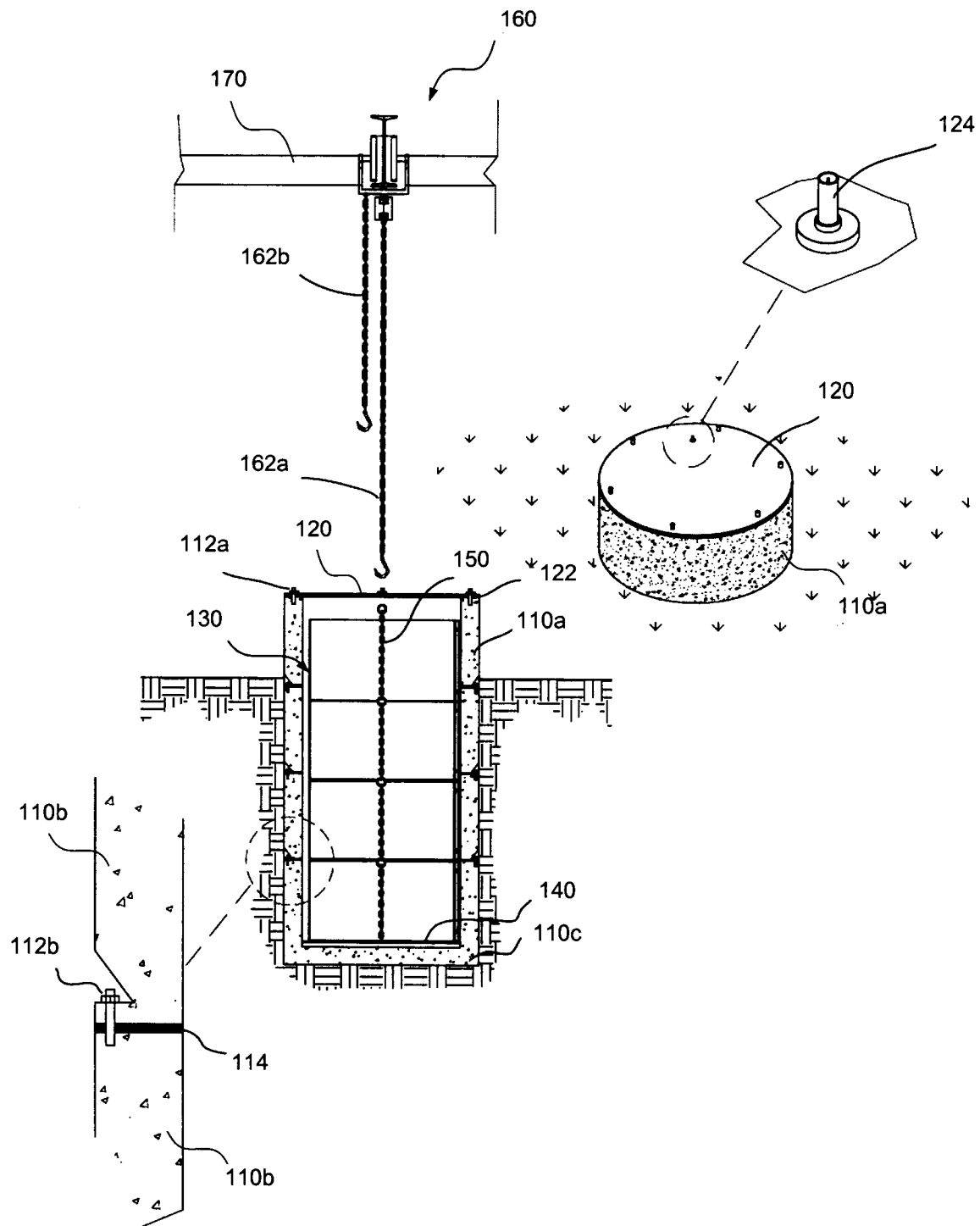


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/MY2015/000104

A. CLASSIFICATION OF SUBJECT MATTER

INV. A01F25/16

ADD.

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)

A01F E04H B65D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 401 548 C (STILL FA CARL) 8 September 1924 (1924-09-08) figure 1 page 2, line 44 - line 63 -----	1-18
A	GB 443 130 A (FERDINAND SCHMIDT) 21 February 1936 (1936-02-21) figures 1-3 page 1, line 64 - line 95 -----	1-18
A	DE 197 38 649 A1 (GOTRA KREISLAUFWIRTSCHAFTS GMB [DE]) 11 March 1999 (1999-03-11) figures 1-6 column 3, line 8 - column 4, line 2 ----- -/-	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* 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

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"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 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

Date of the actual completion of the international search

1 September 2016

Date of mailing of the international search report

13/09/2016

Name and mailing address of the ISA/

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Holtermann, Timm

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2015/000104

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 201 102 771 Y (XINJIANG HONGJI HYDROPNEUMATIC [CN]) 20 August 2008 (2008-08-20) figures 1-3 -----	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/MY2015/000104

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 401548	C	08-09-1924	NONE	

GB 443130	A	21-02-1936	NONE	

DE 19738649	A1	11-03-1999	NONE	

CN 201102771	Y	20-08-2008	NONE	
