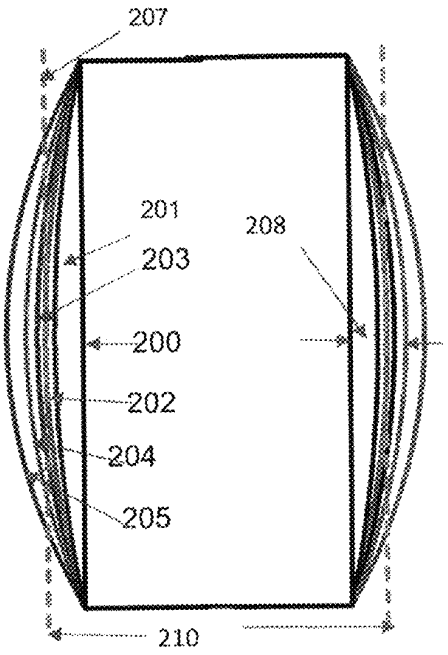


FIG. 1A

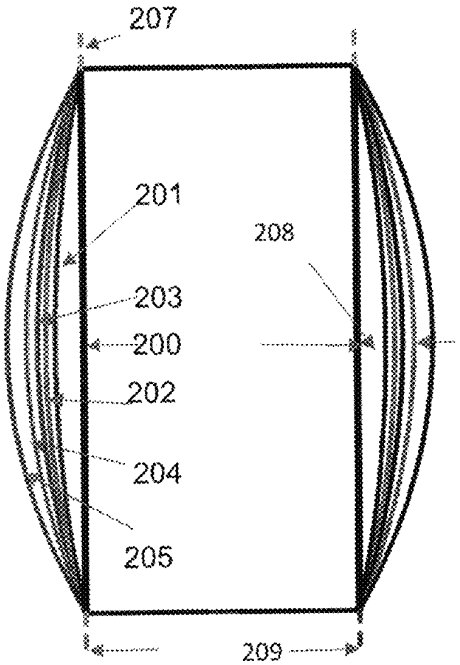


FIG. 1B

Table 1A: Texas A & M Probe

Radius of Probe	Barrel Shape No.	Increase in radius at mid-height in %	Radius of Test Hole
r	201	7.81	1.1 r
r	202	10.42	1.1 r
r	203	12.51	1.1 r
r	204	15.64	1.1 r
r	205	20.87	1.1 r

Table 1A: SBPMT Probe

Radius of Probe	Barrel Shape No.	Increase in radius at mid-height in %	Radius of Probe = Radius of Test Hole
r	201	7.81	r
r	202	10.42	r
r	203	12.51	r
r	204	15.64	r
r	205	20.87	r

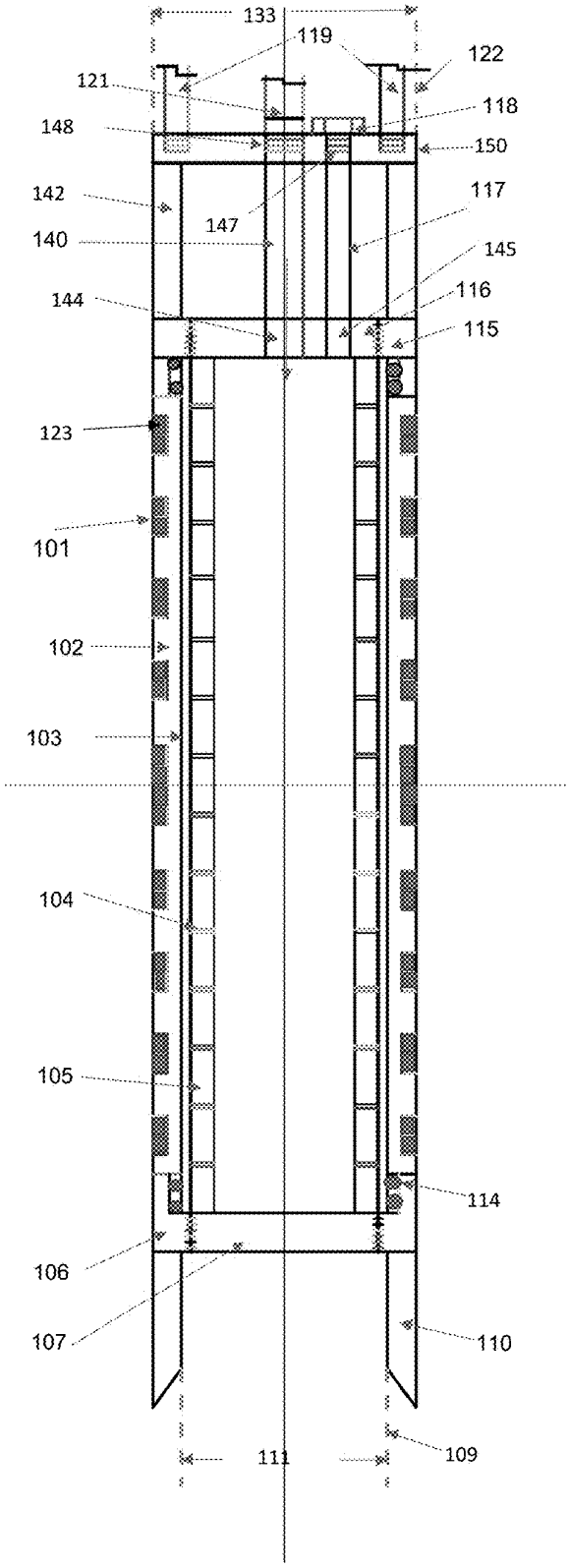

133
119
122
121
118
148
150
142
147
117
140
145
144
116
115
123
101
102
103
104
105
114
106
107
110
111
109

FIG. 2

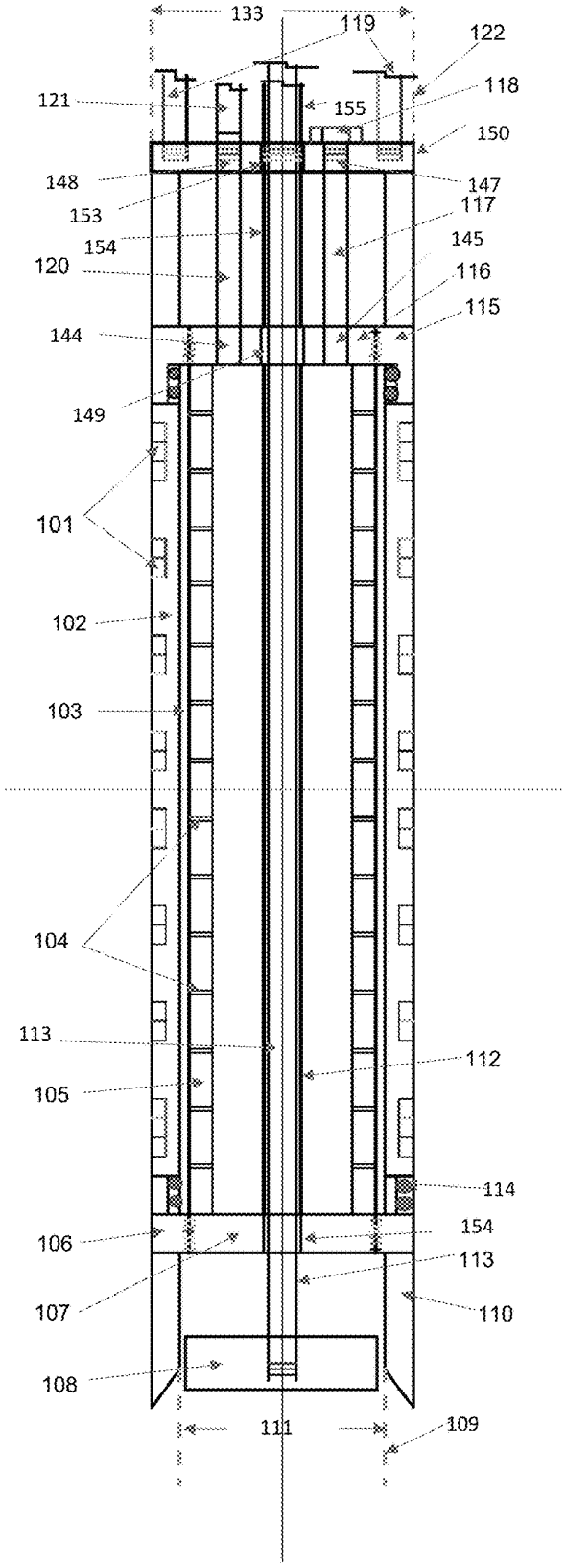

133
119
122
121
118
155
150
148
147
153
117
154
145
120
116
115
144
149
101
102
103
104
113
112
105
114
154
106
113
107
110
108
111
109

FIG. 3

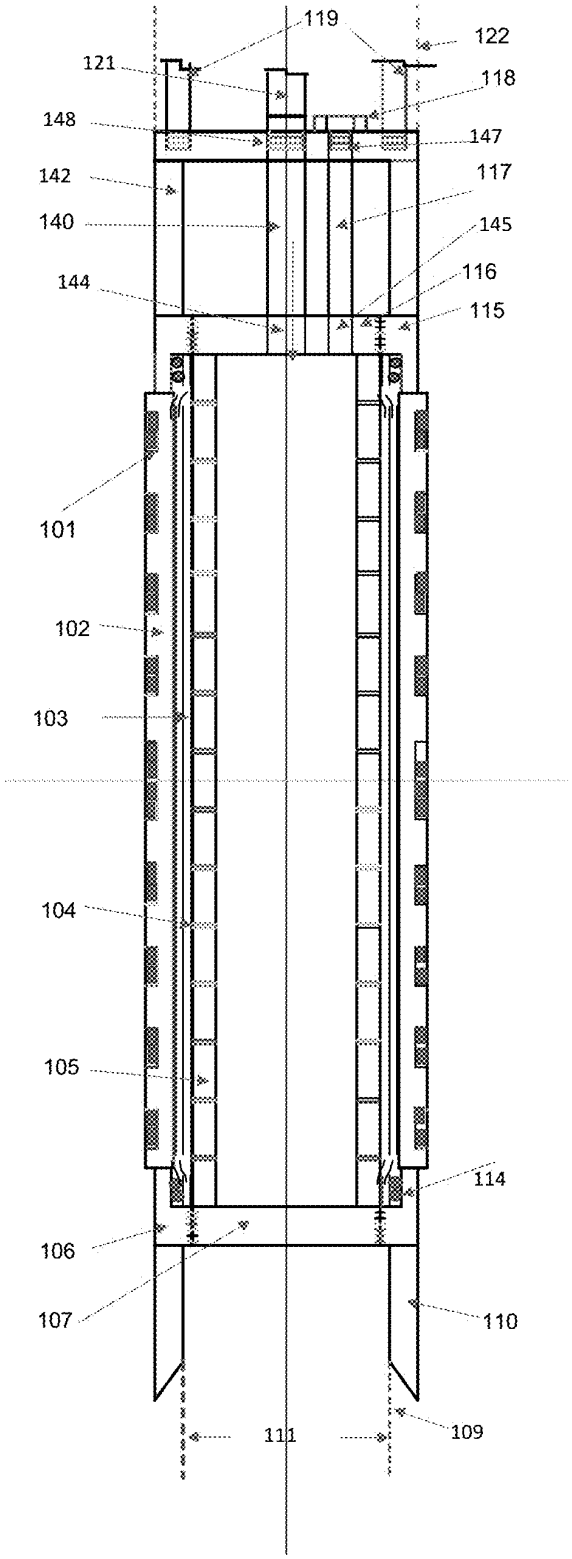

119
122
121
118
148
147
142
117
140
145
144
116
115
101
102
103
104
105
114
106
107
110
111
109

FIG. 4

FIG. 5A

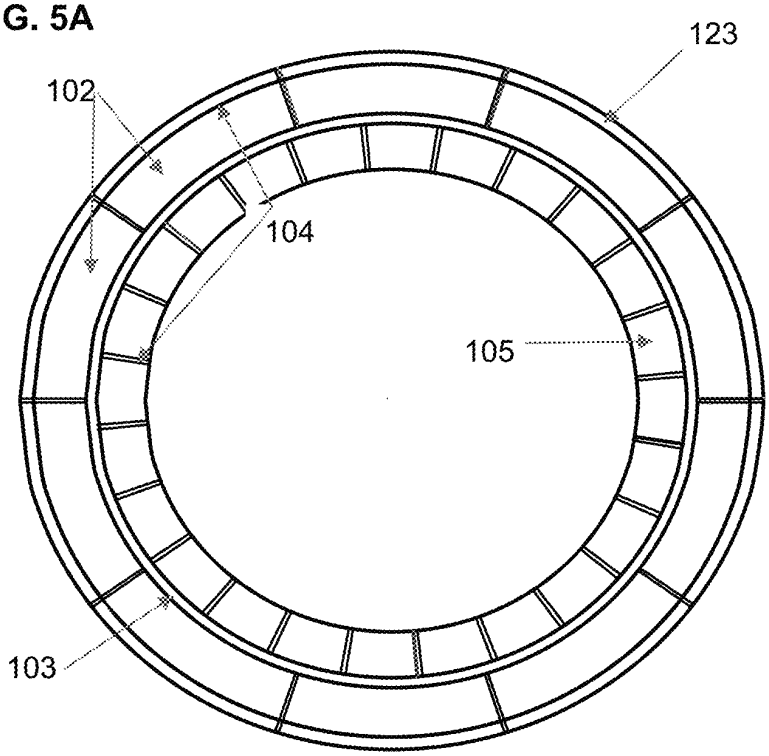


FIG. 5B

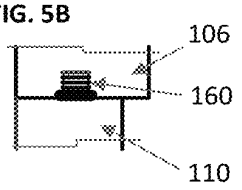


FIG. 5C

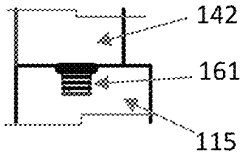


FIG. 5D

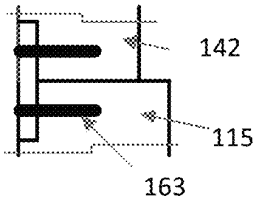


FIG. 5E

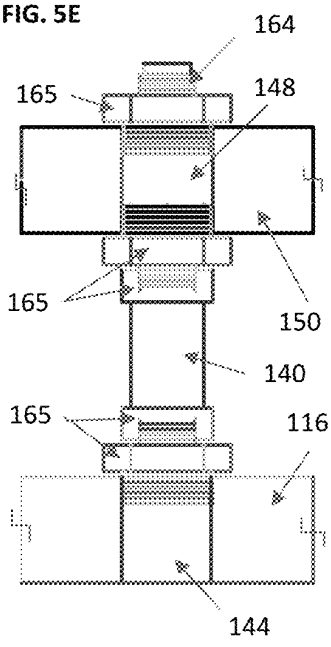
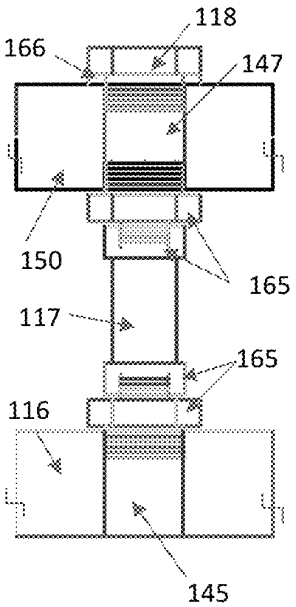


FIG. 5F



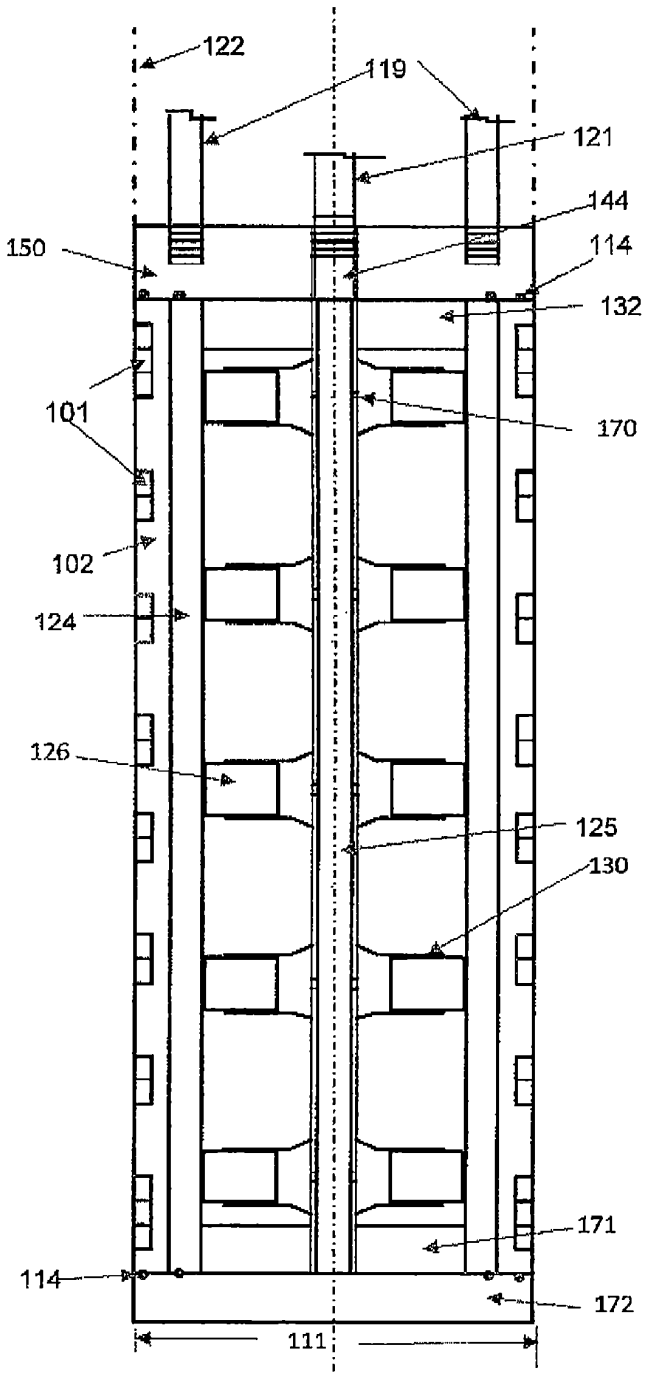

122
119
121
144
150
114
132
101
170
102
124
126
125
130
171
114
172
111

FIG. 6

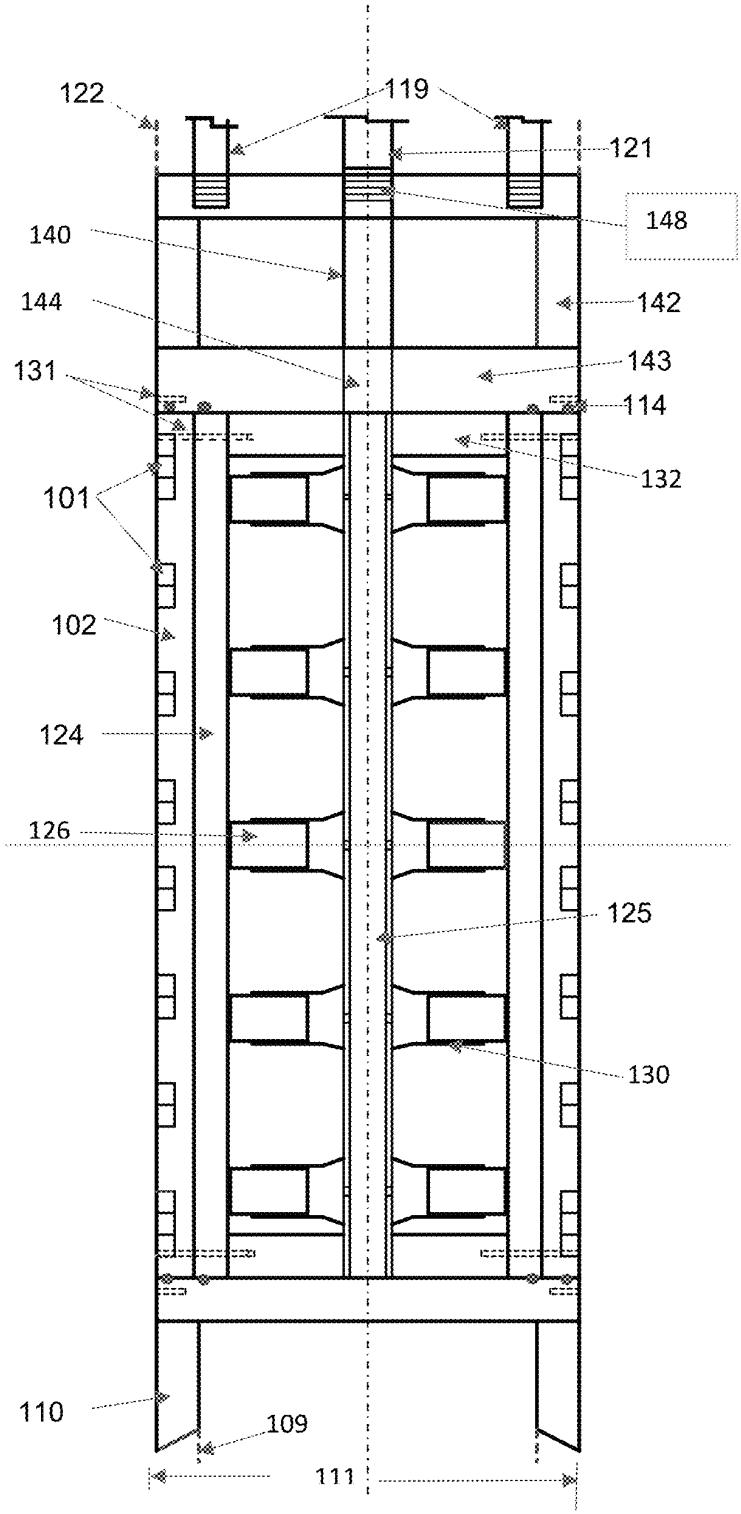

122
119
121
148
140
144
142
131
143
114
132
101
102
124
126
125
130
110
109
111

FIG. 7

FIG. 8A

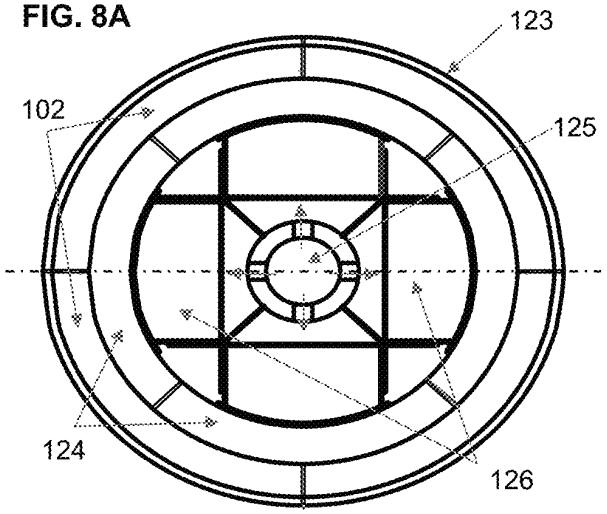


FIG. 8B

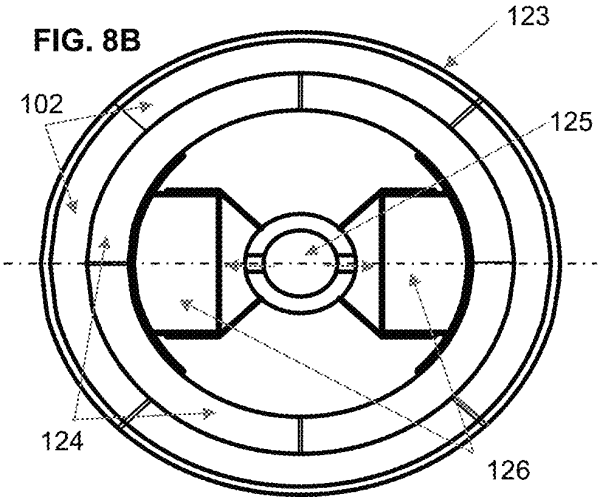


FIG. 8C

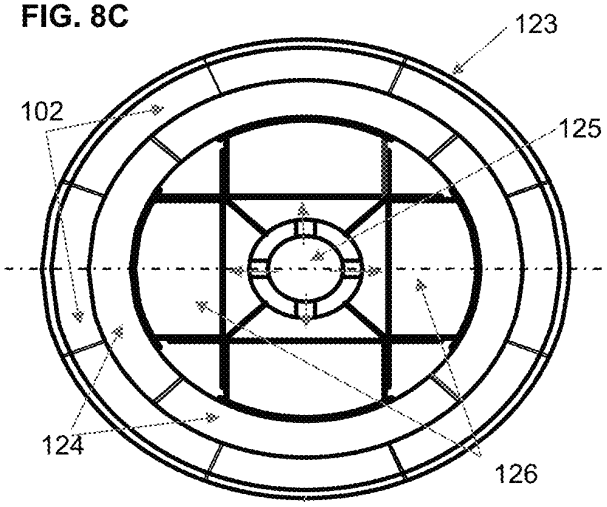


FIG. 9A

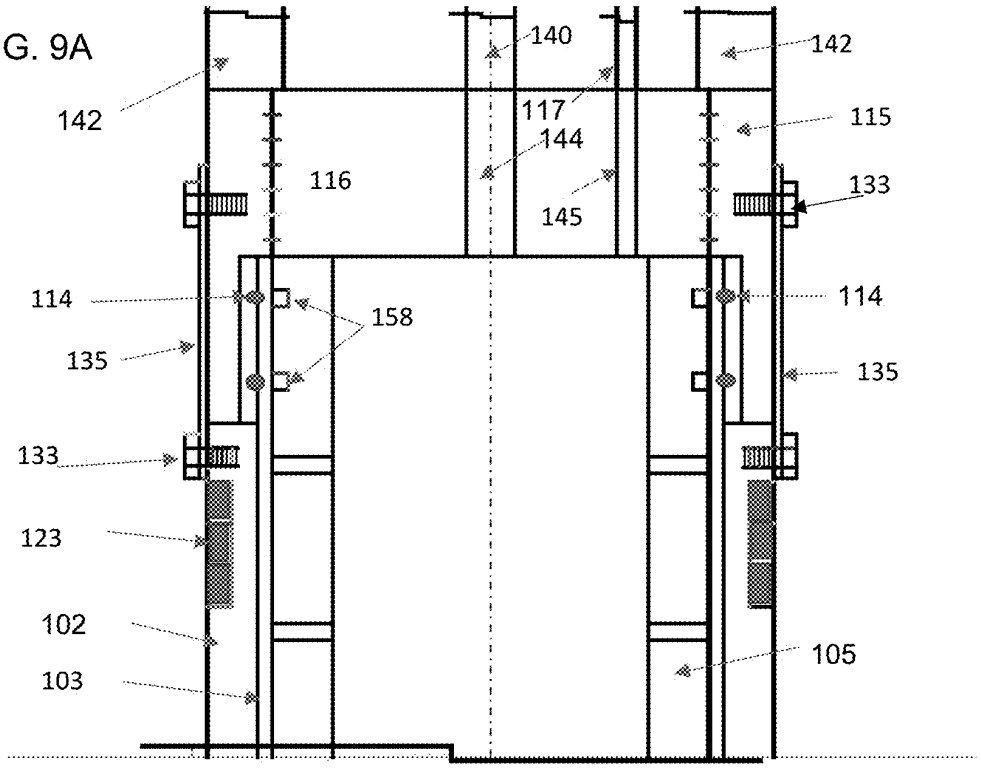

140
142
142
117
115
144
116
133
145
114
158
114
135
135
133
123
102
105
103

FIG. 9B

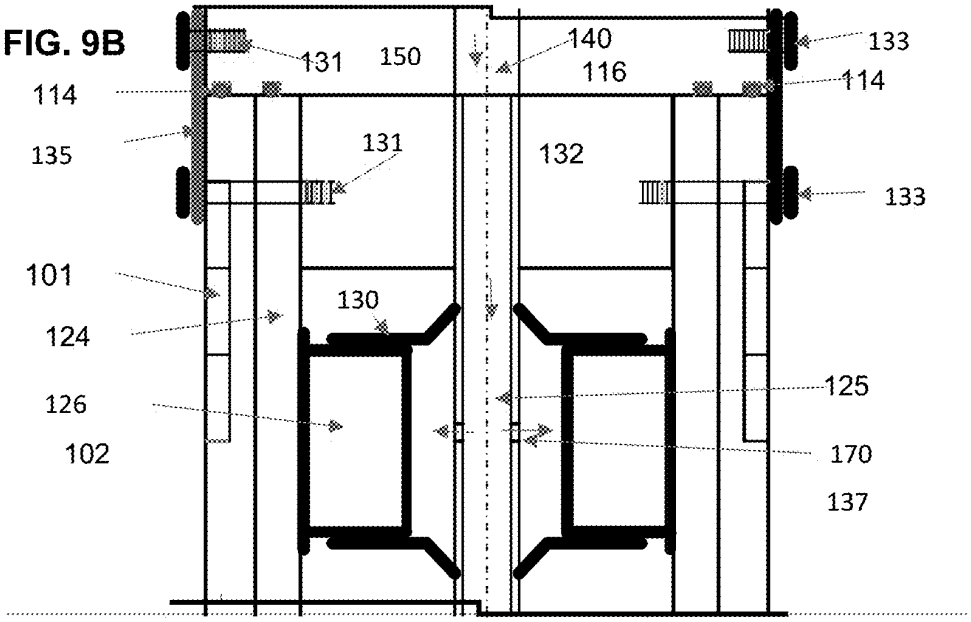

131
150
140
133
116
114
114
135
131
132
133
101
130
124
125
126
170
102
137

FIG. 10A

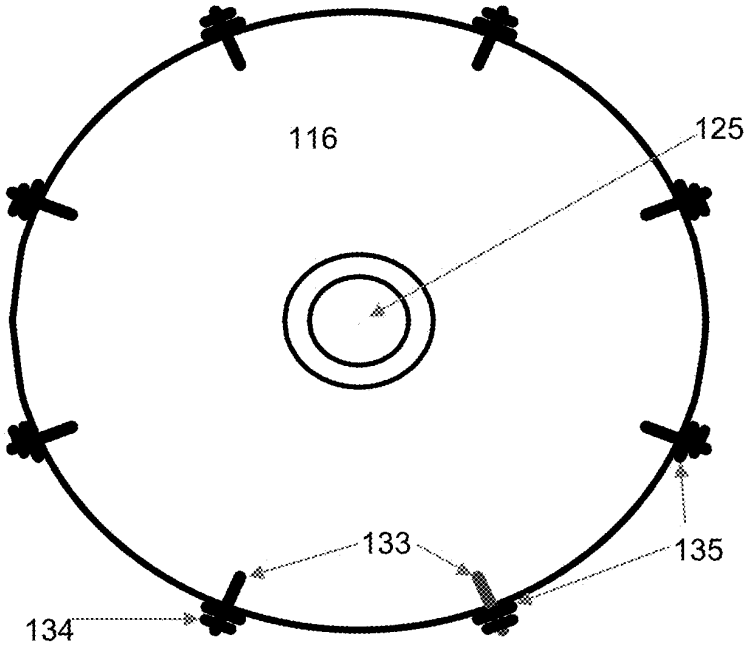


FIG. 10B

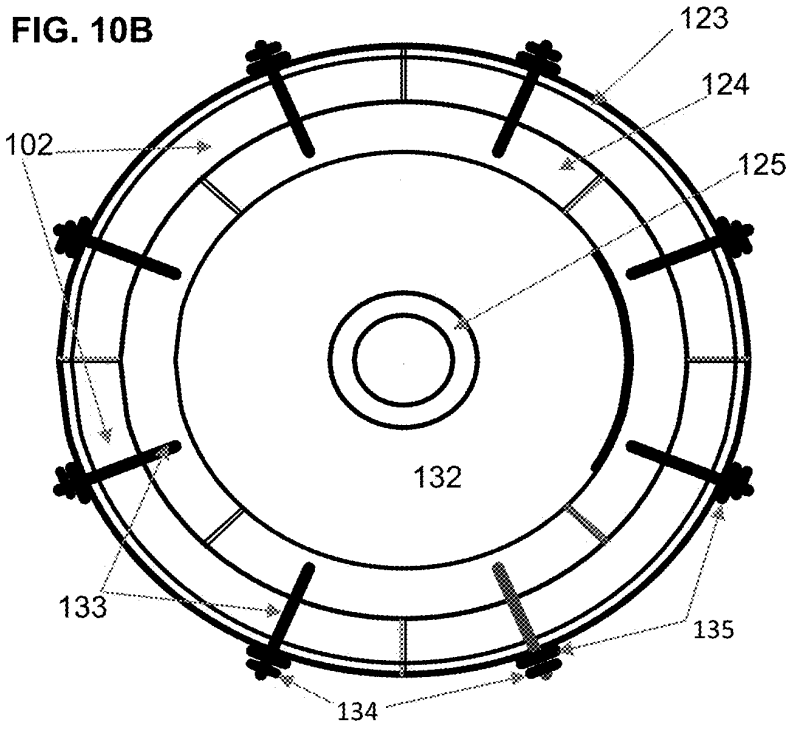


FIG. 11A

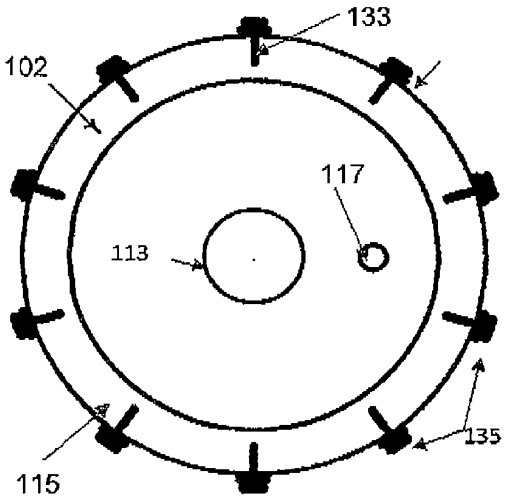


FIG. 11B

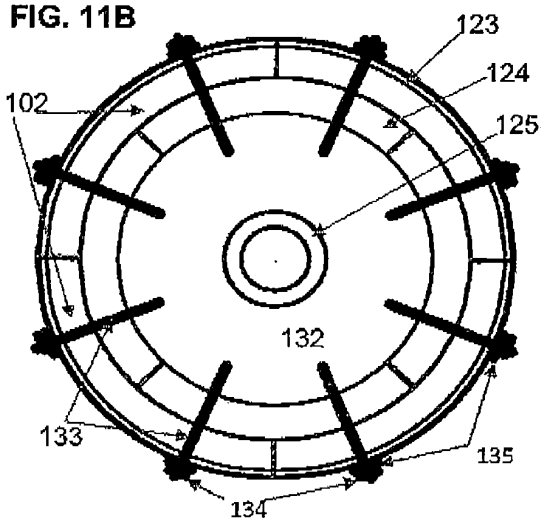
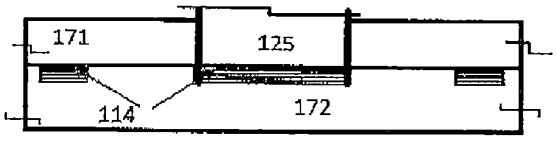


FIG. 11C



7 is that a circular guard tube (**142**) and cutter ring (**110**) have been attached at the top and bottom circular plates (**150** and **172**) to limit decompression at the ends of the expandable jacket during the test. The cover plate (**143**) is attached to the circular guard (**142**). The drill rod (**119**) is attached to the cover plate (**143**). The fluid pipe in between circular plate (**150**) and cover plate (**143**) is attached. The fluid hose/pipe (**121**) from the control panel at the ground surface is fastened to the cover plate (**143**). All other details remain the same. Because, during testing in soils and intermediate geomaterials, not so high lateral pressures are required, therefore the hydraulic capacity of jacks will be reduced and designed to apply bearing plate pressure generally in the range of about 10 to 20 MPa (1500 to 2900 psi).

(e) Measuring System for Above Described Four Pressuremeter Probes Surrounded by Expandable Jacket

The existing systems being used in various types pressuremeters for testing can also be used to measure or calculate radial displacement and applied pressures in the pressuremeters with expandable jacket. Menard Pressuremeter Probe consists of a read-out unit, which consists of a control panel, equipped with devices to regulate the pressure applied to the probe and read its volume changes with pressure increments and time. A nitrogen cylinder provides the pressure source. The box stands on a tripod. It includes the 800 cubic centimeter volumeter with a sight tube, a main pressuremeter regulator, a differential pressure regulator, pressure gauges 0-2.5 and 0-60 bar for measuring pressure in probe and guard cells. A coaxial or twin tubing, flexible, high resistance with small dilation, connects the probe to the control unit. The same system with appropriate changes can be used for the pressuremeter probes with expandable jackets for performing pressuremeter tests in soils and intermediate geomaterials, as described in this application. Texas pressuremeter uses a mechanical actuator which displaces a cylinder piston that travels within a cylinder filled with inflation fluid. It is supported on four columns and has two crank handles, a volume counter, a high precision digital gauge, and a readout box for pressure and volume reading. Similar or the same system can be appropriately adopted with the pressuremeter probes with expandable jacket for measuring volume and pressure increments.

In SBPMT, the expansion is monitored by three or six strain arms, positioned at 120-degree intervals or six strains spaced 60-degree interval, located at mid-height of the expanding test section. The internal pressure is measured by a strain gaged cell within the instrument. The arms are forced to follow the movements of the membrane by strain gaged leaf springs and hence radial expansion is converted to electrical output. The internal pressure is measured by a strain gaged cell within the instrument. A further two cells are attached to the membrane, 180 degrees apart, and these cells measure the changes in pore pressures. The same system can be attempted appropriately by planning to pass leads through the holes in the porous tube.

In Goodman Jack, two linear variable differential transformers (LVDT) displacement transducers are mounted within the jack. The hydraulic pressure exerted by the jacks is measured by pressure gauge. Same type of existing system of LVDT installing in all hydraulic jacks located at the mid-height can also be used for both types of pressuremeters with expandable jacket and hydraulic jacks for testing rocks, soils and intermediate geotechnical materials, as described in this application.

Tests using the pressuremeter probe with expandable jacket shall be generally conducted and analyzed following ASTM Standard for D4719-2020: Standard Test Methods for prebored pressuremeter testing in soils. Cambridge InSitu Self Boring Pressuremeter has few provisions which are different from those in ASTM D4719-2020. Therefore, some changes could be made while conducting tests using the pressuremeter probe with an expandable jacket and analyzing the data. The calibration of pressuremeter probes with expandable jackets shall be performed by pressurizing the probe and measuring or calculating the radial displacement and pressure, to determine the resistance offered by the probe, generally, using the existing calibration device (Gupta, 2018).

REFERENCES

1. Cambridge INSITU Ltd. (2011), "Pressuremeter Testing in Ruritania", www.Cambridge-insitu.com, Cambridge, UK.
2. Gupta, R. C. (2016). "Expandable Jacket and its Calibration Device for Triaxial Tests on Soils", U.S. Pat. No. 9,383,346 B2, United States Patent and Trademark Office, Alexandria, Va. 20133.
3. Gupta, R. C. (2017). "Test Device for Determining Three-Dimensional Consolidation Properties of Soils", U.S. Pat. No. 9,567,722 B2, United States Patent and Trademark Office, Alexandria, Va. 20133.
4. Gupta, R. C. (2018). "Expandable Jacket for triaxial, unconfined and uniaxial compression tests and test device for three-dimensional consolidation and settlement tests", U.S. patent Ser. No. 10/060,898 B2, United States Patent and Trademark Office, Alexandria, Va. 20133.
5. Hustuild, W. A. (1976). "An analysis of the Goodman Jack", The 17th U.S. Symposium on Rock Mechanics, Snowbird, Utah.
6. Menard, L. F. A. (1960). "Device for studying the deformation under load of a homogeneous medium", French Patent FR794886A, French Patent Office, France.
7. In Situ Site Investigation. "High Pressure Dilatometer (HPD)", www.insiyusi.com, Susex, UK.
8. RocTest (2014). "Instruction Manual for Self-Boring Pressuremeter, Model: BOREMAC, www.roctest-group-.com, Canada
9. RocTest (2014). "Texas A&M Pressuremeter, Instruction Manual", www.telemac.com, Canada, USA.
10. Slope Indicator Company (2010). "Introduction and Specifications for Goodman Jack", www.slopeindicator-.com, Stone Mountain, Ga. 30087.

The invention claimed is:

1. A method for determining horizontal stress versus radial strain relationship using a Pressuremeter Probe, the method comprising:

(i) The pressuremeter probe comprising an expandable jacket surrounding and in contact with a membrane, for determining the horizontal stress versus the radial strain relationship for subsurface soils and intermediate geomaterials;

(ii) the expandable jacket comprising a plurality of circular arch shaped segmented plates, and bands or rings, which are expandable;

(iii) the membrane which is impervious and flexible surrounding and in the contact with a porous tube;

(iv) installing the bands or rings in circular grooves cut in an outside surface of the circular arch shaped segmented plates so that the bands or rings are flush with the outside surface of the circular arch shaped segmented plates;

(v) designing thickness of the circular arch shaped segmented plates in order for them to remain vertical with lateral support provided by the bands or rings;

(vi) the porous tube having a plurality of holes which are provided in a grid pattern to let fluid flow to pressurize the membrane;

(vii) designed thickness of the porous tube to remain vertical when the pressure meter probe is pushed in a test hole which is either equal to diameter of the pressuremeter probe or less than the diameter of the pressuremeter probe;

(viii) attaching the porous tube both at its top and bottom ends to top and bottom circular plates using weld connections or thread connections with compression fittings or fittings with O-rings;

(ix) sealing the membrane both at its top and bottom ends using one or more than one O-ring held in place and covered by a circular ring which is thread connected to the top and the bottom circular plates, in order to make it waterproof and leak-proof;

(x) providing an extra layer of a short piece of the membrane from its ends to a small distance below the top end and a small distance above the bottom end of the circular-arch shaped segmented plates, when it is observed during tests that bursting of the membrane is occurring close to the ends of the circular-arch shaped segmented plates;

(xi) providing a guard cell comprising of a circular tube/pipe, thread connected or weld connected to top circular ring attached to the top circular plate;

(xii) providing a cutter ring comprising of the circular tube/pipe, the top end of which thread connected or weld connected to the bottom circular ring attached at the bottom of the porous tube;

(xiii) the bottom end of the cutter ring having a knife edge in order to scrap/cut test hole walls to the size of the pressuremeter probe;

(xiv) the top circular plate attached at the top of the porous tube, having two threaded holes, one for a fluid pipe and other for a vent pipe;

(xv) the guard cell provided with a cover plate;

(xvi) attaching the guard cell to the cover plate by the weld connection or the thread connection;

(xvii) attaching the fluid pipe and the vent pipe in between the cover plate and said top circular plate by the weld connections or the thread connections with the compression fittings or the fittings with the O-rings;

(xviii) sealing threaded vent hole in the cover plate by a vent plug with the compression fittings or the fittings with the O-rings in between;

(xix) the threaded hole for a fluid hose/pipe in the top of the cover plate to be provided with a male end with the compression fitting or the fitting with the O-rings;

(xx) prior to performing the test, connecting a fluid hose/pipe beginning from a control panel to the threaded hole for fluid hose pipe in the cover plate.

2. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Probe in accordance with claim **1**, the method further comprising:

(i) In a first drilling method, drilling a test hole to the diameter equal to the diameter of the pressuremeter probe to a small distance below the bottom of test depth;

(ii) stabilizing the test hole by slurry in subsurface conditions prone to caving during drilling or during performing the test;

(iii) filling the pressuremeter probe with fluid slowly till fluid comes out of the vent pipe with no air bubbles, after which the vent pipe to be closed by the vent plug;

(iv) setting the pressuremeter probe over the test hole and pushing it into the test hole under downward force of a drill rig to the test depth for performing the test;

(v) performing the pressuremeter test in pressure increments and recording readings for each pressure increments along with corresponding increase in volume of fluid inside the membrane or increase in radial displacement/expansion of the membrane and holding each pressure increment up to a selected time interval;

(vi) or performing the pressuremeter test in volume increments and recording the readings for each volume increments along with the corresponding increase in the pressure of fluid inside the membrane or the increase in the radial displacement/expansion of the membrane and holding each volume increment up to the selected time interval;

(vii) after completion of the test, decreasing the pressure in several decrements to zero value and then withdrawing the pressuremeter probe out of the ground or pushing it to next test depth to perform another pressuremeter test;

(viii) after withdrawing the pressuremeter probe out of the ground, drilling the test hole to another test depth and preparing the pressuremeter probe for next test depth;

(ix) in second drilling method, first drilling the test hole to the diameter about equal to the a diameter of the pressuremeter probe up to a depth where top of the pressuremeter will be seated;

(x) preparing the pressuremeter probe to perform the test;

(xi) lowering down the pressuremeter probe in the test hole till the bottom of the pressuremeter probe is seated at the top of the test depth where the test hole's diameter begins to be less than the diameter of the pressuremeter probe;

(xii) pushing the pressuremeter probe by applying downward vertical force taking reaction from the drill rig or a CPT rig or a moveable loaded box/platform or a platform with anchors/piles while the cutter ring scraping/cutting the test hole walls to diameter equal to the diameter of the pressuremeter probe up to or below the bottom of the test depth;

(xiii) performing the pressuremeter test in the pressure increments and recording the readings for each pressure increments along with the corresponding increase in the volume of fluid inside the membrane or the increase in the radial displacement/expansion of the membrane and holding each pressure increments up to the selected time interval;

(xiv) or performing the pressuremeter test in the volume increments and recording the readings for each volume increments along with the corresponding increase in the pressure of fluid inside the membrane or the increase in the radial displacement/expansion of the membrane and holding each volume increments up to the selected time interval;

(xv) after the completion of the test, decreasing the pressure or volume in the selected decrements to zero value;

(xvi) withdrawing the pressuremeter probe out of the ground;

(xvii) preparing the pressuremeter probe for the next test depth/depths in accordance with the specification or drawings using the same procedure as used for the first test;

(xviii) for measurements of the increase of the volume of the fluid inside the membrane, using either measurements from read-out unit in the control panel or measurements from counter of a mechanical actuator;

(xix) or calculating in the increase of the volume of the fluid inside the membrane by measuring the radial displacement/expansion by strain arms, mounted at the mid-height of the expanding section of the pressuremeter;

(xx) measuring the fluid pressure either from the read-out unit in the control panel or from strain gaged cell mounted within the expanding section of the pressuremeter.

3. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Probe in accordance with claim **2**, the method further comprising:

(i) in a third drilling method, the pressuremeter probe is provided with an auger/drill bit to self-bore the test hole;

(ii) for this method, attaching a first pipe at the center of the pressuremeter probe between upper and lower circular plates and then inserting a second pipe inside the first pipe;

(iii) after having inserted the second pipe inside the first pipe to below the lower circular plate attached to a bottom end of the porous tube, attaching the auger/drill bit to the second pipe to self-bore the test hole;

(iv) providing the fluid pipe on left side of the center and the vent pipe on right side of the center of the pressuremeter probe or vice versa;

(v) all other details for the expandable jacket, the membrane, the porous tube, the guard cell and the cutter ring and their attachments remain the same as described for the first and the second drilling methods;

(vi) using the same procedure for performing the pressuremeter test for the third method as explained for the first and the second drilling methods;

(vii) performing the pressuremeter tests using a self-boring pressuremeter test method, continuously one after the other, without withdrawing the pressuremeter probe out of the ground, unless it becomes necessary due to unforeseen circumstances such as bursting of the membrane.

4. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Test Probe in accordance with claim **3**, the method comprising:

(i) for the third drilling method, a drill bit with axial injection of prepared drilling mud/slurry to be used to stabilize the hole for the soils prone to caving during drilling or performing the pressuremeter or the self-boring pressuremeter test;

(ii) for this drilling method, generally using a three-wing bit for clays, silts and fine sands and a roller bit for gravelly soils.

5. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Probe in accordance with claim **2**, the method further comprising:

(i) For the first and the second drilling methods, a drill bit with axial injection of preparing prepared drilling mud/slurry to be used to stabilize the hole for the subsurface soils prone to caving during drilling or performing the pressuremeter or the self-boring pressuremeter test;

(ii) for both drilling methods, generally using a three-wing bit for clays, silts and fine sands and a roller bit for gravelly soils.

6. A method for determining horizontal stress versus radial strain relationship using a Pressuremeter Probe, the method comprising:

(i) the pressuremeter probe comprising an expandable jacket for determining the horizontal stress versus the radial strain relationship for subsurface rocks;

(ii) the expandable jacket comprising two layers of circular arch shaped segmented plates and bands or rings, which are expandable;

(iii) first layer comprising a plurality of the circular arch shaped segmented plates, named as loading circular arch shaped segmented plates, which surround and in contact with a plurality of hydraulic jack assemblies, spaced vertically in the pressuremeter probe;

(iv) second layer comprising a plurality of the circular arch shaped segmented plates surrounding and in contact with the loading circular arch shaped segmented plates;

(v) the bands or rings surrounding the second layer of the circular arch shaped segmented plates;

(vi) staggering the second layer of the circular arch shaped segmented plates on the first layer of the loading circular arch shaped segmented plates, such that the load applied by hydraulic jacks are equally distributed on to the second layer of the circular arch shaped segmented plates, which in turn equally distributes load on test hole walls;

(vii) installing the bands or rings around circular or rectangular grooves in the second layer of the circular arch shaped segmented plates, such that the bands or rings remain flush with outside surface of the circular arch shaped segmented plates;

(viii) installing two O-rings in the circular or rectangular grooves of a top circular plate above the circular arch shaped segmented plates and the two O-rings in the circular or the rectangular grooves of a bottom circular plate below the circular arch shaped segmented plates, such that one of the two O-rings remain in contact with bottom and top ends of the loading circular arch shaped segmented plates and other one of the two remain in contact with the bottom and the top ends of the second layer of the circular arch shaped segmented plates in order to prevent any infiltration of rock fragments into the pressuremeter probe;

(ix) installing a fluid pipe in between the top and the bottom circular plates to let hydraulic fluid flow to hydraulic jack cylinders through holes provided in the fluid pipe;

(x) during pumping the hydraulic fluid with the help of a hydraulic pump, pressurized hydraulic fluid flowing in the fluid pipe and then through the holes in the fluid pipe, flowing in to hydraulic jack cylinders, pushing pistons move forward to radially displace the two layers of the circular arch shaped segmented plates and then radially displacing the test hole walls, while applying equally distributed load on the test hole walls;

(xi) attaching the fluid pipe to the top and the bottom circular plates by either weld connection or threaded connection with compression fittings or fittings with the O-rings;

(xii) providing a threaded circular hole in the center of the top circular plate to attach the fluid pipe or fluid hose to connect to the hydraulic pump located at ground surface;

(xiii) using the compression fittings or the fittings with the O-rings for the threaded connections to connect the

fluid pipe to the top and bottom plates and to connect the fluid pipe/hose to the top plate;

(xiv) providing a threaded circular groove in the top plate to attach drill rods;

(xv) using drill rods to lower down the pressuremeter probe into a test hole to the test depth or to pull out the pressuremeter probe out of the ground after completion of the tests;

(xvi) size of the test hole is equal or very slightly greater than the diameter of the pressuremeter probe, so that the pressuremeter probe when inserted in the test hole touches the test hole walls and smoothly enters in the test hole.

7. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Test Probe in accordance with claim **6**, the method comprising:

(i) for measurement of radial displacement/expansion of the two layers of the circular arch shaped segmented plates, installing LVDTs in the hydraulic jacks located at mid-height of expanding test section of the pressuremeter;

(ii) measuring hydraulic pressure created by the hydraulic pump inside the hydraulic jacks by a pressure gage.

8. A method for determining horizontal stress versus radial strain relationship using a Pressuremeter Probe, the method comprising:

(i) the pressuremeter probe comprising an expandable jacket surrounding and in contact with a hydraulic jack assembly, for determining the horizontal stress versus the radial strain relationship for subsurface soils, and intermediate geomaterials;

(ii) the expandable jacket comprising two layers of circular arch shaped segmented plates and bands or rings, which are expandable;

(iii) first layer comprising a plurality of the circular arch shaped segmented plates, named as loading circular arch shaped segmented plates, which surround and in contact with a plurality of hydraulic jack assemblies, spaced vertically in the pressuremeter probe;

(iv) second layer comprising a plurality of the circular arch shaped segmented plates surrounding and in contact with the loading circular arch shaped segmented plates;

(v) the bands or rings surrounding the second layer of the circular arch shaped segmented plates;

(vi) staggering the second layer of the circular arch shaped segmented plates on the first layer of the loading circular arch shaped segmented plates, such that the load applied by hydraulic jacks are equally distributed on to the second layer of the circular arch shaped segmented plates, which in turn applying equally distributed load on test hole walls;

(vii) installing the bands or rings in and around circular or rectangular grooves in the second layer of circular arch shaped segmented plates, such that the bands or rings remain flush with outside surface of the second layer of the circular arch shaped segmented plates;

(viii) installing two O-rings in the circular or rectangular grooves of top circular plate above the circular arch shaped segmented plates and the two O-rings in the circular or rectangular grooves of bottom circular plate below the circular arch shaped segmented plates, such that one of the two O-rings remain in contact with bottom and top ends of loading circular arch shaped segmented plates and other one of the two remain in contact with the bottom and top ends of the second layer of the circular arch shaped segmented plates in order to prevent any infiltration of rock fragments into the pressuremeter probe;

(ix) installing a fluid pipe in between the top and the bottom circular plates to let hydraulic fluid flow to hydraulic jack cylinders through holes provided in the fluid pipe;

(x) during pumping the hydraulic fluid with the help of hydraulic pump, pressurized hydraulic fluid flows in the fluid pipe and then through the holes in the fluid pipe, fluid flows in to the hydraulic cylinder;

(xi) which in turn, pushing pistons to move forward to radially displace the two layers of the circular arch shaped segmented plates and then radially displacing the test hole walls by applying equally distributed load on the test hole walls;

(xii) attaching the fluid pipe between the top and bottom circular plates by either weld connection or threaded connection with compression fittings or fittings with the O-rings;

(xiii) providing a threaded circular hole in the center of cover plate to attach the fluid pipe or fluid hose which connects to hydraulic pump at the ground surface;

(xiv) using the compression fittings or the fittings with O-rings connecting the fluid pipe between the cover and the top circular plates located vertically below the fluid pipe/hose attached at the top of the cover plate to lead to the hydraulic pump at the ground surface;

(xv) designing thickness of the two layers of the circular arch shaped segmented plates and the fluid pipe in order for them to remain vertical with the lateral support provided by the bands or rings;

(xvi) providing a guard cell comprising of a circular tube/pipe, thread connected or weld connected to the top circular plate located above the two layers of the circular arch shaped segmented plates;

(xvii) providing a cutter ring comprising of the circular tube/pipe, the top end of which thread connected or weld connected to the bottom circular plate located below the two layers of the circular arch shaped segmented plates;

(xviii) the bottom end of the cutter ring having a knife edge in order to scrap/cut the test hole walls to the size of the pressure meter probe;

(xix) the guard cell covered by a cover plate;

(xx) attaching the top of the guard cell to the cover plate by the weld or the thread connection;

(xxi) the threaded hole for the fluid pipe/hose in the cover plate to be provided by the compression fittings or the fittings with O-rings with a male end screwed in to the top of the threaded hole for the fluid pipe and the other end of the compression fitting provided with a tube fitting;

(xxii) providing a threaded circular groove in the top plate to attach drill rods;

(xxiii) using the drill rods to lower down the pressuremeter probe into a test hole at the test depth or to pull out the pressuremeter probe out of the ground after completion of the tests;

(xxiv) this pressuremeter probe which uses the hydraulic jacks shall also be used to determine lateral stress versus radial strain relationship for weak rocks, shales and jointed weak rock rocks.

9. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Probe in accordance with claim **8**, the method comprising:

(i) using two drilling methods for making the test hole;

(ii) in first drilling method, drilling the test hole to a diameter equal to the diameter of pressuremeter probe to a small distance below the bottom of test depth;

(iii) stabilizing the test hole during drilling by slurry;

(iv) setting the pressuremeter probe over the test hole and pushing it into the test hole under downward force of a drill rig to the test depth for performing the test;

(v) performing the pressuremeter test in pressure increments and recording readings of the pressure increments and increase in radial displacement/expansion of the two layers of the circular arch shaped segmented plates and holding each pressure increment to a selected time interval;

(vi) after completion of the test, decreasing the pressure in selected decrements to zero value and then withdrawing the pressuremeter probe out of the ground or pushing it to next test depth to perform another pressuremeter test;

(vii) in second test method, first drilling the test hole to the diameter about equal to the diameter of the pressuremeter probe up to a depth where bottom of pressuremeter probe will be seated;

(viii) preparing the pressuremeter probe to perform the test;

(ix) lowering down the pressuremeter probe in the test hole till the bottom of the pressuremeter probe is seated at the top of the test depth where the test hole's diameter begins less than the diameter of the pressuremeter probe;

(x) pushing the pressuremeter probe by applying downward vertical force taking reaction from drill rig or CPT rig or moveable loaded box/platform or a platform with anchors/piles while cutter ring scraping/cutting the test hole walls to diameter equal to the diameter of the pressuremeter probe up to the bottom of the test depth;

(xi) performing the pressuremeter test in selected pressure increments and taking and recording readings of pressure increments and increase in radial displacement/expansion of the two layers of the circular arch shaped segmented plates by holding each pressure increment to a selected time interval;

(xii) after completion of test, decreasing the pressure in selected increments to zero value;

(xiii) repeating the same procedure to perform next test/tests;

(xiv) for measurement of the radial displacement/expansion of the two layers of the circular arch shaped segmented plates, installing LVDTs in the hydraulic jacks located at mid-height of expanding test section of the pressuremeter;

(xv) measuring hydraulic pressure created by the hydraulic pump inside the hydraulic jacks by a pressure gage.

10. The method for determining the horizontal stress versus the radial strain relationship using the Pressuremeter Test Probe in accordance with claim **8**, the method comprising:

(i) for the first and the second drilling methods, a drill bit with axial injection of prepared drilling mud/slurry to be used to stabilize the hole for the soils prone to caving during drilling or performing the pressuremeter or the self-boring pressuremeter test;

(ii) for both drilling methods, generally using a three-wing bit for clays, silts and fine sands and a roller bit for gravelly soils.

* * * * *