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(54) Title: EARTHQUAKE ISOLATOR

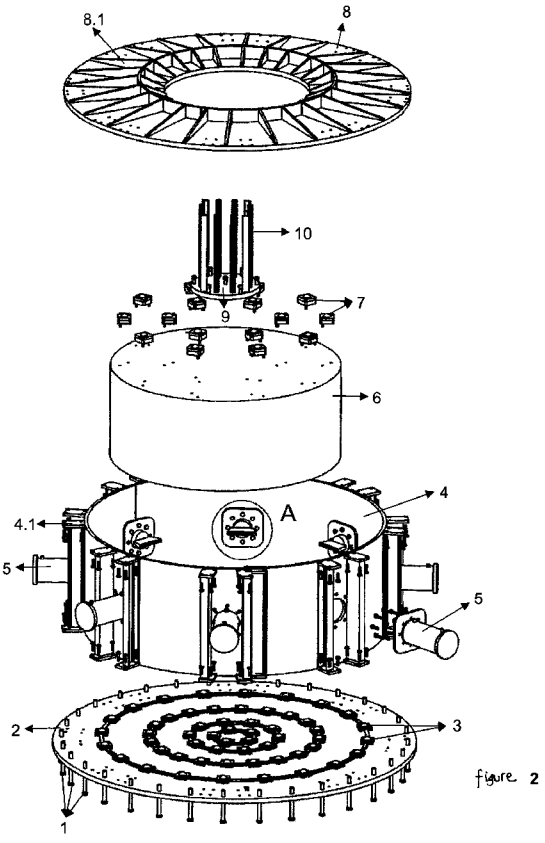


figure 2

(57) Abstract: Invention; is related to isolators eliminating circular forces caused by earthquake forces acting on the building. It is placed between foundation of structures manufactured by steel construction, concrete, prefabricated structure or other methods and structure and which reduces/terminates impact of earthquakes on structures. Thus, damage to be given by earthquake to carrying elements of building is eliminated.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Earthquake Isolator

TECHNICAL FIELD

Invention; is about isolator placed between foundation of structures manufactured by steel construction, concrete, prefabricated structure or other methods and structure and which reduces/terminates impact of earthquakes on structures.

PREVIOUS TECHNIC

The earthquake is defined as shaking of crust of earth by spreading of vibrations in the form of wave due to breaks in the earth's crust. Earthquake, a natural phenomenon indicating that earth on which human being is secure can also move and all the buildings on it can be harmed and people could die.

The science engaged with how earthquakes occur, spreading of earthquake wave on the earth crust, measuring instruments and methods, evaluation and registrations and readings and other issues related to the earthquake is called "SEISMOLOGY."

There is an earth model supported by data obtained from geological and geophysical studies about the internal structure of the earth. According to this model there is lithosphere at the Earth's outer part of 70-100 km thickness. Continents and oceans are located in this lithosphere. There is mantle remaining between the core and lithosphere with thickness of 2,900 km. The bottom of the mantle is considered to consist of a mixture of nickel-iron core. It is known that temperature increases from surface to deeper. It is estimated to be average 5000-6000 ° C. It is concluded that core has a liquid structure depending on the fact that transverse seismic waves don't spread core of earth.

Though in general mantle is solid from surface to deep there are local liquid layers.

There is soft upper mantle under earth crust which is called asthenosphere. Forces occurring here fragment stone shell particularly due to convection currents, and many "plates" are divided. Convection currents formed on the upper mantle are connected to temperatures caused by radioactivity.

As convection currents gets upper cause stresses on stone rollers and then leads to the formation of plates by break of weak zones. Already even now there are ten big plates and many small plates. These plates floats on asthenosphere with continents like a boat move relative to each other with a speed not perceived by people.

Plates are moving away from each other where convection currents rise and hot magma coming out of here form ocean back. At locations where plates come into contact with each other friction and compression occurs. One of the friction plates sink into the mantle below and constitute subduction zones by melting. These sequential events caused by convection currents continue under crust of earth.

Boundaries of these plates which rub each other, compress each other, climb each other or fall under each other appear as earthquake in the world. Vast majority of earthquakes occurring in the world take place on narrow zones at plate boundaries where they force each other.

There is a frictional force between two plates pushing each other or entering under each other that prevents motion. For the motion of such a plate this friction force must be overcome.

When the friction force between one pushed plate and another plate is exceeded a movement takes place. This action takes place in a very short time and has a form of shock. Finally earthquake waves which can spread very far (shock) occur. These waves shake the environment they pass through and energy decreases as waves get farther from the direction of earthquake. Meanwhile land fractures occur on earth which is called as fault line and sometimes visible and extend for miles. These fractures are sometimes not observable on earth and they might be hidden by the surface layers. Sometimes, an old fault line formed due to an old earthquake and came to Earth but covered in time can move again.

In this way formation of the earthquake was described under the theory of "elastic rebound theory" by American Reid in 1911 and has been proven in laboratory with experiments.

According to this theory, energy preserved by unit deformation accumulation elastically depending on time at any point reaches a critical value, it defeats the friction that exists along the fault line and cause motion of fault lines on both sides of rock forms relative to each other. This event is the sudden displacement movement.

This sudden displacement occurs due to discharge of unit deformation energy accumulated at a specific point, discharge in other words with the conversion to mechanical energy, and as a result due to breaking and tearing action earth layers.

In fact, it is impossible for rocks to break without the accumulation of a pre-displacement unit. These unit displacement movements are created by convection currents that occur in the upper mantle, and rocks may show strength until a certain deformation and then fractured. These breakage results in earthquakes. After such cases a part of stress and energy accumulated away from the rocks are removed.

Mostly on faults occurring during this earthquake elastic re-bounds (stroke) are formed on both sides of the faults in the opposite direction.

Faults are usually named according to the direction of movement. Faults with more horizontal movement results in "strike-slip faults." In addition, two separate blocks that form the fault may have movement relative to each other from left or right which is an example of the right or left lateral strike-slip faults.

Faults occurring due to vertical movement are called "dip-slip faults". Most of the faults may have both horizontal and vertical movements.

Earthquakes are natural events each hosting its own unique and many unpredictable variables. Considering the many possibilities earthquake should be treated according to its structure. Studies for the calculation of the behavior of your structure and the strength during major earthquake is the ideal of mankind. For the sake of this ideal many laws, regulations, calculations and specifications were made and continues.

In general in all the calculations and studies made in the world only effects of horizontal direction of earthquakes are taken into account. Engineers calculate earthquake loads to effect structure from both sides similarly and distribute these loads to structure floors at specific rates. In buildings constructed by considering only horizontal forces ductility of nonlinear beams and curtains cannot be calculated correctly. This situation mostly results in bending on collapse of these structures. Probability of survival of people within this type of structure is reduced highly.

Today, rubber isolators and pendulum isolators are used to protect structure against earthquakes. Rubber isolators are formed with rounded rubbers placed between steel plates. Here it is believed that by earthquake is isolated due to rubber horizontal shift and horizontal displacement of each of 15-20 plates. Rubber isolators

should be placed between the columns and beams in single-story structures with or between foundation and structure (viaduct, bridge, and hangar). Rubber isolators disconnect link between foundation and structure. It is not possible for structure to transfer momentum to foundation . Horizontal forces are also suspected to be transferred to foundation. If rubber isolators make horizontal displacement between each plate allows vertical displacement as well. In this case because building will try to be overthrown during earthquake due to the centrifugal force when building is disconnected from foundation building will overturn. This system cannot be applied in the multi-story buildings. It should be taken into account risks posed rubber during the fire.

Pendulum isolators consist of two parts. There is no connection with the basic structure as in the rubber isolator. It cannot handle the momentum of the building and because adherence will increase due to weight of building shift of the pendulum isolators will be weaken. This situation is a barrier to reveal the desired result. It is not suitable for multi-story buildings. It can cause the collapse of a structure that can overcome the earthquake heavily damaged.

BRIEF DESCRIPTION OF THE INVENTION

Invention; is related to isolators eliminating circular forces caused by earthquake forces acting on the building. It is placed between foundation of structures manufactured by steel construction, concrete, prefabricated structure or other methods and structure and which reduces/terminates impact of earthquakes on structures. Thus, damage to be given by earthquake to carrying elements of building is eliminated.

LIST OF FIGURES

Figure 1. Assembled Perspective view
Figure 2. Exploded View Perspective
Figure 3.A Detail View
Figure 4. Mounted Side View
Figure 5. A-A Section View
Figure 6. B Detail View
Figure 7. C Detail View

Figure 8 B-B Section View

Figure 9. D Detail View

Figure 10. Assembled Top View

Figure 11. E Detail View

Figure 12. F Detail View

Figure 13. Side View of the heel piece

Figure 14. Top View of the heel piece

Figure 15. Exploded Perspective view of the heel part

D Figure 16. G Detail View

Figure 17. Bottom Plate and Side View of Old Ball Group

Figure 18. H Detail View

Figure 19. Top View Bottom Plate and Lower Ball Group

Figure 20. Bottom Plate and Lower Ball Group exploded perspective view

Figure 21. I Detail View

Figure 22. Overview of Centering Piston Perspective

Meanings of part numbers specified in figures are as follows:

1. Anchor rod
2. Bottom Chassis
3. Lower Moving Ball Group
4. Body
4.1. Strengthening Pillar
5. Centering Piston
6. Heel
7. Top Ball Group
8. Top chassis
8.1. Flag
9. Link plate
10. Access sprouts

DETAILED DESCRIPTION OF THE INVENTION

Invention; consists of anchor rod (1), lower chassis (2), lower movable ball group (3), body (4) centering piston (5), heel (6), upper ball group (7), upper chassis (8), connection plate (9) connection sprouts (10). Body (4), comprises reinforcing pillar (4.1). The upper chassis (8) contains flag (8.1) on it.

Holes are drilled into sections on body (4) where centering piston (5) to be assembled. At least one strengthening pillar (4.1) is mounted on edges of the hole. Then centering pistons (5) are placed on body (4) and secured. Centering pistons (5) should be secured to be aligned with the vertical axis of the body (4).

Body mounting structure is placed on lower chassis (2) and mounted together rigidly. Then lower moving ball group (3) to meet the mechanical load of building is placed on lower chassis (2) according to the force distribution. Because lower moving ball group (3) is a free moving, carrying element it is deposited in a slot. Lower moving ball group (3) moves freely between heel (6) lower chassis (2).

Connection plate (9) is mounted on heel (6) where upper ball group(7) and connection sprouts (10) are secured. The prepared assembly set is mounted on lower movable ball group (3) to be coaxial with the body (4). Then the upper chassis (8) is connected to body (4) in same axis with lower chassis (2) with reinforcement struts (4.1) rigidly. To increase the strength of upper chassis (8) flags (8.1) are placed on it in a circular axis.

At least one seismic isolator facing the bottom of each carrier column will be secured on the foundation of the structure according to the ground properties with anchor bolts (1). Structure is connected to seismic isolator with connection sprouts (10). In required circumstances perennial foundation will be made on connection sprouts (10) of seismic isolators placed on foundation with specified intervals and structure will be built on this perennial foundation.

The devastating effects that is created by horizontal movements during earthquakes stems from circular form force. So structure faces centrifugal force. This centrifugal force constitutes the devastating effects on structure. To minimize or eliminate this impact the invention provides effective protection.

The invention is used to isolate the resonance faced by structures during an earthquake. When earthquake-induced force starts to impact a structure built on seismic isolator; bottom chassis (2), body (4) and the upper chassis (8) mounted to

anchored to the foundation starts to move together with the foundation. Heel (6), connection plate (9) and the connection sprout (10) tries to maintain its current position together with building. The system to provide this effect is upper ball group (7) in contact with upper chassis (8) and secured to heel (6) (freely movable within housing) and movable bottom ball group (3) located under the heel (6). Upper ball group (7) at the same time transfers momentum coming from the structure to the body (4) with heel (6). Momentum transmitted to body (4) is then transferred to foundation. Due to free movement of lower ball group (3) within the housing friction stemming from the weight of the structure during earthquake is zero. Thus horizontal deflections coming to foundation are eliminated without being transferred to structure. After the earthquake ends heel (6) may be in a position eccentric from the center of seismic isolators. Centering pistons (5) located on the body (4) provides the heel (6) and structure to take original position before the earthquake. Centering piston (5) strokes are equal and are located at equal intervals around. With equal force and speed coming to stroke mills of centering pistons (5) heel (6) is brought to center of earthquake isolators by means of centering pistons (5). Thanks to a free moving ball on tip of the cylinder deformation and friction are minimized.

Because heel (6) will move freely within body (4) during earthquake diameter difference between body (4) and heel (6) is calculated with safety criteria to meet displacement of earthquake in respect to the ground characteristics where the foundation will be established.

06 / 07 / 2014

CLAIMS

1. It is a seismic isolators, characterized with parts of anchor rod (1), lower chassis (2), lower movable ball group (3), body (4) centering piston (5), heel (6), upper ball group (7), upper chassis (8), and connection plate (9) and connection sprouts (10).
2. It is the body (4) mentioned in claim 1 and characterized by compromising reinforcing strut (4.1).
3. It is upper chassis (8) mentioned in claim 1 and characterized by comprising flag (8.1).
4. It is body (4), mentioned in claim 1 and characterized by comprising freely moving heel (6).
5. It is body (4), mentioned in claim 1 and characterized by comprising centering pistons (5) bringing heel (6) to its original position after the earthquake.
6. It is the heel (6) mentioned in Claim 1 and characterized by upper ball group (7) and connection plate (9) and the connection sprouts (10).
7. It is the upper ball group (7) mentioned in Claim 1 and characterized bearing on heel (6).

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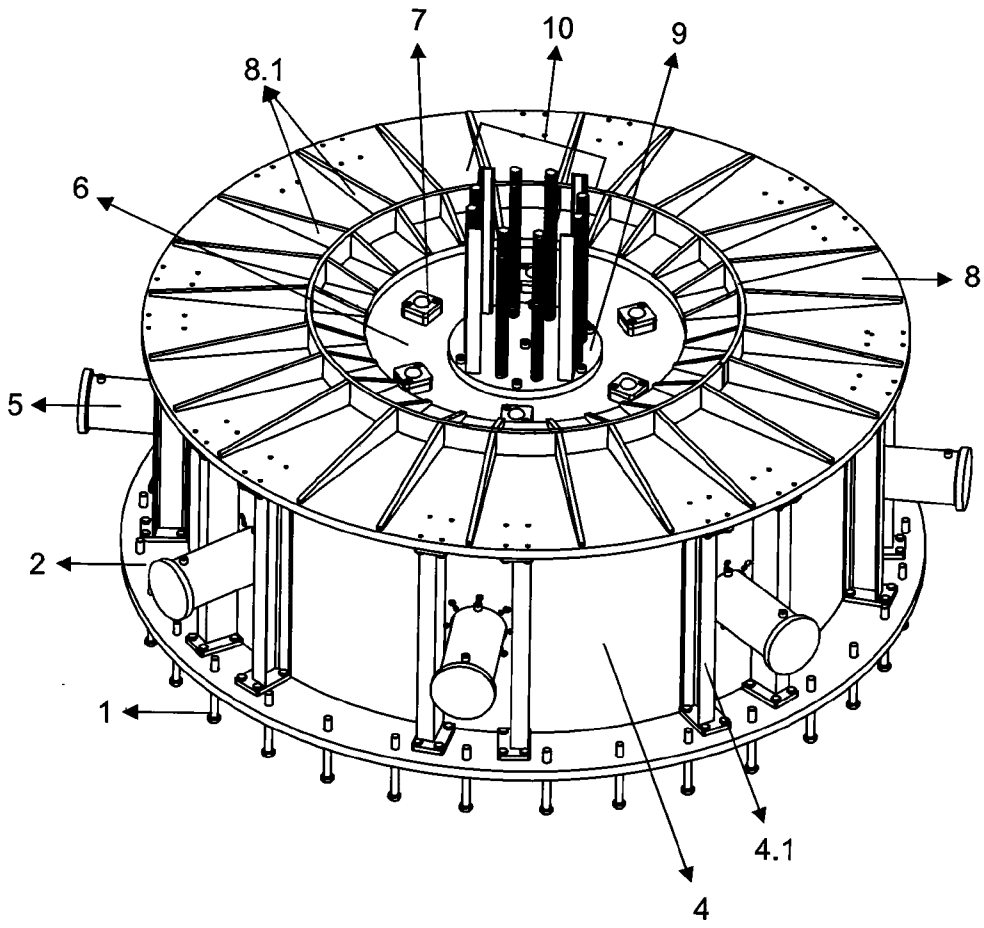


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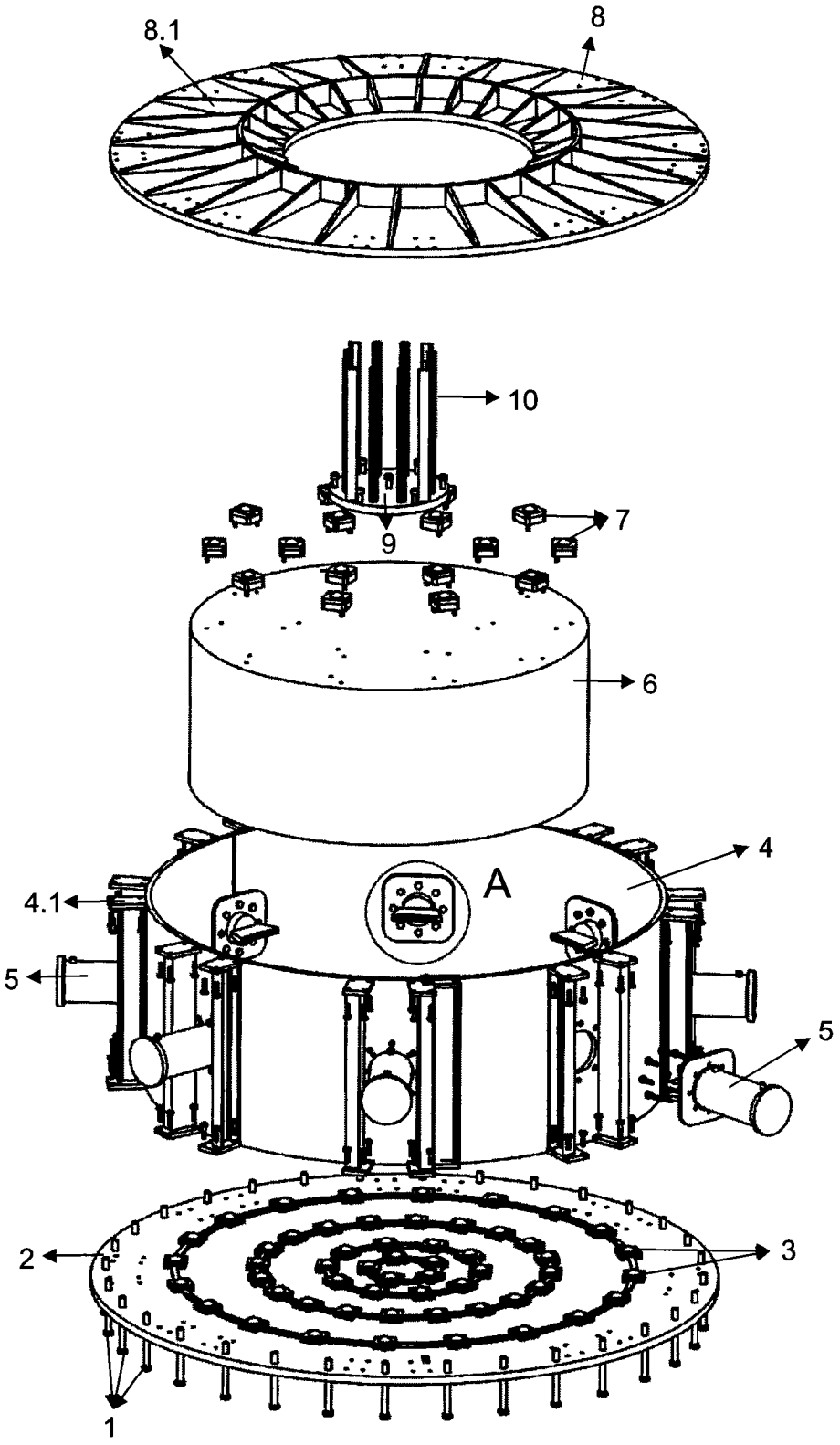


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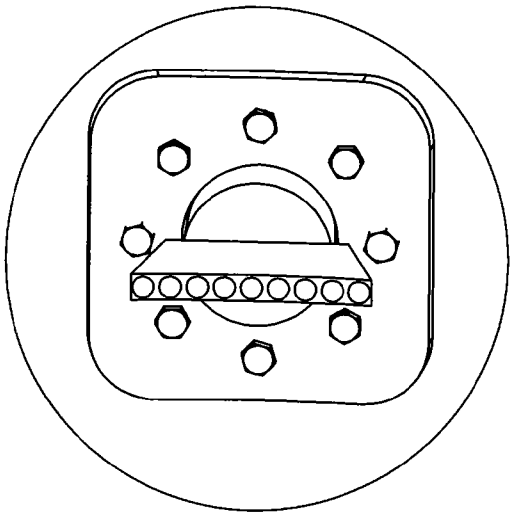


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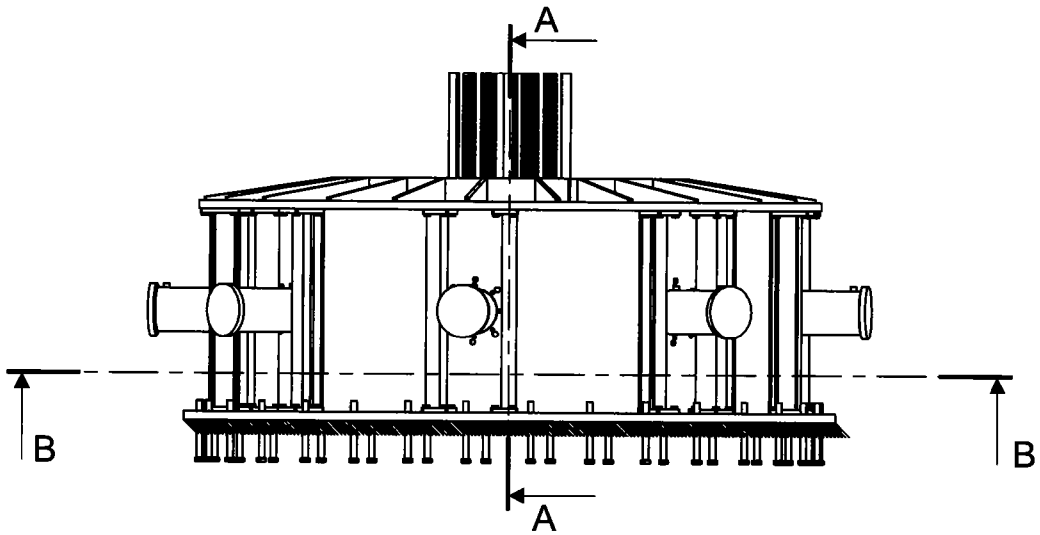
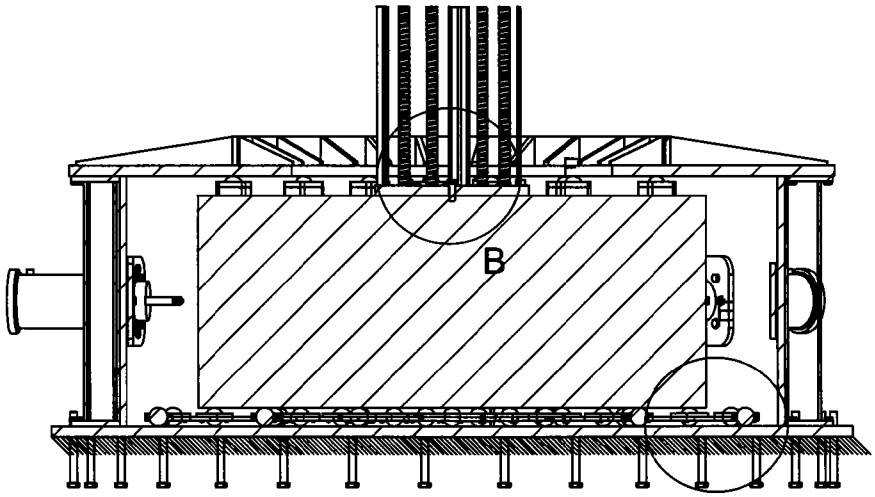


figure 4



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figure 5

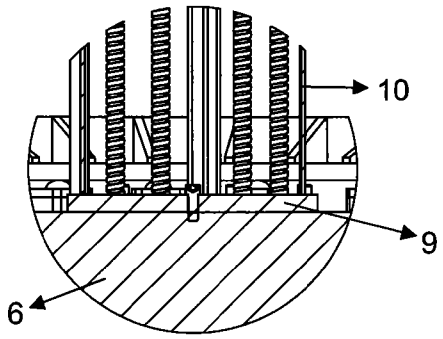


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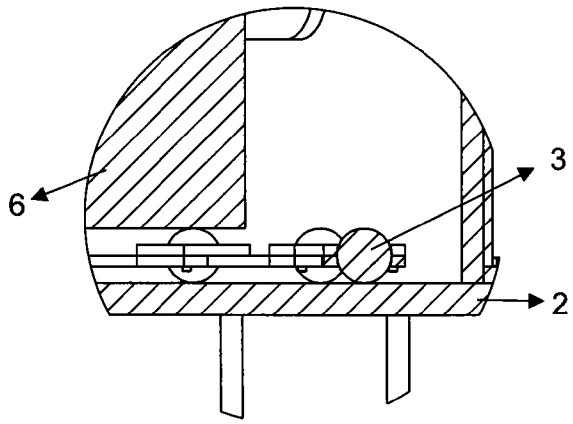


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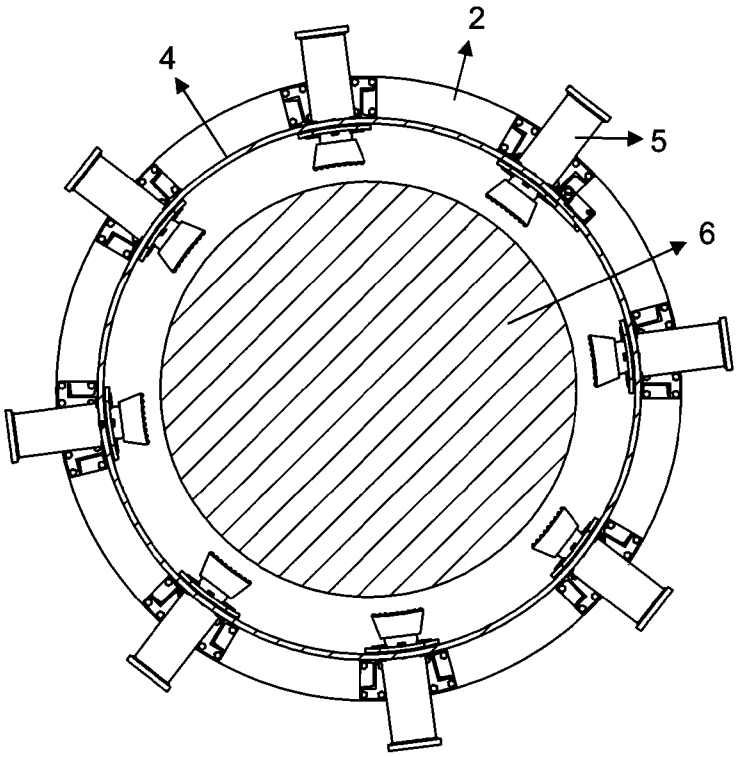


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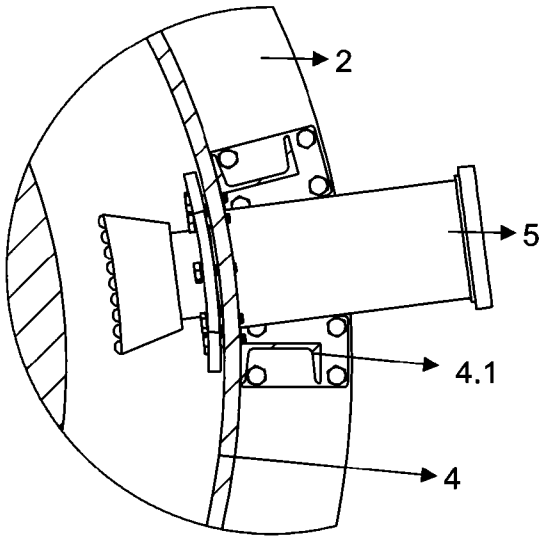


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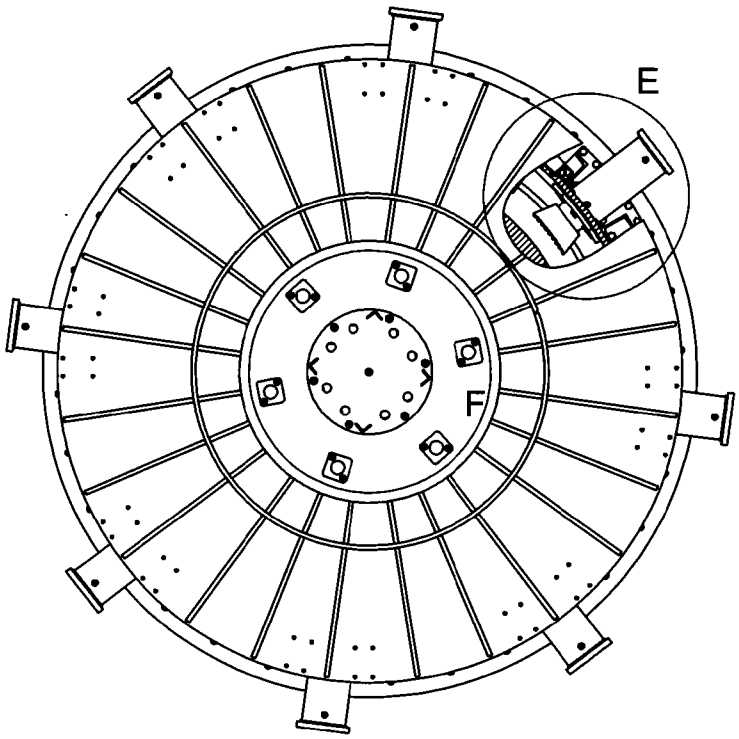


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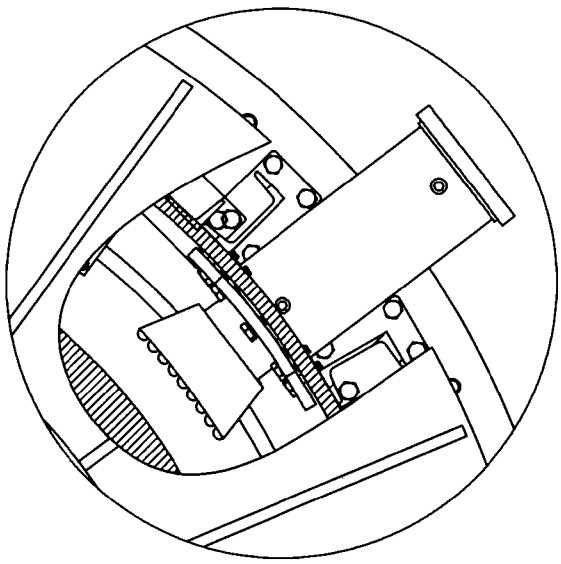


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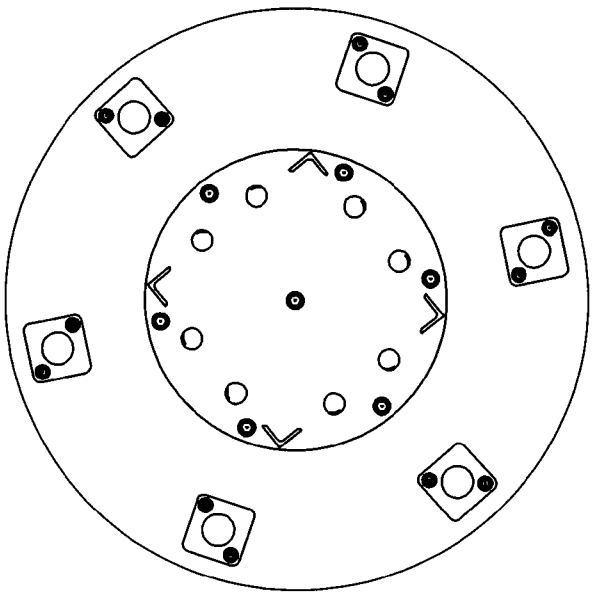


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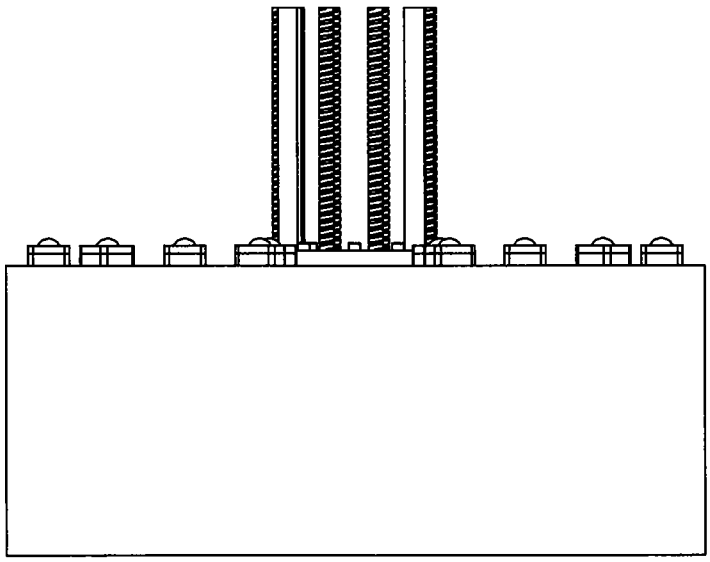


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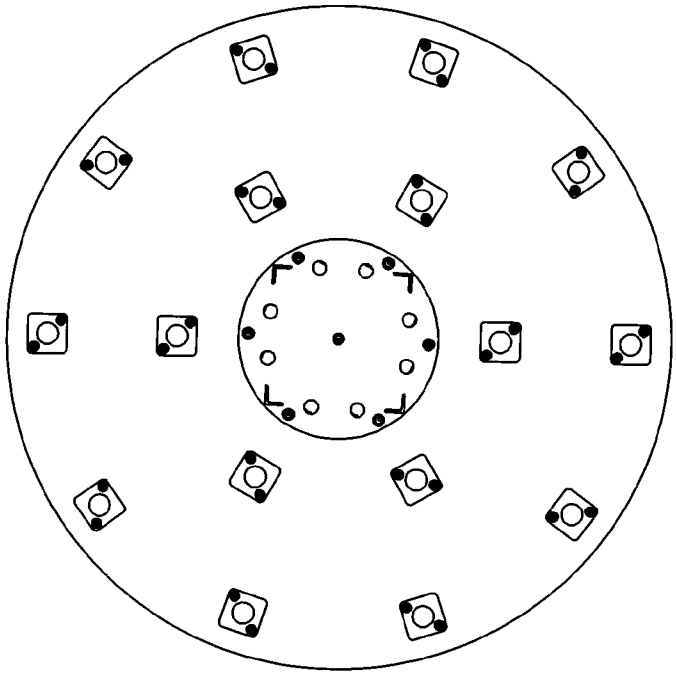


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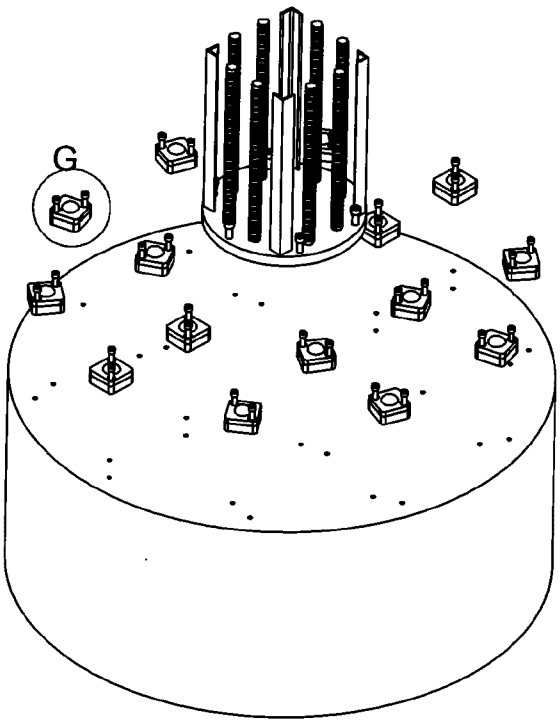


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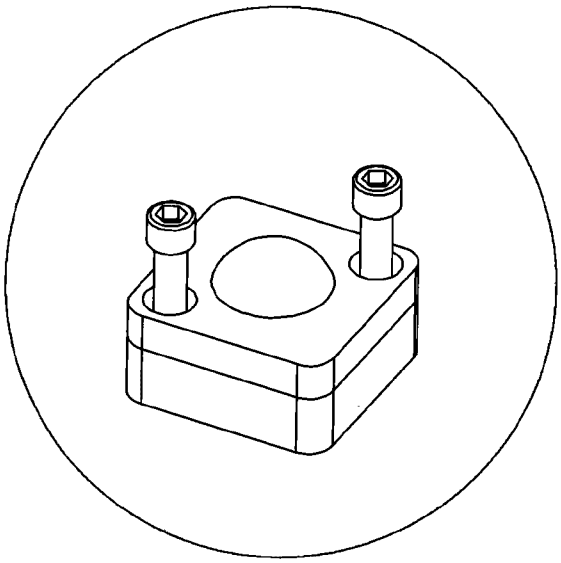


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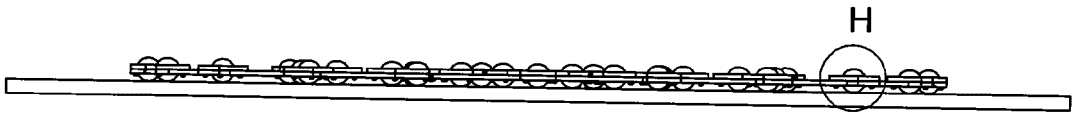


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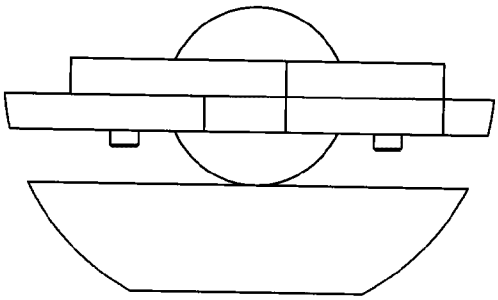


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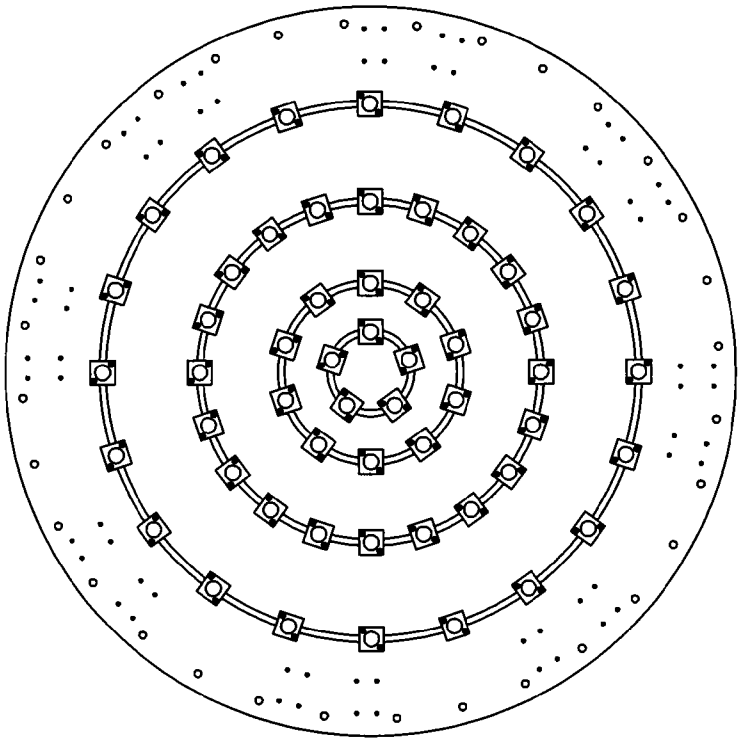


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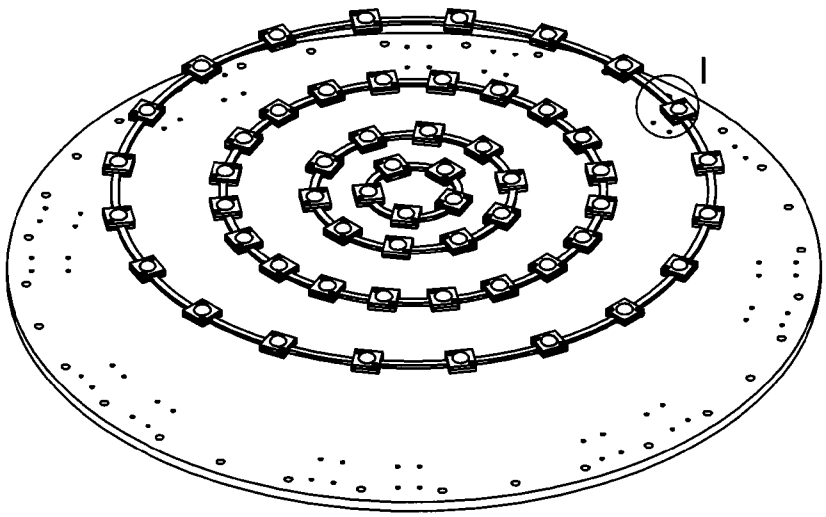


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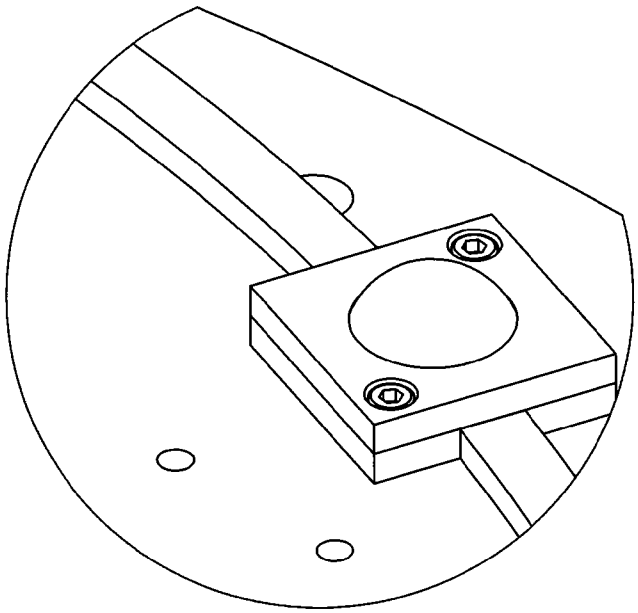


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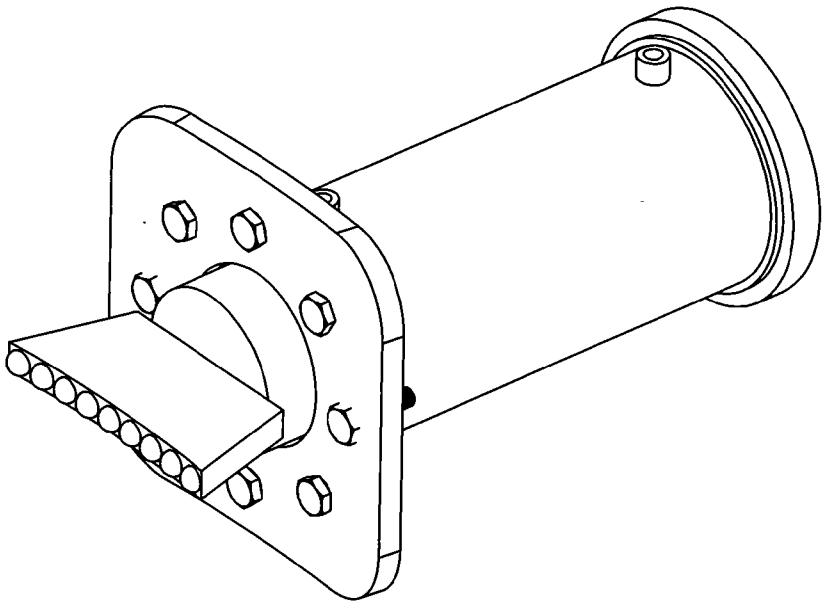


figure 22

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2015/000273

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04H9/02 E04B1/98
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)
E04H E04B F16F E01D

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.
A	JP 3 189617 U (JAPANESE) 20 March 2014 (2014-03-20) the whole document -----	1-7
A	JP 2004 100308 A (OKUMURA CORP; OILES INDUSTRY CO LTD) 2 April 2004 (2004-04-02) the whole document -----	1-7
A	JP 2010 048074 A (OZAKI KAZUNORI) 4 March 2010 (2010-03-04) the whole document -----	1-7

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Date of the actual completion of the international search	Date of mailing of the international search report
26 November 2015	03/12/2015

Name and mailing address of the ISA/	Authorized officer
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Information on patent family members

International application No
PCT/TR2015/000273

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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