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(54) **Title**: DEVICE FOR SUPPORTING MECHANICAL SEAL FACES

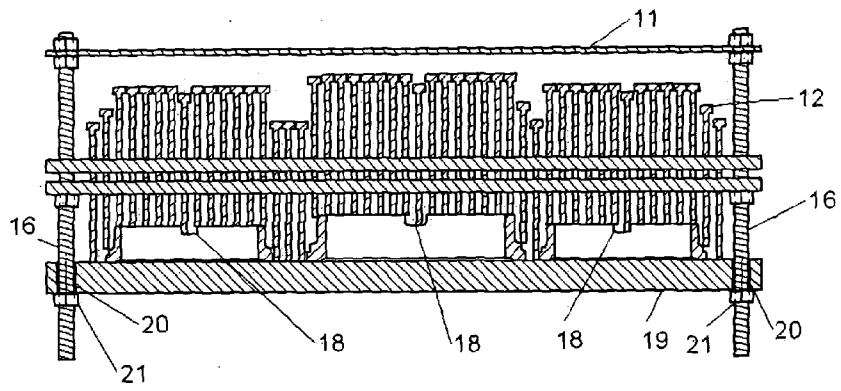

FIGURE 5

(57) **Abstract**: A device is for supporting within a coating chamber a mechanical seal face (8) having an annular sealing surface. The device includes a frame (1) housing first support means (9) for supporting the seal face when the device is in a first orientation with the annular sealing surface resting on a surface of said first support means. Second support means (2) within the frame supports the seal face when the device is in a second orientation.

WO 2013/117885 A1

DEVICE FOR SUPPORTING MECHANICAL SEAL FACES

Field of the Invention

The present invention relates to mechanical seal faces and, in particular, to synthetic diamond coatings applied to mechanical seal faces. When used herein the term "synthetic diamond coatings" includes polycrystalline diamond and ultra monocrystalline diamond as well as diamond like coatings such as graphite. One such coating is known as ADLC (Amorphous Diamond Like Coating).

Background to the Invention

A mechanical seal generally comprises a rotating member attached to a pump shaft and a stationary member attached to a pump housing. The rotating member is in direct contact with the stationary member, which provides the seal. Both the rotating member and the stationary member are commonly referred to in the mechanical sealing industry as seal 'faces'. A basic operating principle of mechanical seals is that the seal faces require a 'fluid film' that provides a lubricant between them in order to function correctly.

Applying a synthetic diamond coating to the seal faces can aid in the performance of the mechanical seal in various different applications.

To apply a synthetic diamond coating to mechanical seal faces a coating chamber is used. The mechanical seal faces are placed inside the coating chamber with the surface to be coated facing outwards from the centre of the coating chamber. A jig like device is generally provided to support the mechanical seal face within a recess provided within a part of the jig. The recess is defined by one or more elements of

the jig. It has been found that the coating applied to a mechanical seal face located in a jig is typically of varying evenness and in particular tends to increase in depth at the outer edge of the seal face. This is undesirable; a uniformly even coating is required. It has been reported in the industry that applying a synthetic diamond coating to the seal faces aids in the performance of the mechanical seal in various differing applications.

To apply a synthetic diamond coating to mechanical seal faces, a coating chamber is used. The mechanical seal faces are placed inside the coating chamber with the chosen surface that is to be coated facing outwards from the centre of the coating chamber.

It is generally accepted that the coating chamber is charged at a fixed rate per cycle of synthetic diamond coating applied. Therefore the greater number of mechanical seal faces that can be placed in each cycle run, the higher is the cost efficiency which can be achieved per seal face.

The nature of mechanical seal faces is that they are available in various different sizes and heights, and, as they are all of circular geometry, they are very inefficient on space. This causes a problem in creating a fixture to hold the mechanical seal faces in the coating chamber. Solutions aimed at solving this problem involve creating a special fixture per seal face that is to be coated. However this causes large inefficiencies of time and cost. Also potentially thousands of specially created fixtures are required for the many different sizes of mechanical seal faces that might go through the synthetic diamond coating cycle.

Statements of the Invention

The present invention relates to a device for supporting within a coating chamber a mechanical seal face having an annular sealing surface, the device comprising a frame and, within the frame, first support means for supporting the seal face when the device is in a first orientation with the annular sealing surface resting on a surface of said first support means, and second support means for supporting the seal face when the device is a second orientation.

Preferably, said first support means provides a planar surface on which the annular sealing surface may be located, said frame being in releasable connection to said first support means, said second support means comprising an array of pins located within said frame and each being independently and longitudinally moveable relative to said frame so as to allow said pins to contact the mechanical seal face such that the mechanical seal face is located between said pins of the array and said support surface.

Preferably, the device includes means for locking the pins to prevent their longitudinal movement relative to the frame.

Preferably, said first support means is removable from said frame.

Preferably, the device includes a pair of spaced apart plates having aligned holes through which the pins extend, one of said plates being moveable radially with respect to the pins to an extent sufficient to lock the pins against longitudinal movement.

Preferably, the aligned holes have diameters larger than those of the pins allowing the pins both angular and axial movement relative to the plates when the holes are aligned.

Preferably, the device is further provided with elongate alignment members which extend through aligned orifices in each said plate. More preferably, the alignment members are provided with means for securing said plates at positions spaced apart by a distance less than the length of the pins.

Preferably, the support member is a board.

Preferably, the device of the invention is able to provide a plurality of side by side recesses, of varying sizes and profiles.

The present invention also provides a method for supporting a mechanical seal face within a coating chamber, the method comprising providing a device of the invention, locating the mechanical seal face within said device and locating the device within said coating chamber.

Brief Description of the Drawings

The accompanying drawings are as follows:-

Figure 1 is a side view of an embodiment of the invention;

Figure 2 shows the embodiment of Figure 1 rotated 180 degrees from that of Figure 1 and ready to be placed over the top of mechanical seal faces;

Figure 3 shows the embodiment of Figure 1 positioned in place, with its pins forming around the mechanical seal faces;

Figure 4 is similar to Figure 3 but showing the pins locked in position once they are set in place;

Figure 5 shows the fixture assembly of Figure 4 positioned inside a coating chamber;

Figure 6 shows the fixture assembly of Figure 4 inside the coating chamber and with base board 9 removed; and

Figure 7 is similar to Figure 4 but shows in detail the way in which the pins interact with said mechanical seal faces.

Detailed Description of the Invention

The invention will now be described, by way of example only, with reference to the accompanying drawings.

Figure 1 shows a side view of a fixture 1 that comprises a number of pins 2, a first plate 3, a second plate 4, a third plate 5, aligning rods 6, and various nuts 7.

Each individual pin 2 is aligned by corresponding concentric orifices located within said first plate 3 and said second plate 4. The pins 2 freely move vertically through the orifices of first plate 3 and second plate 4, to the point where the pins 2 engage with third plate 5, which prevents pins 2 from escaping out of fixture 1.

The first plate 3, second plate 4 and third plate 5 are aligned via aligning rods 6, and are vertically spaced by nuts 7.

Figure 2 is a side view of fixture 1 that has been turned 180 degrees so that the pins 2 have fallen due to gravity until the enlarged ends of pins 2 engage with second plate 4 and can go no further.

Also shown are an undetermined number of mechanical seal faces 8 of varying sizes, which are laid on a board 9. The surfaces of the mechanical seal faces 8 that are to have the synthetic diamond coating applied are in direct contact with board 9. Said board also comprises a number of orifices 10, which correspond to said aligning rods 6 from said fixture 1.

Figure 3 shows fixture 1 laid over the top of the seal faces 8 and it can be seen that pins 2 have formed the shape of said mechanical seal faces 8. Figure 3 also shows how the aligning rods 6 are inserted into orifices 10 of the board 9 and spaced at a distance as to eliminate flex between the first plate 3, second plate 4 and third plate 5.

The board 9 is then locked to said aligning rods 6, by some secondary nuts 11.

Figure 4 shows how said second plate 4 of said fixture 1 is offset from said first plate, which locks said pins in position.

Figure 5 shows how said fixture 1 is then angled inside a coating chamber. At this stage, the fixture is fixed inside the coating chamber.

Figure 6 shows that said secondary nuts 11 are then removed, and said board 9 is removed from said fixture 1. The diamond coating can then be applied to the surfaces of the mechanical seal faces 8 which were in contact with board 9.

Figure 7 shows how the angular and axial movement of the pins 2 allows them to bear on the outer or inner edge of the mechanical seal face, holding it in place.

Claims

1. A device for supporting within a coating chamber a mechanical seal face having an annular sealing surface, the device comprising a frame and, within the frame, first support means for supporting the seal face when the device is in a first orientation with the annular sealing surface resting on a surface of said first support means, and second support means for supporting the seal face when the device is a second orientation.

2. A device according to claim 1, wherein said first support means provides a planar surface on which the or each annular sealing surface may be located and a frame being in releasable connection to said first support means, said second support means comprising an array of pins located within said frame and each being independently and longitudinally moveable relative to said frame so as to allow said pins to contact the mechanical seal face such that the mechanical seal face is located between said pins of the array and said support surface.

3. A device according to claim 2 and further including means for locking the pins relative to the frame.

4. A device according to claim 2 or claim 3, wherein said first support means is removable from said frame.

5. A device according to any of claims 2 to 4, wherein the device includes a pair of spaced apart plates having aligned holes through which the pins extend,

one of said plates being moveable radially with respect to the pins to misalign the holes to an extent sufficient to lock the pins against longitudinal movement.

6. A device according to any of preceding claims, where the aligned holes have diameters larger than those of the first, allowing the pins both angular and axial movement relative to the plates when the holes are aligned.

7. A device according to any of claims 3 to 6, wherein the device is further provided with elongate alignment members which extend through aligned orifices in each said plate.

8. A device according to claim 7, wherein said alignment members are provided with means for securing said plates at positions spaced apart by a distance less than the length of the pins.

9. A device according to any of claims 2 to 8, wherein the support member is a board.

10. A device according to any of preceding claims, wherein the device is able to support a plurality of seal faces of varying sizes and profiles.

11. A method for supporting a mechanical seal face within a coating chamber, the method comprising providing a device according to any the preceding claims, locating the mechanical seal face within said device and locating the device within said coating chamber.

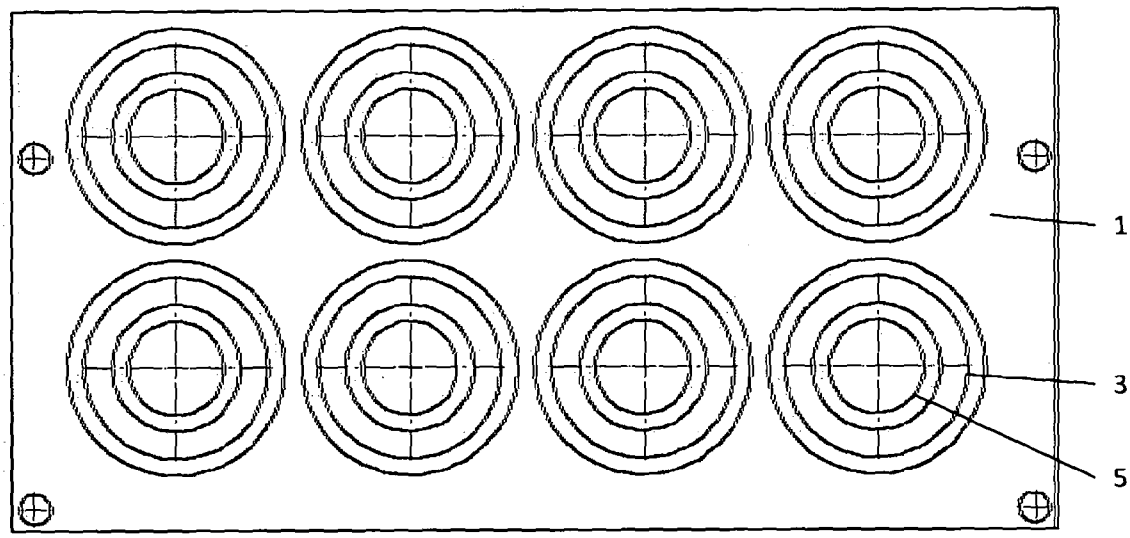

FIGURE 1

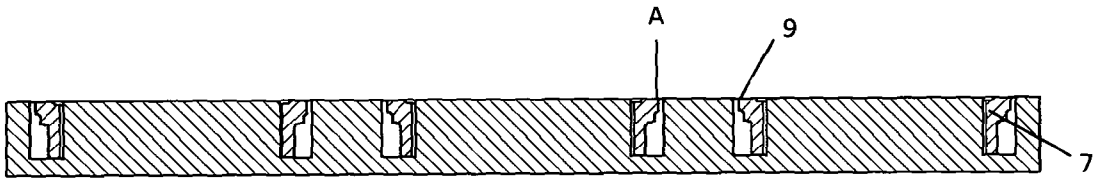

FIGURE 2

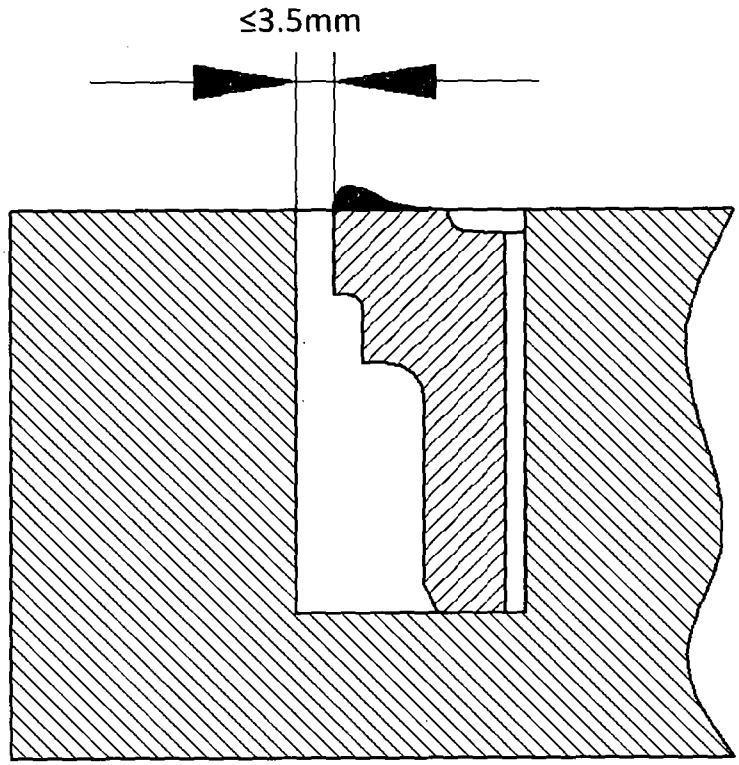

FIGURE 2A

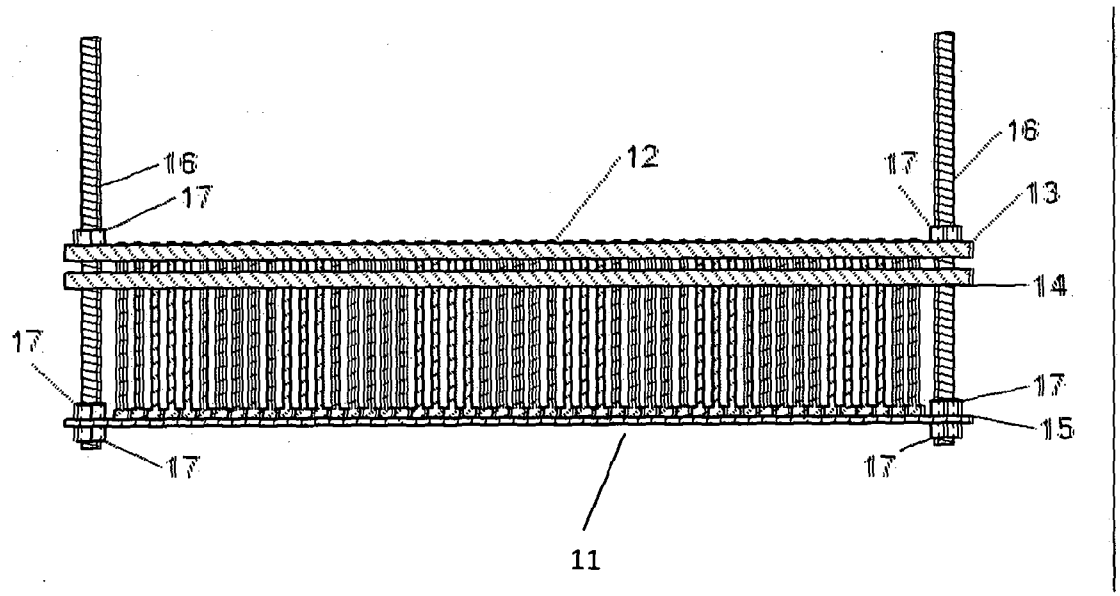

FIGURE 3

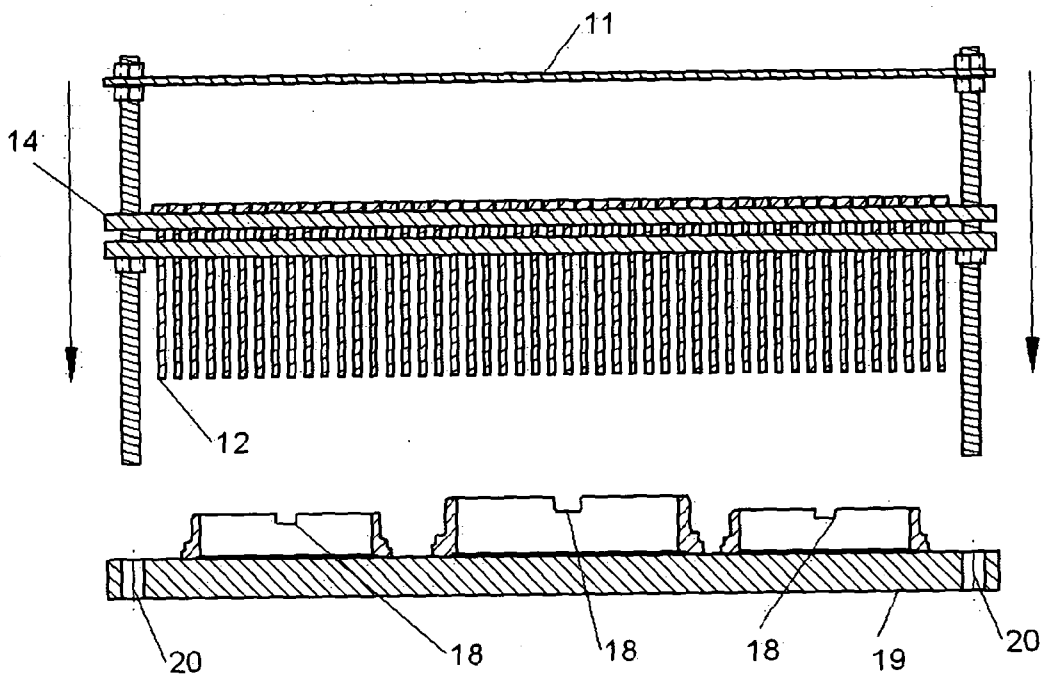

FIGURE 4

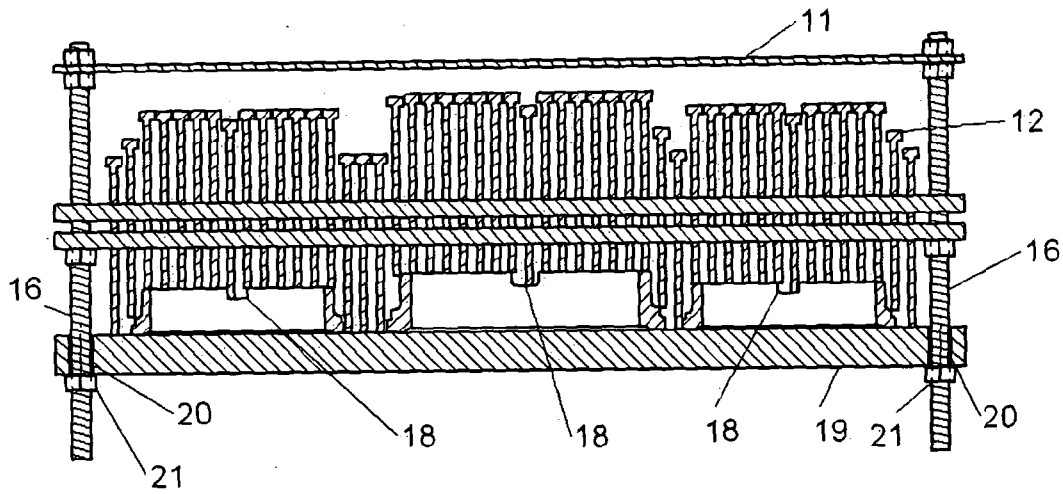

FIGURE 5

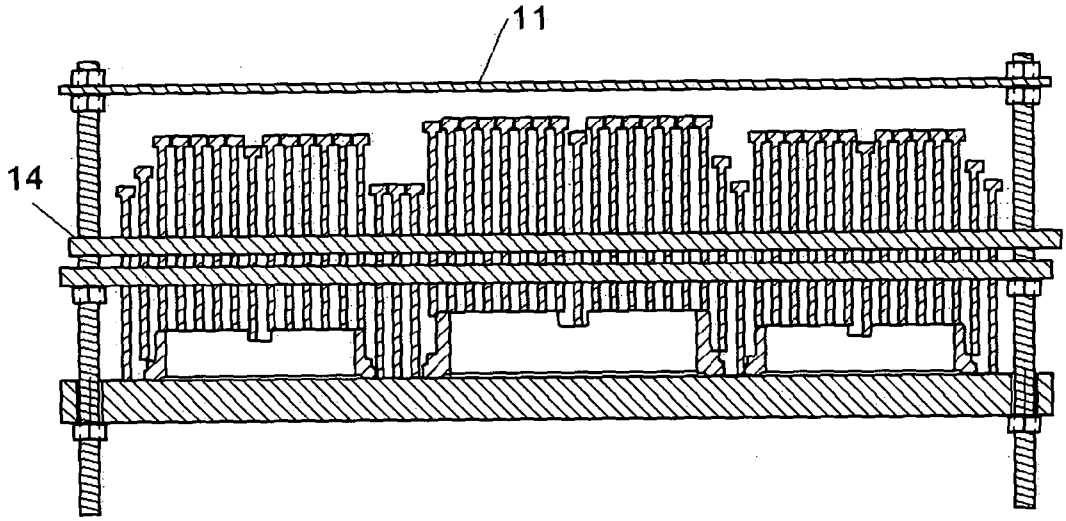

FIGURE 6

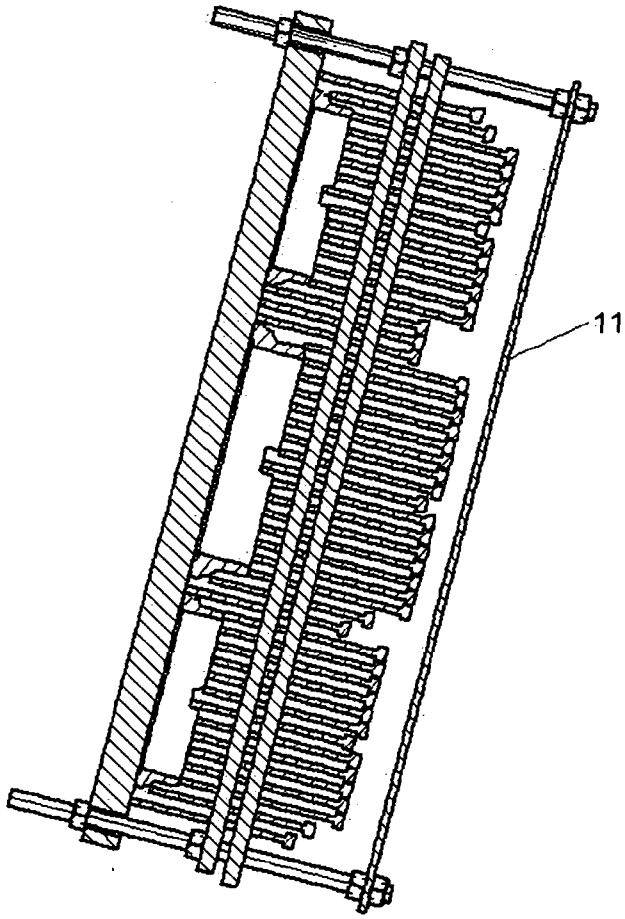

FIGURE 7

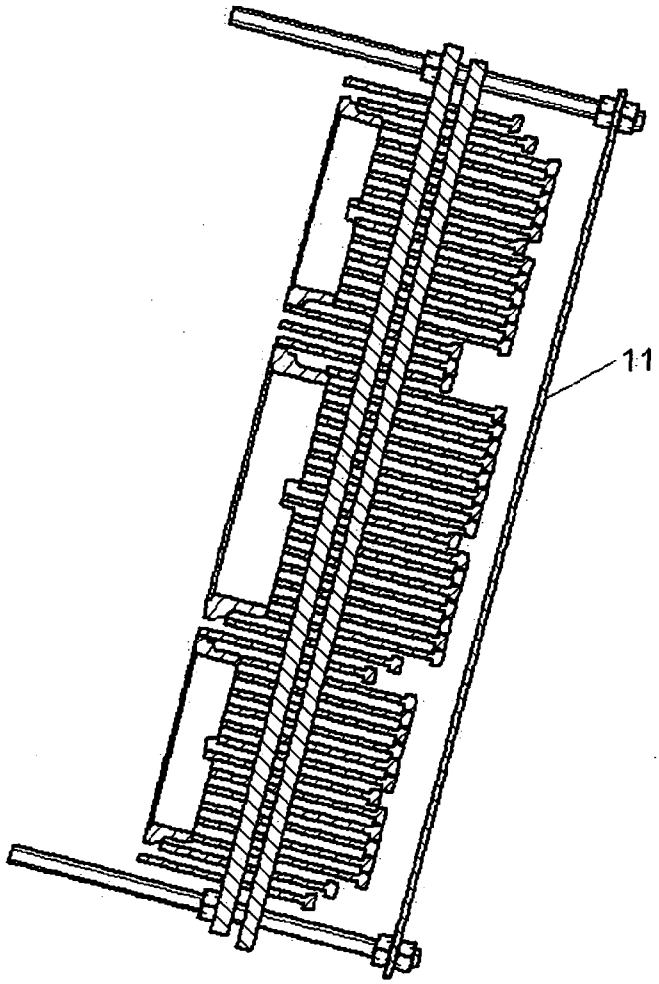

FIGURE 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/000049

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16J15/34 C23C16/458
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)
F16J C23C

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/067954 A1 (LANEE KHAMSIDI [US] ET AL) 12 March 2009 (2009-03-12) paragraph [0025] - paragraph [0035]; figures 3-4	1-4
X	EP 1 482 545 A1 (TOKYO ELECTRON LTD [JP]) 1 December 2004 (2004-12-01) the whole document	1-4
A	DE 100 17 120 C1 (JOSTRA AG [DE]) 7 February 2002 (2002-02-07) abstract; figures	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 June 2013	09/07/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Narminio, Adriano

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2013/000049

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009067954 A1	12-03-2009	NONE	
EP 1482545 A1	01-12-2004	CN 1639855 A	13-07-2005
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