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(54) **SUBSTRATE HOLDER FOR HOLDING A SUBSTRATE IN A CHEMICAL AND/OR ELECTROLYTIC SURFACE TREATMENT OF THE SUBSTRATE**

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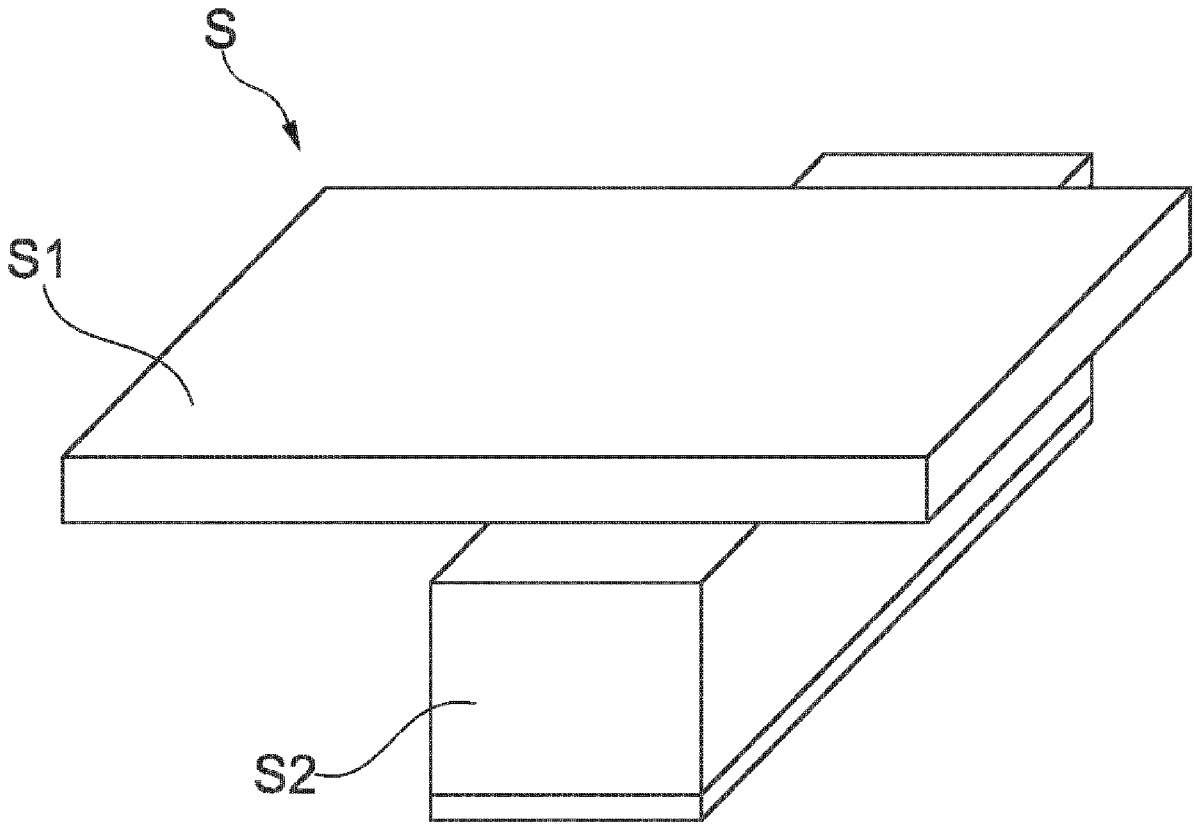
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(57) **ABSTRACT**

The disclosure relates to a substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate, a substrate handling system comprising a substrate holder and an immersion scanner unit and a use of a substrate holder for holding a substrate with a width in a range of 1000 to 3500 mm and a length in a range of 1000 to 4000 mm. The substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate comprises a substrate carrier and a power contact unit. The substrate carrier comprises a frame to carry the substrate. The power contact unit comprises a body, a plurality of main legs extending from the body at least partially along an edge of the substrate carrier and a plurality of side legs each arranged essentially perpendicular at one of the main legs to contact the substrate. The power contact unit further comprises a plurality of retaining elements provided between the body of the power contact unit and the frame of the substrate carrier to keep the substrate in contact with the power contact unit when the substrate is placed onto the substrate carrier.



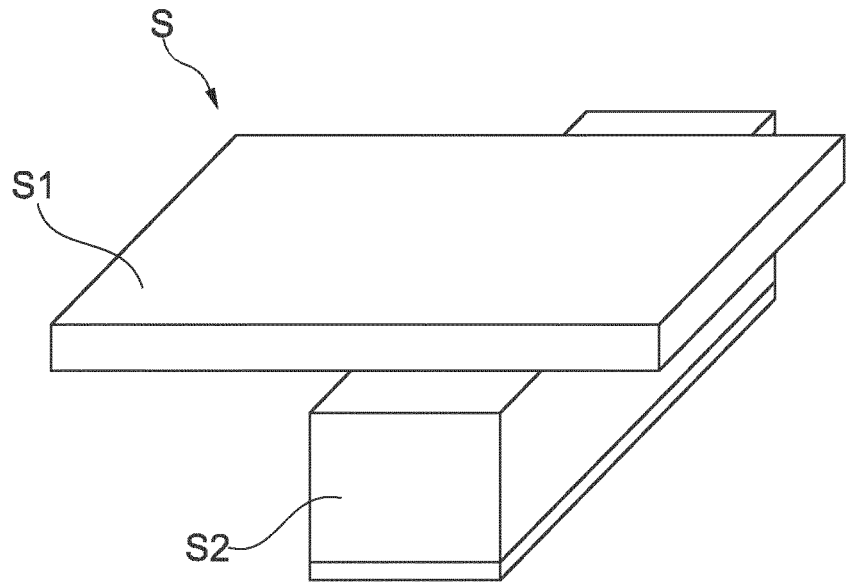


Fig. 1

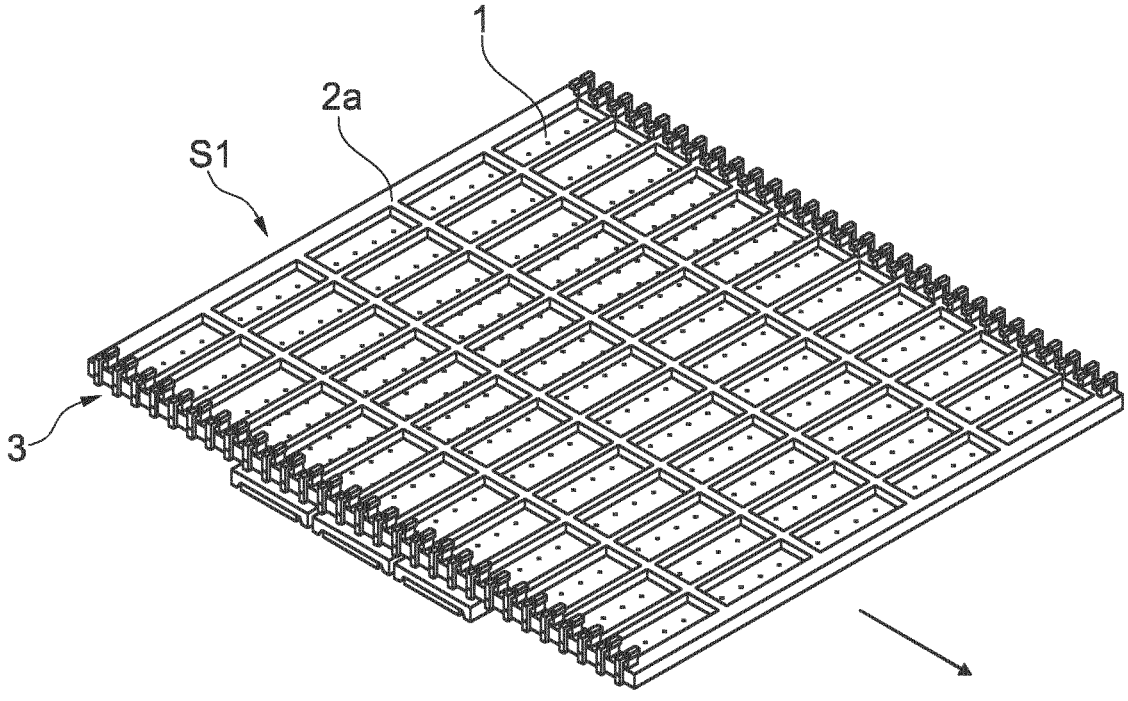


Fig. 2a

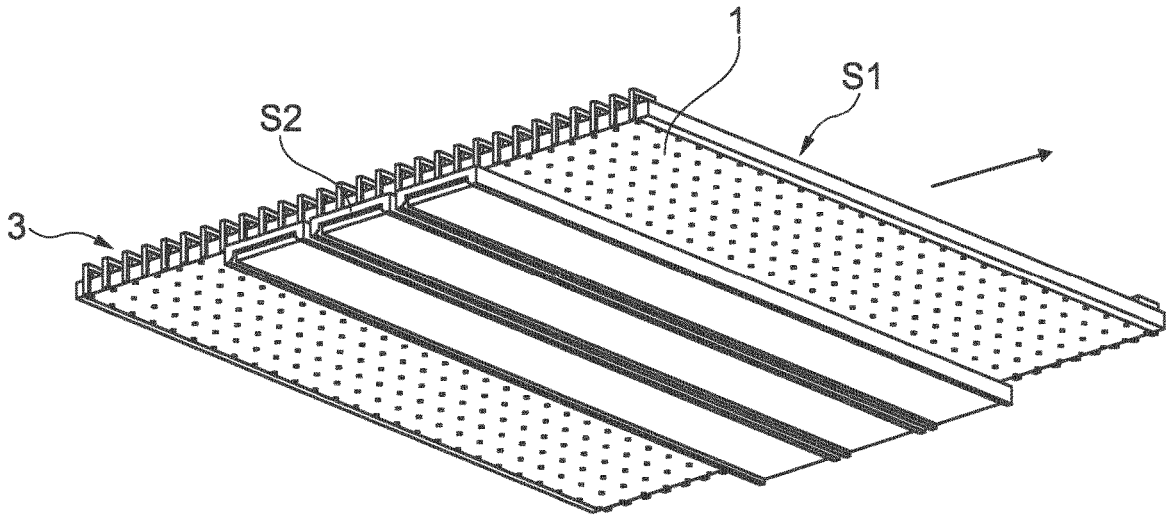


Fig. 2b

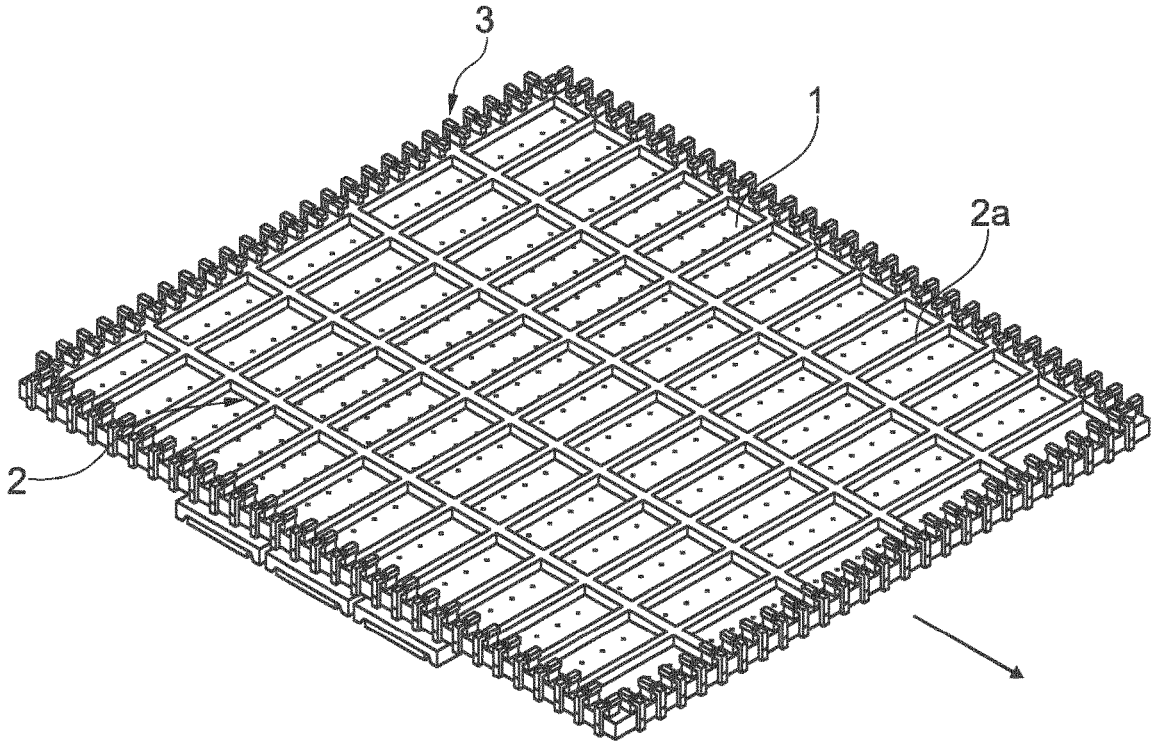


Fig. 3a

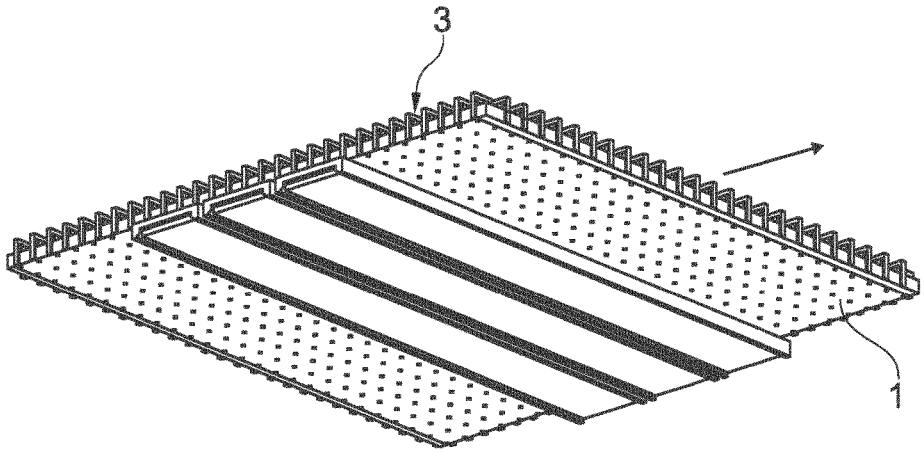


Fig. 3b

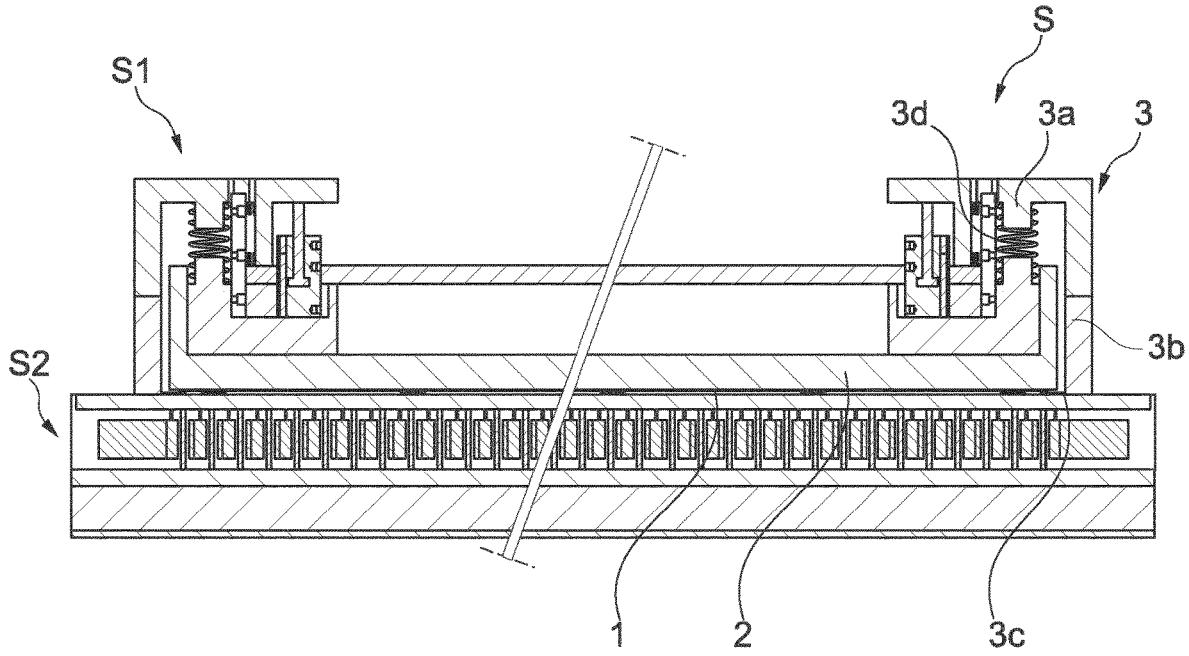


Fig. 4

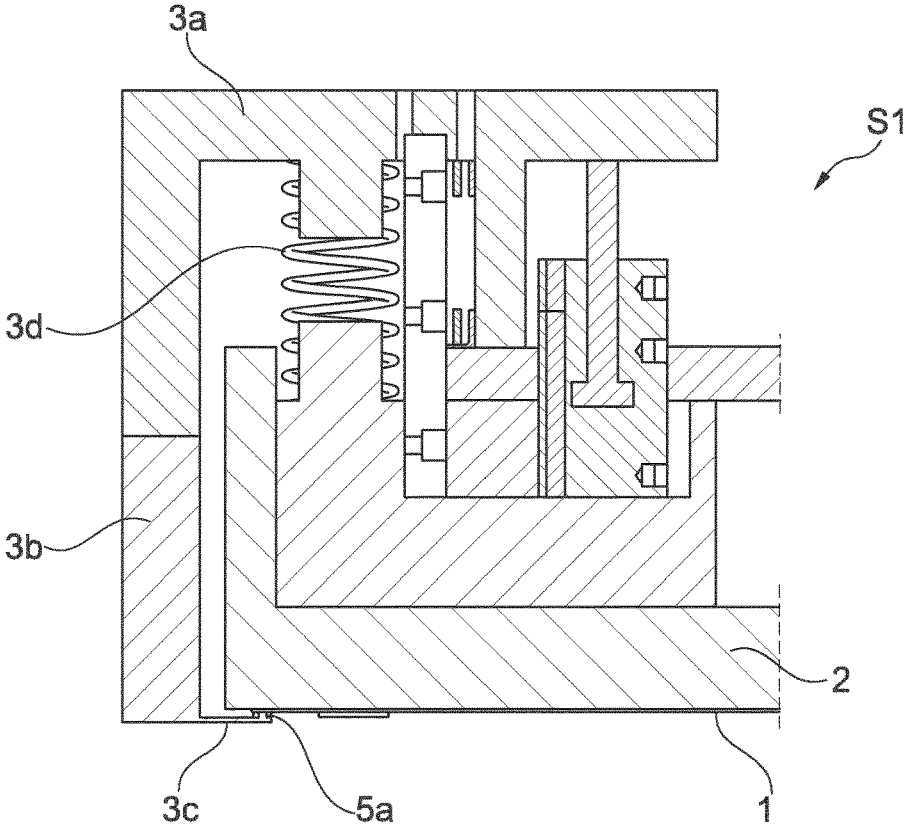


Fig. 4a

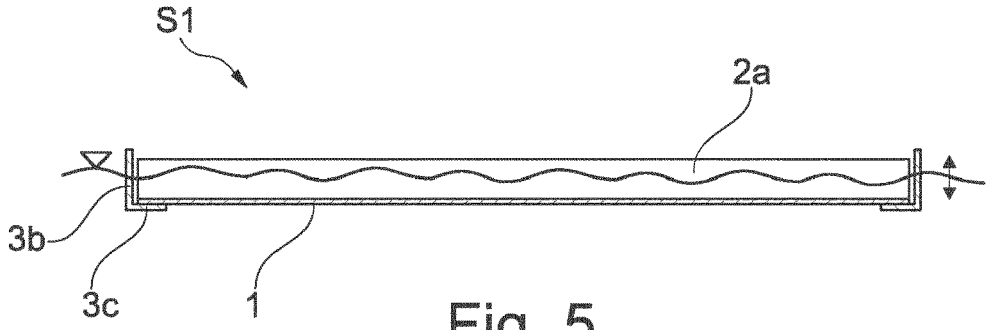


Fig. 5

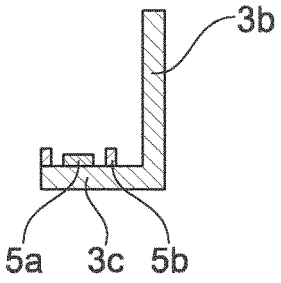


Fig. 5a

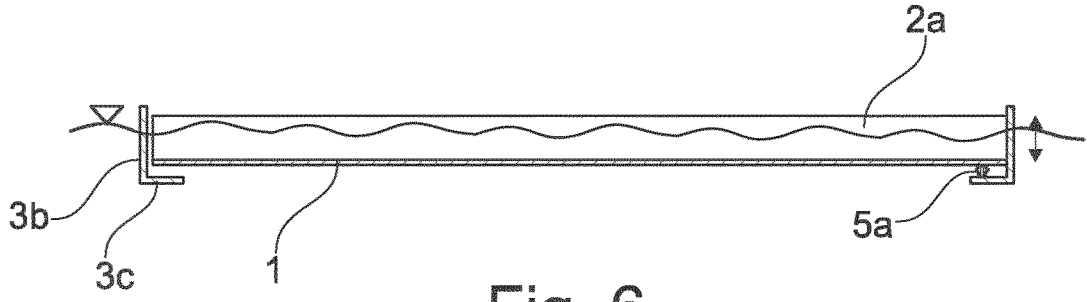


Fig. 6

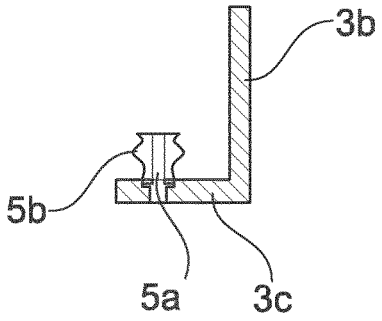


Fig. 6a

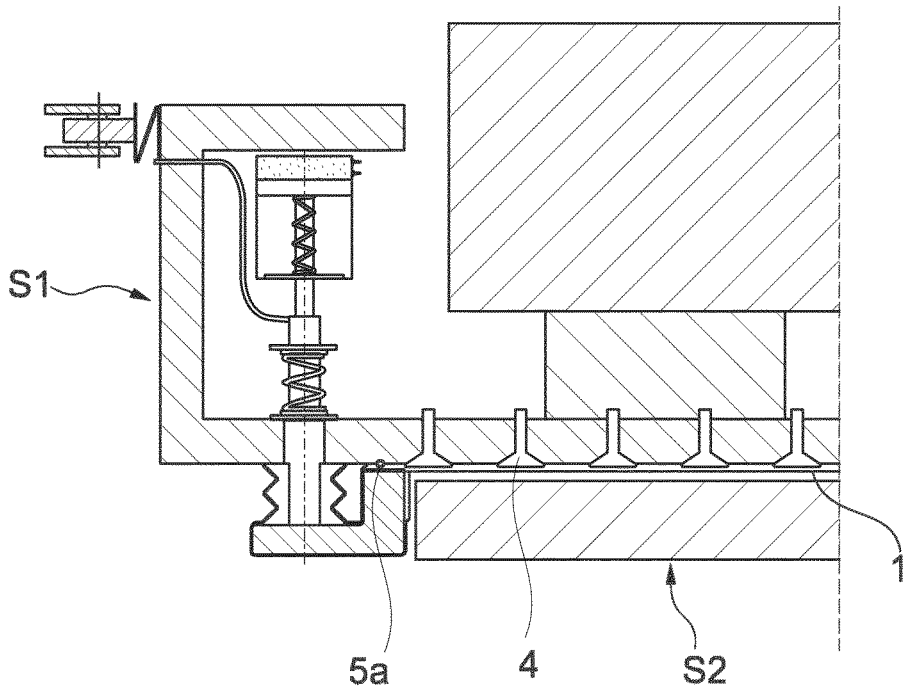


Fig. 7

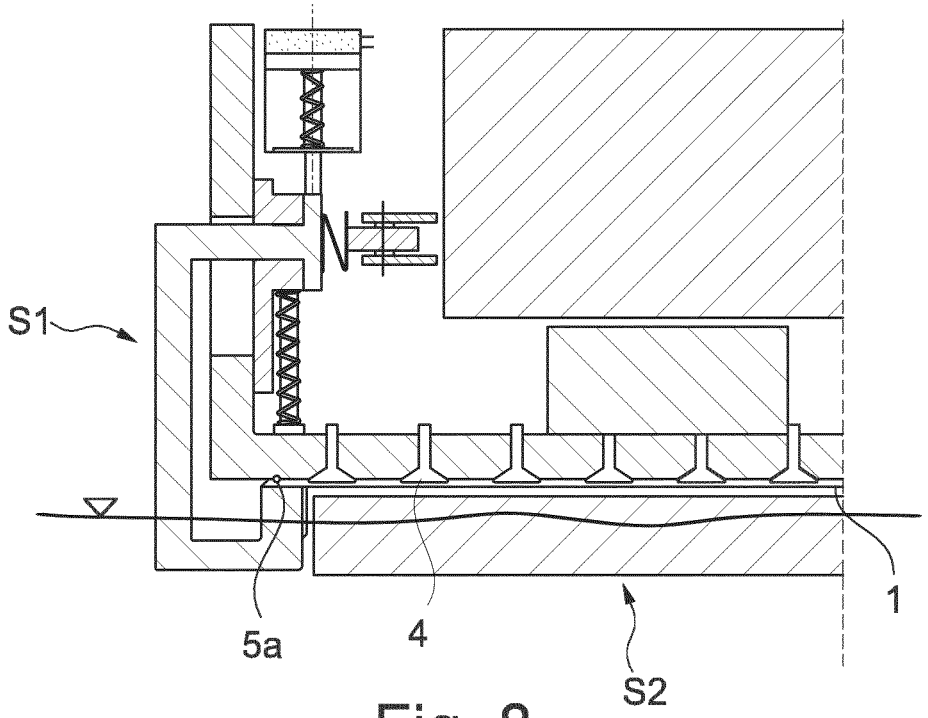


Fig. 8

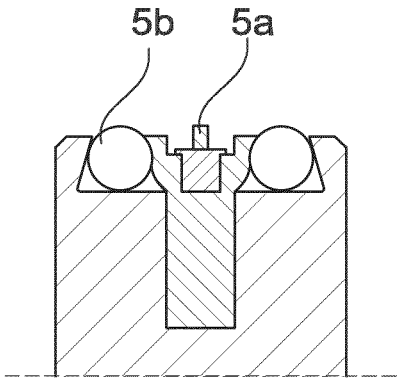


Fig. 9a

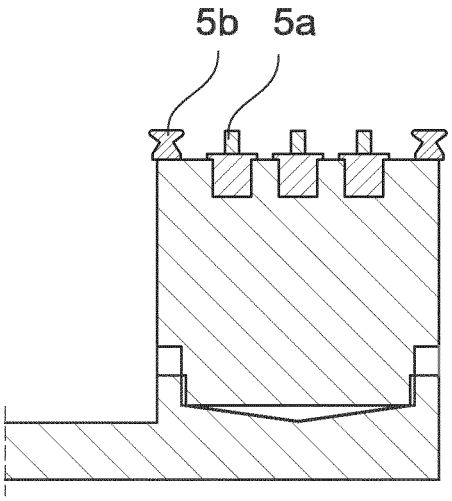


Fig. 9b

SUBSTRATE HOLDER FOR HOLDING A SUBSTRATE IN A CHEMICAL AND/OR ELECTROLYTIC SURFACE TREATMENT OF THE SUBSTRATE

TECHNICAL FIELD

[0001] The disclosure relates to a substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate, a substrate handling system comprising a substrate holder and an immersion scanner unit, as well as a use of a substrate holder for holding a substrate.

BACKGROUND

[0002] Substrates are processed through various systems in the field of semiconductor technology. One of such systems is the so-called high speed plating (HSP) system. In such a system, one or two HSPs together with one or two substrates are immersed into a tank containing an electrolyte and one or several anodes. Within this tank filled with electrolyte, the electrolyte (and with this the current distribution) is directed through the HSP plate(s) towards the substrate surface(s).

[0003] The substrate-to-be processed must be supported by a substrate holder (also called a chuck) in such a HSP system. Substrate held by a substrate holder is transported through various processing stations and held in place in order for the processes to be performed satisfactorily. Especially when a HSP system is combined with a scanning system, the handling, holding and transportation of the processed substrate requires usage of a stable and reliable holding system.

[0004] The prior art does not offer a secure handling and transportation system, which is especially suitable for being used with large substrates.

SUMMARY

[0005] Hence, there may be a need to provide an improved substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate, which provides an accurate and efficient handling of a substrate, particularly for large substrates that go through various processes.

[0006] The problem solved by the present disclosure is solved by the subject-matters of the independent claims, wherein further embodiments are incorporated in the dependent claims.

[0007] It should be noted that the aspects of the disclosure described in the following apply also to the substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate, the substrate handling system comprising a substrate holder and an immersion scanner unit as well as the use of a substrate holder for holding a substrate.

[0008] According to the present disclosure, a substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate is presented.

[0009] The substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate comprises a substrate carrier and a power contact unit. The substrate carrier comprises a frame to carry the substrate. The power contact unit comprises a body, a plurality of main legs extending from the body at least partially along an edge of the substrate carrier and a plurality of side legs each arranged essentially perpendicular at one of the main legs to contact the substrate. The power contact unit further comprises a plurality of retaining elements provided between the body of the power contact unit and the frame of the substrate carrier to keep the substrate in contact with the power contact unit when the substrate is placed onto the substrate carrier.

[0010] The substrate to-be-treated may be placed on the frame of the substrate carrier for the substrate to be carried to a process station. The substrate carrier may comprise a vacuum means for holding the frame thereon. The substrate may function as a cathode, as an anode, or both in an alternating fashion, e.g., depending on the processing time. In case the substrate functions as an anode for certain time periods of the process, the specified anode would become cathodically polarized.

[0011] The main legs extending from the body of the power contact unit and the side legs that are extending essentially perpendicular at one of the main legs may partially surround the substrate placed on the substrate carrier. Essentially perpendicular may mean to be around 90° but can also be between 45° and 90°. The angle between the main legs and the side legs of the power contact unit may be defined according to the substrate to be held by the substrate holder. The main leg and the side leg of the power contact unit may be monolithic, meaning may be produced as a single part. The body of the power contact unit may be one element for all or several main legs. The body of the power contact unit may also comprise a plurality of body elements, wherein each main leg extend from one body element.

[0012] Retaining elements on opposite sides may keep a substrate placed on the frame in contact with the power contact also when the substrate is tilted relative to a center of the substrate, which may occur during transportation or a surface treatment process (for instance pre-wetting, scanning, plating, rinsing, drying, electroless deposition or electrochemical treatment). Such a tilt may normally cause loss of a power contact between the carried substrate and the power contact unit (for instance because the substrate carrier may be tilted with respect to the power contact unit or in other words, its angular position with respect to its original position may change). The retaining elements on opposite sides of the center may prevent losing contact during such tilting of the substrate relative to the substrate carrier and/or the power contact unit.

[0013] Retaining elements on opposite sides of the substrate may be configured to apply different pressure on the frame. Accordingly, the angle between the substrate and the frame may be further adjusted by selecting different retaining elements on opposite sides of the substrate carrier with respect to a center of the substrate carrier. Herewith the substrate may be kept in parallel to the frame (angle in between may be then 0 degrees), as well as in a position not completely parallel but essentially parallel to the frame. The substrate may be compressed between the body of the power contact unit (more specifically the side legs) and the frame. Therefore retaining elements between the body of the power contact unit and the frame may apply force to generate a contact pressure and further ensure that a safe electric contact is maintained during a surface treatment process of the substrate.

[0014] By providing a stable carriage and handling of the substrate, the surface treatment process may be evenly applied to all parts of the substrate (in other words all regions of the substrate surface). Accordingly, the same substrate holder may be used throughout all different chemical or electrolytic surface treatment processes without having the need for unfastening and reloading of the substrate or adjusting the position of the substrate in between the processes.

[0015] In an embodiment, the retaining elements comprise spring elements, pneumatic elements, electric elements, magnetic elements and/or suction elements. The retaining elements may be defined to be one of the listed possibilities depending on the process and the process fluid, which is used during surface treatment. For instance, dependent on the used electrolyte, an electric element or a magnetic element may be improper for usage as the retaining elements, rather a spring element may be more favorable. Additionally, the force needed to-be-applied or the size of the substrate to-be-held may also define the suitable means for the retaining element. For instance, depending on sensitivity of the substrate material at different contact portions, a corresponding retaining element may be selected. Dependent on the used means as retaining element, the compression force applied between the body of the power contact unit and the frame of the substrate carrier may be adjusted. For instance, when the retaining elements are spring elements, spring elements with different elasticity coefficients may be used.

[0016] In an embodiment, the substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate further comprises several electric contact portions. The electric contact portions may be present at the power contact unit, more specifically may be arranged at the side legs to supply electric current to the substrate. The electric contact portions may contact the substrate in a reliable way to provide sufficient current for the electrolytic surface treatment, as well as provide excellent support for the substrate handling. Because the alignment of the substrate with respect to the substrate carrier frame may be controlled, a continuous supply of electric current to the substrate may be provided. Accordingly, an uninterrupted, stable surface treatment process may be conducted. In another embodiment, the electric contact portions may be exchangeable. Accordingly, the defected electric contact portions can be replaced. Further, by changing the electric contact portions, contact areas, which require a higher level of voltage for specific surface treatment processes may be treated.

[0017] In yet another embodiment, the electric contact portions may have a slim design and a thin form. The reduced construction of the electric contact portions may permit small gap processing, i.e. with a small distance between the substrate and the HSP.

[0018] In an embodiment, the power contact unit further comprises electrically conducting lines extending along the main legs and to the electric contact portions in the side legs. Accordingly, with a single voltage source, electric current may be supplied through all electric contact portions without the need for energizing all electric contact portions separately. With this, an even current supply may be provided through each electric contact portion and an equal current density may be obtained on the substrate.

[0019] In an embodiment, the main legs, the side legs, the electric contact portions and/or the retaining elements are only arranged along two opposite edges of the substrate carrier. In other words, the substrate holder may be held along two opposite sides of the substrate and the electric contact portions may supply electric current from opposite edges to the held substrate.

[0020] In another embodiment, the main legs, the side legs, the electric contact portions and/or the retaining elements are arranged along all four edges of the substrate carrier. In other words, the substrate holder may be held along all sides of the substrate to provide an equalized electric current and current density distribution on the substrate. Yet, applied electric current may as well be controlled independently for providing different electric current distribution on different sides of the substrate.

[0021] In an embodiment, the electric contact portions are dry power contacts, wet power contacts and/or contact arms.

[0022] In dry power contact, the power contact unit may comprise a seal around the electric contact portion. When the electric contact portion is surrounded by a seal, a vacuum may be created within the sealed area including the electric contact portion. Dry power contacts may enable defining the supplied power very accurately. Dry power contact may be single power contact and allow for controlling the power level and/or current density distribution individually. Last but not least, the dry power contacts may prevent a surface treatment on and around the contact point with the substrate.

[0023] In one embodiment, the power contact unit may comprise a vacuum exhausting seal with a contact portion in the center for applying suction to the substrate. The seal may be in the form of a bellow. Accordingly, the seal may provide a protection to the electric contact portion from an outer uncontrolled interruption. This kind of point contact of the applied vacuum may be advantageous in that the contact area is minimized on the substrate.

[0024] In wet power contact, on the other hand, the electric contact portion may extend at least along an edge of the substrate to be treated. Wet power contacts may provide same power level and/or same current density to all electric contact portions. In wet power contact, the electric contact portion is not isolated from the surrounding (for instance through a seal around the contact portion) and thus may come into contact with a process fluid. Accordingly, in wet contact a contact portion may be exposed to chemical and/or electrolytic surface treatment. Because surface treatment on and around the electric contact points with the substrate may not be avoided, different to dry power contact, a de-plating process may be additionally needed for reconditioning of the electric contact portions. In both dry and wet contact, the electric contact portion may be easily changeable.

[0025] In an embodiment, the substrate carrier comprises a vacuum unit configured to provide suction between the frame of the substrate carrier and the substrate. Vacuum is here to be understood as all kinds of under pressure relative to the surroundings. The suction applied by the vacuum unit may be adjusted sensitively to adjust the force applied to the substrate held by the vacuum unit. In line with the object of the invention, the vacuum unit provides a safer handling of the held substrate and an accurate positioning of the substrate at the substrate holder. Because the alignment of the substrate with respect to the substrate carrier frame may be controlled precisely, a continuous supply of power (electric current) to the substrate may be provided. Accordingly, an

uncontrolled interruption can be avoided and a stable surface treatment process may be provided.

[0026] The vacuum unit may comprise a vacuum head and optionally, a seal surrounding the vacuum head. Vacuum unit may be also defined to consist of many vacuum heads collected in an area for distributing the applied suction on a contact area of the substrate. For instance, the vacuum heads may be aligned along, for instance an edge of the frame. Different to point contact, using vacuum heads may be advantageous for reducing the pressure applied to the contact area on the substrate. The vacuum unit ensures a stable connection between the power contact unit (more specifically electric contact portion) and the substrate.

[0027] In an embodiment, the power contact unit further comprises vacuum lines extending along the main legs to suction areas (for instance through vacuum unit or vacuum heads), which may be arranged at the side legs to hold the substrate. In this embodiment, the vacuum lines may be surrounded by a seal. The vacuum lines extending along the main legs and the side legs may ensure a safe contact between the power contact unit and the substrate, protected from a disturbance that might come from the environment. Further, the vacuum lines may provide an even application of the suction force on the substrate and a safe holding of the substrate.

[0028] In an embodiment, the substrate carrier is configured to carry only one substrate. In this example, only a single side of the substrate may be aimed to be treated. The substrate may be held from any part of the substrate, for instance from a central area.

[0029] In an embodiment, the substrate carrier is configured to hold the substrate only at its edges and/or corners for a double side chemical and/or electrolytic surface treatment of two sides of the substrate.

[0030] In an embodiment, the substrate carrier is configured to carry two substrates, each on one side of the substrate carrier. This means that the substrate carrier may have necessary structures on both sides for the substrate to be placed thereon, for instance electric contact portions.

[0031] In an embodiment, the substrate carrier is grid-shaped. The grid-shape term defines a pattern or structure made from horizontal and vertical lines crossing each other to form squares or rectangles. The substrate carrier may also be frame-shaped or may have any other shape. Accordingly, the contact of the substrate carrier may be distributed evenly along the substrate surface, without creating stress points on the surface. In this embodiment, vacuum may be applied to a substrate to-be-treated via outlets on the substrate carrier. Thus, vacuum may be distributed throughout the surface of the substrate equally.

[0032] According to the present disclosure, also a substrate handling system is presented. The substrate handling system comprises a substrate holder and an immersion scanner unit. The substrate holder is configured to hold the substrate relative to the immersion scanner unit. The immersion scanner unit may treat the substrate held by the substrate holder, which may move in a translational motion relative to the scanner unit. It can be also, in some instances that the immersion scanner unit moves in a translational motion relative to the substrate holder without needing the substrate to move.

[0033] The substrate carrier may straighten the substrate with respect to the immersion scanner unit. Straightening here may mean to flatten possible disturbances (dents or buckles) on the substrate surface to obtain an essentially planar substrate.

[0034] The substrate carrier may further level the substrate with respect to the immersion scanner unit. Levelling here means adjusting a position of the substrate with respect to the scanner unit. The position may comprise a distance of the substrate to the immersion scanner, as well as a direction of the substrate relative to the scanner unit. The substrate carrier may keep the substrate in a parallel direction relative to the immersion scanner unit, as well as in a position not completely parallel, but essentially parallel to the immersion scanner unit, or in an angular direction relative to the immersion scanner unit. For instance, in this example, levelling may mean to adjust the position of the substrate with respect to the immersion scanner to an angle from 1 to 89 degrees, preferably from 1 to 45 degrees and more preferably from 1 to 30 degrees. A distance between the substrate and the scanner unit may be levelled to a range of 1 and 20 mm, preferably 2 to 15 mm, and more preferably 3 to 10 mm. Further, levelling of the substrate may be changed during the surface treatment process, thus a position and/or an angle of the substrate with respect to the immersion scanner unit.

[0035] In an embodiment, the substrate handling system comprises several immersion scanner units arranged in series.

[0036] At least an anode may be present at a side of the immersion scanner unit opposite to the substrate holder. The anode may be an integral part of the immersion scanner. The anode may as well be a separate part and placed adjacent the immersion scanner. In this embodiment, the substrate handling system may also comprise a spare immersion scanner unit. The spare unit may be present at the same side of the immersion scanner unit, away from the substrate holder.

[0037] In an embodiment, the substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment further comprises an agitation unit configured to move the substrate relative to the immersion scanner unit, preferably in up to three dimensions. Therefore, in this embodiment, the substrate may be brought closer to the immersion scanner in the −Z (third) direction or away from the immersion scanner in the +Z direction.

[0038] The agitation unit can agitate in a frequency from below 1 Hz up to several million Hz, e.g., it can agitate very slowly, but also at very high frequency like in the ultrasonic range and beyond. The agitation unit can be implemented in various ways not limited to the implementation of a mechanical movement system, but can also be achieved through implementation of at least one ultrasonic transducer.

[0039] According to the present disclosure, also a use of a substrate holder for holding a substrate with a width in a range of 1000 to 3500 mm and a length in a range of 1000 to 4000 mm is presented. The substrate holder may be shaped to carry a quadrilateral substrate. Accordingly may be square or rectangle shaped. It may be used with relatively large substrates as defined in the mentioned ranges.

[0040] It shall be understood that the system, the device, and the use according to the independent claims have similar and/or identical preferred embodiments, in particular, as defined in the dependent claims. It shall be understood further that a preferred embodiment of the disclosure can also be any combination of the dependent claims with the respective independent claim.

[0041] These and other aspects of the present disclosure will become apparent from and be elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] Exemplary embodiments of the disclosure will be described in the following with reference to the accompanying drawing:

[0043] FIG. **1** shows schematically and exemplarily an embodiment of a substrate handling system S comprising a substrate holder S**1** and an immersion scanner unit S**2** according to the disclosure.

[0044] FIG. **2***a* shows schematically and exemplarily an embodiment of a substrate handling system S according to the disclosure.

[0045] FIG. **2***b* shows schematically and exemplarily the embodiment of the substrate handling system S according to FIG. **2***a* from another perspective.

[0046] FIG. **3***a* shows schematically and exemplarily another embodiment of a substrate handling system S comprising a substrate holder S**1** and an immersion scanner unit S**2** according to the disclosure.

[0047] FIG. **3***b* shows schematically and exemplarily the embodiment of the substrate handling system S according to FIG. **3***a* from another perspective.

[0048] FIG. **4** shows schematically and exemplarily a cross-sectional view of an embodiment of a substrate handling system S comprising a substrate holder S**1** and an immersion scanner unit S**2** according to the disclosure.

[0049] FIG. **4***a* shows schematically and exemplarily a cross-sectional detail view of the embodiment of the substrate holder S**1** according to FIG. **4**.

[0050] FIG. **5** shows schematically and exemplarily a cross-sectional view of an embodiment of a substrate holder S**1** according to the disclosure.

[0051] FIG. **5***a* shows schematically and exemplarily a detail view of the embodiment of the substrate holder S**1** according to FIG. **5**.

[0052] FIG. **6** shows schematically and exemplarily a cross-sectional view of another embodiment of a substrate holder S**1** according to the disclosure.

[0053] FIG. **6***a* shows schematically and exemplarily a detail view of the embodiment of the substrate holder S**1** according to FIG. **6**.

[0054] FIG. **7** shows schematically and exemplarily detail view of an embodiment of a substrate handling system S comprising electric contact portions **5***a* according to the disclosure.

[0055] FIG. **8** shows schematically and exemplarily detail view of another embodiment of a substrate handling system S comprising electric contact portions **5***a* according to the disclosure.

[0056] FIG. **9***a* shows schematically and exemplarily detail view of an embodiment of an electric contact portion **5***a* according to FIGS. **7** and **8** according to the disclosure.

[0057] FIG. **9***b* shows schematically and exemplarily detail view of another embodiment of an electric contact portion **5***a* according to FIGS. **7** and **8** according to the disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0058] FIG. **1** shows schematically and exemplarily an embodiment of a substrate handling system S comprising a substrate holder S**1** and an immersion scanner unit S**2**, wherein the substrate holder S**1** is configured to hold a substrate **1** relative to the immersion scanner unit S**2**. The substrate **1** is not shown in FIG. **1**.

[0059] FIG. **2***a* shows schematically and exemplarily an embodiment of the substrate handling system S. Here, the substrate handling system S comprises several immersion scanner units S**2** arranged in series. The substrate holder S**1** of the substrate handling system S comprises a substrate carrier **2** and a power contact unit **3**. The substrate carrier **2** comprises a frame **2***a* to carry the substrate **1**. As shown in more detail in FIGS. **4** and **4***a*, the power contact unit **3** comprises a body **3***a*, a plurality of main legs **3***b* extending from the body **3***a* at least partially along an edge of the substrate carrier **2** and a plurality of side legs **3***c* each arranged essentially perpendicular at one of the main legs **3***b* to contact the substrate **1**. The power contact unit **3** further comprises a plurality of retaining elements **3***d* provided between the body **3***a* of the power contact unit **3** and the frame **2***a* of the substrate carrier **2** to retain a connection between the substrate **1** held by the frame **2***a* and the power contact unit **3**.

[0060] The substrate holder S**1** for holding a substrate **1** further comprises several electric contact portions **5***a* arranged at the side legs **3***c* of the power contact units **3** to supply electric current to the substrate **1**, also shown in FIGS. **4***a*, **5***a* and **6***a*.

[0061] Referring back to FIG. **2***a*, at least the main legs **3***b*, the side legs **3***c*, the electric contact portions **5***a* and/or the retaining elements **3***d*, in other words power contact units **3** as a whole are only arranged along two opposite edges of the substrate carrier **2**. The substrate carrier **2** is here grid-shaped.

[0062] FIG. **2***b* shows schematically and exemplarily the embodiment of the substrate handling system S according to FIG. **2***a* from another perspective. At least an anode may be present at a side of the immersion scanner unit S**2**. The anode here is integral with the immersion scanner unit S**2**. FIG. **3***a* shows schematically and exemplarily another embodiment of a substrate handling system S comprising a substrate holder S**1** and an immersion scanner unit S**2** according to the disclosure. The power contact units **3** (at least main legs **3***b*, the side legs **3***c*, the electric contact portions **5***a* and/or the retaining elements **3***d*) are arranged along all four edges of the substrate carrier **2**.

[0063] FIG. **3***b* shows schematically and exemplarily the embodiment of the substrate handling system S according to FIG. **3***a* from another perspective.

[0064] FIG. **4** shows schematically and exemplarily a cross-sectional view of an embodiment of a substrate handling system S comprising a substrate holder S**1** and an immersion scanner unit S**2** according to the disclosure. The retaining elements **3***d* comprise spring elements. In this embodiment, the substrate carrier **2** is configured to carry only one substrate **1**.

[0065] FIG. **4***a* shows schematically and exemplarily a cross-sectional detail view of the embodiment of the substrate holder S**1** according to FIG. **4**. The retaining element **3***d* in the form of a spring element is present between the body **3***a* and the frame **2***a* of the substrate carrier **2**. A single substrate **1** is held in FIG. **4***a* in contact with the electric contact portion **5***a* from one side and the frame **2***a* of the substrate carrier **2** from another side.

[0066] FIGS. **5**, **5***a*, **6** and **6***a* show schematically and exemplarily a cross-sectional view of embodiments of the substrate holder S**1** according to the disclosure. The power contact unit **3** is configured to contact the substrate **1** to supply electric current for surface treatment of the substrate **1**. The power contact unit **3** comprises an electric contact portion **5***a* and a seal **5***b* around the electric contact portion **5***a*. Here the electric contact portion **5***a* contacts the substrate **1** as a single contact point.

[0067] In FIG. **6***a*, a detail of the substrate holder S**1** of FIG. **6** is shown. The substrate carrier **2***a* with the power contact unit **3** is at least partially inside a process fluid, which is depicted with the wavy line across the FIG. **6**. The power contact unit **3** comprises an electric contact portion **5***a* for transmitting electric current to the substrate **1** and a seal **5***b* around the electric contact portion **5***a* in the form of a bellow. The bellow form of the seal **5***b* causes, in addition to sealing, a vacuum effect on the contacted substrate **1**, thereby securing a connection between the electric contact portion **5***a* and the substrate **1**.

[0068] FIGS. **7** and **8** show schematically and exemplarily detail views of embodiments of a substrate handling system S comprising at least a vacuum head **4** and electric contact portion **5***a*. The vacuum head **4** provides suction between the frame **2***a* of the substrate carrier **2** and the substrate **1**. By aligning multiple vacuum heads **4** along for instance an edge of the frame **2***a*, a distributed suction force is applied to the substrate **1**, preventing collection of stress points. The vacuum head **4** ensures a stable connection between the power contact unit **3** (more specifically electric contact portion **5***a*) and the substrate **1**. The electric contact portions **5***a* in the FIGS. **7** and **8** are dry power contacts. Dry power contact is present between the power contact unit **3** and the substrate carrier **2** by providing a seal **5***b* around the electric contact portion **5***a* (not shown in FIGS. **7** and **8**).

[0069] In the embodiment shown in FIGS. **7** and **8**, the substrate holder S**1** further comprises an agitation unit (not shown in the figures) configured to move the substrate **1** relative to the immersion scanner unit S**2** or the immersion scanner unit S**2** relative to the substrate **1**, preferably in up to three dimensions.

[0070] FIGS. **9***a* and **9***b* show schematically and exemplarily detail views of embodiments of an electric contact portion **5***a* according to FIGS. **7** and **8** according to the disclosure. The electric contact portions **5***a* are dry power contacts surrounded with seals **5***b*.

[0071] A person skilled in the art will gather from the above and the following description that, unless otherwise notified, in addition to any combination of features belonging to one type of subject matter also any combination between features relating to different subject matters is considered to be disclosed with this application. However, all features can be combined providing synergetic effects that are more than the simple summation of the features.

[0072] While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive. The disclosure is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing a claimed disclosure, from a study of the drawings, the disclosure, and the dependent claims.

[0073] In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfil the functions of several items re-cited in the claims. The mere fact that certain measures are re-cited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

1. A substrate holder for holding a substrate in a chemical and/or electrolytic surface treatment of the substrate, comprising:

a substrate carrier, and

a power contact unit,

wherein the substrate carrier comprises a frame to carry the substrate,

wherein the power contact unit comprises a body, a plurality of main legs extending from the body at least partially along an edge of the substrate carrier and a plurality of side legs each arranged essentially perpendicular at one of the main legs to contact the substrate, and wherein the power contact unit further comprises a plurality of retaining elements provided between the body of the power contact unit and the frame of the substrate carrier to keep the substrate in contact with the power contact unit when the substrate is placed onto the substrate carrier.

2. The substrate holder according to claim **1**, wherein the retaining elements on opposite sides of the substrate are configured to apply different pressure on the frame.

3. The substrate holder according to claim **1**, wherein the retaining elements comprise spring elements, pneumatic elements, electric elements, magnetic elements and/or suction elements.

4. The substrate holder according to claim **1**, further comprising several electric contact portions arranged at the side legs to supply electric current to the substrate.

5. The substrate holder according to claim **1**, wherein the power contact unit further comprises electrically conducting lines extending along the main legs and to the electric contact portions in the side legs.

6. The substrate holder according to claim **1**, wherein the main legs, the side legs, the electric contact portions and/or the retaining elements are arranged along two opposite edges or along all four edges of the substrate carrier.

7. The substrate holder according to claim **4**, wherein the electric contact portions are dry power contacts, wet power contacts and/or contact arms.

8. The substrate holder according to claim **1**, wherein the substrate carrier comprises a vacuum unit configured to provide suction between the frame of the substrate carrier and the substrate.

9. The substrate holder according to claim **1**, wherein the power contact unit further comprises vacuum lines extending along the main legs to suction areas arranged at the side legs to hold the substrate.

10. The substrate holder according to claim **1**, wherein the substrate carrier is configured to hold the substrate only at its edges and/or corners for a double side chemical and/or electrolytic surface treatment of two sides of the substrate.

11. The substrate holder according to claim **1**, wherein the substrate carrier is configured to carry two substrates on opposite sides of the substrate carrier.

12. The substrate holder according to claim **1**, wherein the substrate carrier is grid-shaped.

13. A substrate handling system comprising the substrate holder according to claim **1** and an immersion scanner unit, wherein the substrate holder is configured to hold the substrate relative to the immersion scanner unit.

14. The substrate handling system according to claim **13**, further comprising an agitation unit configured to move the substrate or the immersion scanner unit relative to each other, preferably in up to three dimensions.

15. A use of the substrate holder according to claim **1** for holding a substrate with a width in a range of 1000 to 3500 mm and a length in a range of 1000 to 4000 mm, preferably a width in a range of 1500 to 3000 mm and a length in a range of 1500 to 3500 mm.

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