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(54) **APPARATUS AND METHOD FOR INK JET PRINTING ITEMS OF CLOTHING AND ACCESSORIES, IN PARTICULAR LEATHER AND/OR POLYURETHANE**

(57) An apparatus (4) for ink jet printing items of clothing and accessories (16), in particular in leather and/or polyurethane, comprising at least one ink jet printing head (8), slidable along a longitudinal printing axis (L-L), a base (12) for supporting at least one item of clothing or accessory (8) to be printed, wherein said base (12) comprises at least one charging plate (14), wherein the item of clothing or accessory (16) is supported by a support device (20), electrically connected to the charging plate (14). The apparatus further comprises electrostatic charging means (24) electrically connected to the apparatus (4) and the at least one charging plate (14), so as to charge the printing head (8) and the at least one charging plate (14), and by means thereof, the support device (20), with opposite electrostatic charges.

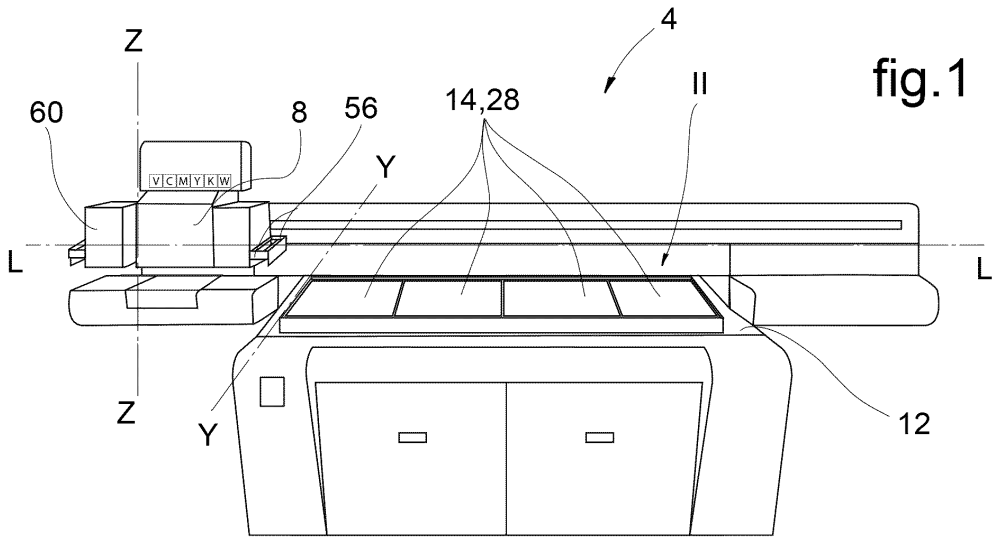

fig.1

EP 4 559 692 A2

Description

FIELD OF APPLICATION

[0001] The present invention relates to a method for ink jet printing items of clothing and accessories, in particular in leather and/or polyurethane.

PRIOR ART

[0002] As is well known, there is an increasing trend in the garment and accessory industry for manufacturers to customize products by affixing decorations, trademarks, logos, and designs of various kinds.

[0003] Such customizations are not easy to achieve.

[0004] In fact, traditional ink jet printing methods are effective in terms of accuracy only when the printing surfaces are regular, typically flat, and made of only one type of material.

[0005] In fact, due to the flatness and uniformity of the surfaces, it is possible to bring the printing head quite close to the object and achieve precise printing, i.e., without smudging.

[0006] If, on the other hand, one is dealing with non-planar, perhaps highly curved surfaces, such as the side portions of footwear comprising both upper and sole parts, then conventional equipment is completely unable to make an accurate, i.e., smudge-free, print.

[0007] In fact, the head may not be brought in close to all the parts to be printed, but may only be placed in the vicinity of the convex or flat portions; for this reason, the concave portions will be significantly farther away than the flat or convex portions, and the accuracy of printing on these portions, or near the transition zones between the flat/convex and concave portions, will be irreparably compromised.

[0008] For these reasons, to date, solutions of the prior art do not allow the use of ink jet printing on items of clothing that do not have regular surfaces. Where irregular surface printing is needed, however, other, more expensive printing techniques are preferred, or said printing is simply avoided except in limited parts of the surface of the item of clothing to be treated.

[0009] For all these reasons, the prior art is severely limited in ink jet printing applications on items of clothing having irregular surfaces or a plurality of materials.

DISCLOSURE OF THE INVENTION

[0010] The need to solve the drawbacks and limitations mentioned with reference to the prior art is therefore felt.

[0011] These needs are met by a printing method according to claim 1.

DESCRIPTION OF THE DRAWINGS

[0012] Further features and advantages of the present invention will become more apparent from the following detailed description of preferred, non-limiting embodiments thereof, wherein:

Fig. 1 is a perspective view of an apparatus for ink jet printing items of clothing and accessories in accordance with an embodiment of the present invention;
Fig. 2 is a plan view from above of the detail II shown in Fig. 1;
Fig. 3 shows, enlarged, the detail III indicated in Fig. 2;
Fig. 4 is a side view of electrostatic charging means of the apparatus in Fig. 1;
Fig. 5 is a perspective view of a projector of the apparatus according to a possible embodiment of the present invention;
Fig. 6 is a perspective view of a device for supporting items of clothing and accessories in accordance with a possible embodiment of the present invention;
Fig. 7 shows the support device in Fig. 6, in the configuration of supporting a pair of shoes to be printed.

[0013] Elements or parts of elements common to the embodiments described hereinafter will be indicated with the same numerical references.

DETAILED DESCRIPTION

[0014] With reference to the aforesaid figures, an apparatus for ink jet printing items of clothing and accessories, in particular in leather and/or polyurethane, is globally denoted with 4.

[0015] First of all, it should be made clear that the term "item of clothing or accessory" should be understood in a broad and non-limiting sense. Therefore, items of clothing and accessories may include, for example, handbags, footwear, belts, purses, cases and the like. This list is indicative and not exhaustive. The same applies to materials which may include leather, leatherette, plastic, rubber and the combinations thereof. "Combinations" means that the same object may comprise a plurality of portions having different geometries and different materials. This is the case, for example, with footwear that may include a leather, cloth or plastic upper that connects to a rubber and/or plastic sole.

[0016] The apparatus 4 comprises at least one ink jet printing head 8 slidable along a longitudinal printing axis L-L, and a base 12 for supporting at least one item of clothing or accessory 16 to be printed.

[0017] The base 12 is provided with at least one charging plate 14 that, as further described below, is configured to electrostatically charge the item of clothing or accessory 16.

[0018] The printing head 8 is supported so that it may reach the portions of the item of clothing or accessory 16 along its travel parallel to the longitudinal printing axis L-L. For this purpose, it is also possible to provide for the printing head 8 to translate perpendicularly to said long-

itudinal printing direction, along a transverse direction Y-Y, which identifies with the longitudinal printing axis L-L a printing plane parallel to the base 12. It is also provided for the printing head 8 to translate along a vertical direction Z-Z, perpendicular to the transverse direction Y-Y and the longitudinal printing axis L-L.

[0019] The item of clothing or accessory 16 is supported by a support device 20, electrically connected to the charging plate 14.

[0020] The apparatus 4 comprises electrostatic charging means 24 electrically connected to the printing head 8 and to the at least one charging plate 14, so as to charge the printing head 8 and the at least one charging plate 14, and by means thereof, the support device 20, with opposite electrostatic charges. For example, the electrostatic charging means 24 comprise an electrostatic generator with dual polarity +/-, individually selectable. The voltage value provided by said electrostatic generator is preferably in the range of 4 KV to 20 KV, for example, viewable on the integrated display.

[0021] In accordance with a possible embodiment, the at least one charging plate 14 comprises a plurality of resistors connected in parallel with said electrostatic charging means 24.

[0022] Preferably, a plurality of charging plates 14 comprising a plurality of resistors or pins all connected in parallel with said electrostatic charging means 24 is provided.

[0023] In accordance with one possible embodiment, the at least one charging plate 14 is at least partially covered with a layer of ionizing dark rubber 28 in which said resistors or pins are embedded. For example, said ionizing dark rubber layer 28 comprises epoxy resins and two-component mixing rubber.

[0024] Preferably, the at least one charging plate 14 is electrically connected to the electrostatic charging means 24 by means of at least one insertion plug 32. This type of connection, a plug-in type, is very useful in that it allows the single electrostatic charging plate 24 to be connected and disconnected quickly, for example to make a replacement, without having to interrupt the operation of the other charging plates 14 in the apparatus 4.

[0025] In accordance with a possible embodiment, the at least one electrostatic charging plate 24 is detachable from the base 12 by means of mechanically removable stops 36. Due to said stops 36 it is possible to remove and reconnect the single charging plate 24 without compromising the operation of the other units.

[0026] Preferably, the at least one charging plate 24 has a greater extension or area 40 with respect to the support device 20, as well as the corresponding item of clothing or accessory 16, with respect to a projection plane on the base 12, so as to comprise and fully include the projection of the support device 20 and of the item of clothing or accessory 16 to be printed. This ensures complete ionization of the item of clothing or accessory 16 and ensures that the ink injected by the printing head 8 propagates in the vertical direction Z-Z, without diverging in a cone, as occurs in the absence of electrostatic charges. In other words, the electrostatic attraction between the printing head 8 and the item of clothing or accessory 16, which are charged with electrical charges opposite to each other, prevents the ink from propagating according to a cone and creating inevitable smudges on the item of clothing or accessory 16.

[0027] In accordance with a possible embodiment, the support device 20 comprises a resting base 44, associated and electrically connected with said at least one charging plate 14, and a cantilevered element 48, with respect to the resting base 44, configured to support the item of clothing or accessory 16 to be printed. The resting base 44 is made of electrically conducting material so as to receive the electrostatic charge from the charging plate 16 with which it is in contact.

[0028] The cantilevered element 48 is electrically connected to the resting base 44 and is in turn made of electrically conducting material so that it may transfer the electrostatic charge to the item of clothing or accessory 16 it supports and with which it is at least partially in contact.

[0029] In accordance with a possible embodiment, the cantilevered element 48 comprises support portions 52 configured to support, in a given position or with a given curvature or flatness, at least a portion of the item of clothing or accessory 16 to be printed. Said support portions 52 serve, for example, to ensure the repeatability of the printing process on repeated items of clothing or accessories 16 from the same batch. For example, due to the support portions 52, it is possible to curve, spread and/or flatten portions of a shoe upper to be printed in series.

[0030] In accordance with a possible embodiment, the apparatus 8 is equipped with a first UV ray LED lamp 56 for drying the injected ink, arranged upstream of nozzles of the printing head 8 for the ink jet, along the longitudinal printing axis L-L.

[0031] In accordance with a possible embodiment, the apparatus 8 is provided with a second UV ray LED lamp 60 for drying the injected ink, arranged downstream of nozzles of the printing head 8 for the ink jet, along the longitudinal printing axis L-L.

[0032] In general, said UV ray lamps 56,60 are intended to allow almost instantaneous drying of the ink injected by the printing head 8. The reason for this expedient is that the injected ink, due to the electrostatic attraction between the printing head 8 and the item of clothing or accessory 16, is aimed directly, without opening in a cone/fan, against the printing surface which, usually, has an irregular and non-planar geometry. For this reason, in the absence of a very rapid drying of the ink, it would quickly tend to run, creating unacceptable smudges that would lead to discarding the printed item of clothing or accessory 16.

[0033] In accordance with a possible embodiment, said first and/or second UV ray LED lamps 56,60 are

spaced apart from the nozzles of the printing head 8, along the longitudinal printing axis L-L, so as to preserve the quality of the printing head and ensure the drying of the injected ink.

[0034] In accordance with a possible embodiment, the apparatus 4 comprises a projector 64 having a resting plane 68 for said support device 20 bearing the item of clothing or accessory 16 to be printed, and a projection head 72 configured to previously project the image to be printed directly on the item of clothing or accessory 8 mounted on the support device 20.

[0035] In particular, the resting plane 68 of the projector 64 is configured so as to exactly replicate the position of the support device 20 when positioned on the base 12 for the subsequent printing. In this way, the operator may previously verify the correct centering of the image to be printed with respect to the item of clothing or accessory 16 and thus the correct positioning of the item of clothing or accessory 16 with respect to the support device 20.

[0036] The apparatus 4 also has a processing and control unit programmed to first centre the image emitted by the projector 64, and then the printing emitted by the printing head 8, on the item of clothing or accessory 8 to be printed.

[0037] Preferably, said processing and control unit is programmed to centre and project the image on the item of clothing or accessory 8 as a function of the distance, with respect to said vertical direction Z-Z, between the printing head 8 and the item of clothing or accessory 16 during the subsequent printing step.

[0038] Preferably, said processing and control unit is programmed to control the injection of ink and the activation of said UV ray LED lamps 56,60 after each passage and injection of ink of the printing head 8 on the item of clothing or accessory 16 to be printed.

[0039] The method of printing an item of clothing or accessory in accordance with the present invention will now be described.

[0040] The apparatus 4 comprises a charging plate 14 or inductive plate, supplied with high voltage (> 10 KV) and low amperometric value, on which metal support devices 20 suitable for holding/supporting items of clothing or accessories 16, such as footwear or other dielectric objects, such as leather, plastic, wood are positioned.

[0041] The inductive charge is transferred from the charging plate 14, by means of the resistors or pins immersed in the insulation itself, to the metal support. This results in an electrostatic "polarization" of the dielectric object (i.e., the item of clothing or accessory 16) supported by the sign corresponding to the voltage supplied. The voltage value in KV may preferably be varied up to a maximum of 20 KV by the generator used.

[0042] In particular, the method of printing an item of clothing or accessory 16 comprises the steps of:

arranging at least one ink jet printing head 8, slidable along a longitudinal printing axis L-L,
arranging a base 12 for supporting at least one item of clothing or accessory 8 to be printed
wherein said base 12 comprises at least one charging plate 14,
wherein the item of clothing or accessory 16 is supported by a support device 20, electrically connected to the charging plate 14,
providing electrostatic charging means 24 electrically connected to the printing head 8 and the at least one charging plate 14,
previously charging the printing head 8 and the at least one charging plate 14 and by means thereof, the support device 20, with opposite electrostatic charges,
printing the item of clothing or accessory 16 by means of passages of said printing head 8 near the item of clothing or accessory 8.

[0043] Printing performed in this way is smudge-free because, due to the electrostatic attraction between the ink of the printing head 8 and the item of clothing or accessory 16 (which are charged with electrical charges opposite to each other), the ink is not able to expand in a cone shape, as is usually the case in the injection heads of the prior art, so that it may be directed extremely precisely onto the surface to be printed, especially if said surface is irregular and inclined.

[0044] In addition, the method may comprise the steps of:

- providing the printing head 8 with at least one UV ray LED lamp 56,60,
- controlling the injection of ink and the activation of said at least one UV ray LED lamp 56,60 after each passage and injection of ink of the printing head 8 on the item of clothing or accessory 8 to be printed. This, as seen, allows instantaneous drying of the injected ink and averts the risk of possible ink dripping/smudging.

[0045] Further, in accordance with a possible embodiment, the method may also comprise the steps of:

- arranging a projector 64 having a resting plane 68 for said support device 20 bearing the item of clothing or accessory 16 to be printed, and a projection head 72 configured to previously project the image to be printed directly on the item of clothing or accessory 16 mounted on the support device 20,

wherein the resting plane 68 of the projector 64 is configured so as to exactly replicate the position of the support device 20 when positioned on the base 12 for printing,
projecting the image to be printed, by the projector 64, on the item of clothing or accessory 16 to be printed in order to simulate the subsequent print and verify the correct centering of the image with respect to the item of clothing or ac-

cessory 16,
printing on the item of clothing or accessory 8.

[0046] These steps make it possible to simulate the correct positioning of the item of clothing or accessory 16 on the support device 20 and also the centering between the support device, when positioned on the base, and the printing head 8. In other words, the user may simulate the exact location of the printing that will be done subsequently on the item of clothing or accessory 16.

[0047] As may be appreciated from that which has been described, the present invention overcomes the drawbacks of the prior art.

[0048] In particular, due to the present invention, it is possible to carry out ink jet printing on items of clothing and/or accessories having different materials and geometries, including highly variable and curvilinear ones, without losing printing precision and without smudging.

[0049] In particular, through the use of electrostatic charges, the cone of the injected ink is reduced until it is vertical/perpendicular to the point of printing, ensuring detail and quality, even at points farthest from the printing head, along said vertical direction.

[0050] The printing applications of the apparatus and method of the present invention are virtually unlimited since, by appropriately calibrating the intensity of the electrostatic charges applied to the printing head and charging plates, it is possible to print effectively and without smudging on an item of clothing or accessory having any type and/or geometric conformation.

[0051] In addition, the apparatus is easy to use: if one charging plate fails, it may be replaced without compromising the operation of the others.

[0052] A person skilled in the art, for the purpose of satisfying contingent and specific needs, may make numerous modifications and variations to the solutions described above.

[0053] The scope of protection of the present invention is defined by the following claims.

Claims

1. Method for printing an item of clothing or accessory comprising the steps of:

    - arranging at least one ink jet printing head (8), slidable along a longitudinal printing axis (I-I),
    - arranging a base (12) for supporting at least one item of clothing or accessory (16) to be printed,
    - wherein said base (12) comprises at least one charging plate (14),
    - wherein the item of clothing or accessory (16) is supported by a support device (20), electrically connected to the charging plate (14),
    - providing electrostatic charging means (24) electrically connected to the printing head (8) and to the at least one charging plate (14),
    - previously charging the printing head (8) and the at least one charging plate (14) and by means thereof, the support device (20), with opposite electrostatic charges,
    - printing the item of clothing or accessory (16) by means of passages of said printing head (8) near the item of clothing or accessory (16),

    the method further comprising the steps of:

    - arranging a projector (64) having a resting plane (68) for said support device (20) bearing the item of clothing or accessory (16) to be printed, and a projection head (72) configured to previously project the image to be printed directly on the item of clothing or accessory (16) mounted on the support device (20),
    - wherein the resting plane (68) of the projector (64) is configured so as to exactly replicate the position of the support device (20) when positioned on the base (12) for printing,
    - projecting the image to be printed, by means of the projector (64), on the item of clothing or accessory (16) to be printed in order to simulate the subsequent printing and to verify the correct centring of the image with respect to the item of clothing or accessory (16),
    - printing on the item of clothing or accessory (16).

2. Method according to claim 1, comprising the steps of:

    - providing the apparatus (4) with at least one UV ray LED lamp (56,60),
    - controlling the injection of ink and the activation of said at least one UV ray LED lamp (56,60) after each passage and injection of ink of the printing head (8) on the item of clothing or accessory (16) to be printed.

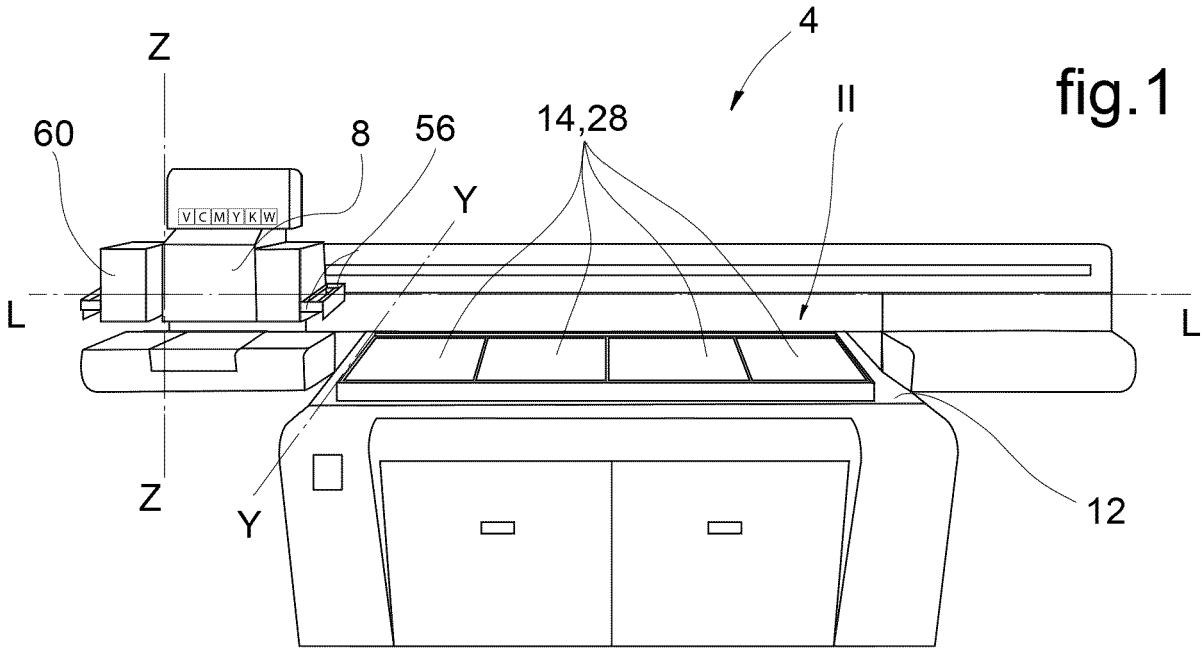
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fig.1

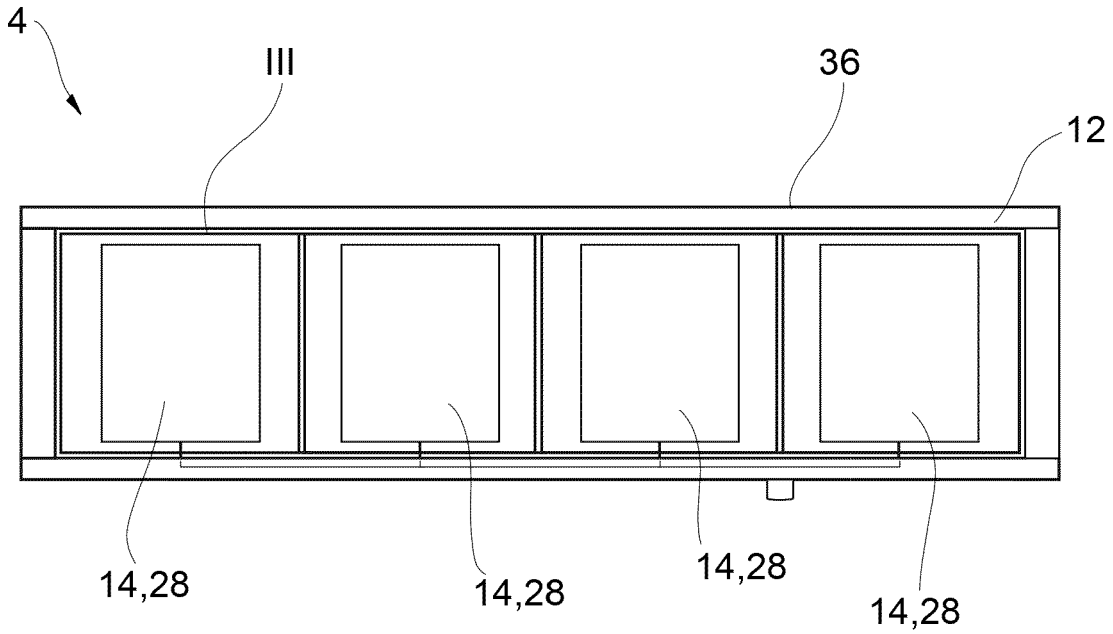
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fig.2

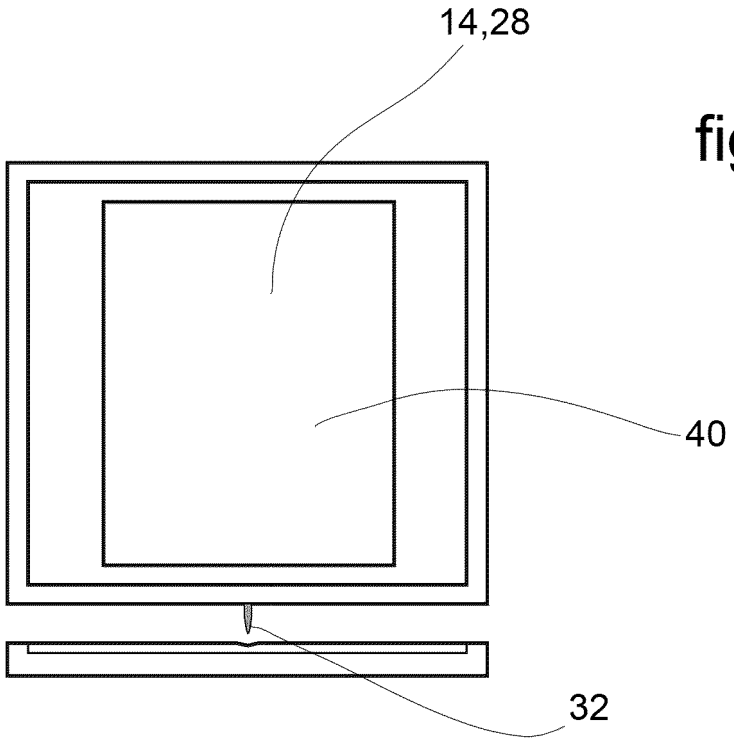

fig.3

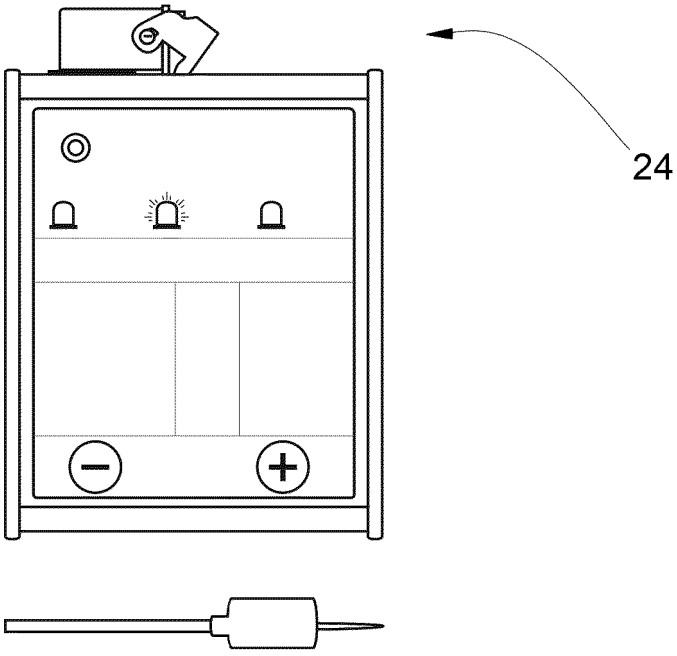

fig.4

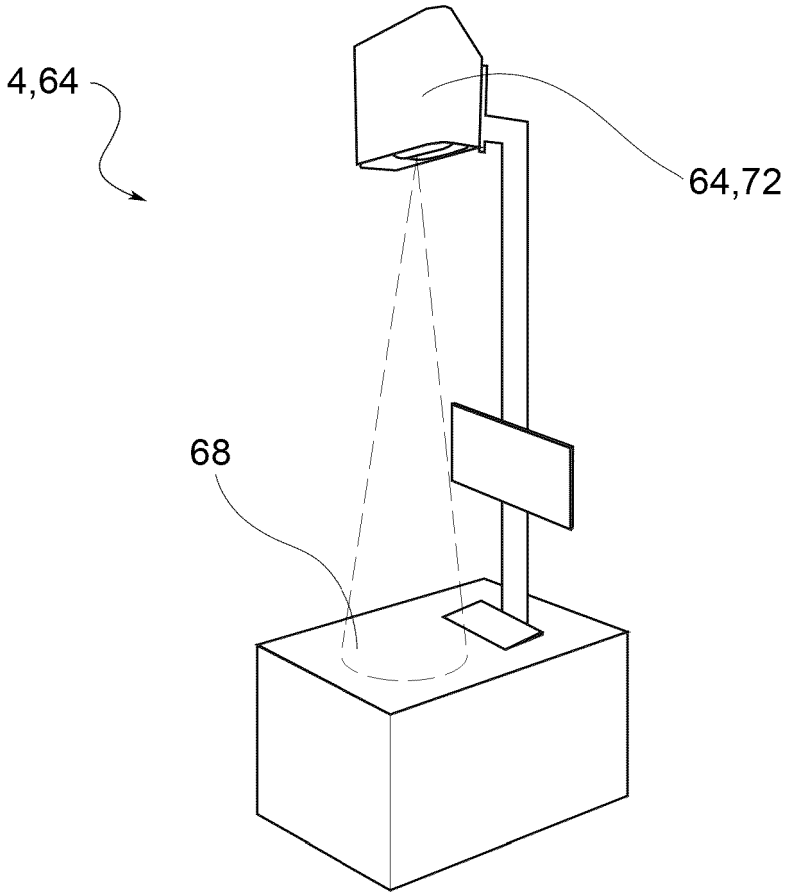

fig.5

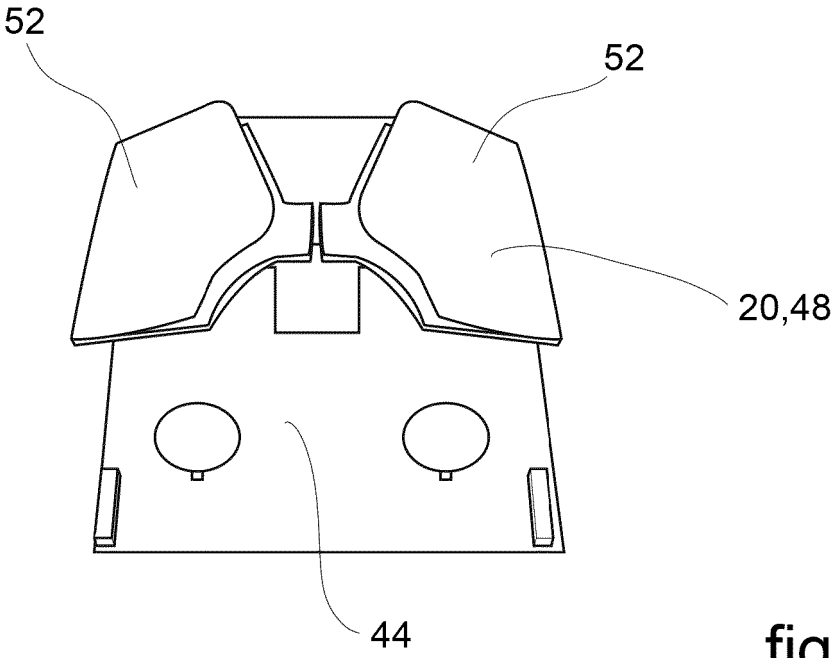

fig.6

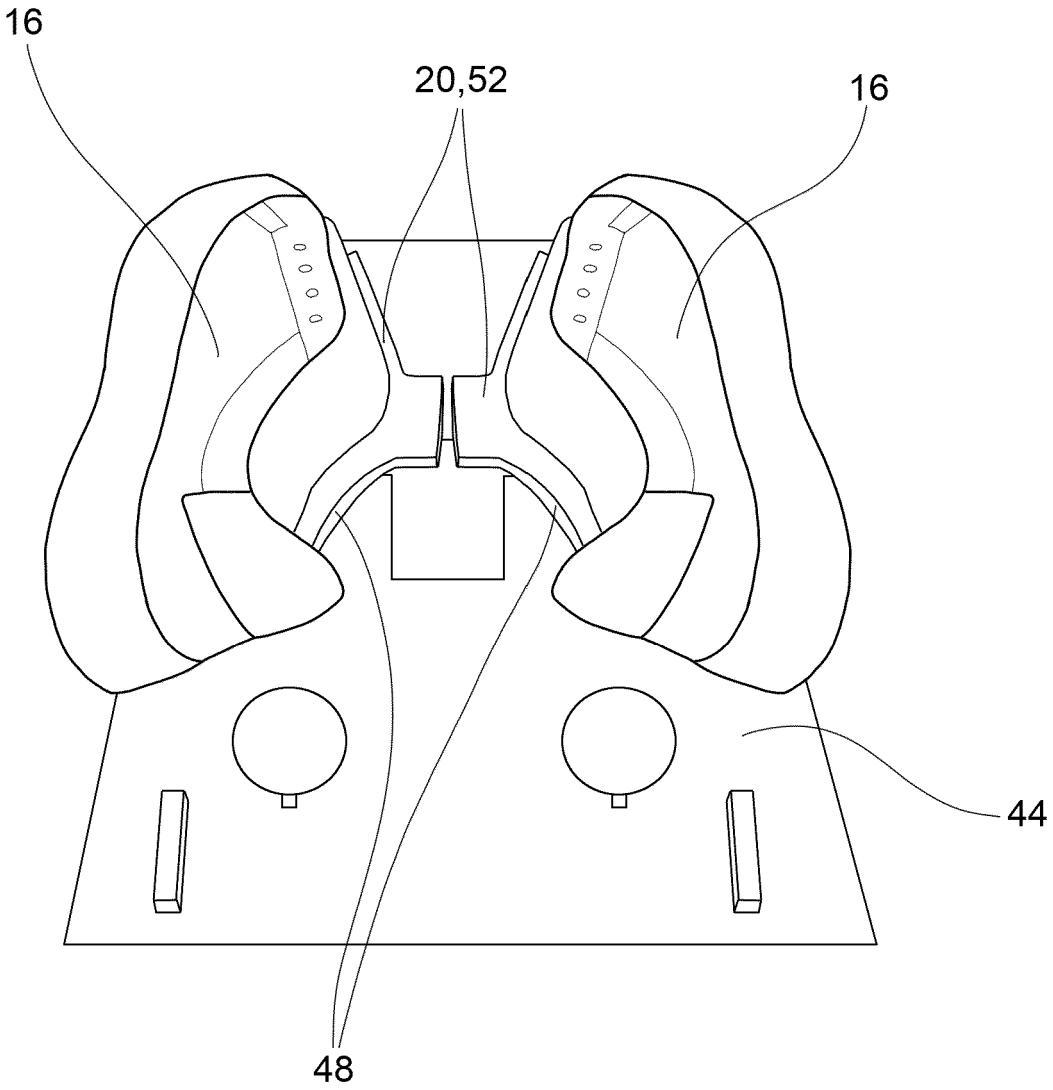

fig.7