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(74) Képviselő:

Horváthné Faber Enikő, ADVOPATENT**Szabadalmi és Védjegy Iroda, Budapest**

(72) (73) Feltaláló(k) és szabadalmas(ok):

Haselsteiner, Hubert, 3332 Biberbach (AT)

(54)

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Az európai szabadalom ellen, megadásának az Európai Szabadalmi Közlönyben való meghirdetésétől számított kilenc hónapon belül, felszólalást lehet benyújtani az Európai Szabadalmi Hivatalnál. (Európai Szabadalmi Egyezmény 99. cikk(1))

A fordítást a szabadalmas az 1995. évi XXXIII. törvény 84/H. §-a szerint nyújtotta be. A fordítás tartalmi helyességét a Szellemi Tulajdon Nemzeti Hivatala nem vizsgálta.

DEVICE AND METHOD FOR APPLYING PAINT AND/OR AN ADHESIVE
TAPE TO A PLATE-SHAPED OBJECT

FIELD OF THE INVENTION

The present invention relates to a paint application device for a glass plate.

The present invention further relates to a method for applying paint to a glass plate.

PRIOR ART

The application of paints to plate-shaped objects is becoming increasingly important particularly in connection with the enamelling of glass. In this case, coloured ceramic layers are burnt into the glass surface during the production of thermally pre-stressed glasses. This process is also designated as printing or coating or enamelling. The enamel (also called enamel) is fused onto the glass in a short time (usually within a few seconds) during a partial pre-stressing or hardening process and forms a solid homogeneous bond with the glass matrix. An essential influential factor in relation to the attainable quality as well as manufacturing costs is in this case a nevertheless perfect and rapid application of paint to the glass surface before the thermal treatment. The glass paints used in this case usually consists of several components with added glass dust. Depending on the desired result, both transparent and also non-transparent or completely opaque

enamels can be produced as well as intermediate stages. Following the burning process such enamelled glass plates are extremely scratch-proof and weather-resistant and are marketed as single-pane safety glass.

The paint application required to produce the enamelling is normally accomplished on one side of the glass plate and can be applied by screen printing, rolling or spraying processes. Both screen printing and also spraying processes are associated both with higher costs and also with longer application times or system set-up times compared with the roller method. Roller methods are less complex in comparison but are also found to be time-consuming and therefore cost-intensive when producing enamellings which do not affect the entire glass plate to be treated but for example only the edge even though they are usually always still cheaper than the mentioned screen printing or spraying processes. Devices for carrying out such roller methods always have a paint application roller whose length is normally in the range of the maximum width of the hardening systems, i.e. between 1500 mm and 3300 mm, and also a counter-pressure roller located thereunder in the operating position. The glass plate to be provided with a paint application is drawn in and through between the paint application roller and the counter-pressure roller and is thereby provided with paint over the entire surface - but also over part of the surface, see below. In this context, mention should be made of JP H11 42453 A which discloses a device comprising a roller for application of paint to plate-shaped components, where the plate-shaped components are moved by means of a conveyor belt during the paint application.

In the past few years however, the demand for glass plates which are not enamelled over the entire surface has increased strongly. Particularly in standard window construction, facade construction but also in interior fittings, in the form of room dividers or in the sanitary area, use is made of glass plates which are merely enamelled at the edge with a more or less thick strip of paint.

In order to manufacture such glass plates, those surfaces which are not to be provided with paint are initially stuck down manually, preferably with a film, before the actual paint application can begin. Furthermore, as a result of their design for full-surface application and the associated length of the paint application roller, known devices for carrying out the rolling method also have the disadvantage that the entire paint application roller must always be impregnated with paint, although an edge of the glass plate which is only a few centimetres wide is to be acted upon with paint. As a result, an unnecessarily high paint consumption is obtained since most of the quantity of paint used is not applied to the glass after the paint application but remains on the long paint application roller or the mentioned film which in turn must be removed again in a time-consuming and quality-reducing manner. Another fact is that when changing paint, the application roller must be cleaned over its entire width in a time-consuming manner and with high loss of paint. Together with the high expenditure on cleaning which is required when changing paint on a paint application roller and which frequently takes longer than an hour, unnecessarily high

manufacturing costs, setting times or stoppage times are also obtained as a result.

A similar set of problems is obtained when applying a thin metal layer - having a typical layer thickness in the sub-nanometre range - in particular to already-hardened glass plates. The application of the metal layer is usually accomplished by vapour deposition or by means of a sputtering process. In this case, a strip-shaped edge should be kept free since during assembly of the finished glass plates an adhesive bonding takes place in this region and an optimal adhesion of the adhesive can only be guaranteed on the glass itself but not on the metal layer. For this purpose the edge region not to be coated is masked off with an adhesive tape. The masking off is usually performed by hand. On the one hand, this is very time-consuming, on the other hand this involves the risk of inaccuracies in the application.

It is therefore the object of the present invention to avoid the disadvantages described above and to provide a device for application of paint to the flat surface of an object, preferably a glass plate with the aid of a paint application roller which has a substantially lower paint consumption than is usually the case with such known devices and makes obsolete the masking off of parts of the glass plate hitherto used for applications of paint not over the entire surface.

DESCRIPTION OF THE INVENTION

According to the invention, this is achieved with a device according to claim 1.

During application, the glass plate therefore must not be moved but lies without moving on a supporting device. Instead, the paint application roller is moved in order to apply a strip of width corresponding to its width or its overlap with the edge of the glass plate. The paint application roller can in this case be guided very precisely so that minimal paint strip widths of 5 mm are possible. In a preferred embodiment of the device according to the invention, it is provided that the paint application roller has a width of 100 mm to 500 mm, preferably 300 mm. Thus, for example, a merely 6 cm wide edge of a glass plate measuring 6 m x 2.8 m can be coated economically with paint/enamel. The movement of the paint application roller is exactly controlled electronically and in cooperation with the glass plate held completely motionlessly, allows an extremely precise application of paint where a precisely accurate commencement or beginning of the paint application is ensured at any arbitrary position along a paint application direction within the glass plate.

The movement of the glass plate is only accomplished before the application process or between application processes in order to align the glass plate relative to the paint application roller so that the desired region of the glass plate can be covered with paint. If larger areas are to be covered with paint, after application of respectively one strip, the glass plate is moved by an appropriate amount so that the larger area is filled piece by piece with paint strips. In this case, the paint strips are applied in an

overlapping manner in order to ensure that no undesirable free region is left between two paint strips. The precise control of the paint application roller enables the overlap of two strips to be restricted to 5 mm width in this case. Alternatively to this, the paint strips can be arranged precisely in rows without an intermediate space. This precision is possible through precise electronic regulation of the movement of the paint application roller over the fixed glass plate. Accordingly an overlap between 0% and 100% of the width of the strip of paint can be achieved.

Even if two adjacent edges of a glass plate are to be coated, an overlap of the paint strips in the corner region where the edges butt against one another can be almost completely avoided or restricted to 5 mm. Compared to this, in known edge coating processes a double coating in the corner region caused by the cross-over of the coating width in each corner of the glass plate cannot be prevented. That is, an overlap comes about here which corresponds to the full width of the paint application roller and leads to an undesirable shadow region.

In addition to the coverage of larger areas, the device according to the invention also makes it possible to produce patterns since the colour application need not necessarily be performed at the edge of the glass plate but for example, can also take place at the centre of the glass plate. For this purpose the glass plate can also be pushed through under the paint application roller raised from the glass plate.

In order to be able to move the paint application roller linearly, in a preferred embodiment of the device according to the invention it is provided that at least one carrier beam which is held in the frame structure and which runs at a distance from the supporting device or at least one guide rail which is held in the frame structure are provided, along which the paint application roller is disposed displaceably. The frame structure can for its part be a table structure. If the paint application roller is moved on guide rails, the glass plate cannot be displaced to an arbitrarily wide extent, but at most as far as these guide rails under the (raised) paint application roller. That is, in this case the manufacture of arbitrary patterns is not possible without restriction since the glass plate, depending on its size, cannot generally be pushed completely through underneath the paint application roller.

The frame structure additionally enables a stable arrangement of the supporting device. Accordingly, in a preferred embodiment of the device according to the invention, it is provided that the supporting device is connected fixedly to the frame structure.

In order to enable a particularly thorough application of paint, the paint application roller must be pressed against the glass plate with a certain pressure. Accordingly it is necessary to support the glass plate. This support can be provided according to the invention by a planar counter-holding section of the supporting device, the width of which at least corresponds to the width of the paint application roller.

Thus, in a preferred embodiment of the device according to the invention, it is provided that the supporting device has a planar counter-holding section against which the paint application roller can be pressed with the glass plate interposed.

In order to fix the counter-holding section for its part spatially stably, it is provided according to the invention to use a profile tube which is part of the frame structure. Therefore in a preferred embodiment of the device according to the invention, it is provided that on the side of the counter-holding section opposite the paint application roller, a profile tube is arranged as part of the frame structure, on which the counter-holding section at least partially rests or is supported.

In a preferred embodiment of the device according to the invention, easy movability of the glass plate on the counter-holding section is achieved whereby the counter-holding section is provided at least partially with an adhesion-reducing coating, preferably made of Teflon. In order to guarantee the correct contact pressure of the paint application roller on the glass plate and to protect the glass plate from any bending stresses, it is necessary that the counter-holding section runs perfectly parallel to the direction of travel of the roller. Accordingly, any irregularities, for example, warped places of the frame structure must be compensated. For this purpose a level compensating plate is fastened to the profile tube, preferably welded on. In turn a segment plate comprising a plurality of segments is disposed on the level compensating plate, where the distance between each segment of the

segment plate and the level compensating plate and therefore from the profile tube can be adjusted. The counter-holding section then rests on the segment plate. Thus, in a preferred embodiment of the device according to the invention it is provided that a segment plate which is adjustable in its distance from the profile tube is disposed between profile tube and counter-holding section of the supporting device. The distance adjustment and the fixing of the segment plate is accomplished in a simple manner by using adjusting screws and fixing screws which are screwed into threads on the level compensating plate. Accordingly, in a preferred embodiment of the device according to the invention it is provided that the distance between profile tube and segment plate can be adjusted and fixed by means of adjusting screws and fixing screws where the adjusting screws and fixing screws are received in a level compensating plate which is fastened on the profile tube, preferably welded on. This possibility for adjustment is also necessary in order to be able to compensate for any level difference which arises between the feed table and the counter-holding plate at a subsequent point in time after installation.

Alternatively to the planar counter-holding section, it is also possible to use a counter-holding roller. For this purpose the supporting device has a recess in which the counter-holding roller can be moved synchronously to the paint application roller in order to ensure a uniform contact pressure over the entire application process. Accordingly in a further preferred embodiment of the device according to the invention, it is provided that the supporting device has a recess in which a counter-holding

roller is disposed, that the counter-holder roller is held displaceably in the frame structure synchronous to the paint application roller and that the paint application roller can be pressed against the counter-holding roller with the item interposed.

In order to apply paint to the paint application roller with a desired thickness, a doctor roller known per se is used which cooperates with the paint application roller and is sometimes also designated as metering roller. In order to guarantee a permanently uniform consistency of the paint to be applied to the paint application roller, a paint mixer unit is used which, when viewed in the direction of application of the paint on the paint application roller, is disposed directly upstream of the paint application roller and the doctor roller. Naturally, the doctor roller and the paint mixer unit must be moved together with the paint application roller. There in a preferred embodiment of the device according to the invention, it is provided that an application unit is provided which comprises at least the paint application roller, the doctor roller cooperating with this, and a paint mixer unit and which application unit is disposed displaceably along the at least one carrier beam or the at least one guide rail.

In particular, when a plurality of different paint layers is to be applied, it is advantageous to provide an additional paint application roller or an additional application unit which can also be moved preferably along the carrier beam or the guide rail. During the paint application with the additional paint application roller, the (first) paint application roller can be cleaned and

optionally provided with another colour so that the application of different colours can be performed in a very time-saving manner. Therefore in a preferred embodiment of the device according to the invention, it is provided that an additional paint application roller is held displaceably in the frame structure.

In particular, in a preferred embodiment of the device according to the invention it is provided that the additional paint application roller is part of an additional application unit where the additional application unit further comprises an additional doctor roller and is disposed displaceably along the at least one carrier beam or the at least one guide rail.

In order to be able to apply even more complex patterns by means of screen printing on an almost arbitrary location of the glass plate, in a preferred embodiment of the device according to the invention it is provided that a squeegee is fastened to the application unit which is displaceable with the application unit and which comprises a floodbar and/or a printing squeegee. The fastening of the squeegee on the application unit is accomplished in this case by means of a holder. The squeegees can be moved by motor or pneumatically.

A screen with a screen frame is inserted into a screen holder which is mounted on the frame structure so that it can be raised and lowered and is aligned with respect to the glass plate. The paint is distributed uniformly in the screen by means of the motor-driven or pneumatically movable floodbar. With the motor-driven or pneumatically

movable printing squeegee, the paint is pressed through the screen onto the glass plate surface. Since the glass plate to be printed is displaced under the screen, the screen printing can be accomplished at different arbitrary positions of the glass plate.

In order to be able to dry applied paint rapidly and without major transport movements of the glass plate, a heating device can be fastened to the application unit and moved with this at a defined distance - typically 5 mm - linearly over the glass plate. The width of the heating device in this case corresponds to the maximum width of the paint application roller, typically 300 mm. From the heating device hot air at typically 200°C to 300°C is blown in the direction of the glass plate. In this way, for example, an applied layer can be pre-dried before the actual enamelling step which takes place at far higher temperatures. Or a first paint layer can be rapidly dried when a further paint layer is subsequently to be applied to the first paint layer. Therefore in a particularly preferred embodiment of the device according to the invention, it is provided that a heating device is fastened to the application unit which is displaceable with the application unit.

In order to apply a paint strip along a first edge of a glass plate, the glass plate is oriented with the first edge parallel to the carrier beam or to the guide rails and positioned so that by moving the paint application roller along the carrier beam or the guide rails, the desired strip of paint is applied, as described above. In order to now apply a paint strip along a second edge which is

usually normal to the first edge, the glass pane can be turned accordingly so that the second edge comes to lie parallel to the carrier beam or to the guide rails.

Alternatively to this, it can however also be provided that the paint application roller or the application unit can be twisted. As a consequence, the twisted paint application roller is now moved in a direction which preferably stands normally on a longitudinal axis of the carrier beam. This is in particular possible when the entire carrier beam together with the application unit is movable in a direction normal to the longitudinal axis of the carrier beam. Therefore, in a preferred embodiment of the device according to the invention it is provided that the paint application roller can be twisted about an axis which stands normally on the supporting device and that the paint application roller is displaceable in a direction normal to a longitudinal axis of the carrier beam, preferably jointly with the carrier beam.

In order to be able to process in particular large glass plates with the device according to the invention, it is provided according to the invention to additionally support these glass plates by means of a feed table which adjoins the supporting device flush. In order to be able to move the glass plate on this feed table easily, the feed table is preferably designed as an air cushion table. Therefore in a preferred embodiment of the device according to the invention it is provided that a feed table is provided which is adjoined flush by the supporting device or of which the supporting device forms a section, wherein the feed table is preferably configured as an air cushion

table. In order to be able to move the glass plate particularly efficiently and precisely on the feed table and position it with respect to the carrier beam or to the guide rails or to the paint application roller and/or to the masking device, in a particularly preferred embodiment of the device according to the invention it is provided that the feed table has at least two conveyor belts in order to linearly move the glass plate, wherein suction elements are disposed on the conveyor belts in order to fix the glass plate. In this case, the suction elements can be fastened in suction element strips which are connected to the conveyor belt by means of crimp connections. In order to be able to align the glass plate with one edge precisely parallel to the carrier beam or to the guide rails, in a particularly preferred embodiment of the device according to the invention it is provided that the feed table comprises a rotary plate which is rotatable about an axis normal to the supporting device and on which rotary plate suction elements are provided for fixing the glass plate. Thus, as described above, paint strips can be applied successively along different edges of the glass plate even when the paint application roller or the application unit or the adhesive device cannot be twisted about an axis which stands normally on the supporting device. In this case, the glass plate need not be moved by hand in the corresponding alignment processes but is moved by motor in a highly precise manner.

In order in this case in particular to align the desired edge of the glass plate perfectly parallel to the paint application roller or to its linear direction of movement along the carrier beam or the guide rails, in a

particularly preferred embodiment of the device according to the invention it is provided that the feed table has at least two optical or mechanical sensors in order to check the alignment of the object. The optical or mechanical sensors can be arranged in this case fixedly in the feed table parallel to the longitudinal axis of the carrier beam or parallel to the guide rails. Alternatively the sensors can be arranged jointly with suction elements on the conveyor belt. In the event that the suction elements are fastened in suction element strips, it is possible to also mount the sensors in the suction element strips or integrate them in the suction element strips. By movement of the conveyor belts or the suction element strips, the sensors can be thus be aligned as required parallel to the longitudinal axis of the carrier beam or parallel to the guide rails.

In a preferred embodiment, all the conveyor belts are moved jointly and parallel or synchronously by means of a common drive belt. In this case, all the sensors are always aligned parallel to the longitudinal axis of the carrier beam or parallel to the guide rails. Those two sensors which are disposed on the two outermost conveyor belts which are still covered by the glass plates are always used.

After a manual pre-orientation by the user, the glass plate is initially positioned above the rotary plate by means of the conveyor belts and the suction elements disposed on the conveyor belts. In this case, the central point of the glass plate should come to lie above the axis of rotation of the rotary plate as far as possible. The suction

elements of the rotary plate are then activated and the suction elements on the conveyor belts are deactivated. Now, the said sensors on the conveyor belt are moved in the direction of the carrier beam/guide rails until the sensors pass the edge of the glass plate facing the carrier beam/the guide rails or the supporting device. As soon as the sensors have passed this glass plate edge, the conveyor belts are stopped and slowly moved backwards. If both sensors now reach the glass plate edge at the same time, this means that the glass plate edge runs parallel to the carrier beam or to the longitudinal axis thereof or to the guide rails and is aligned correctly for paint application. Otherwise, the glass plate must be turned accordingly by means of the rotary plate in order to improve the alignment of the glass plate edge whereupon the alignment is checked again as described above, and so on. The conveyor belt is then moved back a little, typically 200 mm, from the glass plate edge and the suction elements on the conveyor belt again suck the glass plate. The suction elements of the rotary disk are released. Thus, the glass plate can be moved for the coating process in the direction of the carrier beam/guide rails, under the application unit. Finally, for better fixing of the glass plate during the paint application, the air cushion function of the feed table can be deactivated and instead a suction function activated.

According to the invention, the object of the present invention is also achieved by the method according to claim 14.

The linear direction of movement of the paint application roller is in this case to be set the same as the paint application direction of the paint or the linear direction of movement runs parallel to the longitudinal axis of the carrier beam or the guide rails. It should be noted that in principle it is also possible to select an opposite paint application direction with the same direction of rotation of the paint application roller by not pressing the paint application roller against the flat surface of the object, preferably the glass plate. Instead, the paint application roller is moved at a small distance of 0 mm to a few tenths of a millimetre from the glass plate, which lies still, over said glass plate, where the paint application roller turns against the linear movement of the paint application roller or the application unit.

Furthermore, in a particular embodiment of the method according to the invention it is provided that the alignment of the object comprises the following steps:

- synchronous movement of two optical or mechanical sensors which are disposed parallel to the linear direction of movement at a known distance from one another, in a positioning direction which points in the direction of the paint application roller and is normal to the linear direction of movement, until both sensors have passed an edge of the glass plate facing the supporting device;
- synchronous movement of the two sensors at a defined positioning speed contrary to the positioning direction;
- measurement of the time difference between the renewed reaching of the edge by the two sensors;
- calculation of an angle of rotation;
- turning the glass plate through an angle of rotation.

In order to align the glass plate as correctly as possible during the manual placing onto the feed table, in a particularly preferred embodiment of the method according to the invention it is provided that a laser unit is disposed on the application unit in order to produce an optical aid line on the feed table. The laser unit is therefore movable with the application unit so that the aid line can start from an almost arbitrary position along the carrier beam or the guide rails. The user must now orient himself by the aid line and align the glass plate manually so that one edge runs substantially along the aid line. The glass plate is therefore at least coarsely pre-oriented so that usually with the motor precision alignment described above, no major changes in alignment are required. The motor precision alignment can accordingly take place rapidly. The rotary plate is particularly helpful when aligning large glass plates having dimensions of up to 6 m x 2.8 m. For the alignment of smaller glass plates having dimensions between typically 1.2 m x 1.2 m and 0.305 m x 0.305 m, the provision of a further smaller rotary plate has proved advantageous. This is appropriately arranged between two conveyor belts whose spacing measured in the direction of the longitudinal axis of the carrier beam is smaller than that between two conveyor belts between which the large rotary plate is positioned. Furthermore, it is appropriate to position the smaller rotary plate closer to the carrier beam or to the guide rails or to the contact surface so that an arrangement of the smaller rotary plate between the large rotary plane and the contact surface is obtained. Accordingly, in a particularly preferred embodiment of the device according to the invention, it is provided that the feed table has a further rotary plate

which is disposed between the rotary plate and the contact surface, where at least one conveyor belt runs between the rotary plate and the further rotary plate on which suction elements are disposed.

Naturally it is also possible to align the glass plate manually or with the aid of the rotary plate or the additional rotary plate so that no glass plate edge runs parallel to the paint application direction. For example, the glass plate can be oriented so that a surface diagonal or otherwise an arbitrary line runs inside the surface of the glass plate parallel to the paint application direction. In this way, strips or strip patterns can be applied on the glass plate by means of the paint application roller or the additional paint application roller without the strips needing to run parallel to a glass plate edge. This oblique or diagonal paint application is suitable, for example, for applying obliquely running bars onto glass plates of whole glass doors, as required by a European standard, in order to make the opening side of the doors identifiable. Hitherto this was only possible with screen printing processes or by suitable masking of the glass plate combined with the known roller method having intensive paint consumption.

BRIEF DESCRIPTION OF THE FIGURES

The invention is now explained in detail with reference to exemplary embodiments. The drawings are exemplary and are intended to set out the inventive idea but in no way restrict it or even definitively reproduce it.

In the figures:

- Fig. 1 is a plan view of a device according to the invention
- Fig. 2 is a plan view of a device according to the invention with feed table
- Fig. 3 is an axonometric view of a device according to the invention with feed table
- Fig. 4 is an axonometric detailed view of an application unit
- Fig. 5 is an axonometric detailed view of an application unit which is positioned by means of a planar counter-holding section of a supporting device, as well as a section through the counter-holding section, a level compensating plate located thereunder and a profile tube
- Fig. 6 shows a different perspective of Fig. 5
- Fig. 7 shows an axonometric sectional view through a feed table with a rotary plate according to the line of intersection A-A in Fig. 2
- Fig. 8 shows an axonometric view of a screen device which is connected to an application unit
- Fig. 9 shows an axonometric view of a device according to the invention with feed table and an additional application unit
- Fig. 10 shows an axonometric view of a device arranged to be upstanding
- Fig. 11 shows a sectional view of an application unit which is arranged above a counter-holding roller similar to the line of intersection B-B in Fig.

2, where the arrows indicate the viewing direction

Fig. 12 shows a sectional view which shows schematically, in addition to a screen device, a heating device connected to the application unit, similar to the line of intersection B-B in Fig. 2, where the arrows indicate the viewing direction

Fig. 13 shows a sectional view according to the line of intersection A-A in Fig. 2, where the viewing direction is directed contrary to the arrow direction

Fig. 14 shows a side view of a device according to the invention with an application unit and a masking device

Fig. 15 shows an enlarged view of the masking device of Fig. 14

Fig. 16 shows a side view of a device according to the invention with guide rails on which an application unit is movably arranged.

WAYS FOR IMPLEMENTING THE INVENTION

Figure 1 shows a device according to the invention for application of paint to a glass plate 1 (cf. Fig. 2) in plan view. The device comprises a supporting device 3 on which the glass plate 1 can be placed. The supporting device 3 is held in a frame structure 4. An essential part of the depicted embodiment of the frame structure 4 is a carrier beam 5 which is disposed above the supporting device 3 and extends along a longitudinal axis 28. That is, the glass plate 1, resting on the supporting device 3, can

be pushed through under the carrier beam 5 so that not only edge regions of the glass plate 1 but any regions on the glass plate 1 can be provided with paint. Transport hooks 49 (cf. Fig. 3) are also arranged on the frame structure 4 which allow the device to be moved by means of a crane (not shown).

An application unit 14 is disposed on the carrier beam 5, which can be moved along the longitudinal axis 28, where a motor/transmission unit 8 is provided as drive. The application unit 14 comprises a paint application roller 2 which is used to apply paint to the glass plate 1. The paint is in turn applied by means of a doctor roller 15, which is also part of the application unit 14 and is also known as metering roller, in a manner known per se to the paint application roller 2, where the thickness of the paint layer on the paint application roller 2 - and therefore the thickness of the paint layer to be applied to the glass plate 1 - can be set by setting the spacing between paint application roller 2 and doctor roller 15. The application unit 14 further comprises a paint mixer unit 16 (cf. Fig. 4) which ensures that the consistency of the paint applied to the paint application roller 2 remains uniform. Typically for this purpose the paint mixer unit 16 has a stirring element which moves cyclically in the paint. Paint application roller 2, doctor roller 15 and paint mixer unit 16 are driven by means of electric motors which are supplied with power via an energy chain 41.

During movement of the application unit 14 therefore not only the paint application roller 2 but also the doctor roller 15 and the paint mixer unit 16 are moved along the

carrier beam 5. By this means paint strips can be applied to the glass plate 1 whose width corresponds to the width 20 (cf. Fig. 5) of the paint application roller 2, i.e. typically between 100 mm and 500 mm, preferably 300 mm. For narrower paint application widths than the entire width 20 of the paint application roller 2, the glass plate 1 is positioned on the supporting device 3 below the paint application roller 2 only so far that a required overlap corresponding to the required paint application width is obtained.

If an area having a larger width than the width 20 of the paint application roller 2 is to be coated, the first coating process begins with the full width 20 of the paint application roller 2 in the area. Then the glass plate 1 is pulled back by the conveyor belt 30, i.e. away from the carrier beam 5. In this case, a small overlap of about 5 mm is intentionally left. For example with a paint application roller 2 having a width 20 of 300 mm, the glass plate 1 is only pulled back by 295 mm whereby the said paint overlap of about 5 mm is obtained.

The paint application roller 2 can now perform a paint application again which can be the entire width 20 of the paint application roller 2 or only the remaining width to be coated at the edge of the glass plate 1. In the latter case, the paint application roller 2 is located not with its entire width 20 but with only a part of its width 20 over the glass plate 1 during the paint application.

A cleaning tray 36 is used for cleaning the paint application roller 2 and doctor roller 15. This is arranged

at the side next to the supporting device 3 and is covered by the carrier beam 5 so that the application unit 14 can be positioned over the cleaning tray 36.

Between cleaning tray 36 and the supporting device 3, a paint application position 43 for extremely small disks is provided, where glass plates having dimensions of less than 0.305 m x 0.305 m can be fixed and provided with paint by the paint application roller 2. Regardless of where the paint application takes place specifically - whether this be in the region of the supporting device 3 or in the region of the paint application position 43 for extremely small disks - the paint application by the paint application roller 2 always takes place along a paint application direction 60.

If several colours are to be applied, an additional application unit 35 can be provided. The additional application unit 35 comprises an additional paint application roller 17 and an additional doctor roller 34, as shown in Fig. 9, preferably so that a different colour can be applied with the application unit 14. The additional application unit 35 can also be moved by means of a motor/transmission unit 42 along the carrier beam 5 so that the paint application can take place completely similarly to the application with the application unit 14. The paint application with the additional paint application roller 17 is also accomplished in the paint application direction 60 of the paint application roller 2. If more than two colours are to be applied, the paint application roller 2 and the doctor roller 15 can be cleaned in the cleaning tray 36 and provided with another colour and at the same time, another

colour can be applied with the additional application unit 35. As soon as the colour application with the additional application unit 35 has ended, the application unit 14 can take over. The additional paint application roller 17 and the additional doctor roller 34 can now, if necessary, be cleaned for their part in an additional cleaning tray 37 and subsequently provided with another colour and so on. In this case, the additional cleaning tray 37 is arranged as a mirror image to the cleaning tray 36.

If very large glass plates 1 are to be processed, there is a risk that these may not be adequately supported by the supporting device 3 and can tip. Therefore in particular for very large glass plates 1 which for example have dimensions of 6 m x 2.8 m or even larger, it is advantageous to provide a feed table 29. Figure 2 shows a device according to the invention with such a feed table 29 in plan view. The feed table 29 adjoins the supporting device 3 flush so that supporting device 3 and feed table 29 form a flat surface. In order to be able to position the glass plate 1 easily on this surface, the feed table 29 is preferably designed as an air cushion table so that the glass plate 1 can slide on an air cushion over the feed table 29. Accordingly the feed table 29 has air openings 10 from which air flows to form the air cushion.

In order to be able to push larger glass plates 1 far through below the carrier beam 5 without these being able to bend or break, a table 48 is additionally provided which also adjoins the supporting device 3 flush and is disposed on the side opposite the feed table 29, the run-out side.

This table is advantageously also designed as an air cushion table.

In order to be able to initially apply the glass plate 1 more easily onto the feed table 29, the feed table 29 has rollers 45 at its end facing away from the carrier beam 5 as transfer aid. As soon as the glass plate 1 lies completely above the feed table 29, it can be coarsely aligned by the user. For this purpose a mechanical stop 33 can firstly be raised on which the glass plate 1 is placed manually with one edge. In order to be able to better align the glass plate 1 manually, a laser unit 44 (cf. Fig. 4) is disposed on the application unit 14 in order to produce an optical aid line (not shown) on the feed table 29. The laser unit 44 is therefore moved with the application unit so that the aid line which usually stands normally on the mechanical stop 33 can start from almost any position along the carrier beam 5. The user can now coarsely align another edge of the glass plate 1 along the aid line so that the glass plate 1 comes to lie as centrally as possible in relation to the rotary plate 32. In addition, the additional application unit 35 can have an additional laser unit 22 (cf. Fig. 9) which can also produce an optical aid line (not shown) on the feed table 29 in order to further facilitate the alignment of the glass plate 1 by the user.

Subsequently, the glass plate 1 can be moved highly precisely with the aid of conveyor belt 30 linearly on the carrier beam 5 towards and away from this. For this purpose suction elements 31 are provided on the conveyor belt 30 in order to fix the glass plate 1 on the conveyor belts 30. The suction elements 31 are in this case mounted in suction

element strips 54 (cf. in particular Fig. 7) which are connected to the conveyor belt 30 by means of crimp connections (not shown). The conveyor belts 30 are driven jointly or synchronously with the suction element strips 54 via a motor/transmission unit 52 (cf. Fig. 7).

In the axonometric view of Fig. 3, a rotary plate 32 can be seen particularly clearly, which serves as a device for motor precision alignment of the glass plate 1 on the feed table 29. The rotary plate 32 has suction elements 31 for fixing the glass plate 1 and can be turned via a drive belt 11 by means of a motor/transmission unit 38 about an axis of rotation which stands normally on the supporting device 3 like an axis 27 (cf. Fig. 3); see also Fig. 7 which shows an axonometric sectional view along the line of intersection A-A in Fig. 2 where the arrows indicate the viewing direction. A frame 51 of the feed table 29 can be further identified in Fig. 7, which carries the feed table 29 and its components such as, for example, the rotary plate 32, the motor/transmission unit thereof 38 etc.

Finally Fig. 7 shows pneumatic stamps 53 by means of which the rotary plate 32 together with the suction elements 31 arranged thereon as well as the glass plate 1 fixed by means of the suction elements 31 can be raised in order to subsequently turn the glass plate 1. This can be seen even more clearly from Fig. 8 which shows a sectional view according to the line of intersection A-A of Fig. 2, where in this case the viewing direction is oriented contrary to the arrow direction.

In order to align the glass plate 1 automatically with high precision by means of the rotary plate 32 after the manual alignment, optical sensors 47 are provided which in the exemplary embodiment shown are arranged in the suction element strips 54. Since in the exemplary embodiment the conveyor belts 30, as stated are driven jointly or synchronously, the alignment of the sensors 47 is always parallel to the longitudinal axis 28 of the carrier beam. In order now for example to align an edge of the glass plate 1 perfectly parallel to the longitudinal axis 28 of the carrier beam, use is made of those two sensors 47 which are disposed on the two outermost conveyor belts 30 which are not yet covered by the glass plate 1. In Fig. 2 this is the two outermost of the four conveyor belts 30.

Firstly the glass plate 1 is positioned with these conveyor belts 30 and the corresponding suction elements 31 above the rotary plate 32. In this case, the centre point of the glass plate 1 should lie as far as possible above the axis of rotation of the rotary plate 32 where the corresponding manual pre-orientation with the aid of the aid line/s produced with the laser unit 44 and/or the additional laser unit 22 is crucial for this purpose. Then the suction elements 31 of the rotary plate 32 are activated and the suction elements 31 on the conveyor belt 30 are deactivated. Now the said sensors 47 on the conveyor belt 30 are moved in a positioning direction 61 (cf. Fig. 20 in the direction of the carrier beam 5 until the sensors 47 pass a glass plate edge 62 (cf. Fig. 2) facing the carrier beam 5 or the supporting device 3. As soon as the sensors 47 have passed this glass plate edge 62, the conveyor belts 30 are stopped and slowly moved back contrary to the

positioning direction 61 at a defined positioning speed. If both sensors 47 now simultaneously reach the glass plate edge 62, this means that the glass plate edge 62 runs parallel to the carrier beam 5 or its longitudinal axis 28 and is correctly aligned for the paint application. If there is a time difference between the two sensors 47 reaching, the glass plate 1 must be turned accordingly by means of the rotary plate 32 about an angle of rotation in order to improve the alignment of the glass plate edge 62 whereupon the alignment is again checked, as described, and so on. The angle of rotation can be calculated immediately for a known spacing of the two sensors 47 with respect to one another and given positioning speed.

The conveyor belts 30 are then moved a little way, typically 200 mm, back from the glass plate edge 62, i.e. away from the carrier beam 5 or the supporting device 3 and the suction elements 31 again suck the glass plate 1 onto the conveyor belts 30. The suction elements 31 of the rotary disk 32 are released. Thus, the glass plate 1 can be moved in the direction of the carrier beam 5 under the application unit 14 for the coating process. Finally for better fixing of the glass plate 1 during the paint application the air cushion function of the feed table 29 can be deactivated and instead a suction function activated.

The rotary plate 32 in particular facilitates the alignment and turning of large glass plates 1 having dimensions of up to 6 m x 2.8 m or more. For the turning of smaller glass plates 1 having dimensions between typically 1.2 m x 1.2 m and 0.305 m x 0.305 m, the feed table 29 has another

smaller rotary plate 46 which is preferably driven by means of the same motor/transmission unit 38 as the rotary plate 32. The further rotary plate 46 is disposed between an outermost conveyor belt 30 and a following conveyor belt 30 when viewed in a direction parallel to the longitudinal axis 28. The spacing thereof in a direction measured parallel to the longitudinal axis 28 of the carrier beam 5 is smaller than that between the two conveyor belts 30 between which the rotary plate 32 is positioned. In addition, the further rotary plate 46 is positioned closer to the carrier beam 5 or the supporting surface 3 so that an arrangement of the further rotary plate 46 between the rotary plate 32 and the supporting surface 3 is obtained.

The use of the further rotary disk 46 is configured, for example, as follows: after the glass plate 1 has been aligned manually, as described above, the glass plate 1 is fixed by the suction elements 31 in the suction element strip 54 which is connected to that conveyor belt 30 which runs between the rotary plate 32 and the further rotary plate 46. With the aid of this conveyor belt 30 the glass plate 1 is positioned with its central point as far as possible above an axis of rotation of the further rotary plate 46, where the axis of rotation is parallel to the axis. The further rotary plate 46 now takes over the glass plate 1 by activating the suction elements 31 of the further rotary plate 46. After releasing the suction elements 31 in the suction element strip 54, the conveyor belt 30 can be moved in the direction of the carrier beam 5 where the sensor 47 attached to the suction element strip 54 passes the edge of the glass plate 1 facing the carrier beam 5 or the supporting device 3. By this means the

position of the glass plate 1 and the necessary feed for positioning of the glass plate 1 for the paint application is determined. After the suction elements 31 in the suction element strip 54 have taken over the glass plate 1 and the suction elements 31 in the further rotary plate 46 are released from the glass plate 1, further transport of the glass plate 1 can take place. Now the conveyor belt 30 can precisely position the glass plate 1 for coating below the application unit 14. If further edge regions of the glass plate 1 need to be coated, the glass plate 1 is moved back to the further rotary plate 46, the glass plate 1 is turned accordingly and positioned again for the next paint application.

In order to ensure a good-adhering paint application, the paint application roller 2 must be pressed with a certain pressure onto the glass plate 1. Accordingly the supporting device 3 has a special counter-holding section 6 which in the embodiment as depicted, for example, in Fig. 3 is designed to be planar. Figure 5 and Fig. 6 show an axonometric detailed view of the application unit 14 for this purpose, which is positioned by means of the planar counter-holding section 6 of the supporting device 3, as well as a section through the counter-holding section 6. Here a segment plate 12 disposed under the counter-holding section 6 can be seen, which consists of a plurality of segments in the direction of the longitudinal axis 28 of the carrier beam 5. The segment plate 12 is fastened to a level-compensating plate 9 which is welded on a profile tube 7 with an adjustable spacing. The profile tube 7 is connected to the frame structure 4 and is used to support the counter-holding section 6.

Adjusting screws 18 can be seen in the diagram in Fig. 6, which screws are received in threads of the level-compensating plate 9 and by means of which the spacing between the level-compensating plate 9 and the segments of the segment plate 12 can be adjusted. The segments of the segment plate 12 are finally fixed in position by means of fixing screws 19. In this way the segment plate 12 guarantees a perfectly parallel course of the counter-holding section 6 for linear movement of the paint application roller 2 since irregularities or a twisting of the frame structure 4 can be compensated. A uniform correct contact pressure of the paint application roller 2 on the glass plate 1 is hereby guaranteed. Furthermore, the glass plate 1 is protected from any bending stresses.

Figure 11 shows as an alternative to the planar counter-holding section 6 a counter-holding roller 13 in a sectional view similar to the line of intersection B-B in Fig. 2, where the arrows indicate the viewing direction. The counter-holding roller 13 ensures optimal support of the glass plate 1 during paint application by the paint application roller 2 and is moved synchronously with the paint application roller 2 parallel to the longitudinal axis 18 of the carrier beam 5. The counter-holding roller 13 is in this case disposed in a recess (not shown) of the supporting device 3 and held movably in the frame structure 4.

Figure 8 shows an axonometric detailed view of an embodiment of the device according to the invention in which a squeegee 21 is fastened to the application unit 14,

more precisely to a screw-on plate 50 of the application unit 14 (cf. Fig. 5 or Fig. 6) by means of a holder (not shown) and can be moved with the application unit 14. In this way, complex patterns can also be applied at any point and paint can also be applied over a large area on the glass plate 1 by means of screen printing.

The squeegee 21 comprises a floodbar 24 for distributing the paint on a screen 23 which is mounted in a screen frame 26. The screen 23 is inserted with the screen frame 26 into a screen holder (not shown) which is mounted on the frame structure 4 so that it can be raised and lowered and is aligned with respect to the glass plate 1. The squeegee 21 further comprises a printing squeegee 25 for pressing the paint through the screen 23 onto the glass plate 1. The floodbar 24 is moved by means of pneumatic cylinder 39, the printing squeegee 25 by means of pneumatic cylinder 40. By moving the glass plate 1 to be printed under the screen 23, the screen printing can be accomplished at different arbitrary positions of the glass plate 1.

In order to be able to dry applied paint rapidly and without major transporting movements of the glass plate 1, a heating device 59 can be fastened to the application unit 14 as shown schematically in the sectional view of Fig. 12. The heating device 59 can be fastened to the application unit 14 additionally or alternatively to the screen device 21. The heating device 59 is moved linearly over the glass plate with the application unit 14 at a defined distance - typically 5 mm. The feed speed is typically between 0.5 m/min and 3 m/min, preferably 1 m/min and depends inter alia on the thickness of the paint application to be dried.

The width of the heating device 59 in this case corresponds to the width 20 of the paint application roller 2, typically 300 mm. Hot air with typically 200°C to 300°C is blown out of the heating device 59 in the direction of the glass plate 1. In this way, for example, an applied layer can be pre-dried before the actual enamelling step, which takes place at far higher temperatures. The heating device 59 can also be of great advantage when an application of two different colours is required, since when using two applications units 14, 35 and the heating device 59 two different colours can be applied almost immediately after one another.

Figure 10 finally shows an embodiment in which the device is shown upstanding. The carrier beam 5 here encloses an angle of somewhat less than 90°, typically 75° or 84° with the horizontal since glass plates 1 can readily be transported upstanding at such angles. Regardless of this the application unit 14 with the paint application roller 2, the doctor roller 15 and the colour mixer unit 16 travel along the carrier beam 5 during paint application. Accordingly the frame structure 4 is designed so that in addition to the carrier beam 5, an air cushion rear wall 56 known per se is fixed at the same angle as the carrier beam 5.

The glass plate 1 is moved by means of transport rollers 57 in the direction of the supporting device 3 under the paint application roller 2. If the paint is to be applied along different edges of the glass plate 1, the glass plate 1 is moved back from the supporting device 3 by means of the transport rollers 57 and turned accordingly at the air

cushion rear wall 56. For this purpose, the air cushion rear wall 56 has circular arc shaped guides 58 in which pivoting feet 55 are disposed. The pivoting feet 55 are moved in the guides 58 and thereby turn the glass plate 1 through 90°. If this rotation is sufficient, the glass plate 1 is moved back to the supporting device 3 and the corresponding edge is coated with paint. If however a rotation through 180° is desired, after the first rotation through 90° the glass plate 1 is moved away from the supporting device 3 again by means of the transport rollers 57 and again turned through 90°, whereupon paint application can take place.

The side view of Fig. 14 shows an alternative embodiment which comprises a masking device in addition to the application unit 14. In the example shown the masking device 63 is disposed displaceably on the same carrier beam 5, i.e. the paint application direction 60 is at the same time also the linear direction of the masking device 63. A motor/transmission unit 68 serves as drive for the displacement or movement of the masking device 63.

Figure 15 shows an enlarged view of the masking device 63 of Fig. 14. An adhesive tape 64 is unrolled from a roll and applied to the glass plate 1 by means of a deflecting roller 65. When viewed contrary to the direction of movement, the deflecting roller 65 is adjoined by a guide unit 66 with a cutting tool. On the one hand the guide unit 66 is used for precise alignment of the adhesive tape 64, on the other hand, the adhesive tape 64 can be cut with the cutting tool to obtain strips of defined length.

A pressing roller 67 is located downstream of the guide unit 66 when viewed contrary to the direction of movement. This presses the adhesive tape 64 against the surface of the glass plate 1 and brings about a smoothing of the adhesive tape 64 so that air bubbles or air inclusions between adhesive tape 64 and glass plate 1 are avoided. If after application of the adhesive tape 64, the glass plate 1 is provided with a thin metal layer, for example by means of a sputtering process taking place in vacuum or at negative pressure, no air inclusions or air bubbles are present which expand as a result of the negative pressure and could result in detachment of the adhesive tape 64.

In exactly the same way as the application of paint by means of the paint application roller 2 which has a certain width 20, several strips of adhesive tape 64 can be applied in an overlapping manner and/or adjacent to one another. Thus, regions on the surface of the glass plate 1 can be covered with adhesive tape 64 which are wider than the width of the adhesive tape 64. Typical widths of the adhesive tape 64 are between 10 mm and 80 mm, where any gradations in millimetre steps in between are commercially usual.

Depending on the width of the adhesive tape 64, it is possible to provide a defined overhang of the adhesive tape 64 over the edge of the glass plate 1. This is particularly appropriate when the adhesive tape 64 is unrolled in a following processing step over the edge of the glass plate 1 and should be pressed firmly on the front side of the glass plate 1 which together with the surface of the glass plate 1 adjoins the edge of the glass plate 1.

Figure 16 finally shows a side view of another embodiment of the device according to the invention. In this case, the application unit 14 is arranged movably along guide rails 69 where the drive is again accomplished via the motor/transmission unit 8. The paint application direction 60 in Fig. 16 is normal to the plane of the drawing and points into this. It is generally noted for all the exemplary embodiments shown that naturally the opposite direction is also a possible direction for the paint application or adhesive tape application.

The guide rails 69 are held in the frame structure 4 and run in the example shown parallel to a front side of the feed table 29. The glass plate 1 is pushed over the feed table 29 on an air cushion under the paint application roller 2 and over the supporting device 3. In contrast to those variants in which a carrier beam 5 running at a distance from the supporting device 3 is provided, in the exemplary embodiment of Fig. 16 the glass plate 1 can be pushed not completely under the paint application roller 2. Instead the glass plate 1 can be displaced at most so far under the paint application roller 2 until the glass plate 1 impacts against the nearest guide rail 69. In practice stops (not shown) are usually provided which delimit the displacement of the glass plate 1 in the direction of the guide rails 69 somewhat earlier. The embodiment of Fig. 16 is therefore primarily suitable for application of paint in the edge region of the surface of the glass plate 1. Otherwise the application of paint takes place in exactly the same way as the application in the presence of a carrier beam 5 described above.

Naturally in the case of the embodiment with guide rails 69, in addition to the application unit 14 a masking device 63 can be provided, which for its part can be moved along the guide rails 69 (not shown). This allows the application of strips of adhesive tape 1 to the surface of the glass plate 1, in particular in the region of the edge of the surface of the glass plate 1.

REFERENCE LIST

- 1 Glass plate
- 2 Paint application roller
- 3 Supporting device
- 4 Frame structure
- 5 Carrier beam
- 6 Counter-holding section
- 7 Profile tube
- 8 Motor/transmission unit for moving application unit
- 9 Level compensating plate
- 10 Air opening
- 11 Drive belt
- 12 Segment plate
- 13 Counter-holding roller
- 14 Application unit
- 15 Doctor roller
- 16 Colour mixer unit
- 17 Additional paint application roller
- 18 Adjusting screw
- 19 Fixing screw
- 20 Width of paint application roller
- 21 Squeegee
- 22 Additional laser unit
- 23 Screen
- 24 Floodbar
- 25 Printing squeegee
- 26 Screen frame

- 27 Axis normal to the supporting device
- 28 Longitudinal axis of the carrier beam
- 29 Feed table
- 30 Conveyor belt
- 31 Suction element
- 32 Rotary plate
- 33 Stop
- 34 Additional doctor roller
- 35 Additional application unit
- 36 Cleaning tray
- 37 Additional cleaning tray
- 38 Motor/transmission unit for rotary plate
- 39 Pneumatic cylinder for floodbar
- 40 Pneumatic cylinder for printing squeegee
- 41 Energy chain
- 42 Motor for moving additional application unit
- 43 Paint application position for very small disks
- 44 Laser unit
- 45 Rollers as transfer aid
- 46 Further rotary plate for smaller disks
- 47 Optical sensor
- 48 Table for run-out side
- 49 Transport hook
- 50 Screw-on plate
- 51 Frame of feed table
- 52 Motor/transmission unit for conveyor belts
- 53 Pneumatic stamp
- 54 Suction element strip
- 55 Pivoting foot for glass turning movement

- 56 Air cushion rear wall
- 57 Transport roller
- 58 Guide
- 59 Heating device
- 60 Paint application direction
- 61 Positioning direction
- 62 Glass plate edge
- 63 Masking device
- 64 Adhesive tape
- 65 Deflecting roller
- 66 Guide unit with cutting tool
- 67 Contact roller
- 68 Motor/transmission unit for moving masking device
- 69 Guide rail

Szabadalmi igénypontok

1. Festékfelhordó berendezés üveglaphoz (1), amely berendezés tartalmaz egy támasztóberendezést (3) a festékfelhordásnál ezen mozdulatlanul felfekvő üveglap (1) számára, valamint legalább egy festékfelhordó hengert (2) a festékfelhordáshoz az üveglapra (1), a festékfelhordó henger (2) egy keretszerkezetben (4), a keretszerkezethez (4) viszonyítva eltolhatóan van rögzítve, továbbá a festékfelhordó henger (2) együttműködik egy adagolóhengerrel (15) a festék kívánt vastagságban való felhordásához a festékfelhordó hengerre (2).

2. Az 1. igénypont szerinti berendezés, **azzal jellemezve, hogy** legalább egy, a keretszerkezetben (4) rögzített, a támasztóberendezéstől (3) távközzel elhelyezett tartógerendát (5), vagy legalább egy, a keretszerkezetben (4) rögzített vezetősínt (69) tartalmaz, amelyek mentén a festékfelhordó henger (2) eltolhatóan van elhelyezve.

3. Az 1.-2. igénypontok egyike szerinti berendezés, **azzal jellemezve, hogy** a támasztóberendezés (3) egy sík ellentartó szakasszal (6) rendelkezik, amelyhez hozzászorítható a festékfelhordó henger (2) az üveglap (1) közbehelyezésével.

4. Az 1.-3. igénypontok egyike szerinti berendezés, **azzal jellemezve, hogy** a támasztóberendezésen (3) mélyedés van kialakítva, amelyben ellentartó görgő (13) van elhelyezve, az ellentartó görgő a keretszerkezetben (4) a festékfelhordó hengerrel (2) szinkronban eltolhatóan van rögzítve, továbbá a festékfelhordó henger (2) az üveglap (1) közbehelyezésével az ellentartó görgőhöz (13) szorítható.

5. A 2.-4. igénypontok egyike szerinti berendezés, **azzal jellemezve, hogy** felhordóegységet (14) tartalmaz, amely legalább a festékfelhordó hengert (2), az ezzel együttműködő adagolóhengert (15), valamint színkeverő egységet (16) foglal magában, és a felhordóegység (14) a legalább egy tartógerenda (5) vagy a legalább egy vezetősín (69) mentén eltolhatóan van elhelyezve.

6. A 2.-5. igénypontok egyike szerinti berendezés, **azzal jellemezve, hogy** a keretszerkezetben (4) egy kiegészítő festékfelhordó henger (17) van eltolhatóan rögzítve, a kiegészítő festékfelhordó henger (17) előnyösen egy kiegészítő felhordóegység (35) része, a kiegészítő felhordóegység (35) egy kiegészítő adagolóhengert (34) is tartalmaz, és a legalább egy tartógerenda (5) vagy a legalább egy vezetősín (69) mentén eltolhatóan van elhelyezve.

7. Az 5.-6. igénypontok egyike, amennyiben az 5. igényponttól függ, szerinti berendezés, **azzal jellemezve, hogy** a felhordóegységen (14) rákelszerkezet (21) van rögzítve, amely a

felhordóegységgel (14) együtt eltolható, és amely terítórákelt (24) és nyomórákelt (25) tartalmaz.

8. Az 5.-7. igénypontok egyike, amennyiben az 5. igényponttól függ, szerinti berendezés, **azzal jellemezve, hogy** a felhordóegységen (14) fűtőberendezés (59) van rögzítve, amely a felhordóegységgel (14) mozgatható.

9. A 2.-8. igénypontok egyike, amennyiben a 2. igényponttól függ, szerinti berendezés, **azzal jellemezve, hogy** a festékfelhordó henger (2) a támasztóberendezésre (3) merőleges tengely (27) körül elfordítható, továbbá a festékfelhordó henger (2) a tartógerenda (5) hossztengelyére (28) merőleges irányban eltolható, előnyösen a tartógerendával (5) együtt.

10. Az 1.-9. igénypontok egyike szerinti berendezés, **azzal jellemezve, hogy** adagolóasztalt (29) tartalmaz, amelyhez a támasztóberendezés (3) síkban csatlakozik, vagy amelynek egy részét a támasztóberendezés (3) alkotja, és az adagolóasztal (29) előnyösen légpárnás asztalként van kialakítva.

11. A 10. igénypont szerinti berendezés, **azzal jellemezve, hogy** az adagolóasztal (29) legalább két szállítóhevederrel (30) van ellátva az üveglap (1) lineáris mozgatásához, továbbá a szállítóhevedereken (30) szívóelemek (31) vannak elhelyezve az üveglap (1) rögzítéséhez.

12. A 10.-11. igénypontok egyike szerinti berendezés, **azzal jellemezve, hogy** az adagolóasztal (29) forgólappal (32) rendelkezik, amely a támasztóberendezésre (3) merőleges tengely (27) körül forgatható, és a forgólapon (32) szívóelemek (31) vannak elhelyezve az üveglap (1) rögzítéséhez.

13. A 12. igénypont szerinti berendezés, **azzal jellemezve, hogy** az adagolóasztal (29) egy további forgólappal (46) rendelkezik, amely a forgólap (32) és a támasztófelület (3) között van elhelyezve, továbbá a forgólap (32) és a további forgólap (46) között legalább egy szállítóheveder (30) fut, amelyen szívóelemek (31) vannak elhelyezve.

14. Eljárás festék felhordására üveglapra (1), amely eljárás a következő lépéseket tartalmazza:

- az üveglap (1) beigazítása egy festékfelhordó henger (2) lineáris mozgásirányába (60);
- a beigazított üveglap (1) pozicionálása egy támasztóberendezés (3) és a festékfelhordó henger (2) között, ahol a festékfelhordó henger (2) szélessége (20) legalább részben átfedi az üveglapot (1);
- az üveglap (1) helyzetének rögzítése;
- a festékfelhordó henger (2) pozicionálása a lineáris mozgásirány (60) mentén, vagy a lineáris mozgásiránnyal (60) szemben;
- a festékfelhordó henger (2) hozzászorítása az üveglaphoz (1);

- a festékfelhordó henger (2) mozgatása a lineáris mozgásirány (60) mentén.

15. A 14. igénypont szerinti eljárás, **azzal jellemezve, hogy** az üveglap (1) beigazítása a következő lépéseket tartalmazza:

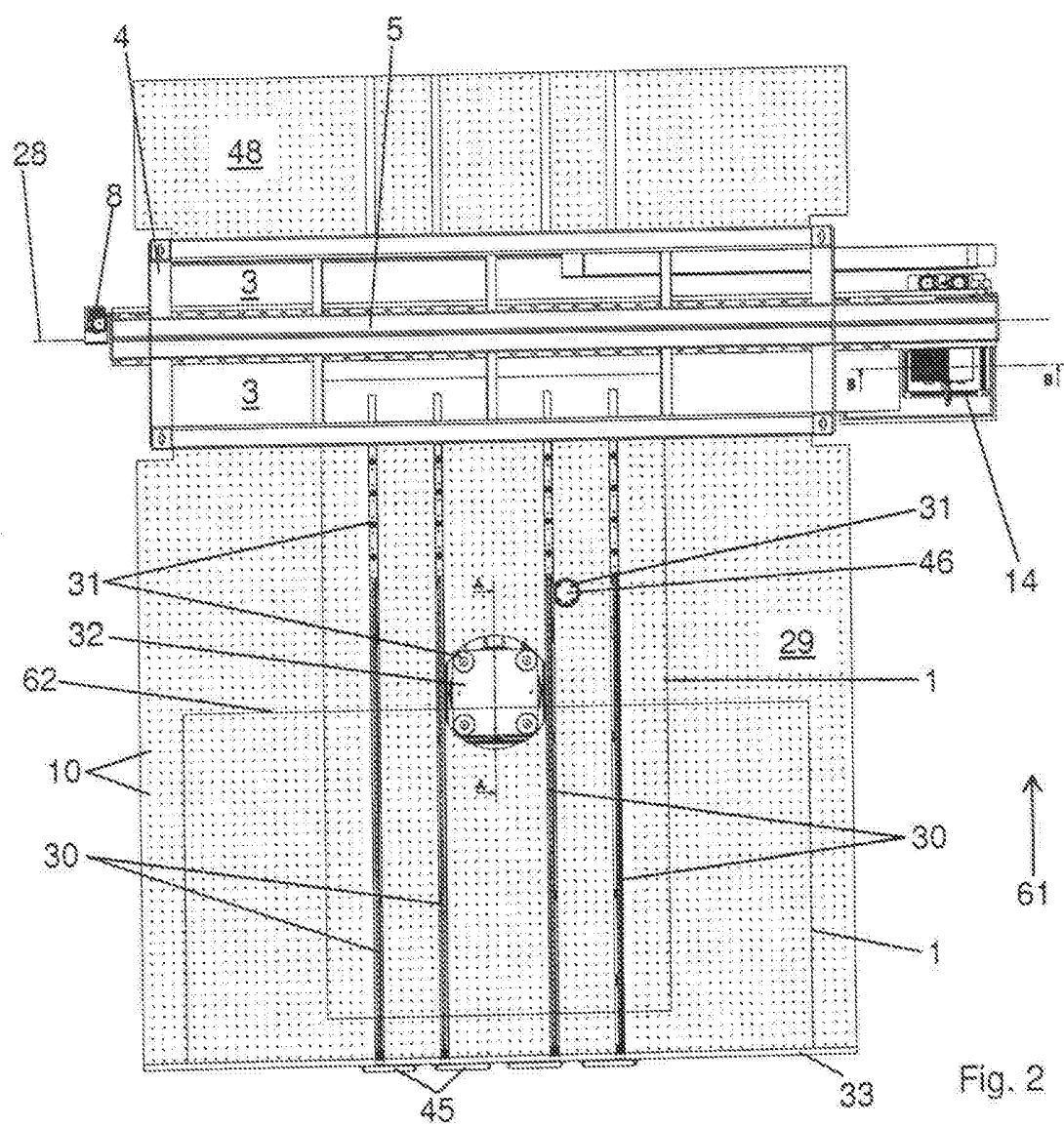
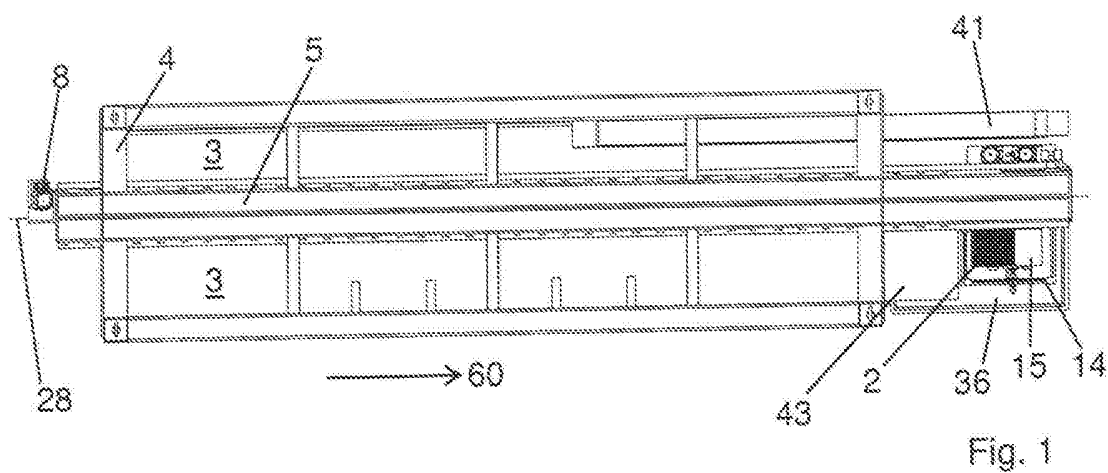
- a lineáris mozgásiránnyal (60) párhuzamosan egymástól ismert távolságban elhelyezett két optikai vagy mechanikus érzékelő (47) szinkron mozgatása a festékfelhordó henger (2) irányába mutató és a lineáris mozgásirányra (60) merőleges pozicionálási irányban (61), amíg mindkét érzékelő (47) áthalad az üveglap (1) támasztóberendezés (3) felőli élén (62);

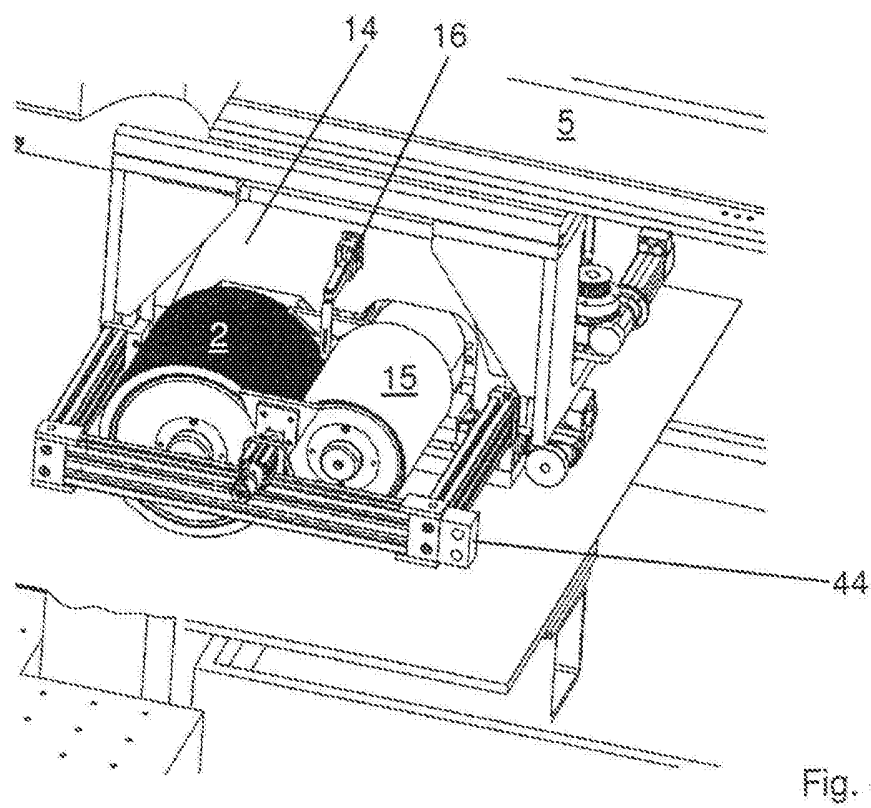
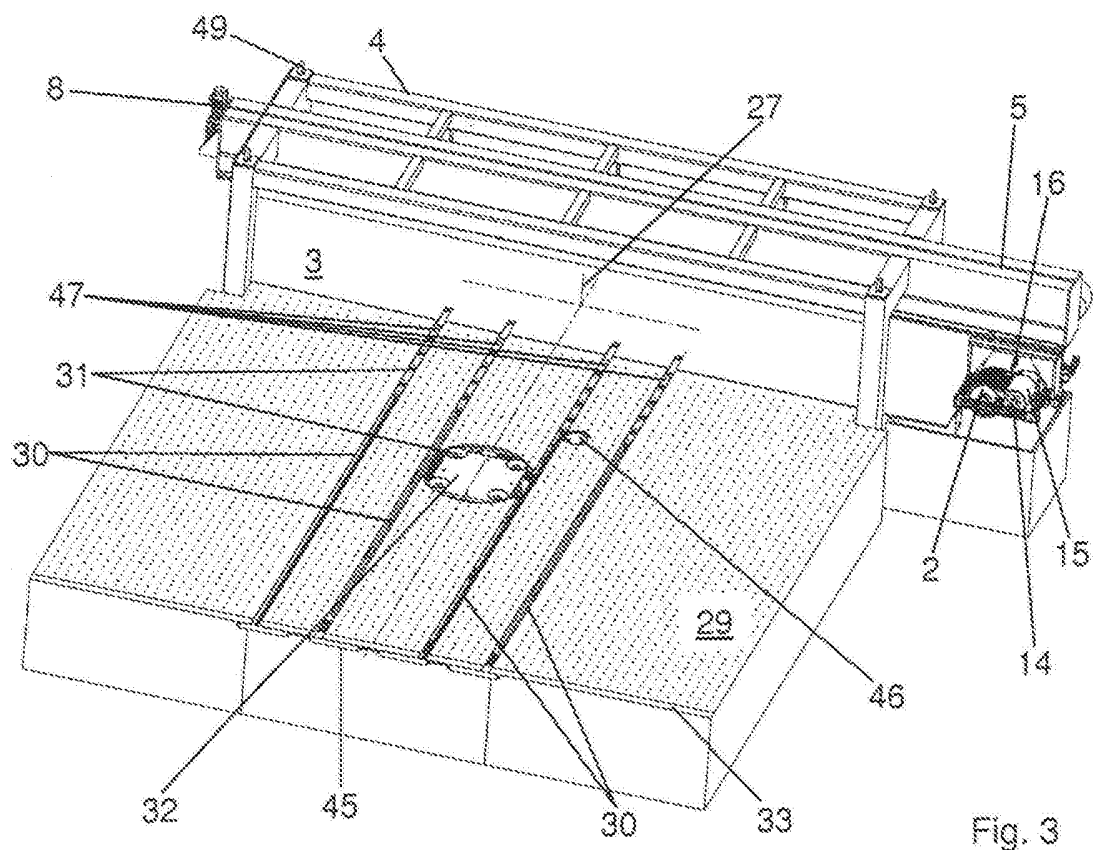
- a két érzékelő (47) szinkron mozgatása meghatározott pozicionálási sebességgel a pozicionálási iránnyal (61) szemben;

- időkülönbség mérése az élnek (62) a két érzékelő (47) általi újabb elérése között;

- elfordítási szög számítása;

- az üveglap (1) elfordítása az elfordítási szöggel.





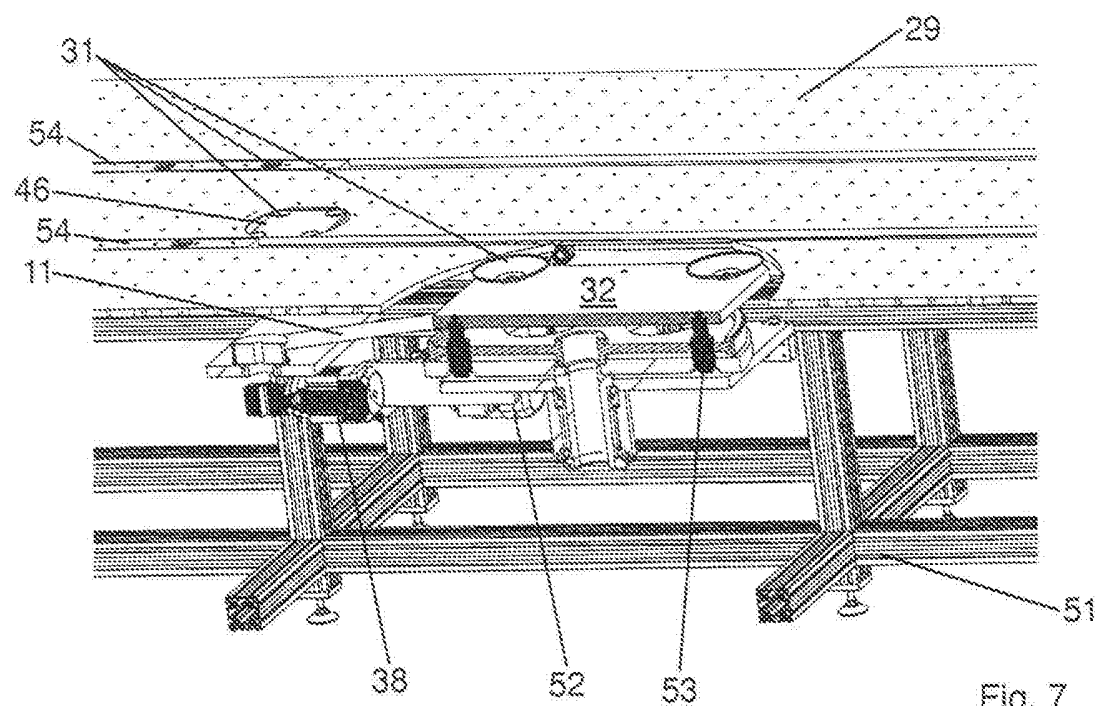


Fig. 7

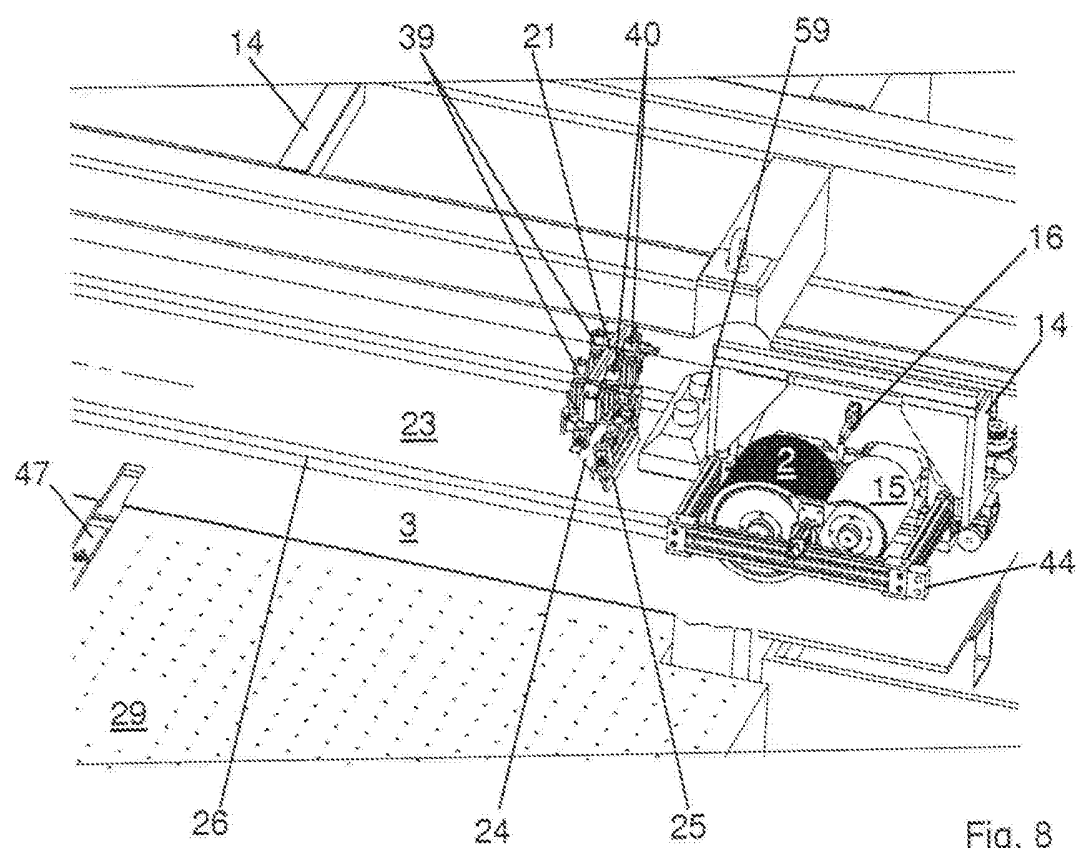
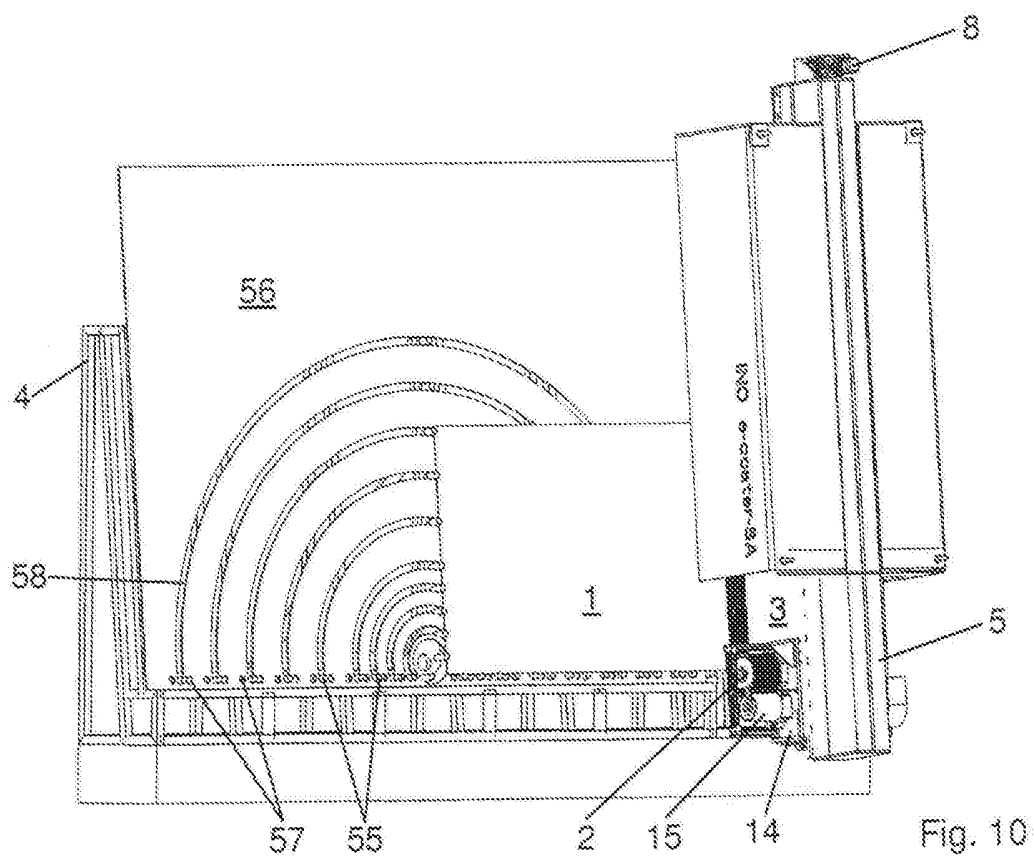
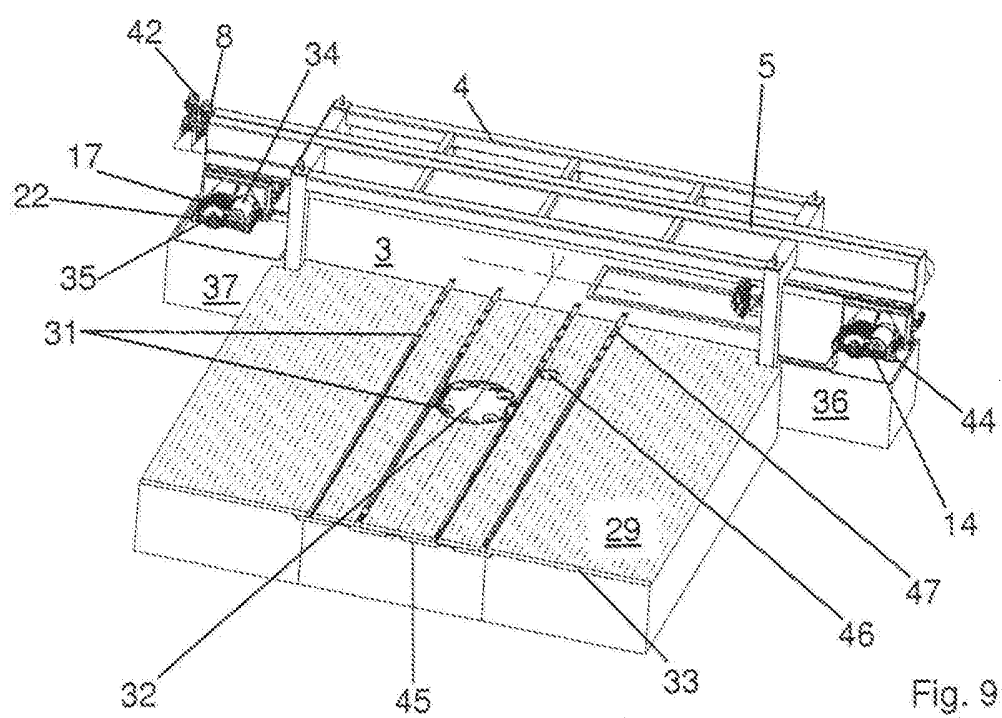


Fig. 8



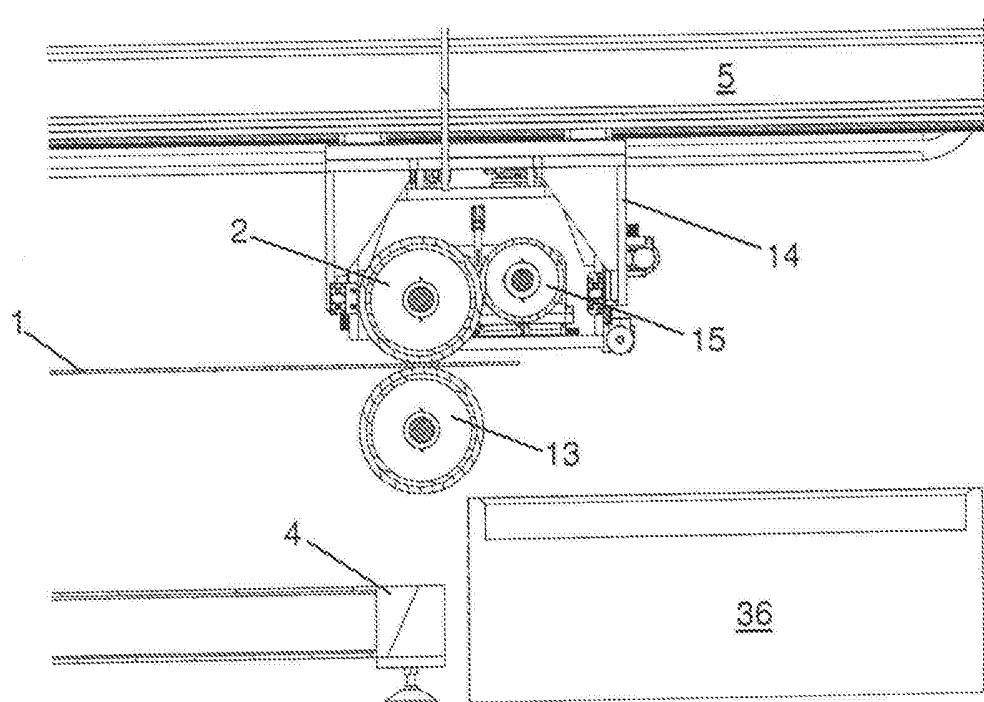


Fig. 11

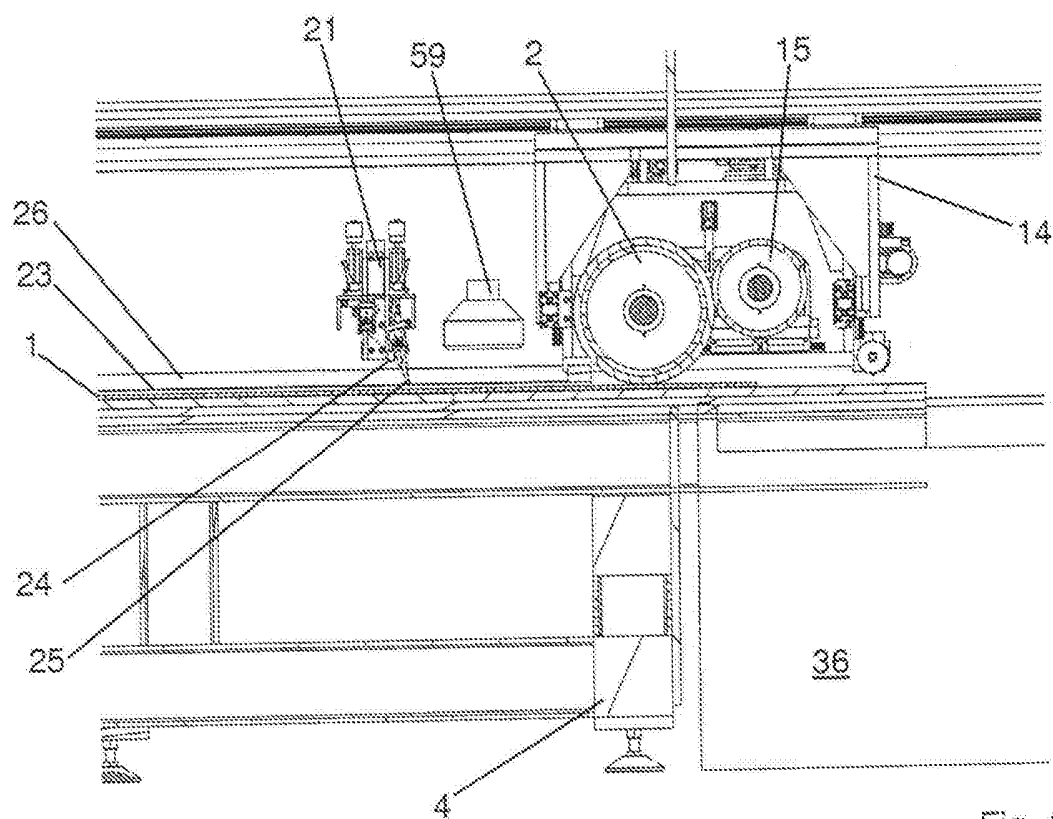


Fig. 12

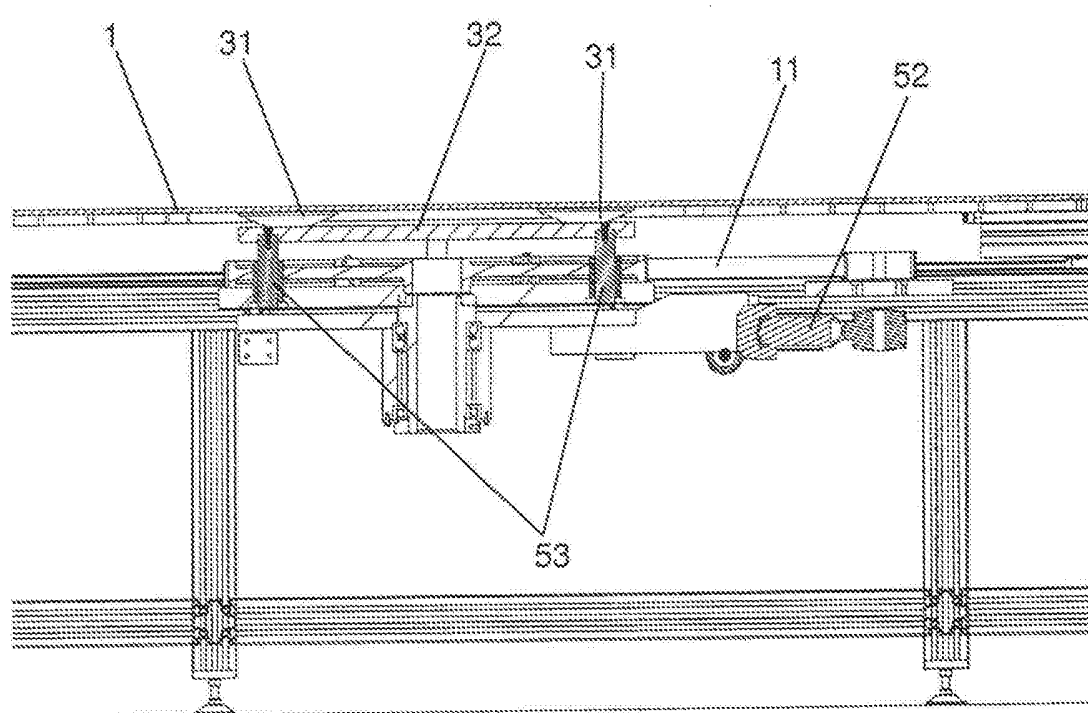


Fig. 13

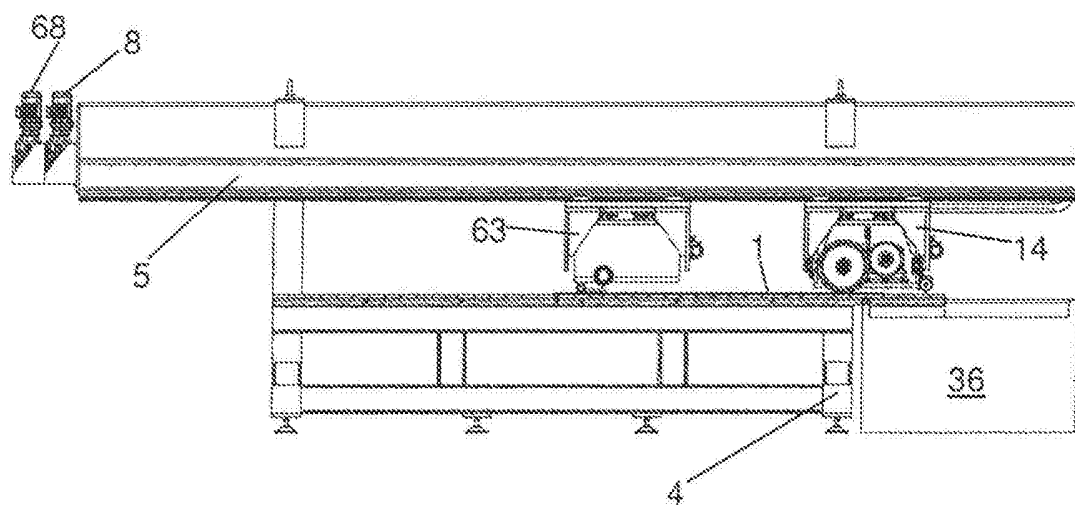


Fig. 14

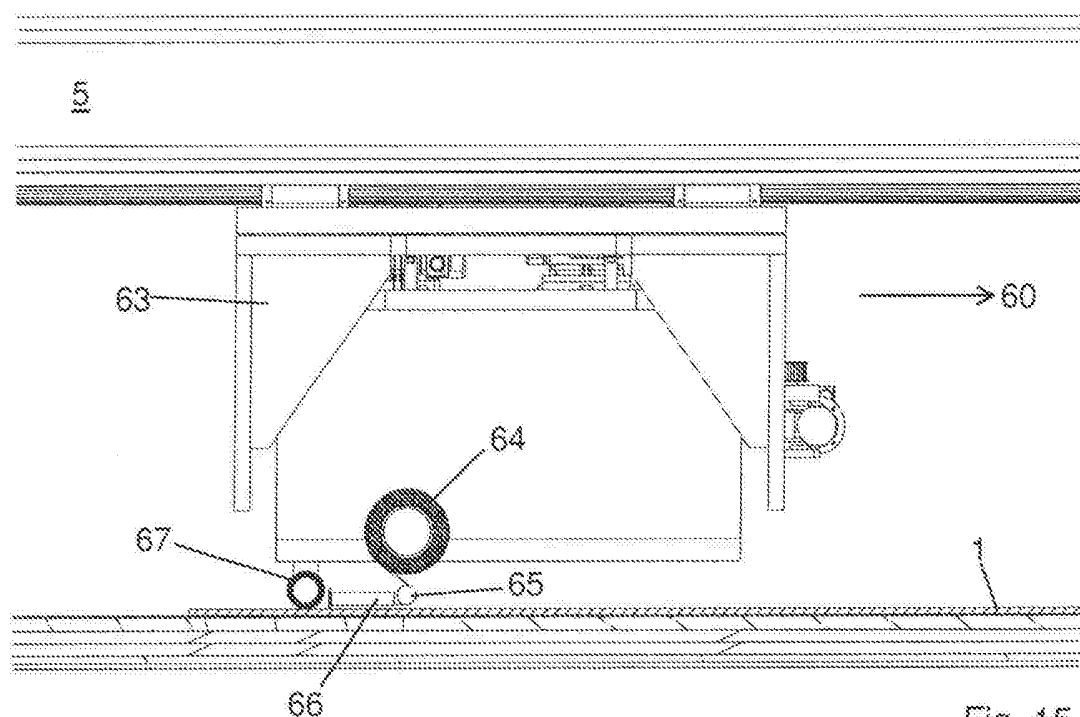


Fig. 15

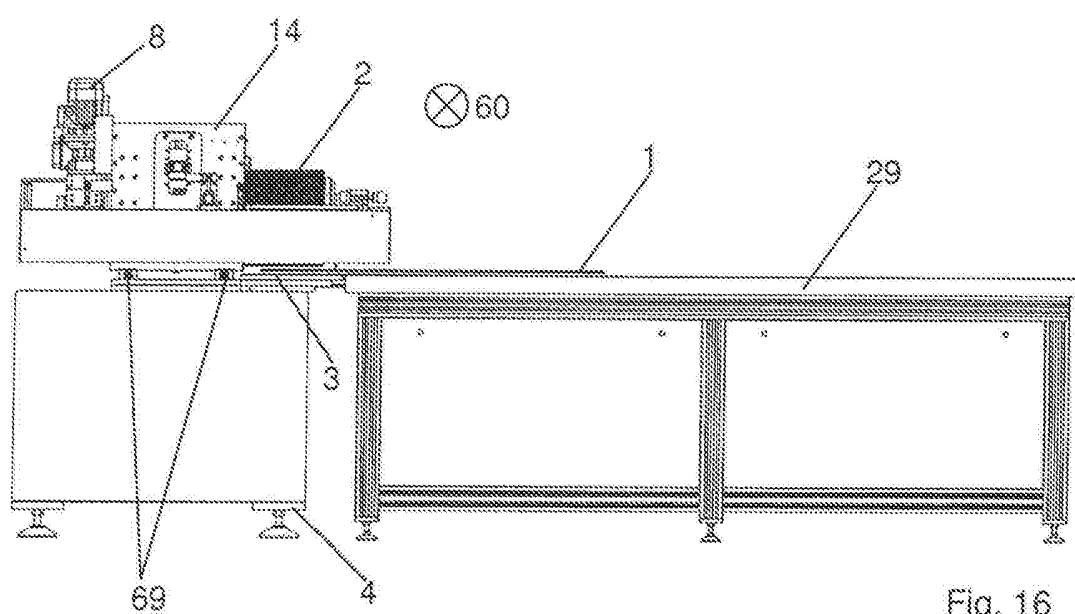


Fig. 16