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DEVICE FOR COATING SUBSTRATES IN SEMICONDUCTOR
PRODUCTION ✓

The invention relates to a device for coating of semiconductor substrates in two steps. In the first step the coating medium or lacquer is applied with an open capillary slot that is filled with the lacquer and across which the substrate with the surface to be coated facing downwardly is guided. In the second step, the lacquer layer thickness is made more uniform and thinner in a spinning operation with the surface to be coated facing downwardly.

In the field of semiconductor production the object of coating rectangular or round substrates with a uniform layer of a lacquer or a coating medium that is initially liquid is encountered in order to produce color filters or special protective layers. For this purpose in conventional devices the substrates are connected to a turntable in a horizontal position whereby the surface to be coated faces upwardly. A certain amount of lacquer or coating medium is dripped onto the center of the plate from above via a jet. Subsequently, the turntable is rotated. Due to the centrifugal force the liquid is distributed over the substrate during the rotational movement. A great portion of the liquid is spun off the plate across its edge. The uniformness of the layer thickness that is achievable with this method depends on the magnitude of the rotational acceleration and the

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rotational velocity.

The disadvantage of the known method is that approximately up to 95% of the employed amount of lacquer is spun off the substrate. This spun off lacquer cannot be reused and is thus lost.

An improvement of this lacquering and coating method has been achieved by supplying the liquid via a very narrow open channel so that the liquid is applied to the surface to be coated which is facing downwardly by capillary and adhesion effects.

Such a device is, for example, especially well suitable for lacquering or coating of relatively large plates in the thin layer technology, for example, for LCD monitors etc. However, the uniformness of the lacquer thickness achievable with this method is not in all cases satisfactory for lacquering substrates for manufacturing highly integrated circuits.

It is therefore an object of the present invention to improve the known lacquering and coating processes with respect to the aforementioned criteria and to achieve for lacquering of semiconductor substrates the required high uniformness of the lacquer layer thickness.

According to the invention the solution to this object for a device of the aforementioned kind is comprised of the characterizing features of patent



claim 1. The lacquer is first applied to the substrate with a capillary slot. Subsequently, the substrate, with the lacquered surface facing downwardly, is spun with a suitable velocity. During this process the centrifugal force acts on the lacquer layer, i.e., an outwardly oriented displacement force. Naturally, within the lacquer layer an equilibrium between the displacement force and the adhesion force must be established. The areas of the lacquer layer in which the adhesion forces to the substrate surface, respectively, the underlying lacquer layers is too small, are displaced toward the edge of the substrate and a portion thereof is spun off across the edge. Accordingly, the lacquer layer thickness across the substrate surface is made more uniform and is reduced.

It has been proven to be especially advantageous to apply the lacquer onto the substrate surface (prelacquering). With this the optimal conditions for the effectiveness of the subsequent spinning process are provided.

It is furthermore especially advantageous, to fasten the substrates for the prelacquering step and the subsequent spinning step, with the surface to be lacquered facing downwardly, to the same holder, comprised of a turntable with drive shaft and corresponding drive motor.

Furthermore, one should preferably proceed such that this holder is connected to a horizontally



arranged linear transport device which provides for the transport of the substrates from the loading station to the unloading station and between the treatment stations as well as the uniform movement of the substrates across the capillary slot required during prelacquering.

It is advantageous to arrange a protective ring of a suitable shape about the rotating substrate. With it the lacquer, which is spun off across the edge of the substrate as described above, is caught and removed in a directed manner.

Another advantageous embodiment of the invention is characterized in that the protective ring can be lowered into a lower rest position when the spinning process is not performed. With this measure the substrate can be transported in the horizontal direction from the prelacquering station to the spinning position without any impediment. When the substrate reaches this position, the protective ring is raised to the level of the substrate in order to perform its function during the spinning process.

More advantageously, the inventive lacquering device is provided with a loading and unloading device so that the entire lacquering process can be automated. This is necessary in view of the manufacturing conditions in semiconductor production and allows for a uniform and reproducible lacquering result for large numbers of produced pieces.



Further details and advantageous embodiments of the invention will become apparent from the embodiments, described in the following and represented in the drawings, which embodiments are not to be understood as a limitation of the invention, and from the dependent claims. It is shown in:

- Fig. 1 a side view of the complete design of the inventive lacquering and coating device;
- Fig. 2 a view of the device for precoating that is part of the device represented in Fig. 1; and
- Fig. 3 a perspective view of the spinning device as part of the device according to Fig. 2.

Fig. 1 shows a first embodiment of an inventive lacquering device 10. On the frame 11 the channel 12 for the precoating step and the protective ring 22 of the spinning station 13 as well as the supports 14 and 15 for the linear transport device 16 are connected. At the movable part of the linear transport device 16 the rotating motor 17 and at its shaft 18 the turntable 19. The substrate 20 is connected to the plate holding device 19, for example, by vacuum. For this purpose, the holding device 19 is provided with respective vacuum bores, not represented in the drawing. In the context of the present invention,

other holding devices known to a person skilled in the art can be used.

The open channel 12 with the capillary slot 21 for the prelacquering step is represented in cross-section in Fig. 1 and is further represented in Fig. 2, also in section, in a perspective view.

Adjacent to the prelacquering device the protective ring 22 for the spinning process is arranged. It is connected to one or more stands 23 and 24 which can automatically adjust the height position of the protective ring 22. For example, they may be pneumatically adjustable units, but also other devices, known to a person skilled in the art. For the spinning process the protective ring 22 is vertically upwardly displaced with one or more stands 23 and 24, until the protective ring 22 surrounds the substrate in a suitable manner. In Fig. 2 the substrate to be lacquered is shown above the protective ring 22 connected to the turntable 19 and the motor shaft 18. This position is represented in Fig. 1 in a dash-dotted line and illustrates the situation before or after the spinning process in which the substrate is connected to the linear transport device 16 in a position predetermined for the spinning process the protective ring 22 however in this position has not yet been displaced upwardly or has already been lowered. This upward and downward movement of the protective ring 22 is necessary so that it does not obstruct the substrate during its horizontal transport with the



linear transport device 16.

Fig. 1 shows the protective ring 22 in cross-section. Its cross-section has a slanted U-shaped profile. This embodiment ensures that the lacquer or coating medium spun across the edge of the substrate is caught within the annular profile and is guided downwardly to the inner edge of the protective ring 22 from where it is removed completely from the inventive device with a lacquer removal 25.

For a fully automated version of the coating device automatic loading and unloading stations are provided in the areas indicated respectively at 26 and 27 in Fig. 1. The loading device removes the substrate 20 to be lacquered from a magazine connected to the coating device at an appropriate location and transfers it onto the plate holding device 19. The unloading device receives the substrate 20 from the holding device 19 and places it into a magazine provided at a suitable location.

Mode of operation of the lacquering device:

In a first step a substrate 20 is automatically or manually connected to the turntable 19. The turntable at this moment is in the area which is indicated by reference numeral 26 in Fig. 1. Subsequently, the linear transport device 16 is moved in the direction of arrow 28, i.e., in direction toward the channel 12.

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As soon as the leading point of the substrate 20 reaches the upper edge of the capillary slot 21, prelacquering begins. Of course, the substrate 20 is moved across the capillary slot 21 of the channel 12 during the step of prelacquering.

After completion of the precoating step the substrate 20 is moved together with the turntable 19, the motor 17, and the drive shaft 18 in the direction of arrow 28 until it is centered above the protective ring 22 which is at this moment in its lowered rest position. When the substrate 20 has reached this position, the protective ring 22 is moved upwardly until the substrate 20 is surrounded by it in a suitable manner. Then the spinning process starts with which the lacquer layer thickness on the substrate is made more uniform and thinner. The excess lacquer is spun off into the protective ring 22 and is removed via the lacquer removal 25.

After completion of the spinning process the protective ring 22 is again lowered. The substrate 20 is subsequently transported by the transport device 16 into the area shown at 27 in Fig. 1 where it is automatically or manually removed from the turntable 19.

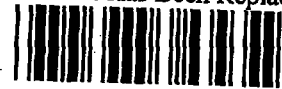
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Patent Claims

1. Device for lacquering (10) substrates (20) in two steps, characterized in that in the first step the substrate (20) is prelacquered via a capillary slot (21) and in a second step the thus applied lacquer layer thickness is made more uniform and thinner in a spinning process.
2. Device according to claim 1, characterized in that during the prelacquering as well as the spinning process the surface of the substrate (20) to be lacquered is facing downwardly.
3. Device according to at least one of the preceding claims, characterized in that the substrate (20) is connected, with the surface to be coated facing downwardly, during the entire lacquering process to a turntable (19) with motor and motor shaft (18).
4. Device according to at least one of the preceding claims, characterized in that the treatment stations for the prelacquering and the spinning process are arranged adjacent to one another and that the substrate (20) is transported between these stations with a linear transport device (16).
5. Device according to at least one of the preceding claims, characterized in that for the spinning process a protective ring (22)



with a slanted U-shaped cross-sectional profile is arranged about the rotating substrate (20) in order to catch the spun-off lacquer.

Device according to at least one of the preceding claims, characterized in that the protective ring (22) is lowered into a lower rest position below the substrate (20), when the spinning process is not performed.

Device according to at least one of the preceding claims, characterized in that the lacquering device (10) is provided with a respective loading (26) and a respective unloading station (27) and is thus operable in a fully automated manner.

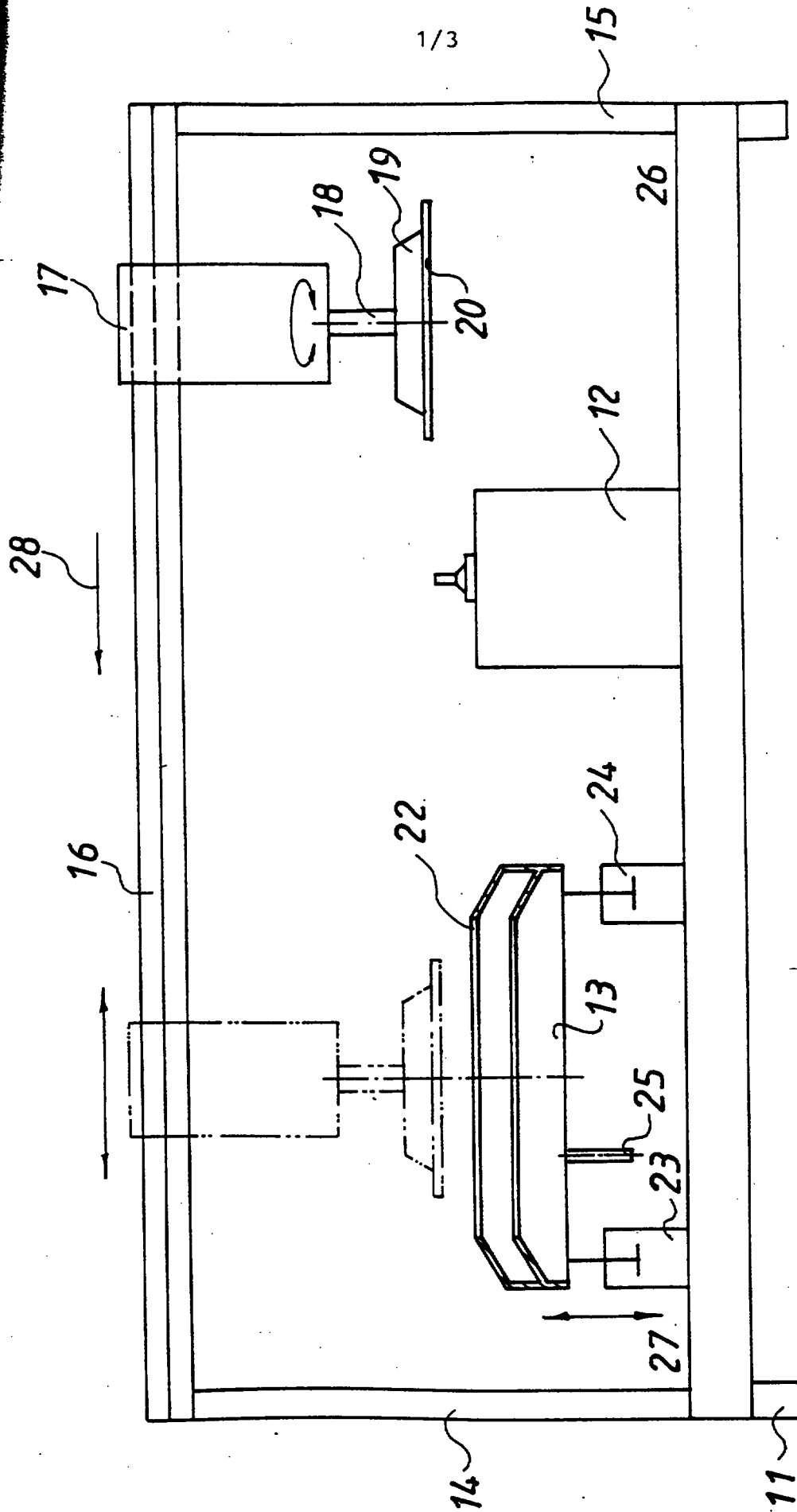


Fig. 1

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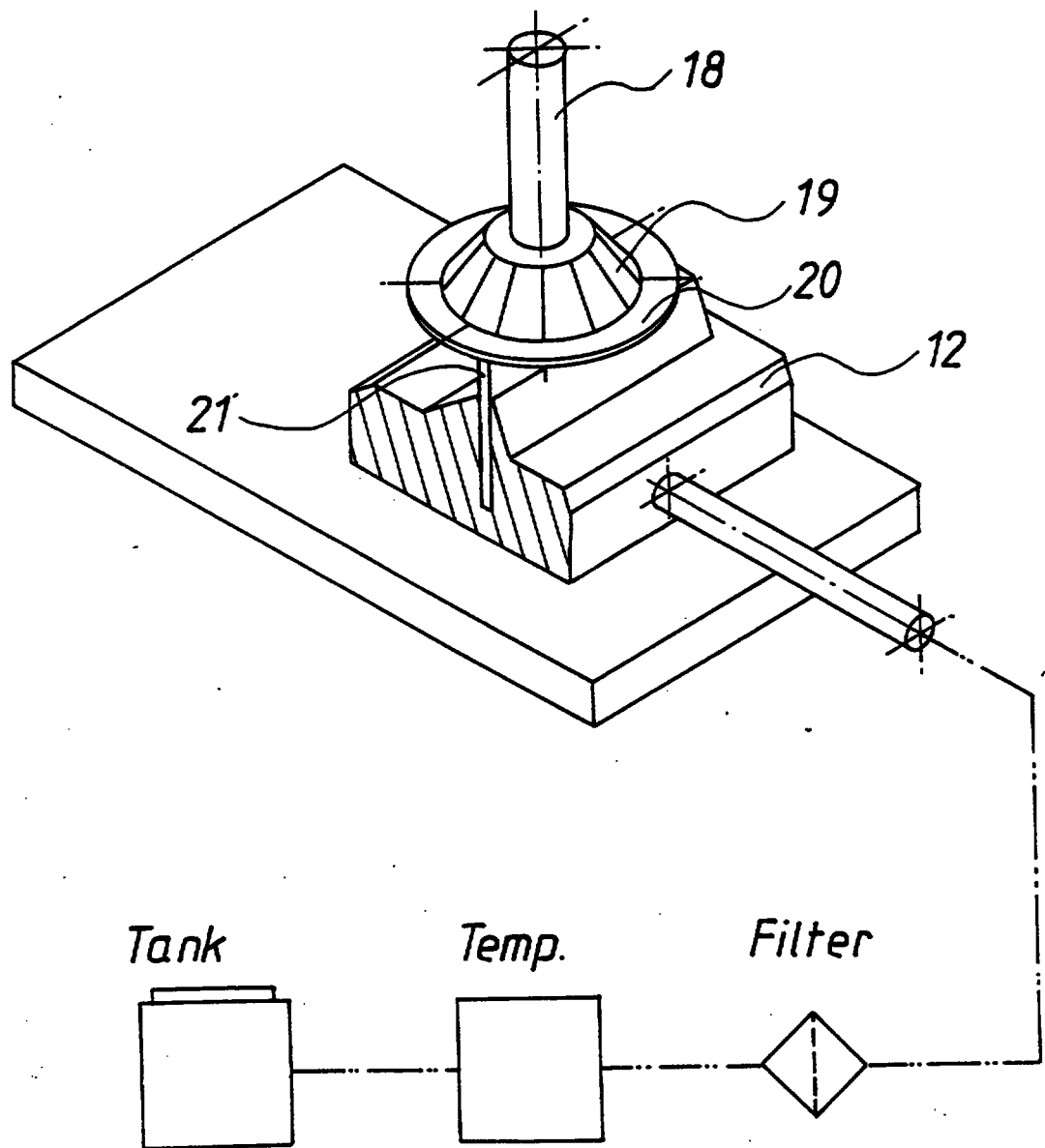


Fig. 2

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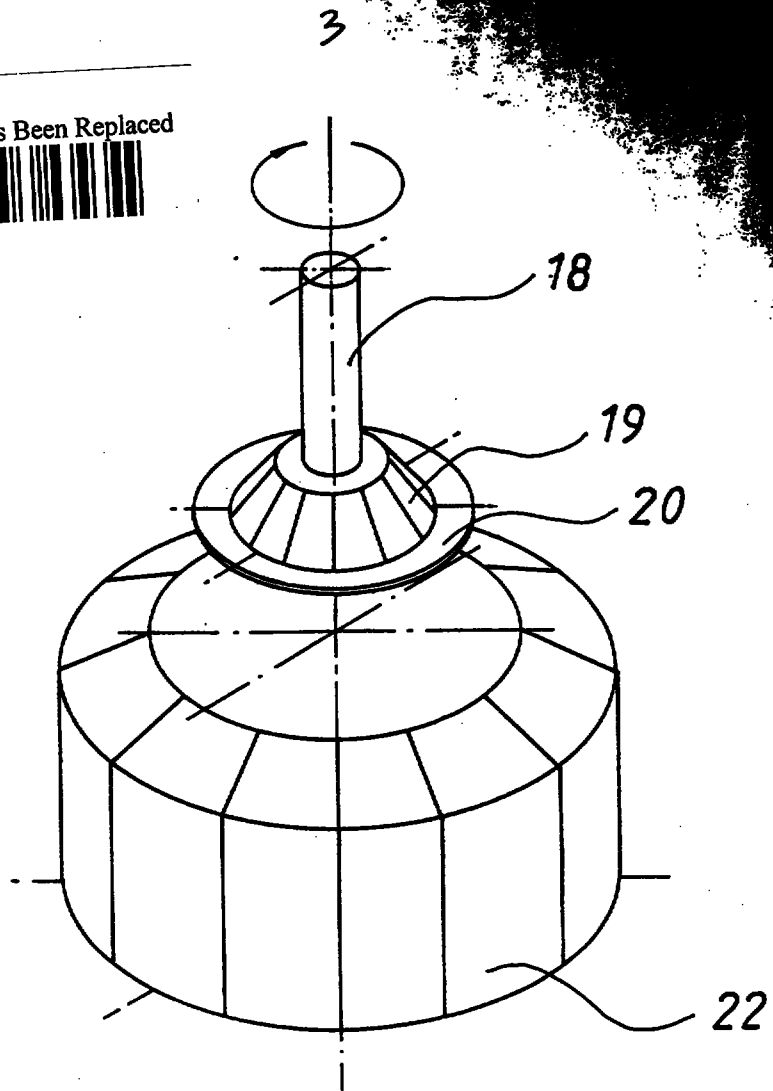


Fig. 3

DEVICE FOR COATING SUBSTRATES IN SEMICONDUCTOR PRODUCTION

Abstract

In a device for lacquering substrates (20) in a first step the lacquer is applied with a capillary slot (21) to the substrate (20) and in a second step the lacquer layer thickness is reduced and made more uniform by a spinning process.

(In connection with Fig. 1)

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DEVICE FOR COATING SUBSTRATES IN SEMICONDUCTOR
MANUFACTURE

Description

When manufacturing semiconductors, often the need arises to coat rectangular or circular substrates with a uniform layer of lacquer or other, initially liquid media, e.g. colour filters or special protective layers. When using conventional devices, the substrates are fixed horizontally, with the surface to be lacquered upwards, onto a turntable. A certain amount of the lacquer or liquid is applied by dropping from above through a nozzle onto the centre of the substrate. Then the turntable is moved. The liquid is distributed over the substrate during the rotating movement owing to the centrifugal force. A large part of the liquid is thrown off the edge of the plate. The obtainable uniformity of the coating thickness depends on the parameters of rotation acceleration and rotation speed. It is a disadvantage that up to 95% of the used volume of lacquer is thrown off the edge of the substrate. The centrifuged substrate can no longer be used and, thus, is wasted.

From IBM Technical Disclosure Bulletin, volume 32, No. 1, June 1989, pages 311 - 313 it is known to fix the substrate with the surface to be lacquered downwards on the turntable. For lacquering purposes this side is initially emerged in a tank with resist, then dropped off in a chamfered position of 5° and finally centrifuged in a centrifugal drum. According to the disclosure of this reference the volume of resist which is thrown off can be reduced by about 70%. However, the device is complicated since the centrifugal drum must be moved in horizontal direction over the tank containing the resist. In the process it cannot be avoided that the resist is being rendered impure which, as a result, impairs the quality of the lacquering.

The process of lacquering and coating has been improved by applying the liquid through a very narrow, open chamfer onto a surface of the substrate pointing downwards, wherein use is made of capillary and adhesive effects. This process is, e.g. disclosed in US 2 046 596, wherein a narrow band of celluloid (for the manufacture of films) is moved over a capillary gap and thus coated with the liquid supplied through the said capillary gap from beneath.

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Such devices are appropriate for lacquering or coating comparably large plates in thin-film technology, e.g., LCD screens. The uniformity of the lacquer thickness obtained by this method is, however, not always sufficient for lacquering substrates in LSI circuit manufacture.

Therefore, it is an object of the invention to improve the known methods of lacquering and coating in respect of the above-mentioned criteria.

According to the invention this problem is solved by a device for lacquering a substrate with a lacquer coating, comprising a turntable which is associated with a drive motor and to which the substrate is fastenable with the surface to be lacquered downwards, a pre-lacquering station which has a capillary gap, across the upper side of which the substrate is movable by its surface to be lacquered by means of a linear transport unit serving for the linear advance of the turntable in order to pre-lacquer this surface with lacquer from the capillary gap, and a centrifuging station to which the turntable is movable by the linear transport unit after the pre-lacquering in order to make uniform and reduce the lacquer coating thickness there by rotation of the turntable. Hence, in a first step the lacquer is applied to the substrate through the capillary gap. Then, the substrate, with the surface to be lacquered also downwards, is centrifuged at an appropriate rotation speed. In this process a centrifugal force, i.e. a displacement force directed towards the outside, is acting upon the lacquer coating. Naturally, an equilibrium of displacement force and adhesion force must result in the lacquer coating. The areas of the lacquer in which the adhesion to the surface of the substrate and/or the lacquer coating beneath it is too small are displaced towards the edge of the substrate and part thereof is thrown off the edge. Thus the lacquer coating thickness is made uniform and reduced as a whole on the surface of the substrate. Support on a linear transport unit allows the transport of the substrate between the processing stations and also the regular movement of the substrate over the capillary gap necessary for pre-lacquering.

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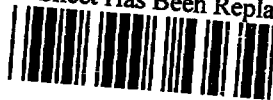
It is an advantage if, according to claim 3, the centrifuging station has a protective ring which surrounds the rotating substrate. The lacquer which is thrown off the edge of the substrate is collected therein and let off in a targeted manner.

A further advantageous embodiment of the invention is characterised in that the protective ring is constructed such that it can be lifted or lowered to enable the movement of the substrate by the linear transport unit. Thus, the substrate can be transported without difficulty in horizontal direction from the pre-lacquering station to the centrifuging station. If the substrate reaches the centrifuging station, the protective ring is lifted from below to the level of the substrate in order to fulfil its function during the centrifuging process.

Moreover, the device according to the invention is advantageously provided with an automatic leading and unloading station which renders it possible to automate the entire lacquering process. This allows a uniform and reproducible lacquering of a large number of pieces.

Further details and advantageous embodiments of the invention follow from the embodiments described hereinafter and shown in the drawing as well as from the further subclaims which are, however, not intended to limit the invention in any way. In the drawing:

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Fig. 1 shows the entire layout of the lacquering and coating device according to the invention

Fig. 2 shows the pre-lacquering station as a part of the device according to Fig. 1

Fig. 3 shows the centrifuging station as a part of the device according to Fig. 2.

Fig. 1 shows a first embodiment of the coating device 10 according to the invention. On the structure 11 the chamfer for pre-lacquering 12 and the protective ring of the centrifuging station 13 as well as the stands 14 and 15 for the linear transport unit 16 are mounted. To the movable part of the linear transport unit 16 the drive motor 17 is fixed and to the motor shaft 18 the turntable 19 is fixed. The substrate 20 adheres to the turntable 19 by means of vacuum. To this end the holding device 19 is provided with respective vacuum bores which are not illustrated. Other holding devices known to the man skilled in the art can also be used within the framework of the invention.

The open chamfer 12 with the capillary gap 21 for pre-lacquering is shown in Fig. 1 in cross-section and a perspective view thereof is shown in Fig. 2 in cross-section as well.

The protective ring 22 for the centrifuging process is arranged next to the pre-lacquering station. It is fixed to one or several stands 23 and 24 which can self-actively adjust the level of height of the protective ring. These can be, for instance, pneumatically adjustable units or other devices known to the man skilled in the art. For the centrifuging process the protective ring 22 is lifted vertically over the stand(s) 23 and 24 in upward direction until surrounding the substrate in an appropriate manner. Fig. 3 shows the substrate to be lacquered on the turntable 19 and the motor shaft 18 above the protective ring 22. The same illustration is shown in Fig. 1 by the dotted lines. It corresponds to the situation before or after the centrifuging process,

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while the substrate is positioned on the linear transport unit 16 such as to be centrifuged, but the protective ring has not yet been lifted or has already been lowered again, respectively. This lifting and lowering of the protective ring 22 is necessary to avoid that the substrate is obstructed during transport along the linear unit 16 in horizontal direction.

Fig. 1 shows a cross-sectional view of the protective ring 22. The protective ring has a chamfered U-profile cross-section. This ensures that the lacquer thrown off the edge of the substrate is safely collected in the ring profile and let off towards the lower internal edge of the protective ring from which it can be fully disposed over the lacquer outlet (25).

In order to realise an all-automatic version of the lacquering device, in the area marked 26 in Fig. 1 an automatic loading station is mounted and in the area marked 27 an automatic unloading station is mounted. The loading station takes the substrate 20 to be lacquered from a magazine mounted in a certain place and leads it to the turntable 19. The unloading station takes the substrate 20 from the turntable 19 and again disposes it in a magazine mounted in a certain place.

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Mode of operation of the lacquering device:

In a first step a substrate 20 is fixed on the turntable 19 either automatically or manually. At this moment the turntable is positioned in the area marked 26 in Fig. 1. Then, the linear transport unit 16 starts moving in the direction of the arrow marked 28, i.e. in the direction of the chamfer 12.

As soon as the foremost tip of the substrate reaches the upper edge of the capillary gap 21, the pre-lacquering commences. Naturally, the substrate 20 is moved over the capillary gap 21 in the chamfer 12 during pre-lacquering.

When the pre-lacquering is completed, the substrate 20 is transported by the turntable 19 and motor 17 comprising the shaft 18 in the direction of the arrow 28 until it is positioned exactly above the protective ring 22 in waiting position. Once this position is reached, the protective ring 22 is lifted until surrounding the substrate 20 in an appropriate manner. Then the centrifuging process starts through which the lacquer coating thickness on the substrate is made uniform and reduced. The excess lacquer is centrifuged into the protective ring 22 and is let off from there through the lacquer outlet 25.

After completion of the centrifuging process the protective ring 22 is lowered again. then, the substrate 20 is again transported via the transport unit 16 to the area marked 27 in Fig. 1 where it is removed from the turntable 19 either automatically or manually.

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CLAIMS

1. Device for lacquering a substrate with a lacquer coating, comprising a turntable (19) which is associated with a drive motor (18) and to which the substrate (20) is fastenable with the surface to be lacquered downwards, a pre-lacquering station (12) which has a capillary gap (21), across the upper side of which the substrate (20) is movable by its surface to be lacquered by means of a linear transport unit serving for the linear advance of the turntable (19) in order to pre-lacquer this surface with lacquer from the capillary gap (21), and a centrifuging station (22) to which the turntable (19) is movable by the linear transport unit (16) after the pre-lacquering in order to make uniform and reduce the lacquer coating thickness there by rotation of the turntable (19).
2. Device according to claim 1, in which the processing station for the pre-lacquering and for the centrifuging procedure are arranged adjacent to one another.
3. Device according to claim 1 or 2, in which the centrifuging station has a protective ring (22) with a chamfered U-profile cross-section, which surrounds the rotating substrate (20) during the centrifuging.
4. Device according to claim 3, in which the protective ring (22) is constructed such that it can be lifted or lowered to enable the movement of the substrate (20) by the linear transport unit (16).
5. Device according to one or more of the preceding claims, in which a loading station (26) for the automatic loading of the turntable (19) is provided.
6. Device according to one or more of the preceding claims, in which an unloading station (27) for the automatic unloading of the turntable (19) is provided.

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DEVICE FOR COATING SUBSTRATES IN SEMICONDUCTOR
MANUFACTURE

ABSTRACT

In a device for lacquering substrates (20) in a first step the lacquer is applied with a capillary slot (21) to the substrate (20) and in a second step the lacquer layer thickness is reduced and made more uniform by a spinning process.

Figure 1

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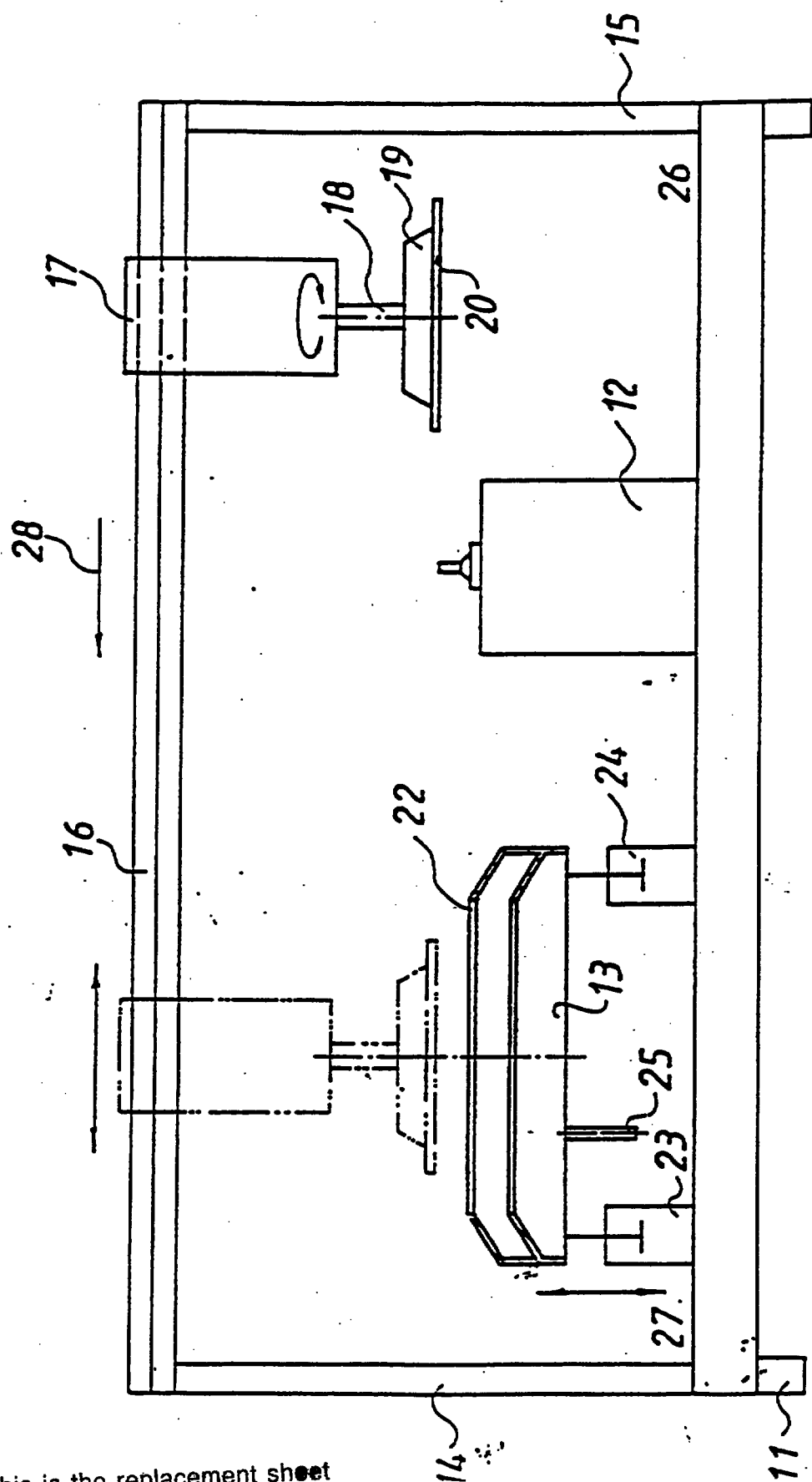


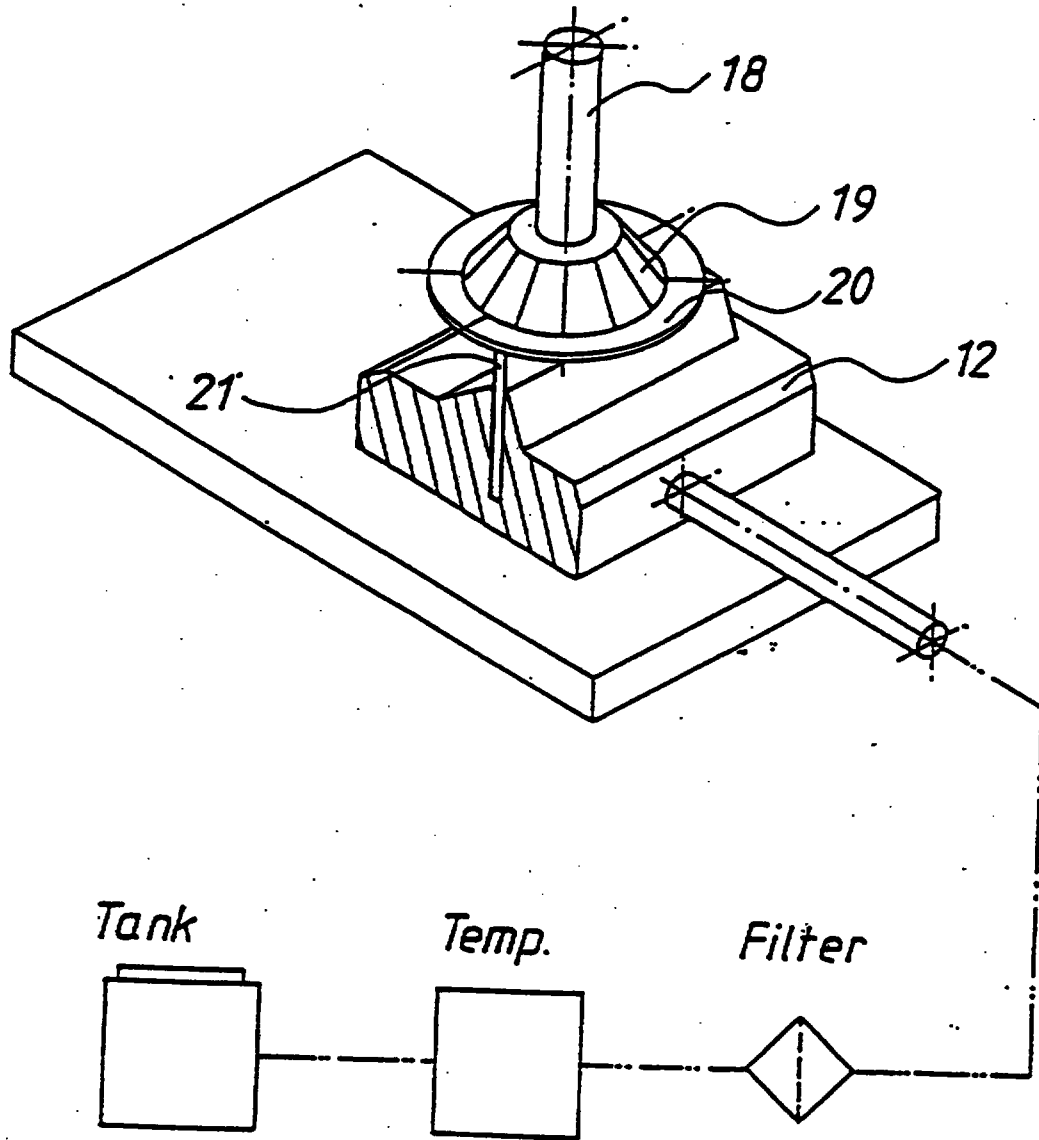
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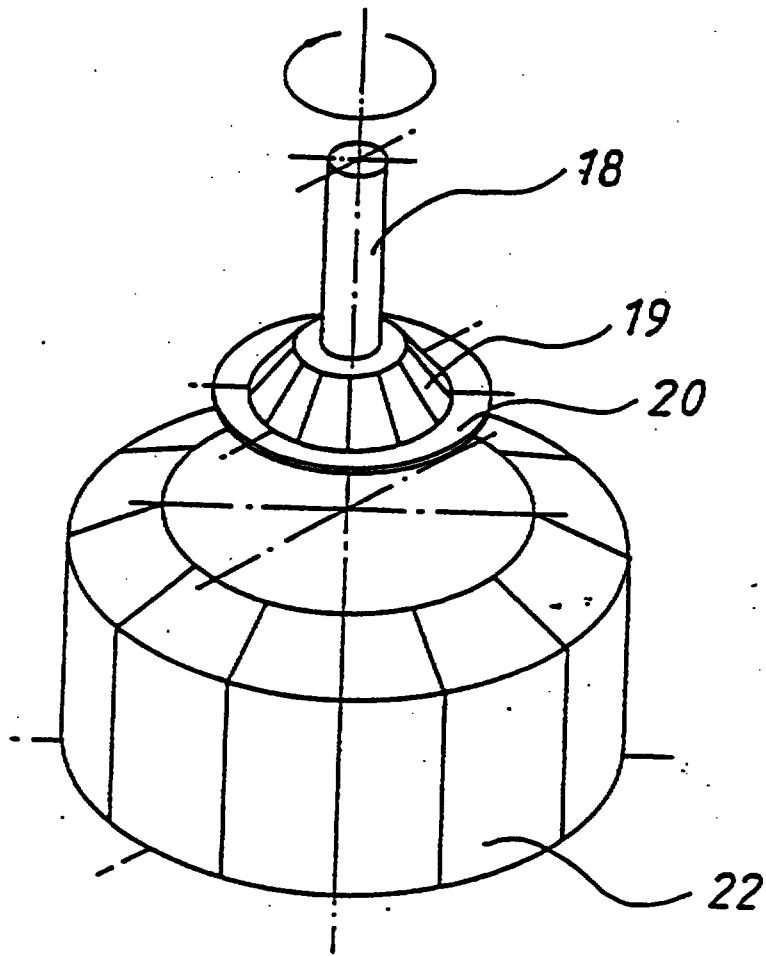
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DEVICE FOR COATING SUBSTRATES IN SEMICONDUCTOR MANUFACTURE

Description

When manufacturing semiconductors, often the need arises to coat rectangular or circular substrates with a uniform layer of lacquer or other, initially liquid media, e.g. colour filters or special protective layers. When using conventional devices, the substrates are fixed horizontally, with the surface to be lacquered upwards, onto a turntable. A certain amount of the lacquer or liquid is applied by dropping from above through a nozzle onto the centre of the substrate. Then the turntable is moved. The liquid is distributed over the substrate during the rotating movement owing to the centrifugal force. A large part of the liquid is thrown off the edge of the plate. The obtainable uniformity of the coating thickness depends on the parameters of rotation acceleration and rotation speed. It is a disadvantage that up to 95% of the used volume of lacquer is thrown off the edge of the substrate. The centrifuged substrate can no longer be used and, thus, is wasted.

From IBM Technical Disclosure Bulletin, volume 32, No. 1, June 1989, pages 311 - 313 it is known to fix the substrate with the surface to be lacquered downwards on the turntable. For lacquering purposes this side is initially emerged in a tank with resist, then dropped off in a chamfered position of 5° and finally centrifuged in a centrifugal drum. According to the disclosure of this reference the volume of resist which is thrown off can be reduced by about 70%. However, the device is complicated since the centrifugal drum must be moved in horizontal direction over the tank containing the resist. In the process it cannot be avoided that the resist is being rendered impure which, as a result, impairs the quality of the lacquering.

The process of lacquering and coating has been improved by applying the liquid through a very narrow, open chamfer onto a surface of the substrate pointing downwards, wherein use is made of capillary and adhesive effects. This process is, e.g. disclosed in US 2 046 596, wherein a narrow band of celluloid (for the manufacture of films) is moved over a capillary gap and thus coated with the liquid supplied through the said capillary gap from beneath.

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Such devices are appropriate for lacquering or coating comparably large plates in thin-film technology, e.g., LCD screens. The uniformity of the lacquer thickness obtained by this method is, however, not always sufficient for lacquering substrates in LSI circuit manufacture.

Therefore, it is an object of the invention to improve the known methods of lacquering and coating in respect of the above-mentioned criteria.

According to the invention this problem is solved by a device for lacquering a substrate with a lacquer coating, comprising a turntable which is associated with a drive motor and to which the substrate is fastenable with the surface to be lacquered downwards, a pre-lacquering station which has a capillary gap, across the upper side of which the substrate is movable by its surface to be lacquered by means of a linear transport unit serving for the linear advance of the turntable in order to pre-lacquer this surface with lacquer from the capillary gap, and a centrifuging station to which the turntable is movable by the linear transport unit after the pre-lacquering in order to make uniform and reduce the lacquer coating thickness there by rotation of the turntable. Hence, in a first step the lacquer is applied to the substrate through the capillary gap. Then, the substrate, with the surface to be lacquered also downwards, is centrifuged at an appropriate rotation speed. In this process a centrifugal force, i.e. a displacement force directed towards the outside, is acting upon the lacquer coating. Naturally, an equilibrium of displacement force and adhesion force must result in the lacquer coating. The areas of the lacquer in which the adhesion to the surface of the substrate and/or the lacquer coating beneath it is too small are displaced towards the edge of the substrate and part thereof is thrown off the edge. Thus the lacquer coating thickness is made uniform and reduced as a whole on the surface of the substrate. Support on a linear transport unit allows the transport of the substrate between the processing stations and also the regular movement of the substrate over the capillary gap necessary for pre-lacquering.

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It is an advantage if, according to claim 3, the centrifuging station has a protective ring which surrounds the rotating substrate. The lacquer which is thrown off the edge of the substrate is collected therein and let off in a targeted manner.

A further advantageous embodiment of the invention is characterised in that the protective ring is constructed such that it can be lifted or lowered to enable the movement of the substrate by the linear transport unit. Thus, the substrate can be transported without difficulty in horizontal direction from the pre-lacquering station to the centrifuging station. If the substrate reaches the centrifuging station, the protective ring is lifted from below to the level of the substrate in order to fulfil its function during the centrifuging process.

Moreover, the device according to the invention is advantageously provided with an automatic leading and unloading station which renders it possible to automate the entire lacquering process. This allows a uniform and reproducible lacquering of a large number of pieces.

Further details and advantageous embodiments of the invention follow from the embodiments described hereinafter and shown in the drawing as well as from the further subclaims which are, however, not intended to limit the invention in any way. In the drawing:

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Fig. 1 shows the entire layout of the lacquering and coating device according to the invention

Fig. 2 shows the pre-lacquering station as a part of the device according to Fig. 1

Fig. 3 shows the centrifuging station as a part of the device according to Fig. 2.

Fig. 1 shows a first embodiment of the coating device 10 according to the invention. On the structure 11 the chamfer for pre-lacquering 12 and the protective ring of the centrifuging station 13 as well as the stands 14 and 15 for the linear transport unit 16 are mounted. To the movable part of the linear transport unit 16 the drive motor 17 is fixed and to the motor shaft 18 the turntable 19 is fixed. The substrate 20 adheres to the turntable 19 by means of vacuum. To this end the holding device 19 is provided with respective vacuum bores which are not illustrated. Other holding devices known to the man skilled in the art can also be used within the framework of the invention.

The open chamfer 12 with the capillary gap 21 for pre-lacquering is shown in Fig. 1 in cross-section and a perspective view thereof is shown in Fig. 2 in cross-section as well.

The protective ring 22 for the centrifuging process is arranged next to the pre-lacquering station. It is fixed to one or several stands 23 and 24 which can self-actively adjust the level of height of the protective ring. These can be, for instance, pneumatically adjustable units or other devices known to the man skilled in the art. For the centrifuging process the protective ring 22 is lifted vertically over the stand(s) 23 and 24 in upward direction until surrounding the substrate in an appropriate manner. Fig. 3 shows the substrate to be lacquered on the turntable 19 and the motor shaft 18 above the protective ring 22. The same illustration is shown in Fig. 1 by the dotted lines. It corresponds to the situation before or after the centrifuging process,

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while the substrate is positioned on the linear transport unit 16 such as to be centrifuged, but the protective ring has not yet been lifted or has already been lowered again, respectively. This lifting and lowering of the protective ring 22 is necessary to avoid that the substrate is obstructed during transport along the linear unit 16 in horizontal direction.

Fig. 1 shows a cross-sectional view of the protective ring 22. The protective ring has a chamfered U-profile cross-section. This ensures that the lacquer thrown off the edge of the substrate is safely collected in the ring profile and let off towards the lower internal edge of the protective ring from which it can be fully disposed over the lacquer outlet (25).

In order to realise an all-automatic version of the lacquering device, in the area marked 26 in Fig. 1 an automatic loading station is mounted and in the area marked 27 an automatic unloading station is mounted. The loading station takes the substrate 20 to be lacquered from a magazine mounted in a certain place and leads it to the turntable 19. The unloading station takes the substrate 20 from the turntable 19 and again disposes it in a magazine mounted in a certain place.

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Mode of operation of the lacquering device:

In a first step a substrate 20 is fixed on the turntable 19 either automatically or manually. At this moment the turntable is positioned in the area marked 26 in Fig. 1. Then, the linear transport unit 16 starts moving in the direction of the arrow marked 28, i.e. in the direction of the chamfer 12.

As soon as the foremost tip of the substrate reaches the upper edge of the capillary gap 21, the pre-lacquering commences. Naturally, the substrate 20 is moved over the capillary gap 21 in the chamfer 12 during pre-lacquering.

When the pre-lacquering is completed, the substrate 20 is transported by the turntable 19 and motor 17 comprising the shaft 18 in the direction of the arrow 28 until it is positioned exactly above the protective ring 22 in waiting position. Once this position is reached, the protective ring 22 is lifted until surrounding the substrate 20 in an appropriate manner. Then the centrifuging process starts through which the lacquer coating thickness on the substrate is made uniform and reduced. The excess lacquer is centrifuged into the protective ring 22 and is let off from there through the lacquer outlet 25.

After completion of the centrifuging process the protective ring 22 is lowered again. then, the substrate 20 is again transported via the transport unit 16 to the area marked 27 in Fig. 1 where it is removed from the turntable 19 either automatically or manually.

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CLAIMS



1. Device for lacquering a substrate with a lacquer coating, comprising a turntable (19) which is associated with a drive motor (18) and to which the substrate (20) is fastenable with the surface to be lacquered downwards, a pre-lacquering station (12) which has a capillary gap (21), across the upper side of which the substrate (20) is movable by its surface to be lacquered by means of a linear transport unit serving for the linear advance of the turntable (19) in order to pre-lacquer this surface with lacquer from the capillary gap (21), and a centrifuging station (22) to which the turntable (19) is movable by the linear transport unit (16) after the pre-lacquering in order to make uniform and reduce the lacquer coating thickness there by rotation of the turntable (19).
2. Device according to claim 1, in which the processing station for the pre-lacquering and for the centrifuging procedure are arranged adjacent to one another.
3. Device according to claim 1 or 2, in which the centrifuging station has a protective ring (22) with a chamfered U-profile cross-section, which surrounds the rotating substrate (20) during the centrifuging.
4. Device according to claim 3, in which the protective ring (22) is constructed such that it can be lifted or lowered to enable the movement of the substrate (20) by the linear transport unit (16).
5. Device according to one or more of the preceding claims, in which a loading station (26) for the automatic loading of the turntable (19) is provided.
6. Device according to one or more of the preceding claims, in which an unloading station (27) for the automatic unloading of the turntable (19) is provided.

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DEVICE FOR COATING SUBSTRATES IN SEMICONDUCTOR MANUFACTURE

ABSTRACT

In a device for lacquering substrates (20) in a first step the lacquer is applied with a capillary slot (21) to the substrate (20) and in a second step the lacquer layer thickness is reduced and made more uniform by a spinning process.

Figure 1

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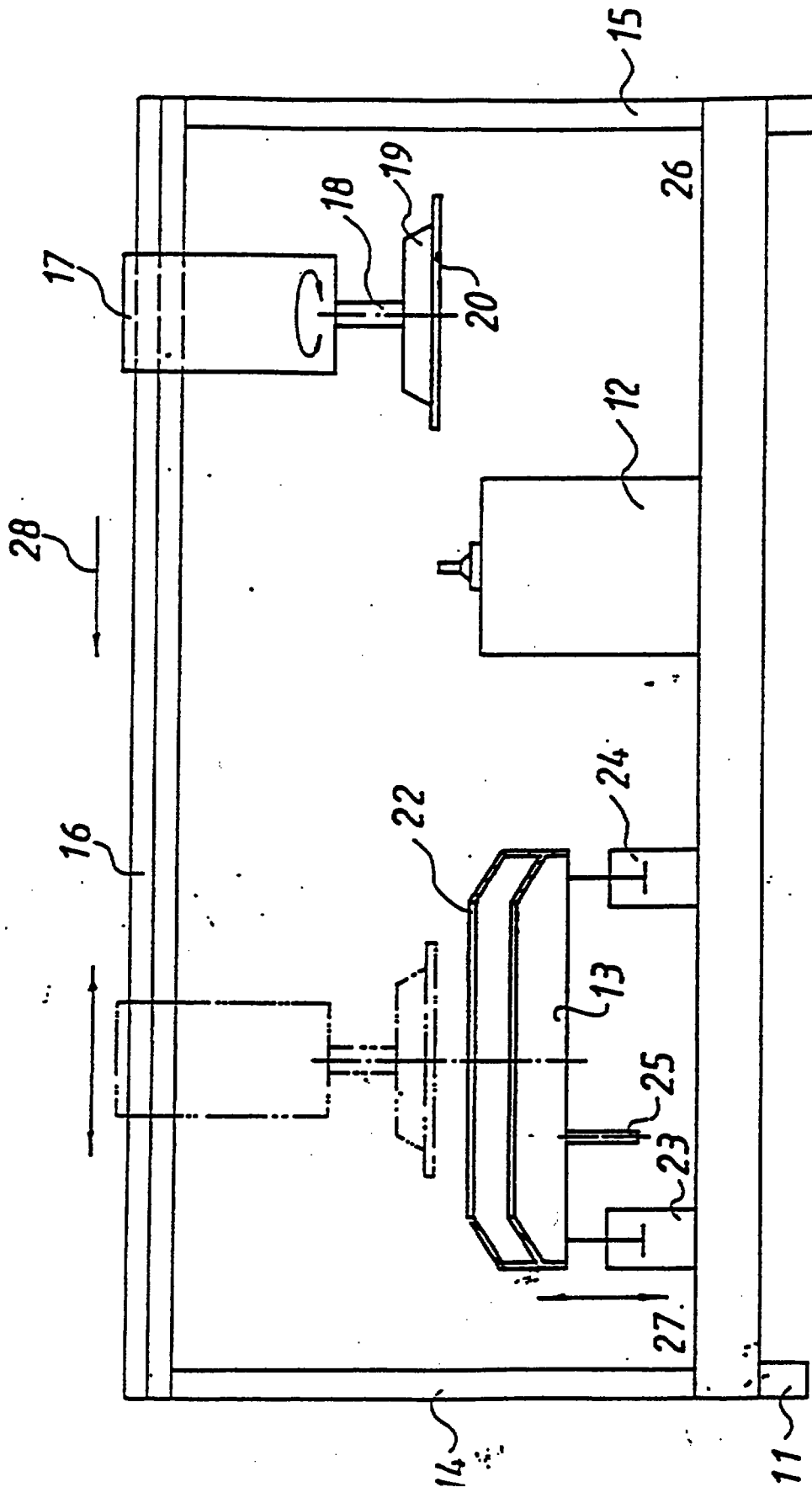


Fig. 1

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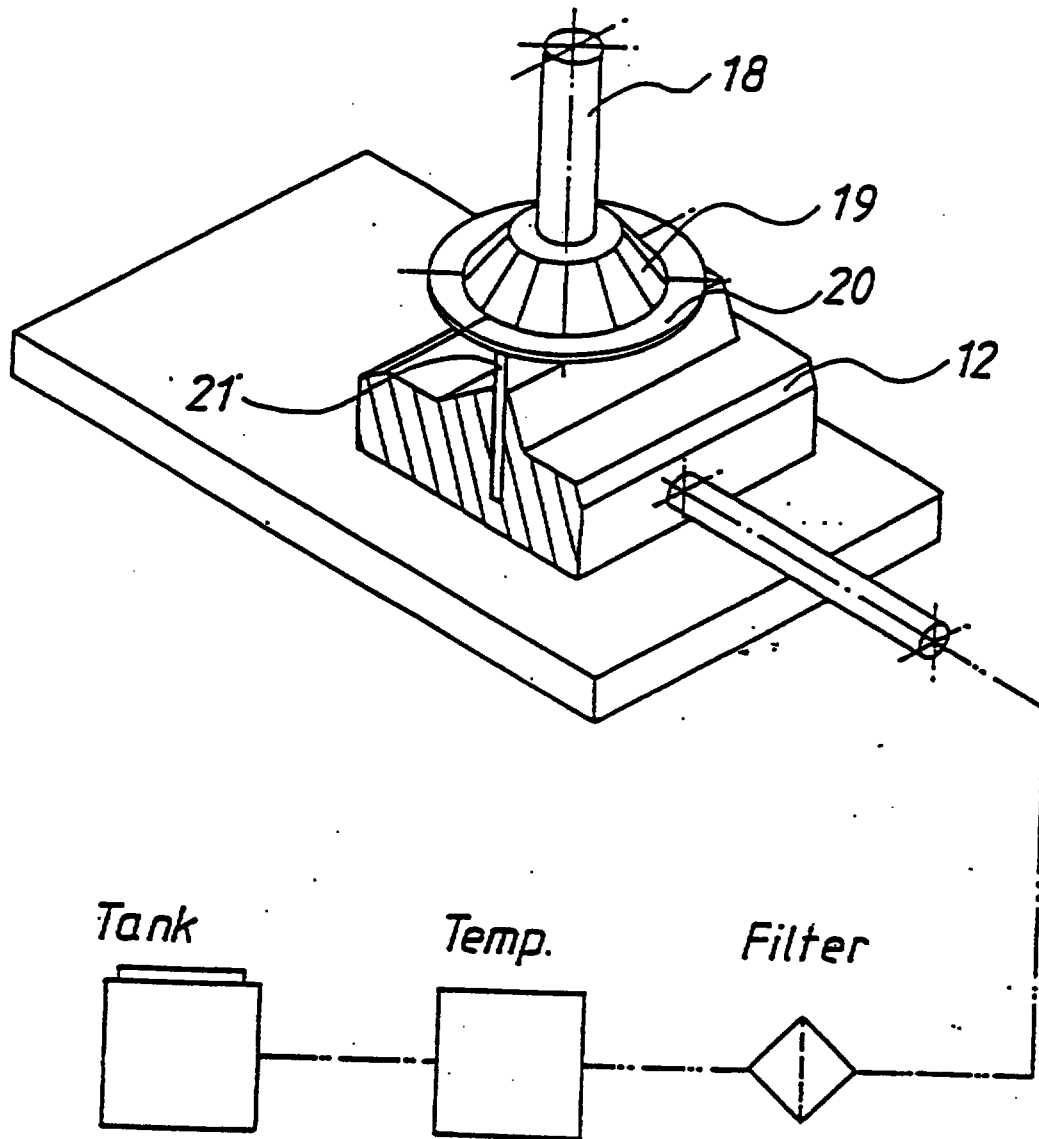


Fig. 2

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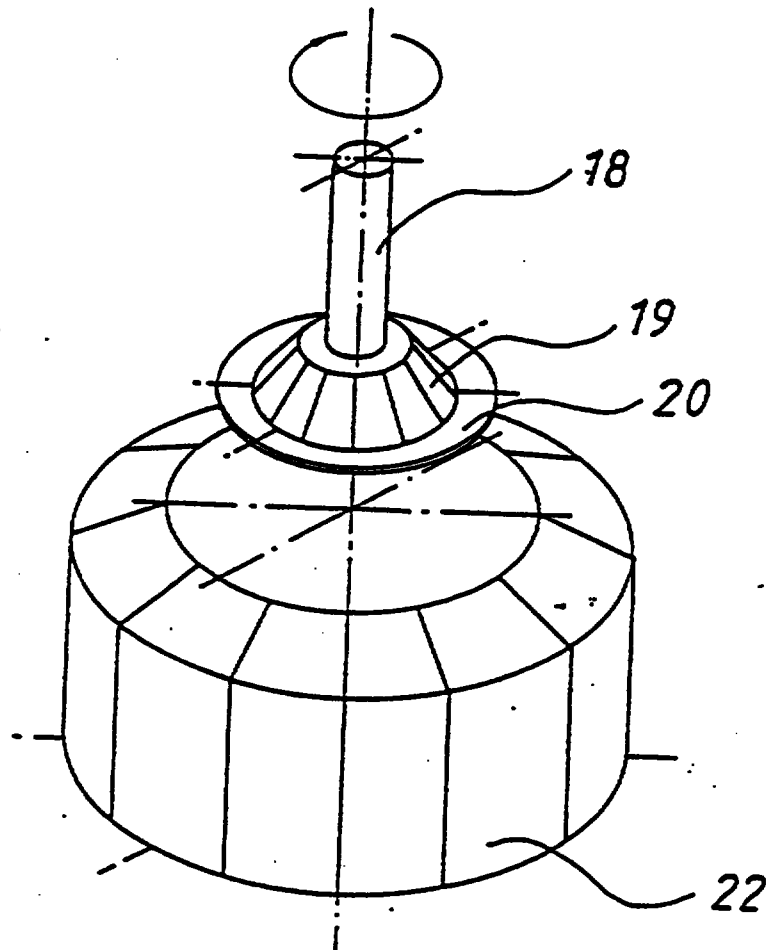


Fig. 3