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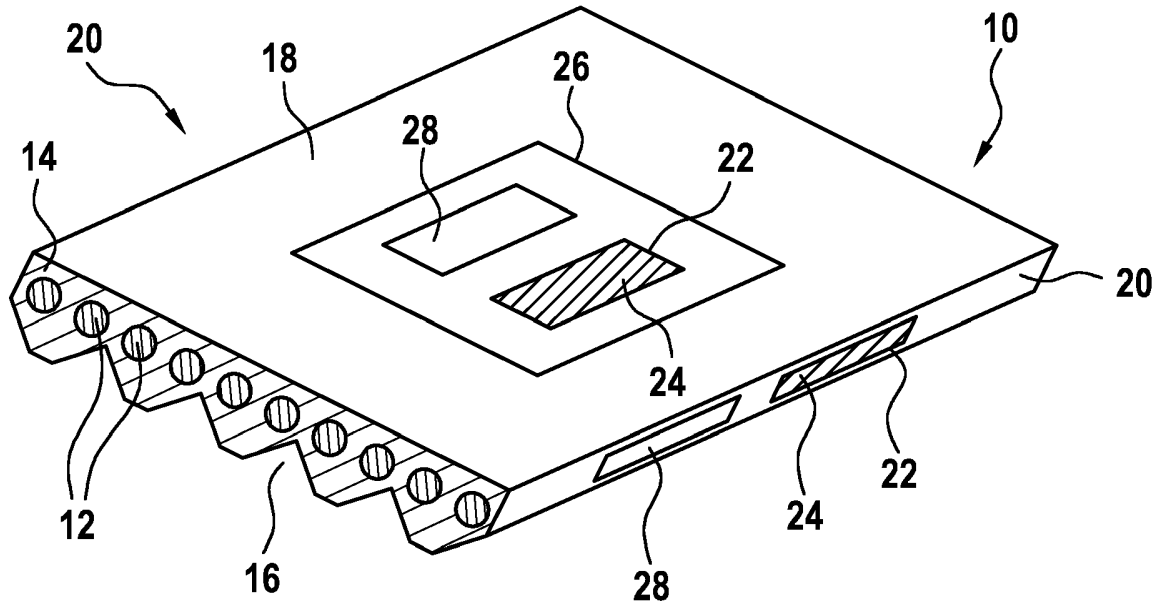
(54) TRACTION MEANS AGING INDICATOR

(57) A traction means (10) for an elevator system (30) comprises a visual indicator (22) provided on the traction means (10) for indicating an aging of the traction means (10), wherein the visual indicator (22) comprises pigments (24) that are selected to change a visual appearance due to physical conditions, the traction means (10) is exposed to.

Fig. 1



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Description

[0001] The present invention relates to a traction means of an elevator, the use of pigments and a method for determining the aging of a traction means.

[0002] Traction means such as belts and cables may comprise one or more metal strands that are encased in elastomer material. Elastomers, such as polyurethane and rubber, used in traction belts and traction cables may lose their physical properties such as elasticity and elongation on break, due to physical conditions they are exposed to. Depending on operational area and stress, the elastomers lose their properties with a different speed.

[0003] For example, anti-oxidants are included into the elastomers, which reduce a degrading of the elastomers. However, also the anti-oxidants are not stable for a long time and lose their effect depending on the environmental conditions. At the end of the life time, the elastomers tend to become more brittle and to develop cracks. A traction means with cracks may not provide enough protection for the metal strands from corrosion. Furthermore, the reduced physical properties may influence the traction properties and the friction of the traction means.

[0004] The overall life time of a traction means may be restricted to a specific value, such as 15 years, to cover all possible environmental exposers. This life time may start after the production of the traction means and may be provided on the traction means in the form of a code. During inspection, a service technician may interpret the code and may determine the remaining life time.

[0005] There may be a need for better determining the wear and/or aging of a traction means. There also may be a need for easier detecting worn and/or aged traction means.

[0006] Such needs may be met with the subject-matter of the independent claims. Advantageous embodiments are defined in the dependent claims.

[0007] Ideas underlying embodiments of the present invention may be interpreted as being based, inter alia, on the following observations and recognitions.

[0008] An aspect of the invention relates to a traction means for an elevator. A traction means may be a traction belt or a traction cable, which may be wound around pulleys. An elevator may be a device adapted for transporting things and persons vertically. The traction means may be adapted for vertically pulling an elevator cabin or an elevator platform. Additionally, weights may be attached to the traction means. The traction means may be moved by a drive, such as an electrical motor.

[0009] According to an aspect of the invention, the traction means comprises a visual indicator provided on the traction means for indicating a wear of the traction means, wherein the visual indicator comprises pigments that are selected to change a visual appearance, such as color, due to physical conditions, the traction means is exposed to. A visual indicator may be an area of pigments that are visible or may become visible for a person monitoring the visual indicator. The visual indicator may be provided in the form of a token and/or may comprise readable symbols, such as letters, numbers, etc. For example, the visual indicator may be a pigment field.

[0010] The pigments may change color due to a chemical reaction that is effected by the physical conditions. For example, oxygen or chemical radicals in the vicinity of the traction means may react with the pigments. The degrading of the traction belt may be caused by the same chemical substances, and thus the color change of the visual indicator may indicate the amount of substances and/or time, the traction means was exposed to, which may be used as an indicator for the wear of the traction means.

[0011] The visual indicator may comprise a chemical substance that is also used in the traction means and which decay or vanishing is a reason of the degrading of the traction means. For example, the chemical substance may be a softening agent for plastics material. The visual appearance of the visual indicator may depend on the chemical substance and/or the presence of the chemical substance. Since the visual indicator is exposed to the same physical conditions as the traction means, the chemical substance in the visual indicator may decay or vanish as fast as in the traction means and the visual appearance of the visual indicator may be strongly correlated with the degrading of the traction means.

[0012] The visual indicator may be seen as a service indicator. With the visual indicator, the wear and/or aging of a traction means may be determined more easily, in particular by unexperienced service personnel.

[0013] According to an aspect of the invention, the pigments change between two base colors. Base colors may be chosen from black, white, green, yellow, red, blue, i. e. colors that not only differ in intensity but in quality. One possibility is that the pigments change from black to yellow or another bright color. It also may be possible that the visual indicator behaves like a traffic light and changes from green to red.

[0014] According to an aspect of the invention, the pigments change a color intensity. In this case, the pigments may change in one base color from a low intensity to a high intensity, or vice versa. For example, the change may be from dark yellow to bright yellow. The color intensity may be proportional to the exposer with the physical condition.

[0015] According to an aspect of the invention, the physical conditions are at least one of a temperature, a humidity exposer, a light exposer, a UV (ultraviolet) light exposer, a chemical radical exposer, an oxygen exposer. The temperature may be either an environmental temperature as well as a temperature inside the traction means that, for example, is increased due to friction of the traction means.

[0016] According to an aspect of the invention, the pigments are selected, such that they change to a final color after 10 years, when they are exposed to a predefined average of physical conditions during these 10 years. For example, chemical substances for the pigments are

chosen, such that the pigments change from an initial color to the final color during a rather long time interval, such as 10 years or 15 years. Usually, the traction means is exchanged after this time interval. However, when the pigments do not have changed to the final color, the service technician may decide that the aging and/or wear of the traction means was slower as expected and therefore, the traction means need not yet be exchanged.

[0017] According to an aspect of the invention, the visual indicator is provided on a foil attached to the traction means. It may be possible that the visual indicator is painted or printed to a foil that may have a self-adhesive side and/or that may be attached or glued to the traction means by a service technician, when the traction means has been installed. It also may be possible that the foil is attached to the traction means during production.

[0018] According to an aspect of the invention, further readable information is printed to the foil. For example, besides the visual indicator, a code encoding the production year / time of the traction means and/or a serial number may be provided on the foil.

[0019] According to an aspect of the invention, the visual indicator is printed or painted on the traction means. The pigments may be provided directly on the traction means during production. In this production step, also further readable codes may be printed or painted on the traction means besides the visual indicator.

[0020] In both cases, i.e. whether the visual indicator is provided directly on the traction means or the visual indicator is attached with a foil on the traction means, it may be that the visual indicator is protected by a protection foil that may be removed from the visual indicator to activate it. For example, the protection foil may be impermeable to light, UV light, oxygen or chemical radicals. When the foil is removed, these physical conditions from the environment may start to interact with the pigments.

[0021] According to an aspect of the invention, the traction means is a traction belt with a profiled side and a back side. Usually, a traction belt has a profiled side, which touches pulleys of the elevator system and a back side that it is not in direct touch with other components of the elevator system. The visual indicator may be provided on the back side and/or a narrow side of the traction belt, i.e. areas of the traction belt that are not directly exposed to other components of the elevator system that may damage the visual indicator.

[0022] According to an aspect of the invention, the traction means comprises at least one metal strand embedded into a plastics material, wherein the visual indicator is provided on a surface of the plastics material. Another possibility is that the traction means is a coated cable on which surface the visual indicator is provided.

[0023] According to an aspect of the invention, the traction means comprises a plurality of visual indicators that are provided along an extension direction of the traction means. For example, a number of visual indicators may be attached to the traction means in specific distances during production. In such a way, the monitoring of the traction means may be performed in different sections of the traction means. In such a way, areas with wear may be detected.

[0024] A further aspect of the invention relates to an elevator system with a traction means according to one of the previous claims. For example, such an elevator system may comprise a drive, an elevator cabin in a shaft, automatic doors, etc.

[0025] According to an aspect of the invention, the elevator system comprises a reference visual indicator protected from the physical conditions, the traction means is exposed to, such that a visual appearance, such as color, of the visual indicator on the traction means is comparable to the reference visual indicator. The reference visual indicator may be provided and/or attached on a further equipment of the elevator system. For example, the reference visual indicator may be identical or at least may comprise the same pigments as the visual indicator on the tractions means. Furthermore, the reference visual indicator may be provided on a foil, which may be used to attach the reference visual indicator to a further equipment of the elevator system.

[0026] As an example, the pigments may be sensitive to temperature. When the reference visual indicator is provided in the shaft, it is exposed to the same environment temperature changes as the traction means. However, the visual indicator on the traction means additionally are exposed to higher temperatures that are caused by friction inside the traction means. By comparing the reference visual indicator with the visual indicator on the tractions means, it may be possible to determine the degrading of the traction means based on the internal friction of the traction means.

[0027] In the case, the visual indicator is adapted for monitoring the temperature of the traction means, it indirectly may monitor the overall mechanical stress, such as the number of bends, of the traction means.

[0028] A further aspect of the invention relates to a use of a visual indicator for determining an aging of a traction means of an elevator, wherein the visual indicator comprises pigments that are selected to change color due to physical conditions, the traction means is exposed to. As mentioned above, the visual indicator may be provided on the traction means.

[0029] A further aspect of the invention relates to a method of determining the aging of a traction means. For example, the method may be performed by a service technician inspecting the traction means.

[0030] According to an aspect of the invention, the method comprises: providing a visual indicator on the traction means, wherein the visual indicator comprises pigments that are selected to change from an initial color to a final color due to physical conditions, the traction means is exposed to; comparing an actual color of the visual indicator with a reference color; and deciding that the traction means is aged, when the actual color is the reference color. For example, the visual indicator may be attached to the traction means, directly after installa-

tion of its elevator system. It also may be possible that the visual indicator is activated by removing a protection foil. After that, a service technician may look at the visual indicator regularly (for example every year), whether the visual indicator has changed color or has changed color to a color indicating a specific wear. In this case, the service technician may decide that the traction means has to be replaced.

[0031] In the following, advantageous embodiments of the invention will be described with reference to the enclosed drawings. However, neither the drawings nor the description shall be interpreted as limiting the invention.

Fig. 1 schematically shows a perspective view of a traction means according to an embodiment of the invention.

Fig. 2 schematically shows an elevator system according to an embodiment of the invention.

Fig. 3 shows a diagram illustrating a method for determining an aging of a traction means according to an embodiment of the invention.

[0032] The figures are only schematic and not to scale. Same reference signs refer to same or similar features.

[0033] Fig. 1 shows a traction means 10 in the form of a traction belt, which comprises a number of metal strands 12, which are embedded in a plastics material 14. The plastics material 14 may be a polymer, such as an elastomer or a rubber material.

[0034] The traction means 10 in the form of a traction belt has a substantially rectangular cross-section with a profiled front side 16, a substantially flush back side 18 and two narrow sides 20. It has to be noted that here and in the following, the traction means 10 also may be a coated cable, which may have a more round or circular cross-section.

[0035] On the traction means 10, a visual indicator 22 is provided. As shown in Fig. 1, the visual indicator 22 may be provided on the surface of the plastics material. Furthermore, in the case of a traction belt, the visual indicator 22 may be provided on the flush back side 18 and/or on a flush narrow side 20.

[0036] As shown in Fig. 1, the visual indicator 22 may have a simple shape, such as a circle or rectangle. However, it is also possible that it has the shape of a token or contains a code, which may be in letters and/or numbers. Furthermore, the visual indicator 22 may comprise a computer-readable code, such as a bar code.

[0037] The visual indicator 22 comprises pigments 24, which are adapted for changing color, when they are exposed to physical conditions of the traction means 10 and/or the environment of the traction means 10. Such physical conditions may include a temperature, a humidity exposer, a light exposer, a UV light exposer, a chemical radical exposer, an oxygen exposer. In other words, when the pigments 24 are exposed for a specific time to one or more physical conditions, they change between an initial color to a final color.

[0038] The color change may be in the intensity of the original color, i.e. the final color may have the same base color as the initial color. For example, the initial color may be dark red and the final color may be light red. Then the time of exposer with the physical condition may be correlated with the color change. It may be possible that the color intensity is measured with a device, which then may determine the time of exposure from the color change. In general, the color change also may be monitored by a person, which looks on the visual indicator and decides, whether the color has changed to the final color. Another option is that the color change is between base colors, i.e. that the initial color is another base color as the final color. Base colors may be black, white, red, green, blue, yellow, etc. Base colors may be colors that a person may simply distinguish from each other.

[0039] The color change of the pigments 24 may be based on a chemical reaction that is effected and/or accelerated by the physical condition. Furthermore, the pigments 24 may be chosen that they react with the same physical condition as substances of the plastics material 14. For example, it may be that the plastics material 14 degrades due to the exposer to UV light. When pigments 24 are chosen that also react with UV light, the color change of the pigments may be an indicator for the degrading and the aging of the traction means 10. Other physical conditions that may influence the degrading of the plastics material 14 are humidity, oxygen, and other chemical radicals.

[0040] It may be that the visual indicator 22 is directly provided on the traction means 10. For example, the pigments 24 may be directly printed or painted on the traction means 10. Another possibility is that the visual indicator 22 is provided on a foil 26, which, for example, may have a self-adhesive side and/or is glued to the traction means 10. Also, the visual indicator 22 may be embedded in a jacket material, e.g. in the plastics material 18.

[0041] Besides the visual indicator 22, a code field 28 may be provided on the traction means 10. The code field 28 may be directly provided on the traction means 10 or may be provided on the foil 26. The code field 28 may contain human and/or computer-readable information.

[0042] Fig. 2 schematically shows an elevator system 30, which comprises an elevator cabin 32 which is moved by a drive 34 in an elevator shaft 36 via the traction means 10. The traction means 10 may be guided by pulleys 38. When the traction means 10 is a traction belt, the profiled side 16 may run over the pulleys 38, while the back side 18 is not in contact with other components of the elevator system 30.

[0043] On the traction means 10, several visual indicators 22 may be provided. The visual indicators 22 may be provided along a longitudinal extension of the traction means, for example in regular distances to each other. With visual indicators 22 in different areas and/or sec-

tions of the traction means 10, not only the overall traction means 10 but the areas and/or sections of the traction means 10 may be monitored separately.

[0044] It may be that a reference visual indicator 40 is provided in the elevator system 30, which is not attached to the traction means 10. For example, the reference visual indicator 40 may be attached to the elevator shaft 36 or another component of the elevator system 30. In such a way, the reference color field 40 may be exposed to physical conditions in the environment of the traction means 10 but not to physical conditions directly at the traction means 10. As an example, the reference visual indicator 40 and the one or more visual indicators 22, which may be based on the same pigments 24, may be sensitive to temperature. By comparing the color of the reference visual indicator 40 with the color of a visual indicator 22, an overall difference in temperature over time between the traction means 10 and the environment may be determined. This may be an indicator for an overall friction of the traction means 10, because friction may be the main cause for a higher temperature of the traction means 10 as of the environment. Thus, as being an indicator for friction, this indicator also may be an indicator for wear and aging of the traction means 10.

[0045] Fig. 3 shows a diagram illustrating a method for determining an aging of a traction means.

[0046] In step S10, a visual indicator 22 is provided on the traction means 10, wherein the visual indicator 22 comprises pigments 24 that are selected to change from an initial color 42 to a final color 44 due to physical conditions, the traction means 10 is exposed to. For example, the visual indicator 22 is printed or painted on the traction means 10 during production. It also may be possible that the visual indicator 22 is attached to the traction means 10 directly after installation, for example in a foil 26.

[0047] As indicated in Fig. 3, the visual indicator 22 is exposed to physical conditions and starts to change color. After a specific amount of exposer to the specific physical conditions, to which the pigments 24 are sensitive, the visual indicator 22 has changed color. For example, the pigments 24 may have been selected that after an average exposer of 10 years or 15 years or more, a complete color change to the final color 44 has taken place.

[0048] In step S12, a service technician compares an actual color of the visual indicator 22 with a reference color 46. In a simple case, the reference color 46 is known to the service technician, who looks on the visual indicator 22. The reference color 46 may be the final color 44.

[0049] In step S 14, when the actual color of the visual indicator 22 is the reference color, the service technician decides that the traction means 10 is aged.

[0050] Finally, it should be noted that the term "comprising" does not exclude other elements or steps and the "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

List of reference signs

[0051]

10	traction means
12	metal strand
14	plastics material
16	profiled side
18	back side
20	narrow side
22	visual indicator
24	pigments
26	foil
28	code field
30	elevator system
32	elevator cabin
34	drive
36	elevator cabin
38	pulley
40	reference visual indicator
42	initial color
44	final color
46	reference color

Claims

1. A traction means (10) for an elevator system (30), the traction means (10) comprising a visual indicator (22) provided on the traction means (10) for indicating an aging of the traction means (10);
wherein the visual indicator (22) comprises pigments (24) that are selected to change a visual appearance due to physical conditions, the traction means (10) is exposed to.

2. The traction means (10) of claim 1,
wherein the physical conditions are at least one of temperature, a humidity exposer, a light exposer, a UV light exposer, a chemical radical exposer and an oxygen exposer.

3. The traction means (10) of claim 1 or 2,
wherein the pigments (24) change between two base colors.

4. The traction means (10) of one of the preceding claims,
wherein the pigments (24) change in a color intensity.

5. The traction means (10) of one of the preceding claims,
wherein the pigments (24) are selected, such that they change to a final color after 10 years, when they are exposed to a predefined average of physical con-

ditions during these 10 years.

6. The traction means (10) of one of the preceding claims,
wherein the visual indicator (22) is provided on a foil (26) attached to the traction means (10).

7. The traction means (10) of claim 6,
wherein further readable information (28) is printed to the foil (26).

8. The traction means (10) of one of the preceding claims,
wherein the visual indicator (22) is printed or painted on the traction means (10).

9. The traction means (10) of one of the preceding claims,
wherein the traction means (10) is a traction belt with a profiled side (16) and a back side (18);
wherein the visual indicator (22) is provided on the back side (18) and/or a narrow side (20) of the traction belt.

10. The traction means (10) of one of the preceding claims,
wherein the traction means (10) comprises at least one metal strand (12) embedded into a plastics material (14);
wherein the visual indicator (22) is provided on a surface of the plastics material (14).

11. The traction means (10) of one of the preceding claims,
wherein the traction means (10) comprises a plurality of visual indicators (22) that are provided along an extension direction of the traction means (10).

12. The traction means (10) of one of the preceding claims,
wherein the traction means (10) comprises at least one metal strand (12) embedded into a plastics material (14);
wherein the traction means (10) comprises a plurality of visual indicators (22) that are provided along an extension direction of the traction means (10) on a surface of the plastics material (14);
wherein the pigments (24) of the visual indicators (22) are selected, such that they change color after 10 years, when they are exposed to a predefined average of physical conditions during these 10 years.

13. An elevator system (30) with a traction means (10) according to one of the previous claims,
wherein the elevator system (30) comprises a reference visual indicator (40) protected from physical conditions, the traction means (10) is exposed to, such that a visual appearance of the visual indicator (22) on the traction means (10) is comparable to a color of the reference visual indicator (40).

14. A use of a visual indicator (22) for determining an aging of a traction means (10) of an elevator system (30),
wherein the visual indicator (22) comprises pigments (24) that are selected to change color due to physical conditions, the traction means (10) is exposed to.

15. A method of determining the aging of a traction means (10), the method comprising:

providing a visual indicator (22) on the traction means (10), wherein the visual indicator (22) comprises pigments (24) that are selected to change from an initial color (42) to a final color (44) due to physical conditions, the traction means is exposed to;
comparing an actual color of the visual indicator (22) with a reference color (46);
deciding that the traction means (10) is aged, when the actual color is the reference color (46).

Fig. 1

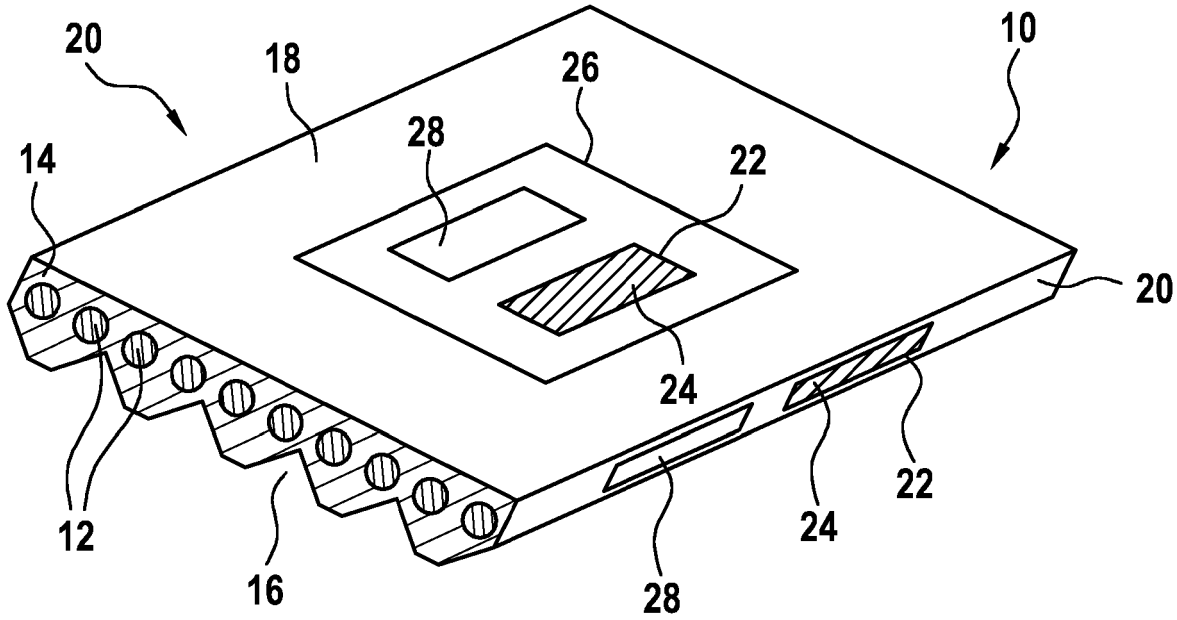


Fig. 2

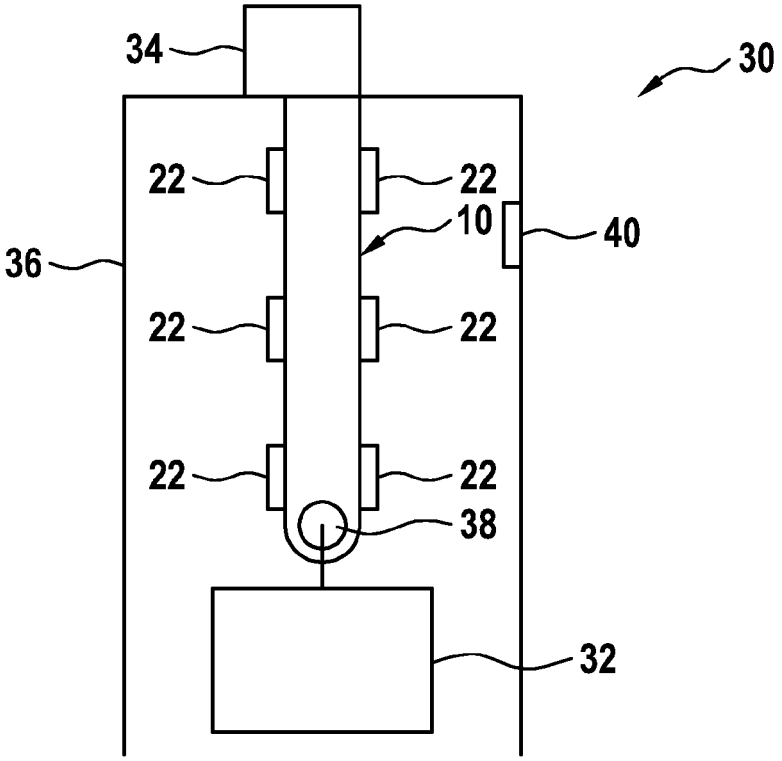
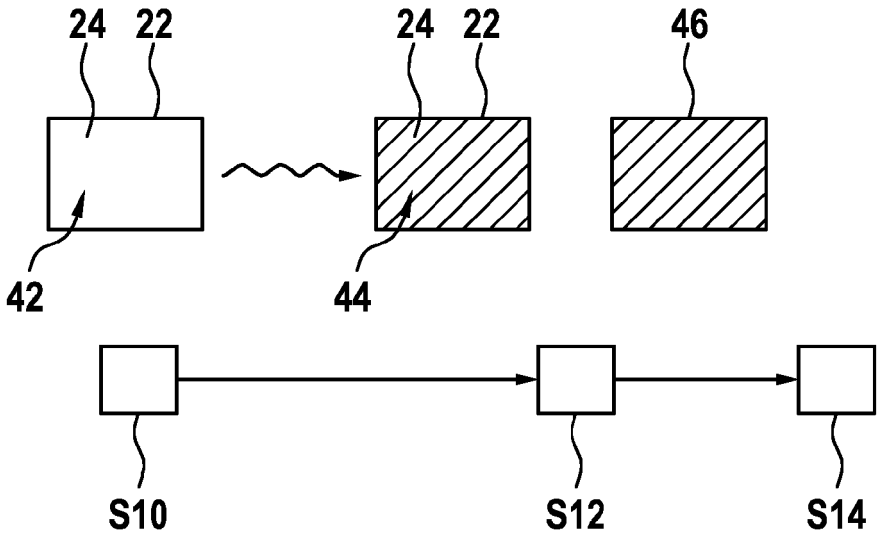


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 6660

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B66B D07B B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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