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(54) **GUIDING TUBE FOR CLEANING AND DRYING ELECTRICAL TERMINALS**

(57) A guiding tube for cleaning and/or drying of electrical terminals comprises: a terminal inlet and a terminal outlet, and an enclosed channel connecting the inlet and the outlet; wherein the channel is adapted to guide a medium for cleaning and/or drying of terminals, and at least one medium inlet port, for introducing

a medium into the channel. A system adapted for cleaning and/or drying terminals comprises: a first guiding tube; taped or belted terminals arranged on a carrier strip for guiding through the tube; and a source for a cleaning and/or drying medium connectable with the medium inlet port.

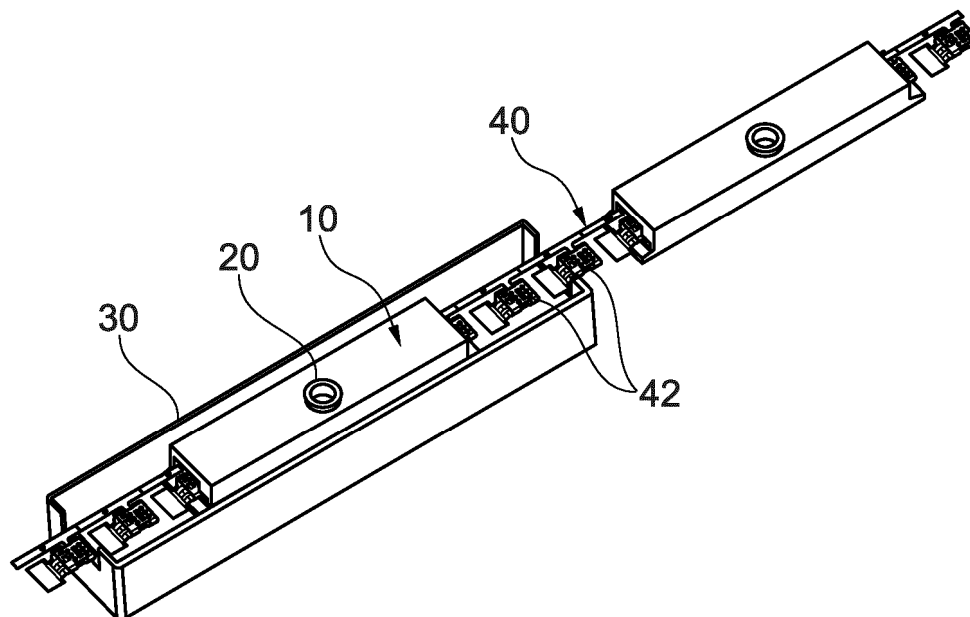


Fig. 4

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Description

1. Field of the invention

[0001] The present disclosure relates to a guiding tube, a system, and a method for cleaning and/or drying electrical terminals. Specifically, the present disclosure pertains to a guiding tube designed to facilitate the introduction of a cleaning or drying medium, a system incorporating such a tube, and a method for utilizing the system to clean and/or dry terminals.

2. Background

[0002] In the field of electrical terminal processing, it is common to encounter challenges related to the cleaning and drying of terminals, which are necessary for ensuring optimal electrical connectivity and performance. Known systems typically involve the use of bulky machinery that can be inefficient and time-consuming. These approaches often require significant human intervention, which can lead to inconsistencies in cleaning quality and potential damage to the terminals.

[0003] Automated systems for terminal cleaning and drying have been developed to address some of these issues, yet they often involve complex setups and require substantial space and resources. While such systems can improve efficiency, they may still struggle with effectively cleaning terminals that are densely packed or have intricate geometries. Moreover, the drying process can be uneven, leading to residual moisture that may affect terminal performance or lead to corrosion over time.

[0004] In view of the foregoing, there is a need for cleaning and drying mechanisms for terminals. It is thus an object of the present invention to overcome some or all the deficiencies of the prior art.

3. Summary

[0005] The above objects are at least partially achieved by the subject matter of independent claim 1. Preferred embodiments are the subject of the dependent claims, and the skilled person will find clues to other suitable aspects of the present invention in the overall disclosure of the present application.

[0006] An aspect of the invention relates to a guiding tube for cleaning and/or drying of electrical terminals, comprising: a terminal inlet and a terminal outlet, and an enclosed channel connecting the inlet and the outlet; wherein the channel is adapted to guide a medium for cleaning and/or drying of terminals, and at least one medium inlet port, for introducing a medium into the channel.

[0007] The guiding tube ensures controlled handling of terminals, preventing damage during cleaning. The enclosed channel allows for a controlled flow of cleaning liquid and/or warm/hot air for drying, enhancing effi-

ciency. The medium inlet port facilitates precise introduction of cleaning and drying mediums, ensuring thorough cleaning and drying of terminals without bulk handling risks. One advantage of the guiding tube is that it allows among others an integration into a continuous assembly line, where e.g., electrical contact terminals are mass produced from long strips of sheet metal, as is common in the industry.

[0008] Further improvement is achieved when the guiding tube is adapted to receive belted terminals at the inlet, guide the belted terminals through the channel and to output the terminals at the outlet.

[0009] The skilled person knows, that electrical contact terminals are often mass manufactured from strips of sheet metal, that are stamped and bend into the desired shape in a continuous process. During the various stages of processing, the terminals-to-be remain attached to a continuous strip, which allows an automated transfer of the same to the processing stations. In the past, the cleaning and subsequent drying of the terminals was done after the terminals were separated from the belt in washer drums, which often lead to uneven cleaning results. The guiding tube can process the still belted terminals without needing to align or insert individual pieces. The guiding tube ensures that the entire belt of terminals is uniformly exposed to the cleaning or drying medium during transit through the channel.

[0010] Further improvement is achieved when the terminal inlet comprises at least one guide ramp adapted to facilitate introduction of the terminals into the channel.

[0011] Such a guide ramp eases the insertion of e.g., belted terminals into the cleaning or drying system, especially when fed automatically from a reel or conveyor. The ramp gently aligns the terminals with the channel opening, minimizing mechanical stress and preventing potential damage or disruption to the terminal belt.

[0012] Further improvements is achieved when the cross-section of the inlet, and/or the outlet, and/or the channel corresponds to a projection of the terminal in a plane perpendicular to the insertion direction of the terminal.

[0013] Projection of a shape, in the context of projective geometry, refers to the representation of a three-dimensional object on a two-dimensional plane. This concept is used to ensure that the shape of an object, such as an electrical terminal, fits snugly and securely within the guiding tube, respectively the channel of the tube. The cross-section of the channel is designed to correspond to the projection of the terminal in a plane perpendicular to the direction of insertion. For example, if a terminal has an L-shape in cross-section as seen in insertion direction, the cross-section of the channel and its openings will mirror that L-shape. This design prevents the terminal from twisting, tilting, or becoming misaligned as it travels through the tube, ensuring effi-

cient handling and processing. The area of the cross-section is typically larger than the area of the projection to allow space for the cleaning or drying medium to flow around the terminal without excessive movement inside the channel.

[0014] This can be further improved when the area of the cross-section is 5 % to 50 % larger than the area of the projection, preferably 5 % to 30 % larger, more preferably 5 % to 20 % larger.

[0015] Such a controlled clearance allows just enough space around the terminal to let the cleaning or drying medium (such as compressed air or cleaning fluid) flow effectively around it, without letting the terminal move or rattle excessively inside the channel. For example, if the terminal has small protrusions or irregular surfaces, the slightly oversized channel ensures smooth passage while still maintaining alignment. By choosing an area that is only slightly larger than the area of the projection of the terminals, like e.g., only 5 % larger, the frictional forces of the flow of the medium around and through the terminals increases, leading to better cleaning and drying results.

[0016] Further improvement is achieved when the guiding tube has a generally rectangular cross-section and is preferably made from plastic by injection molding.

[0017] Such a rectangular cross-section offers a simple and stable geometry, ideal for use in automated terminal cleaning or drying systems.

[0018] Another aspect of the invention relates to a system adapted for cleaning and/or drying terminals, comprising: a first guiding tube according to the invention; taped or belted terminals arranged on a carrier strip for guiding through the tube; and a source for a cleaning and/or drying medium connectable with the medium inlet port.

[0019] The source for a cleaning and/or drying medium may refer to a device that supplies air or liquid for cleaning or drying. Such a system could be used on an automated production line where terminals on a continuous carrier strip are fed through the guiding tube. As the strip moves through the tube, connected pumps or air compressors can deliver a cleaning and or drying medium via the inlet port. This ensures each terminal is cleaned and/or dried in a uniform manner before further processing. Thus, the system can advantageously be integrated in a continuous production line for the mass production of electrical terminals.

[0020] This can be further improved when the medium comprises washing liquid and/or air, preferably hot air.

[0021] A washing liquid can be introduced through the medium inlet to clean the terminals. Alternatively, hot air can be applied to dry the terminals as they continue moving through the guiding tube.

[0022] This can be further improved, when the system further comprises means for adjusting the volume of washing liquid and air introduced to the medium inlet

port.

[0023] Such a system could comprise adjustable valves or flow regulators connected to the medium supply lines, allowing to fine-tune the volume of washing liquid for more intensive cleaning or increase airflow—particularly hot air—for faster drying. Such adjustability is valuable when processing different types of terminals or accommodating varying contamination levels.

[0024] This can be further improved when the system further comprises at least one drip tray configured to collect liquids, adapted to receive the guiding tube therein.

[0025] Such a drip tray can be positioned directly beneath the guiding tube and might have contours or slots to securely accommodate the tube. As washing liquid is sprayed onto or over the terminals, any excess is captured in the tray rather than spilling into the surrounding equipment or work area.

[0026] This can be further improved when the system further comprises a transport mechanism configured to move the belted/taped terminals through the guiding tube.

[0027] Such a transport mechanism could be a motorized feed unit that engages with the carrier strip holding the taped terminals. As the mechanism pulls the terminals through the guiding tube, it maintains a controlled speed and tension, allowing for synchronized cleaning and/or drying.

[0028] This can be further improved when the system further comprises a second guiding tube; wherein the first guiding tube is configured to apply a washing liquid and the second guiding tube is configured to apply warm and/or hot air to the taped terminals.

[0029] Such a system can be arranged in two stages: taped terminals are first guided through the first tube, where a washing liquid is applied to remove contaminants. Afterward, the terminals pass through the second guiding tube, where they are exposed to warm or hot air for thorough drying. This dual-tube setup ensures sequential and efficient cleaning and drying without manual intervention or interruption in the production flow.

[0030] This can be further improved when the first guiding tube is tilted at an angle of preferably 30 to 60 degrees, most preferably about 45 degrees, to facilitate the outflow of the liquid through the inlet and/or the outlet.

[0031] Tilting the first guiding tube at approximately 45 degrees allows gravity to assist in draining used washing liquid out of the channel. This orientation helps prevent fluid accumulation inside the tube, reduces the risk of splashing or backflow, and enhances the overall efficiency of the cleaning process.

[0032] Another aspect of the invention relates to a method for cleaning and/or drying terminals, comprising the steps: providing a system in accordance with the invention; transporting the terminals through the first guiding tube; introducing a washing liquid into the

channel via the medium port.

[0033] Such a method is used in an automated terminal processing line. Taped or belted terminals are fed through a guiding tube, and a controlled volume of washing liquid is injected into the channel. As the terminals move through, the liquid washes away contaminants such as oil, dust, or debris.

[0034] This can be further improved when the method further comprises the steps: providing a second guiding tube; arranging the second guiding tube behind the first guiding tube in transport direction of the terminals; introducing air, preferably hot air, into the second guiding tube via the medium inlet port of the second guiding tube.

[0035] With such a method, terminals are cleaned with washing liquid in the first guiding tube and are immediately transferred into the second guiding tube without stopping the transport flow. There, hot air is applied to remove moisture, ensuring the terminals are completely dry by the time they exit. This sequential process enables continuous, automated cleaning and drying of terminals with high consistency.

[0036] This can be further improved when the method further comprises the step of controlling the flow rate and/or temperature of the washing liquid and/or hot air to optimize the cleaning and drying efficiency.

[0037] Such a step could be realized with flow control valves and/or temperature regulators that are integrated into the system to precisely manage the delivery of washing liquid and/or hot air. For instance, a higher flow rate may be used for heavily contaminated terminals, while a lower rate may suffice for light cleaning-conserving resources. Similarly, adjusting the air temperature allows faster drying without damaging heat-sensitive components.

[0038] This can be further improved when the terminals are transported through the tube at a speed of 50 to 300 terminals per minute, preferably 70 to 200 terminals per minute, most preferably 100 to 150 terminals per minute.

[0039] With such a method, the terminals are fed through the guiding tubes at for instance around 120 terminals per minute, balancing throughput and processing time to ensure each terminal receives adequate cleaning and drying. This controlled speed supports high-volume production while maintaining quality and consistency. Adjusting the speed allows the method to be fine-tuned for different terminal sizes, contamination levels, or process requirements.

[0040] The guiding tube can be further improved when the channel geometry is designed to direct the liquid and/or hot air flow toward the terminal surfaces.

[0041] With for instance inner walls of the channel including contours, nozzles, or directional grooves that guide the cleaning liquid or hot air directly onto the important areas of each terminal-such as contact surfaces or recessed features, such a targeted flow design increases the effectiveness of cleaning and drying, en-

suring contaminants are thoroughly removed and moisture does not remain in hard-to-reach areas.

4. Brief description of the figures

[0042] In the following, preferred embodiments of the disclosure are disclosed by reference to the accompanying figures.

Figure 1: shows an embodiment of a guiding tube according to the invention in a 3D perspective view.

Figure 2: shows the guiding tube of Fig. 1 in a front view.

Figure 3: shows the guiding tube of Fig. 1 in a cross sectional view.

Figure 4: shows an embodiment of a system for cleaning and/or drying terminals, including a guiding tube, belted terminals, and a drip tray.

Figure 5: shows an embodiment of a system for cleaning and drying terminals.

5. Detailed description of the figures

[0043] The subsequent sections provide a detailed description of the invention, referencing the accompanying illustrations for clarity. The descriptions represent examples only and are not intended to limit the invention's scope. Identical reference numerals across the figures and text denote the same components. The illustrations may not reflect actual size or scale; their dimensions, proportions, and depictions of elements might be enhanced for better understanding and visual convenience.

[0044] Figure 1 shows a guiding tube 10 designed for the cleaning and/or drying of electrical terminals. The guiding tube 10 features a terminal inlet 12 and a terminal outlet 14, connected by an enclosed channel 16 that extends longitudinally throughout the tube. Channel 16 is configured to allow the insertion and through-transport of contact terminals and to guide a medium, such as washing liquid or air, for the purpose of cleaning and/or drying the terminals. At the terminal inlet 12, there is at least one guide ramp 18, which is adapted to facilitate the introduction of terminals into inlet 12, respectively channel 16. The guide ramp 18 ensures smooth entry of the terminals into the guiding tube 10.

[0045] The guiding tube 10 also includes a medium inlet port 20, which is used to introduce the cleaning and/or drying medium into the channel 16. The medium inlet port 20 is placed in the middle of the guiding tube to ensure effective distribution of the medium throughout the channel 16.

[0046] The guiding tube 10 is constructed with a rectangular cross-section, which provides structural stability and ease of manufacturing. It is preferably made as one integral part, e.g., by injection molded plastic.

[0047] Figure 2 shows the guiding tube of Fig. 1 in a front view. At the forefront is the terminal inlet 12, which serves as the entry point for the terminals into the guiding tube. The channel 16 is not open but enclosed by the walls of the tube, ensuring that the medium used for cleaning or drying is effectively directed towards the terminals without any leakage or loss. The cross-section of the inlet 12, outlet 14, and channel 16 is designed to correspond to a projection of the terminal in a plane perpendicular to the insertion direction of the terminal. In the shown embodiment, the projection of the terminals is L-shaped.

[0048] Adjacent to the terminal inlet 12 is the guide ramp 18, which is specifically adapted to facilitate the introduction of terminals into the channel 16. The guide ramp 18 provides a sloped surface that helps in the smooth transition of terminals from the inlet 12 into the channel 16.

[0049] Figure 3 shows the guiding tube of Fig. 1 in a cross sectional view. The enclosed channel 16 connects terminal inlet 12 and terminal outlet 14. The medium is introduced into the channel through the medium inlet port 20. The guide ramps 18 are positioned at both the inlet 12 and the outlet 14.

[0050] Figure 4 shows an embodiment of a system for cleaning and/or drying terminals, including a guiding tube, belted terminals, and a drip tray, showcasing the integration of the guiding tube 10 with other components. The system includes taped or belted terminals 42 arranged on a carrier strip 40. The terminals 42 are guided through the tube 10, which is housed within a drip tray 30. The drip tray 30 is arranged and configured to collect liquids, thus preventing any spillage or leakage during the cleaning and drying process. The medium inlet port 20 is on the guiding tube 10, allowing for the introduction of a cleaning and/or drying medium, such as washing liquid or air, into the channel 16.

[0051] The guiding tube 10 is designed to accommodate the belted terminals 42, which are fed into inlet 12 and guided through channel 16 until they exit at outlet 14. The system may also feature additional components such as transport mechanisms for moving the taped terminals through the guiding tube 10.

[0052] Figure 5 shows another embodiment of a system for cleaning and drying terminals. The system comprises a first guiding tube 10, which is positioned at an angle to facilitate the flow of washing liquid 51. The terminals 42 are arranged on a carrier strip (as in Fig. 4) and are transported through the first guiding tube 10. The guiding tube 10 is connected to a water source in form of a pump 53 that supplies the washing liquid 51. The liquid/water is introduced into the channel of the guiding tube 10 via a medium inlet port 20. The guiding tube 10 is arranged tilted at an angle, which is prefer-

ably about 45 degrees, to facilitate the outflow of the washing liquid through the inlet and/or outlet. The liquid flows down the guiding tube 10 and is collected in a drip tray 30 positioned below the guiding tube.

[0053] After passing through the first guiding tube 10, the terminals 42 are transported by a conveyer 70 to a second guiding tube 10'. The second guiding tube 10' is designed to apply warm and/or hot air to the terminals 42 for drying. The hot air is introduced into the channel of the second guiding tube 10' via the medium inlet port. The second guiding tube 10' is connected to a source 54 that supplies the hot air in form of a hot air blower.

[0054] The system is designed to clean and dry terminals at a speed of for instance 50 to 300 terminals per minute, preferably 70 to 200 terminals per minute, most preferably 100 to 150 terminals per minute. The channel geometry of the guiding tubes is designed to direct the liquid and hot air flow toward the terminal surfaces, ensuring efficient cleaning and drying.

Reference list:

[0055]

10, 10':	guiding tube
12:	terminal inlet
14:	terminal outlet
16:	enclosed channel
18:	guide ramp
20:	medium inlet port
30:	drip tray
40:	carrier strip
42:	terminal
51:	cleaning liquid
54:	hot air blower
53:	pump
70:	conveyer

Claims

1. A guiding tube (10) for cleaning and/or drying of electrical terminals (42), comprising:
 - a terminal inlet (12) and a terminal outlet (14), and
 - an enclosed channel (16) connecting the inlet (12) and the outlet (14);
 - wherein the channel (16) is adapted to guide a medium for cleaning and/or drying of terminals, and
 - at least one medium inlet port (20), for introducing a medium into the channel (16).
2. The guiding tube (10) according to claim 1, wherein the guiding tube (10) is adapted to receive belted terminals (42) at the inlet, guide the belted terminals (42) through the channel (16) and to output

the terminals (42) at the outlet (14).

3. The guiding tube (10) according to claim 1 or 2, wherein the terminal inlet (12) comprises at least one guide ramp (18) adapted to facilitate introduction of the terminals into the channel. 5
4. The guiding tube (10) according to any one of the preceding claims, wherein the cross-section of the inlet, and/or the outlet, and/or the channel corresponds to a projection of the terminal (42) in a plane perpendicular to the insertion direction of the terminal (42). 10
5. The guiding tube (10) according to claim 4, wherein the area of the cross-section is 5 % to 50 % larger than the area of the projection, preferably 5 % to 30 % larger, more preferably 5 % to 20 % larger. 15
6. The guiding tube (10) according to any one of the preceding claims, wherein the guiding tube (10) has essentially a rectangular cross-section and is preferably made from plastic by injection molding. 20
7. A system adapted for cleaning and/or drying terminals, comprising: 25
 - a first guiding tube (10) in accordance with any one of claims 1 to 6;
 - taped or belted terminals (42) arranged on a carrier strip (40) for guiding through the tube; and 30
 - a source for a cleaning and/or drying medium connectable with the medium inlet port (20). 35
8. The system of the preceding claim, wherein the medium comprises washing liquid and/or air, preferably hot air. 35
9. The system of the preceding claim, further comprising means for adjusting the volume of washing liquid and air introduced to the medium inlet port (20). 40
10. The system according to any one of claims 7 to 9, further comprising: 45
 - at least one drip tray (30) configured to collect liquids, adapted to receive the guiding tube (10) therein. 50
11. The system according to any one of claims 7 to 10, further comprising: 50
 - a transport mechanism configured to move the taped terminals (42) through the guiding tube (10). 55
12. The system according to any one of claims 7 to 11, further comprising:

a second guiding tube (10'); wherein the first guiding tube (10) is configured to apply a washing liquid and the second guiding tube (10') is configured to apply warm and/or hot air to the taped terminals.

13. The system according to any one of claims 7 to 12, wherein the first guiding tube (10) is tilted at an angle of preferably 30 to 60 degrees, most preferably about 45 degrees, to facilitate the outflow of the liquid through the inlet and/or the outlet.
14. A method for cleaning and/or drying terminals, comprising the steps:
 - providing a system in accordance with any one of claims 7 to 13;
 - transporting the terminals through the first guiding tube (10);
 - introducing a washing liquid into the channel via the medium port.
15. The method of claim 14, further comprising the steps:
 - providing a second guiding tube (10');
 - arranging the second guiding tube (10') behind the first guiding tube (10) in transport direction of the terminals;
 - introducing air, preferably hot air, into the second guiding tube (10') via the medium inlet port (20) of the second guiding tube (10').

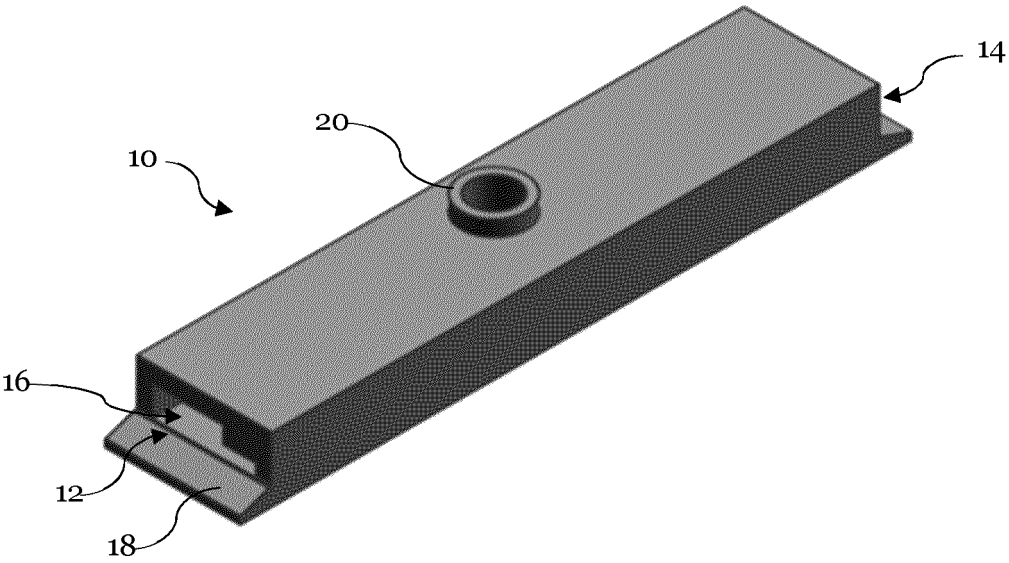


Fig. 1

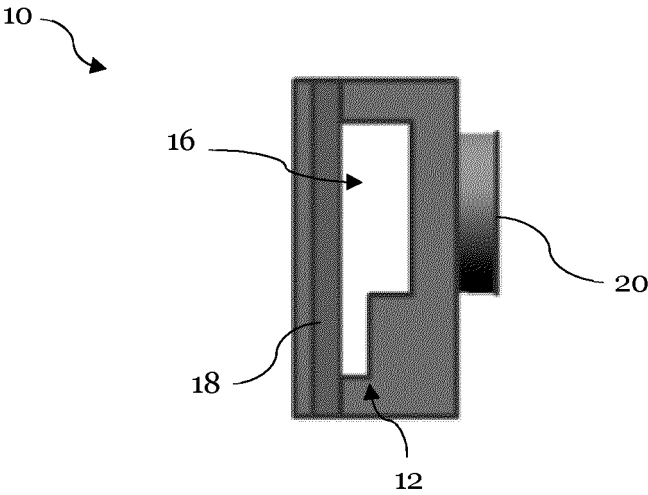


Fig. 2

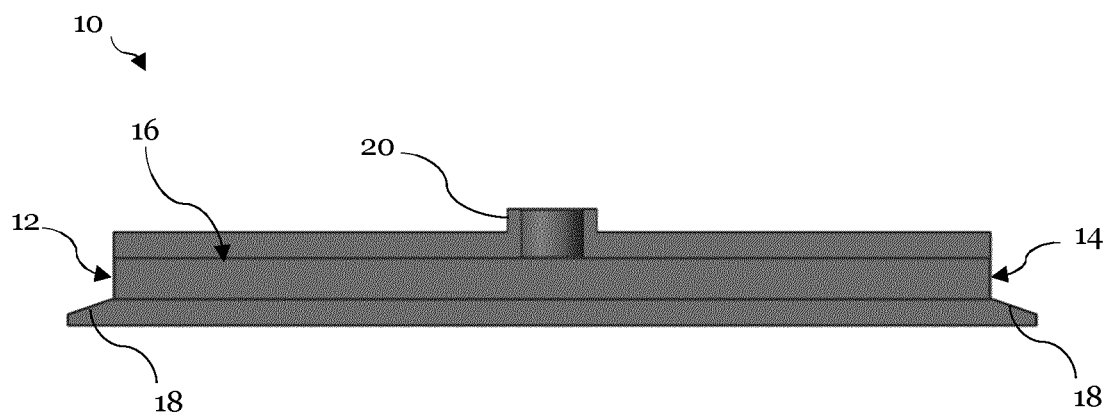


Fig. 3

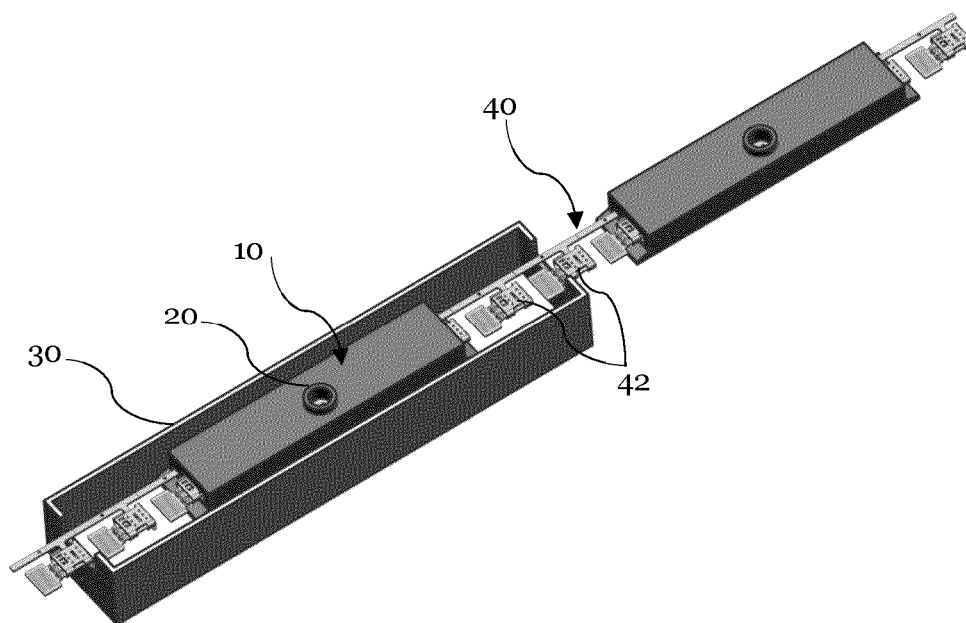


Fig. 4

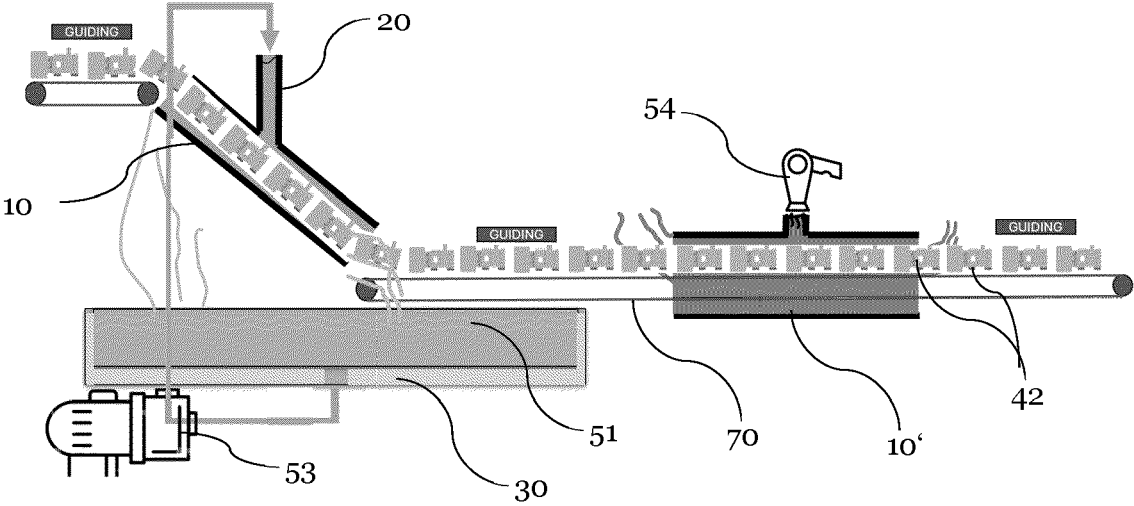


Fig. 5



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Application Number

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		26 September 2025	Plontz, Nicolas
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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