



- (51) International Patent Classification:
C25B 9/06 (2006.01) *F02M 25/12* (2006.01)
- (21) International Application Number:
PCT/TH2011/000022
- (22) International Filing Date:
10 June 2011 (10.06.2011)
- (25) Filing Language: English
- (26) Publication Language: English
- (72) Inventor; and
- (71) Applicant : **TRIDSADEERAK, Sukij** [TH/TH]; 53 Moo
15 Sub District Pasak, Muang District, Lamphun 51000
(TH).
- (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, 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, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, 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.

- (84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

[Continued on next page]

- (54) Title: ELECTROLYSIS CELL FOR THE PREPARATION OF HYDROGEN

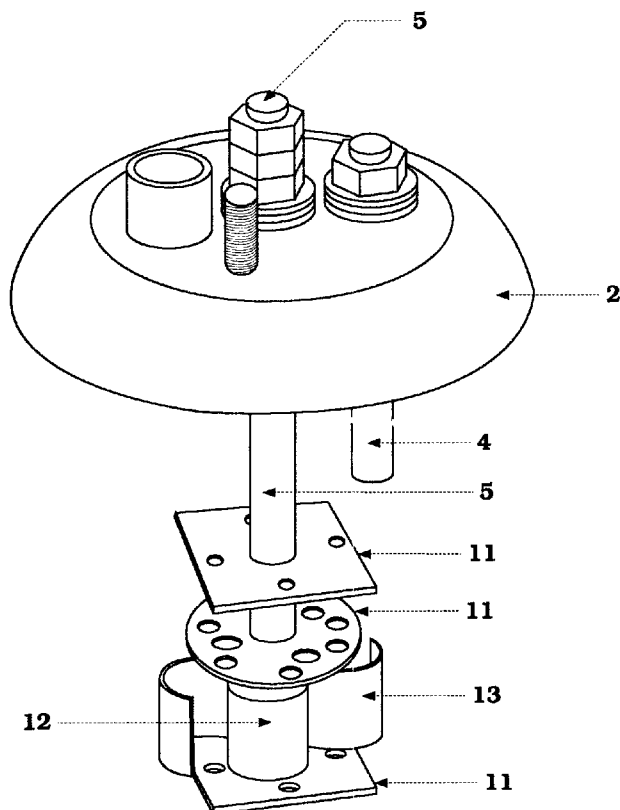


Figure 2

(57) Abstract: The electrolysis cell for the preparation of hydrogen consists of a cylinder tank, square cell plates, and a permanent magnet which are attached to a shaft. The shaft is then connected to a lid which has a hydrogen pipe connector which allows the hydrogen gas produced to flow through to the hydrogen pipe and an engine combustion chamber.

Published:

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

— *with amended claims (Art. 19(1))*

INVENTION DETAIL**Title of Invention**

5 **ELECTROLYSIS CELL FOR THE PREPARATION OF HYDROGEN**

Related Field

Electrical Engineering, Physics

10 **Invention Background**

Equipment which contains electrolyte solution tank induces electrolysis process, or Brown Gas, in electrolyte solution with water as the main element. Normally when the electrical current is passed through, it does not generate adequate reaction or the electrolyte solution creates frog-egg-like bubbles. The process doesn't generate adequate hydrogen gas to use in conjunction with fossil fuels in a internal and external combustion engines.

15

Invention characteristics and Vision

While all petrol and other fuel, i.e. LPG and CNG, prices are sky rocketing, they still emit toxic gas and cause green house effect in the world. Hydrogen energy is an alternative fuel option that will help reduce air pollution and yield global warming. It is one of the cleanest energy sources which also help clean the engine combustion chamber and reduce 90% of CO emission. Hydrogen system separates hydrogen gas from water or electrolyte solution by electrolysis process.

20

WDH4 Hydrogen Separation Tank consists of a cylinder tank with 3 holders for holding the equipment tightly to a structure. It separates hydrogen gas by applying electrical current from a DC power supply through electrolyte solution via anode and cathode.

25

WDH4 Hydrogen Separation Tank also contains a spherical lid, welded to the tank, for installing anode and cathode which will be connected to the cell plates and permanent magnets for catalyzing the electrolysis process. The lid also contains neutral shaft for balancing electrical current, a thermometer for measuring the temperature inside the tank, a hydrogen gas pipe connector, and it also let negative electrical current from a DC power supply passes through to the equipment.

30

Detail design of the Invention

Fig.1 shows the WDH4 Hydrogen Separation Tank which has a stainless steel cylinder tank (1) with 3 holders (10) for holding the equipment to a structure. The tank is for holding the electrolyte solution and produces hydrogen gas by allowing electrical current from a DC power supply to pass through. The cylinder shape tank is designed to speed up the electrolysis process by allowing the electrolyte solution flows clockwise without hitting any edges when the electrical current is passing through. A hole is made near the bottom edge of the tank for installing an L shaped stainless steel pipe (9). The short end of the L shaped pipe is connected to the tank (1) while the long end goes up taller than the tank and contains a screw top for installing electrolyte solution meter for measuring the electrolyte solution level inside the tank.

A hole is made on the side, a little bit below the top edge of the tank (1) for installing an L shaped stainless steel pipe (8). The short end of the L shaped pipe is connected to the tank (1) while the long end goes up taller than the lid (2) and connects to its own lid (15). This pipe (8) is for refilling electrolyte solution into the tank.

The lid (2) is a spherical stainless steel lid, welded to the tank (1). The lid contains 4 holes on the top for installing anode shaft (5), cathode shaft (6), neutral shaft + thermometer (4), and hydrogen pipe connector (3).

The cathode is connected to the lid (2) and it supplies negative electrical current to the lid and the tank. On the other hand, the anode supplies positive electrical current to the stainless steel shaft which is connected to the cell plates.

The hydrogen pipe connector (3) is a stainless steel connector with inside braiding. It connects to the lid (2) and it is the exit to the hydrogen pipe (7) and engine combustion chamber for hydrogen gas produced.

Neutral shaft + thermometer (4) is a hollow stainless steel shaft for installing the thermometer. The end of the shaft which goes inside the tank is completely sealed so the electrolyte solution cannot enter the hollow shaft. The other end of the shaft contains a hole for the wire from the sensor (14) to exit. The neutral shaft also balances the electrical current in the nodes while the DC current from DC power supply varies, depending on the alternator.

Anode shaft (5) is a stainless steel shaft for supplying positive charge current from a DC power supply, and it connects to the cell plates and permanent magnets.

Cathode shaft (6) is a stainless steel shaft for supplying negative charge current from a DC power supply.

Hydrogen pipe (7) is a Teflon pipe that leads the hydrogen gas produced into the combustion chamber.

Electrolyte solution refilling pipe (8) is a stainless steel pipe for refilling electrolyte solution when the level reaches the defined level.

Refilling lid (15) is a stainless steel lid, welded to the refilling pipe. It is an entry point for refilling electrolyte solution.

Electrolyte solution level checking pipe (9) is a stainless steel pipe for inserting electrolyte solution level checking tool.

Fig. 2 shows the hydrogen separation cell plate set. It contains a center anode shaft (5) made from stainless steel and connects to the lid (2). The bottom of the shaft is connected to the cell plates (11) and a permanent magnet (12). The magnets are completely covered in stainless steel case and are positioned in between the cell plates.

The cell plates (11) are divided into 3 cell plates, the top, middle, and bottom cell plates. The top and bottom cell plates are made from square stainless steel plate with holes drilled into the defined positions. The middle cell plate is made from circular stainless steel plate with holes drilled into the defined positions. The permanent magnet is positioned in between the middle and the bottom cell plates.

The S or Z shaped stainless steel plate (13) are made from flat rectangle stainless steel plates cut into S or Z shape. The Z plate is connected to the anode shaft and the stainless steel case of the magnet.

Figure 3 shows the top cell plate (11A) with 1 circle (11.1) and 5 holes which are defined by the angle of the angle of the triangular pyramid.

For the top cell plate, the first hole (11.2) is in the center of the cell plate. This hole defines the angle of the other holes and it is for connecting the anode shaft (5) to the cell plate (11).

The second, third, fourth, and fifth holes (11.3, 11.4, 11.5, 11.6) are on the circumference of the circle (11.1). These holes are positioned in the triangular pyramid shape with the center hole (11.3) and they help catalyzing the electrolysis process. All holes on 11.1 have the same size and help balancing hydrogen separation process while the current from the DC power supply varies.

The top cell plate contains 4 equal size holes and 1 larger center hole. The 4 equal size holes are on the circumference of the circle (11.1) and are in the position of a triangular pyramid shape so that each hole makes the tip of the triangle.

The middle cell plate (11B) contains 2 circles, inner circle (11.8) and outer circle (11.7), with different radius, depending on the angle of the triangular pyramid shape that also define the position of the 10 holes on the cell plate.

5 The first hole (11.9) is in the center of the cell plate. This hole defines the angle of the other holes and also defines the vertical angle of the shaft (5) which is connected to the cell plate (11).

10 The second, third, and fourth holes (11.10, 11.11, 11.12) are positioned on the circumference of the inner hole (11.8) in the position of a triangular pyramid shape with the center hole (11.9). The holes on the inner circle help catalyzing the electrolysis process. All holes on 11.14 have the same size and help balancing hydrogen separation process while the current from the DC power supply varies.

15 The fifth, sixth, seventh, eighth, ninth, and tenth holes (11.13, 11.14, 11.15, 11.16, 11.17, 11.18) are positioned on the outer circle (11.8) in the triangular pyramid shape together with the center hole (11.9). The holes on the outer circle help catalyzing the electrolysis process. All holes on 11.13 have the same size and help balancing hydrogen separation process while the current from the DC power supply varies.

20 The middle cell plate contains 10 holes. The center hole is for connecting the cell plate to the shaft. The other 9 holes are positioned on 2 circles, inner and outer circles. The inner circle contains 4 holes, including the center hole, while the outer circle contains 6 holes.

The inner circle contains 4 holes in the triangular pyramid shape together with the center hole, creating 4 triangles.

25 The outer circle contains 6 holes in the triangular pyramid shape together with the center hole and the holes in the inner circle, creating 12 triangles. The holes on the outer circle are unequally spread apart.

The bottom cell plate (11A) is exactly the same as the top cell plate. It is also installed in the same angle and direction as the top cell plate.

30 Cell plate set (Fig. 2) consists of a permanent magnet (12) which is completely covered in stainless steel case to prevent corrosion from electrolyte solution and prolong the life of the magnet. The magnet is connected to the S plate and it is installed in between the middle and the bottom cell plates and they are connected to the anode shaft. The magnets are for creating electromagnetic field while the DC current passes through the electrolyte solution.

35 S or Z shaped plate (Fig. 2 (12)) is made from a stainless steel rectangle plate cut into an S or a Z shape. The plate is connected to the anode shaft (5), and acts as the catalyst to increase

the speed of the clockwise flow of the electrolyte solution when electrical current passes through the cell plate in the electrolysis process.

The electric and magnetic field (EMF) is the imaginary line drawn to show the area and intensity of the force between objects with different voltage, this field is called electric field. The electric field occurs around an object with electric current passing through and called magnetic field. In the case where both fields are mentioned, the fields are called EMFs or Electromagnetic Field.

The electromagnetic field is very useful in the electrolysis process. It helps the alternator and 12 Volts battery, or the capacitor, to produce adequate amount of hydrogen gas to be used with fossil fuels, including LPG and CNG. In the past, we, the inventor, were not able to produce adequate amount of hydrogen gas. A lot of electrical current had to be supplied in order to get enough hydrogen gas. Electromagnetic field helps double the hydrogen gas produced by acting similarly to the DC power supply in the form of an alternator inside the tank. (See the magnet installation in Fig.2)

The permanent magnets (12) installed inside the tank helps create electromagnetic field and strengthen electrical current without adding another battery. It is the method to increase hydrogen gas produced which can be said that the electrical energy is transformed into mechanical energy in the form of latent energy.

Electrolysis is the process of passing DC current into electrolyte solution and creates a chemical reaction, resulting in water and energy. The equipment which separates the solution with electricity is called electrolyte cell and it consists of electrical nodes, electrolyte solution container, and a DC power supply (alternator, battery, and capacitor). When a DC power supply supplies the current through electrolyte solution inside the hydrogen production tank, the hydrogen separation equipments and DC power supply (i.e. Alternator) will create a reaction that causes hydrogen to separate from electrolyte solution. Once the hydrogen gas is produced, the electrolysis process is completed.

Brief Description of Figure 1, 2, 3

- | | |
|----------|---|
| Figure 1 | Shows the picture of the WDH4 Hydrogen Separation tank |
| Figure 2 | Shows how cell plates, magnet, and Z plate are connected to the shaft |
| Figure 3 | Shows the cell plates and the holes positions |

Best Manufacturing Method

The WDH4 Hydrogen Separation Tank should be manufactured as described above.

5

10

15

20

25

30

35

Claims

1. The WDH4 Hydrogen Separation Tank consists of:

5 1.1 A cylinder hydrogen separation chamber with 3 holders at the bottom. The tank acts as the container for electrolyte solution and it allows electrical current to run through.

1.2 2 holes are made on the side of the tank, 1 above the bottom edge of the tank and 1 below the top edge of the tank. The bottom hole is for connecting the electrolyte solution level meter pipe while the top hole is for connecting the refilling pipe.

10 1.3 A spherical stainless steel lid welded onto the tank. The top of the lid contains 4 holes for installing an anode shaft, a cathode shaft, a neutral shaft + thermometer, and a hydrogen pipe connector.

15 1.4 The cell plates are circular and square stainless steel plates with 20 varied size holes. The holes are positioned along the circumferences of the circles on the cell plates. The top cell plate contains 5 holes, including the center hole for defining the triangular pyramid shape angles and for attaching the cell plate to the shaft. The circle on the top plate contains 4 equal size holes in the position so that each hole makes the tip of the triangle, creating 4 triangles. The middle cell plate contains 10 holes, including the center hole for attaching the cell plate to the shaft and for defining the angles of the triangular pyramid. The inner circle of the middle plate contains 3 equal size holes, while the outer circle contain another 9 equal size holes. The holes are positioned in the triangular pyramid shape so that each hole makes the tip of the triangle, creating 12 triangles. The bottom cell plate contains 5 holes, including the center hole for defining the triangular pyramid shape angles and for attaching the cell plate to the shaft. The circle on the bottom plate contains 4 equal size holes in the position so that each hole makes the tip of the triangle, creating 4 triangles. The holes on the inner and outer circles are equally spread apart. The top and the bottom cell plates are installed in the same angle and direction.

25 30 1.5 The permanent magnet is completely covered in stainless steel case. It is positioned in between the middle and the bottom cell plates and it is connected to shaft with the Z plate in between. The magnet helps creating electromagnetic field while DC current is passing through the electrolyte solution.

1.6 The fan set is an S or Z shaped stainless steel plate. It is attached to the shaft that also holds the cell plates and the magnet. It helps increase the flow speed of electrolyte solution, thus increases the reaction to produce hydrogen gas when electrical current passes through the electrolyte solution.

5

10

15

20

25

30

35

1. The WDH4 Hydrogen Separation Tank consists of:

- 1.1 A cylinder hydrogen separation chamber with 3 holders at the bottom. The tank acts as the container for electrolyte solution and it allows electrical current to run through.**
- 1.2 2 holes are made on the side of the tank, 1 above the bottom edge of the tank and 1 below the top edge of the tank. The bottom hole is for connecting the electrolyte solution level meter pipe while the top hole is for connecting the refilling pipe.**
- 1.3 A spherical stainless steel lid welded onto the tank. The top of the lid contains 4 holes for installing an anode shaft, a cathode shaft, a neutral shaft + thermometer, and a hydrogen pipe connector.**
- 1.4 The cell plates are circular and square stainless steel plates with 20 varied size holes. The holes are positioned along the circumferences of the circles on the cell plates. The top cell plate contains 5 holes, including the center hole for defining the triangular pyramid shape angles and for attaching the cell plate to the shaft. The circle on the top plate contains 4 equal size holes in the position so that each hole makes the tip of the triangle, creating 4 triangles. The middle cell plate contains 10 holes, including the center hole for attaching the cell plate to the shaft and for defining the angles of the triangular pyramid. The inner circle of the middle plate contains 3 equal size holes, while the outer circle contain another 9 equal size holes. The holes are positioned in the triangular pyramid shape so that each hole makes the tip of the triangle, creating 12 triangles. The bottom cell plate contains 5 holes, including the center hole for defining the triangular pyramid shape angles and for attaching the cell plate to the shaft. The circle on the bottom plate contains 4 equal size holes in the position so that each hole makes the tip of the triangle, creating 4 triangles. The holes on the inner and outer circles are equally spread apart. The top and the bottom cell plates are installed in the same angle and direction so that the holes are lined straight to one another and at an angle with the magnetic field.**
- 1.5 The permanent magnet is completely covered in stainless steel case. It is positioned in between the middle and the bottom cell plates and it is connected to shaft with the Z plate in between. The magnet helps creating electromagnetic field while DC current is passing through the electrolyte solution.**

1.6 The stirrer set is an S or Z shaped stainless steel plate. It is attached to the shaft that also holds the cell plates and the magnet. It helps increase the flow speed of electrolyte solution, thus increases the reaction to produce hydrogen gas when electrical current passes through the electrolyte solution.

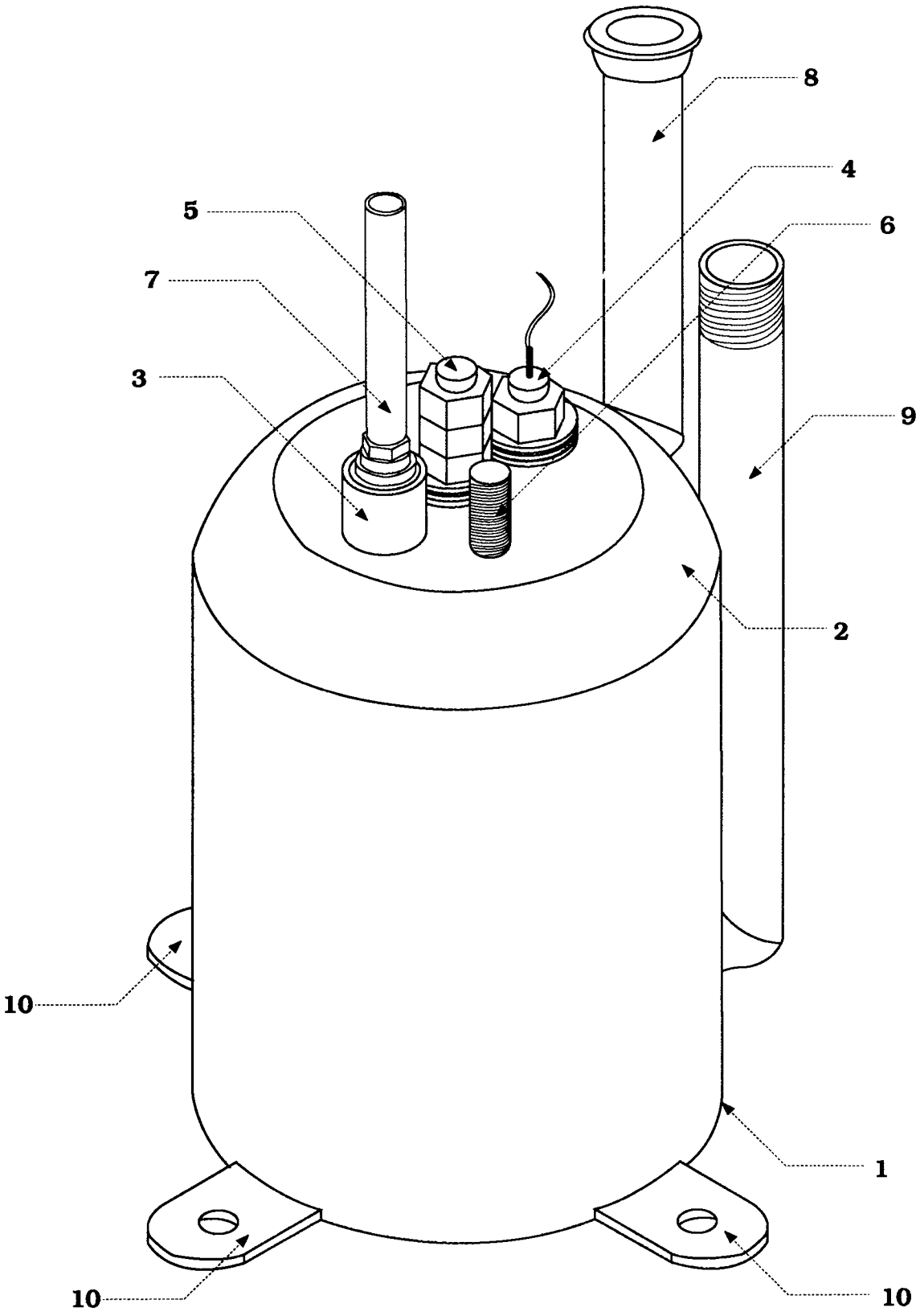


Figure 1

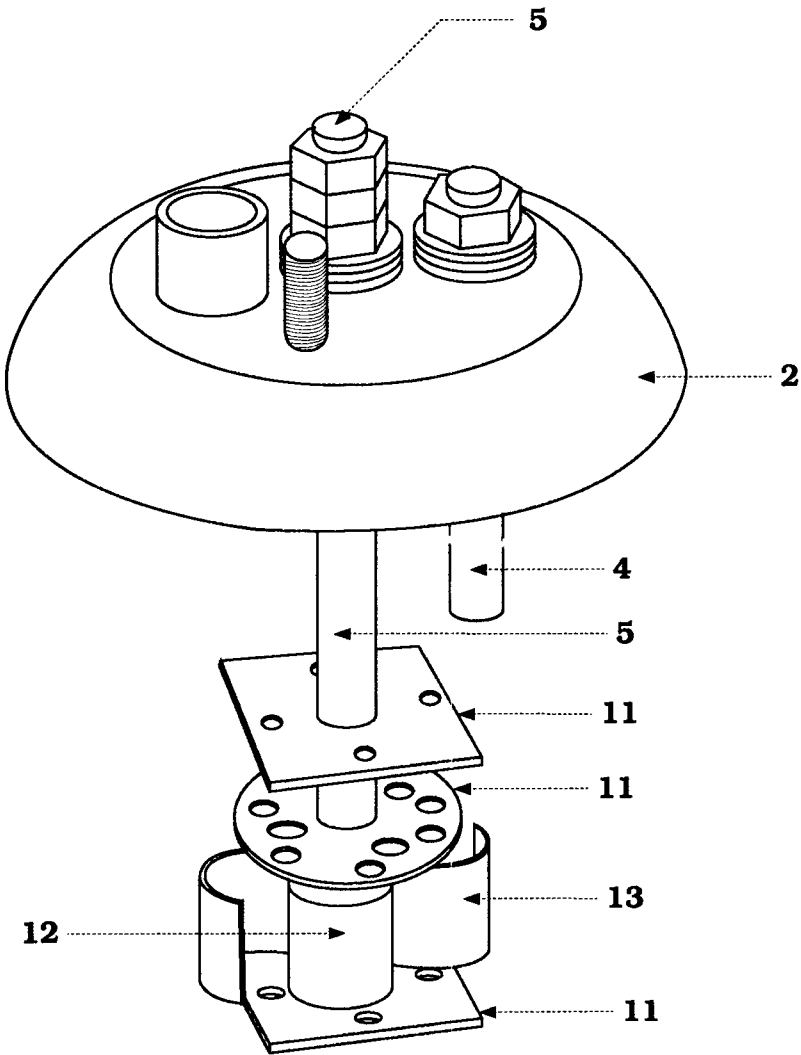


Figure 2

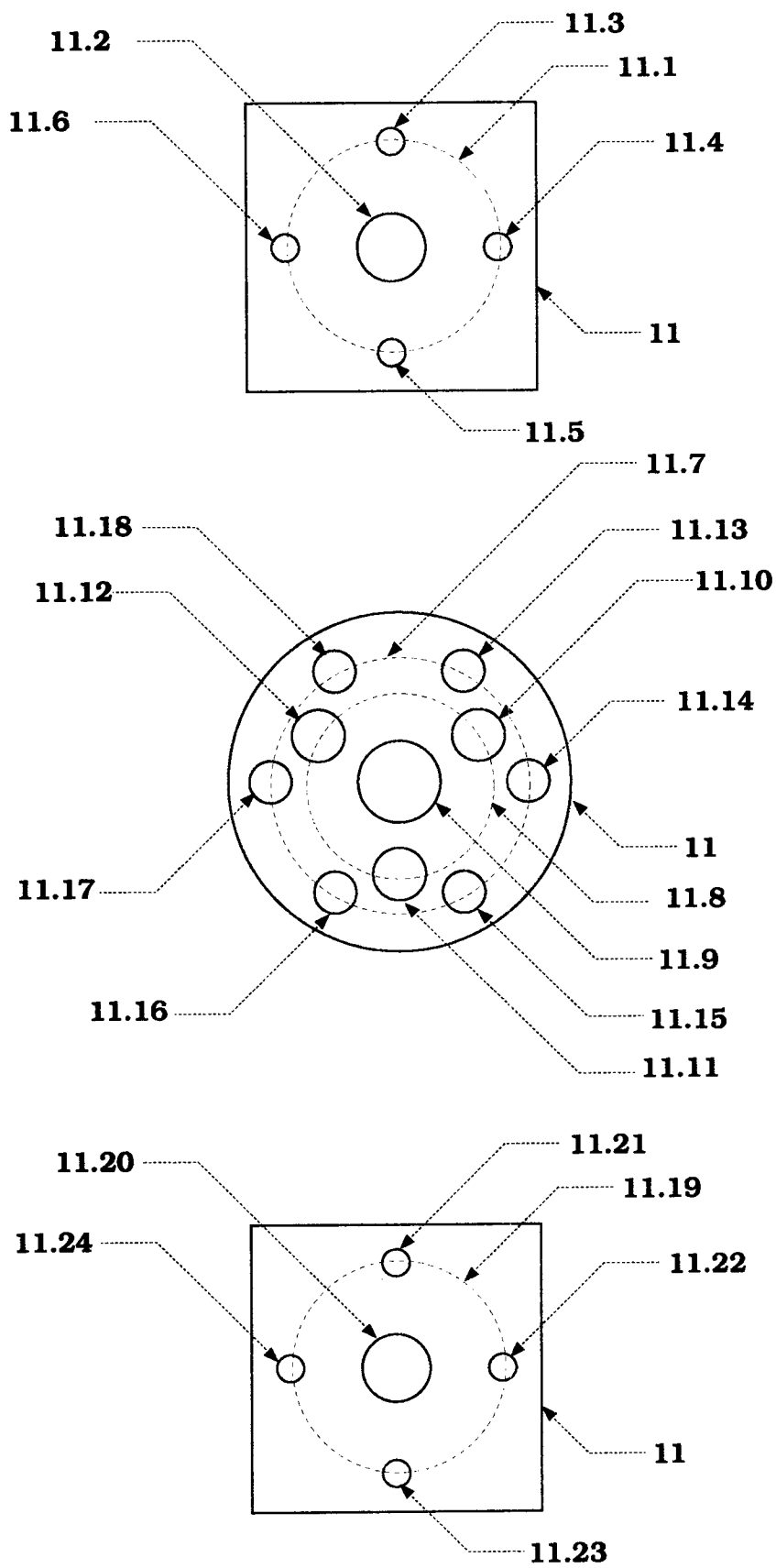


Figure 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/TH2011/000022

A. CLASSIFICATION OF SUBJECT MATTER
INV. C25B9/06 F02M25/12
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)

C25B F02B F02M

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/163877 A1 (BROWN SANFORD [US] ET AL) 19 July 2007 (2007-07-19) paragraph [0034]; claim 1 -----	1
Y	US 2006/291822 A1 (SHELDON CARLTON W [US]) 28 December 2006 (2006-12-28) paragraphs [0022] - [0027], [0038]; claims 1,31-34 -----	1
A	US 2010/116648 A1 (HWANG BOO-SUNG [KR]) 13 May 2010 (2010-05-13) paragraph [0022]; claim 1 -----	1
A	US 4 442 801 A (GLYNN JOHN D [US] ET AL) 17 April 1984 (1984-04-17) column 3, lines 52-62; claim 1; figure 2 -----	1

☐ 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 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

"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

29 February 2012

Date of mailing of the international search report

09/03/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Hammerstein, G

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/TH2011/000022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007163877 A1	19-07-2007	US 2007163877 A1	19-07-2007
		US 2011203918 A1	25-08-2011

US 2006291822 A1	28-12-2006	NONE	

US 2010116648 A1	13-05-2010	AU 2009230746 A1	27-05-2010
		CN 101736356 A	16-06-2010
		EP 2184383 A1	12-05-2010
		JP 2010111944 A	20-05-2010
		KR 100896436 B1	12-05-2009
		RU 2009140166 A	10-05-2011
		TW 201020343 A	01-06-2010
		US 2010116648 A1	13-05-2010
		ZA 200907808 A	26-05-2010

US 4442801 A	17-04-1984	NONE	
