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## (54) AUTOMOTIVE LIGHT

(57) Automotive light (1) comprising: a substantially basin-shaped rear casing (2); a front half-shell (3) which is arranged to close the mouth of the rear casing (2); one or more lighting assemblies (4, 5, 6) each of which emits light on command, and is located inside the rear casing (2) so as to selectively backlight a corresponding transparent or semi-transparent sector of the front half-shell (3); an LCD panel (10) that extends skimmed over, or is incorporated into, the front half-shell (3) so as to be crossed by the light also crossing the half-shell (3); and an electronic control unit (11) which is adapted to drive the LCD panel (10) so as to make, on command, the body of the LCD panel (10) transparent or opaque to the incident light.

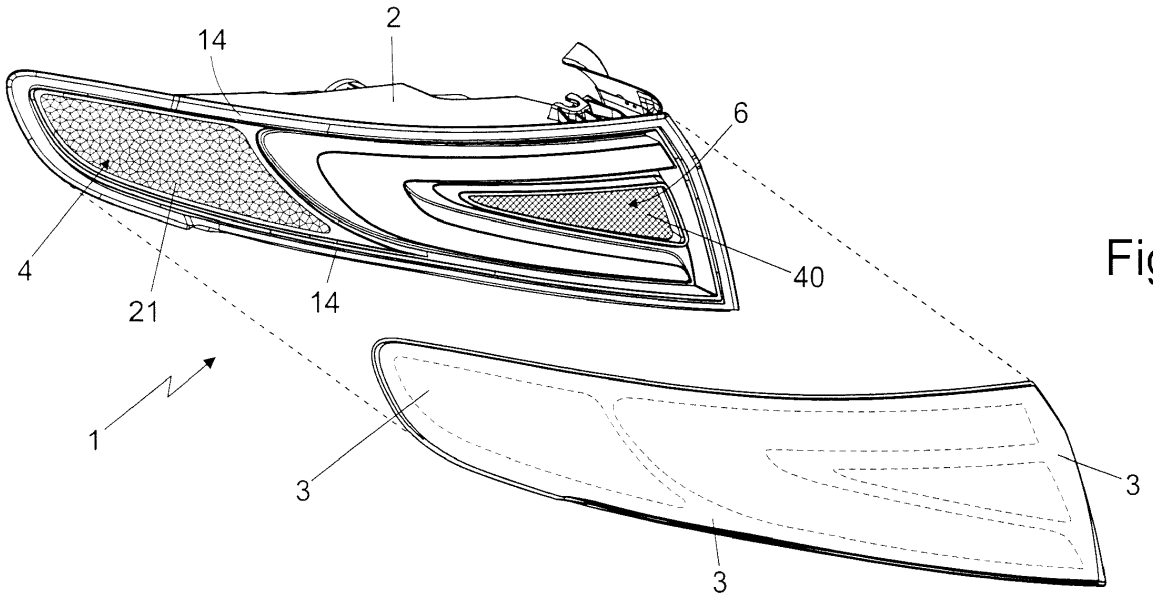


Fig. 1

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## Description

**[0001]** The present invention relates to an automotive light.

**[0002]** More specifically, the present invention preferably relates to a taillight for cars and similar vehicles, i. e. a lighting apparatus adapted to be incorporated in a motor vehicle with the function of signalling the position, sudden deceleration and/or turn direction of the vehicle, and/or with the function of lighting the area surrounding the vehicle. Use to which the following disclosure specifically refers without however any loss of generality.

**[0003]** As we know, taillights for cars and the like generally comprise: a rigid and substantially basin-shaped rear casing which is structured to be stably recessed into a compartment specially realized in the rear part of the vehicle bodywork; a front half-shell which is arranged to close of the mouth of the rear casing so as to surface outside the vehicle bodywork, and is provided with a plurality of transparent or semi-transparent sectors, generally of a different colour from one another; and a series of lighting assemblies which are located inside the casing, each immediately beneath a respective transparent or semi-transparent sector of the front half-shell, so as to be able to selectively backlight the superjacent transparent or semi-transparent sector of the front half-shell.

**[0004]** Usually each transparent or semi-transparent sector of the front half-shell is moreover exclusively associated with a specific light signal adapted to indicate the position of the vehicle, its sudden deceleration or the turning direction of the vehicle while driving, and each lighting assembly is specifically structured to emit, on command, a light beam that, once exited from the automotive light through the corresponding transparent or semi-transparent sector of the half-shell, meets the approval specifications (colour and light distribution) provided for this light signal.

**[0005]** In the up-to-date taillights, usually each lighting assembly is basically made up of one or more high-power LEDs (acronym of Light Emitting Diode) that are placed inside the rear casing, generally close to the bottom of the casing together with the relative control electronics; and of a light-guide body which is made of polymethylmethacrylate (PMMA) or other photoconductive material, and is placed inside the rear casing with a first end immediately adjacent to the LED(s) and a second end skimmed over the transparent or semi-transparent sector to be backlighted, in order to channel, by total internal reflection, the light emitted by the LED or LEDs up to the same transparent or semi-transparent sector of the half-shell.

**[0006]** Usually the second end of the light-guide body is also specifically structured/shaped so as to direct the light emitted by the LEDs towards the facing transparent or semi-transparent sector of the half-shell, so as to be able to backlight the whole transparent or semi-transparent sector of the half-shell in a substantially even manner.

**[0007]** Unfortunately, the front half-shell of the automotive light is always faced outside of the vehicle, leaving visible the various transparent or semi-transparent coloured sectors visible, with the aesthetic problems that this entails.

**[0008]** According to some people, in fact, the presence of the headlights and/or of the taillights in some way jeopardize the line/silhouette of the car.

**[0009]** Aim of the present invention is to realize automotive lights that, when not in use, camouflage with the vehicle bodywork.

**[0010]** In compliance with these aims, according to the present invention there is provided an automotive light as defined in claim 1 and preferably, though not necessarily, in any one of the depending claims.

**[0011]** The present invention will now be described with reference to the accompanying drawings illustrating a nonlimiting embodiment thereof, in which:

- Figure 1 is a partially exploded perspective view of an automotive light realized according to the teachings of the present invention;
- Figure 2 is an exploded perspective view of the backlighting system of the automotive light shown in Figure 1, with parts in transparency and parts removed for clarity; whereas
- Figures 3 and 4 are two front views of the automotive light shown in Figures 1 and 2, in two different operating configurations.

**[0012]** With reference to Figures 1 and 2, numeral 1 indicates as a whole an automotive light, i.e. a lighting apparatus particularly adapted to be placed on the front or rear part of the bodywork of a motor vehicle, with the function of emitting light signals adapted to indicate the position of the vehicle and/or the sudden deceleration of the vehicle and/or the turning direction of the vehicle while driving.

**[0013]** In other words, the automotive light 1 is adapted to be attached to the front or rear part of the bodywork of a car, van, truck, motorcycle or other similar motor vehicle, to perform the function of a headlight or taillight.

**[0014]** In the example shown, in particular, the automotive light 1 is preferably structured to be stably recessed into the rear part of the bodywork of a car or other similar motor vehicle.

**[0015]** In other words, the automotive light 1 is a taillight for cars and the like.

**[0016]** Obviously, in a different embodiment the automotive light 1 could also be structured so as to simply cantilever fixed to the rear part of the vehicle bodywork (not shown).

**[0017]** With reference to Figures 1 and 2, the automotive light 1 firstly comprises: a rear casing 2, substantially rigid and preferably made of plastic material, which is substantially basin-shaped, and is preferably structured so as to be at least partially recessed into a seat specially formed in the rear part of the vehicle bodywork (not shown); and a front half-shell 3, substantially rigid and

preferably made of plastic material, which is arranged to close the mouth of rear casing 2, preferably so as to be able to surface outside the vehicle bodywork; and one or more electrically-powered lighting assemblies, which emit light on command and are located inside the casing each immediately beneath a respective transparent or semi-transparent sector of the front half-shell 3, so as to be able to selectively backlight the superjacent transparent or semi-transparent sector of front half-shell 3.

**[0018]** In the example shown, in particular, front half-shell 3 is preferably provided with at least three transparent or semi-transparent sectors, optionally also coloured.

**[0019]** Therefore automotive light 1 is preferably provided with at least three electrically-powered lighting assemblies 4, 5 and 6, each of which is arranged inside the rear casing 2 in a position to be able to backlight a corresponding transparent or semi-transparent part of front half-shell 3, preferably separately and independently from the other lighting assemblies of the automotive light.

**[0020]** In addition, in the example shown the rear casing 2 is preferably made of an opaque plastic material, preferably via an injection moulding process. The front half-shell 3, on the other hand, is preferably made of a transparent or semi-transparent plastic material, such as for example polycarbonate or polymethyl-methacrylate, also in this case preferably via an injection moulding process.

**[0021]** With reference to Figures 1 and 2, in addition, the automotive light 1 also comprises: a thin intermediate LCD panel 10 (acronym of Liquid Crystal Display) which extends skimmed over the front half-shell 3, preferably substantially for the whole extent of the same front half-shell 3, so as to be crossed by the light crossing the front half-shell 3; and an electronic control unit 11 which is located inside the rear casing 2, preferably behind the various lighting assemblies 4, 5 of the automotive light, and is adapted to drive the LCD panel 10 so as to make, on command, the body of the LCD panel transparent or opaque to the incident light.

**[0022]** In more detail, the intermediate LCD panel 10 is preferably placed inside the rear casing 2 attached to the rear face of front half-shell 3, and is capable of assuming, on command and alternately, a transparent configuration to the incident light and an opaque configuration to the incident light.

**[0023]** In the transparent configuration, the LCD panel 10 allows the light emitted by the single lighting assemblies 4, 5, 6 to freely come out from the front half-shell 3, and to the exterior/ambient light to freely enter/penetrate into the automotive light 1 through the front half-shell 3.

**[0024]** When transparent to the incident light, therefore the intermediate LCD panel 10 allows the various lighting assemblies 4, 5, 6 of automotive light 1 to backlight the respective transparent or semi-transparent sectors of front half-shell 3.

**[0025]** In the opaque configuration, on the other hand, the LCD panel 10 prevents the light emitted by the individual lighting assemblies 4, 5, 6 from coming out of front half-shell 3, and the external/ambient light to enter/penetrate into the automotive headlight 1 through front half-shell 3.

**[0026]** When opaque to the incident light, therefore, the LCD panel 10 is able to substantially hide all the internal components of automotive light 1, giving the front half-shell 3 a predetermined opaque colour which is preferably more or less uniform throughout the whole extent of the front half-shell 3.

**[0027]** The electronic control unit 11, in turn, is preferably programmed/configured to turn/place the LCD panel 10 in the transparent configuration solely when the car or other motor vehicle mounting the automotive light 1 has the engine running and/or is moving.

**[0028]** In other words, the electronic control unit 11 is preferably programmed/configured so as to turn/place the LCD panel 10 in the transparent configuration when it receives a predetermined electric or electronic control signal. This control signal is preferably associated with the starting or running of the engine of the car or other vehicle mounting the automotive light 1.

**[0029]** In addition or alternative, the electronic control unit 11 may also be programmed/configured so as to turn/place the LCD panel 10 in the transparent configuration when any of the lighting assemblies 4, 5 and 6 of automotive light is switched on/activated to backlight the corresponding semi-transparent or transparent sector of front half-shell 3.

**[0030]** With reference to Figures 1 and 2, in the example shown, in particular, the intermediate LCD panel 10 has a curved shape substantially complementary to the rear face of the front half-shell 3, and is preferably divided into a multitude of small-size basic sectors or pixels, preferably arranged in a matrix configuration, each of which is able to, selectively and alternately, allow or prevent the light to pass through the same pixel.

**[0031]** In other words, each pixel of the LCD panel 10 can be selectively and alternatively transparent or opaque to the light passing through the front half-shell 3.

**[0032]** Preferably finally the LCD panel 10 has a known TFT architecture (acronym of Thin Film Transistor).

**[0033]** In addition the LCD panel 10 can be a cholesteric liquid crystal display (ChLCD).

**[0034]** Being an optoelectronic device widely known and easily available on the market, the LCD panel 10 won't be further described.

**[0035]** The electronic control unit 11, in turn, is preferably adapted to control the transparent or opaque state of the individual pixels of the intermediate LCD panel 10, so as to be able to selectively allow or prevent the incident light to pass through limited single portions of LCD panel 10.

**[0036]** In more detail, LCD panel 10 is preferably divided into a plurality of active portions 10a each of which is aligned to a respective transparent or semi-transparent sector of front half-shell 3, and preferably has a shape substantially equal to that of the same transparent or semi-transparent sector.

**[0037]** The electronic control unit 11, in turn, is preferably adapted to control the transparent or opaque state of each active portion 10a of LCD panel 10, or rather of the pixel (s) inside each active portion 10a of LCD panel 10, so as to selectively allow or prevent the light to pass through the same active portion 10a, separately and independently with respect to the other active portions 10a of the same LCD panel 10.

**[0038]** In other words, electronic control unit 11 is capable of controlling the passing of the light through each individual transparent or semi-transparent sector of front half-shell 3 separately and independently from the other transparent or semi-transparent sectors of front half-shell 3.

**[0039]** Preferably, the electronic control unit 11 is moreover adapted to also synchronise the switching of the individual active portions 10a of LCD panel 10 with the activation/ turning on of the single lighting assemblies 4, 5 and 6 of automotive light 1.

**[0040]** In more detail, the electronic control unit 11 is preferably configured to cause the switching of each active portion 10a of LCD panel 10 from the opaque to the transparent configuration when the corresponding lighting assembly 4, 5 and 6 is activated/turned on, and to cause the switching of the same active portion 10a of LCD panel 10 from the transparent to the opaque configuration when the corresponding lighting assembly 4, 5 and 6 is deactivated/ switched off.

**[0041]** In other words, the electronic control unit 11 is preferably programmed/configured to turn/place the single active portions 10a of LCD panel 10 in the transparent configuration when it receives a predetermined electric or electronic control signal. This control signal preferably corresponds to the electric or electronic signal of switching on/off the lighting assembly 4, 5 or 6.

**[0042]** With particular reference to Figures 1 and 2, preferably the lighting assembly 4 in turn comprises: a light bulb 20 or the like, which is placed inside the rear casing 2, preferably, though not necessarily, close to the bottom of rear casing 2; and a reflector body (not shown) preferably with a cup-shaped structure, which is placed inside the rear casing 2 so as to at least partially surround the light bulb 20, and is, in turn, structured to direct the light emitted by the light bulb 20 towards the corresponding and immediately superjacent transparent or semi-transparent sector of front half-shell 3.

**[0043]** Preferably the lighting assembly 4 additionally also comprises a diffusing body 21 preferably with a platelike structure, which is located between the reflector body and the transparent or semi-transparent sector of front half-shell 3, and is structured to scatter the light directed towards the front half-shell 3 preferably substantially evenly over the whole extent of the corresponding transparent or semi-transparent sector of the half-shell.

**[0044]** The lighting assembly 5, on the other hand, preferably comprises: a series of LEDs 30 (acronym of Light Emitting Diode) that are placed inside the rear casing 2, preferably spaced one beside the other so as to form at least one row of LED; and a concave reflector body 31, which is arranged inside the rear casing 2 at the LEDs 30, and is structured to direct the light emitted by the various LEDs 30 towards the corresponding and immediately superjacent transparent or semi-transparent sector of front half-shell 3.

**[0045]** Preferably, the LEDs 30 are moreover fixed on one or more (two in the example shown) support boards 32 that preferably also host the electronic power-supply and/or control circuits of the same LEDs (not shown), and are placed inside the rear casing 2 preferably close to the bottom of the casing 2.

**[0046]** With reference to Figures 1 and 2, lastly the lighting assembly 6 preferably comprises: a light-guide body 40 which is made of a photoconductive material, is placed inside the rear casing 2 with its front end facing and/or adjacent to the corresponding transparent or semi-transparent sector of front half-shell 3, and with its rear end facing the bottom of rear casing 2; and one or more LEDs 41 (acronym of Light Emitting Diode) that are arranged inside the rear casing 2, close or adjacent to the rear end of the light-guide body 40, so as to direct the emitted light inside the light-guide body 40.

**[0047]** The light then travels within the guide-light body 40 by total internal reflection, and comes out in known manner from the front end of light-guide body 40 directed towards the facing front half-shell 3.

**[0048]** In the example shown, in particular, the guide-light body 40 is preferably made of polymethylmethacrylate (PMMA), preferably via an injection moulding process.

**[0049]** Obviously, the guide-light body 40 can also be made of polycarbonate or other similar plastic material.

**[0050]** The LED or LEDs 41, on the other hand, are preferably placed on a supporting board 42 that preferably also hosts the electronic power-supply and/or control circuits of the LEDs (not shown), and is arranged inside the rear casing 2 preferably adjacent to the rear end of guide-light body 40.

**[0051]** With reference to Figures 1 and 2, preferably the automotive light 1 finally comprises an opaque spacer mask 14 preferably with a plate-like structure, which is interposed between the lighting assemblies 4, 5 and 6 and the front half-shell 3, or rather the LCD panel 10, and is provided with a series of pass-through openings each of which is aligned to a respective transparent or semi-transparent sector of front half-shell 3, and preferably furthermore substantially copies the shape of the immediately superjacent transparent or semi-transparent sector.

**[0052]** Spacer mask 14 is adapted to hide to sight some components of the automotive light 1.

**[0053]** Preferably, spacer mask 14 is furthermore adapted to directly support one or more components of the lighting assembly 4 and/or 5 and/or 6.

**[0054]** In the example shown, in particular, the spacer mask 14 is preferably made of opaque plastic material, and is preferably structured to support the diffusing body

21 of lighting assembly 4 and/or the reflector body 31 of lighting assembly 5 and/or the guide-light body 40 of lighting assembly 6.

**[0055]** Operation of the automotive light 1 is easily inferable from what is written above.

**[0056]** With reference to Figures 1 and 4, when intermediate LCD panel 10 is transparent to the incident light, the light emitted by the individual lighting assemblies 4, 5 of automotive light 1 can freely pass through the front half-shell 3, allowing the automotive light 1 to emit the light signals for automotive use for which it was specifically created.

**[0057]** With reference to Figure 3, when instead the LCD panel 10 is opaque to the incident light, the front half-shell 3 acts like an opaque body/screen more or less of a uniform colour, which hides to sight all the components of automotive light 1 located inside the rear casing 2.

**[0058]** Obviously the colour of front half-shell 3 when the LCD panel 10 is opaque to the incident light, is a function of the material constituting the front half-shell 3 and the optoelectronic structure of LCD panel 10.

**[0059]** In more detail, experimental tests have shown that the front half-shell 3 becomes black or dark grey when LCD panel 10 has an optoelectronic structure like that of traditional monochrome active-matrix LCD displays with TFT architecture.

**[0060]** Conversely, using an LCD panel 10 with an optoelectronic structure like that of the cholesteric liquid crystal displays (ChLCD), it is possible to give the front half-shell 3 a predetermined opaque colour.

**[0061]** The advantages associated with the particular structure of automotive light 1 are considerable.

**[0062]** Firstly, thanks to the presence of the intermediate LCD panel 10, the front half-shell 3 can assume a uniform opaque colour that, when equal or similar to that of the vehicle body, allows the automotive light 1 to be more or less effectively camouflaged.

**[0063]** In addition, the possibility of making selectively transparent only the parts of front half-shell 3 that emit the various light signals, makes perception of the same light signals more immediate with all the advantages this entails.

**[0064]** It is finally clear that modifications and variations may be made to the automotive light 1 described above without however departing from the scope of the present invention.

**[0065]** For example the LCD panel 10, instead of being located on the rear face of front half-shell 3, may be incorporated into the front half-shell 3, preferably substantially for the whole extent of front half-shell 3.

## Claims

1. A automotive light (1) comprising: a substantially basin-shaped rear casing (2); a front half-shell (3) which is arranged to close the mouth of the rear casing (2); and one or more lighting assemblies (4, 5, 6) each of which emits light on command, and is located inside the rear casing (2) so as to be able to selectively backlight a corresponding transparent or semi-transparent sector of the front half-shell (3);
the automotive light (1) **being characterised by** additionally comprising: a LCD panel (10) that extends skimmed over, or is incorporated into, the front half-shell (3) so as to be crossed by the light crossing also the front half-shell (3); and an electronic control unit (11) which is adapted to drive the LCD panel (10) so as to make, on command, the body of the LCD panel (10) transparent or opaque to the incident light.

2. Automotive light according to Claim 1, wherein the LCD panel (10) occupies substantially the entire extent of the front half-shell (3).

3. Automotive light according to Claim 1 or 2, wherein the LCD panel (10), when opaque to the incident light, gives a predetermined opaque colour to the front half-shell (3), so as to substantially hide to sight the components located inside the rear casing (2).

4. Automotive light according to any one of the preceding claims, wherein the front half-shell (3) is provided with a plurality of transparent or semi-transparent sectors, each of which is backlighted by a respective lighting assembly (4, 5, 6).

5. Automotive light according to Claim 4, wherein the LCD panel (10) is divided into different active portions (10a) each of which is aligned to a respective transparent or semi-transparent sector of the front half-shell (3); and wherein the electronic control unit (11) is adapted to separately control the transparent or opaque state of each individual active portion (10a) of the LCD panel (10).

6. Automotive light according to Claim 5, wherein each active portion (10a) of the LCD panel (10) has a shape substantially equal to that of the corresponding transparent or semi-transparent sector of the front half-shell (3).

7. Automotive light according to any one of the preceding claims, wherein the electronic control unit (11) is configured to turn/place the LCD panel (10), or selectively the individual active portions (10a) of the LCD panel (10), in the transparent configuration when it receives a predetermined control signal.

8. Automotive light according to Claim 6, wherein said control signal is associated with the starting or running of the engine of the vehicle in which the automotive light (1) is mounted.

**9.** Automotive light according to any one of the preceding claims, wherein the electronic control unit (11) is located inside the rear casing (2).

**10.** Automotive light according to any one of the preceding claims, wherein the LCD panel (10) has a TFT architecture.

**11.** Automotive light according to any one of the preceding claims, wherein the LCD panel (10) is a cholesteric liquid crystal display (ChLCD).

Fig. 1

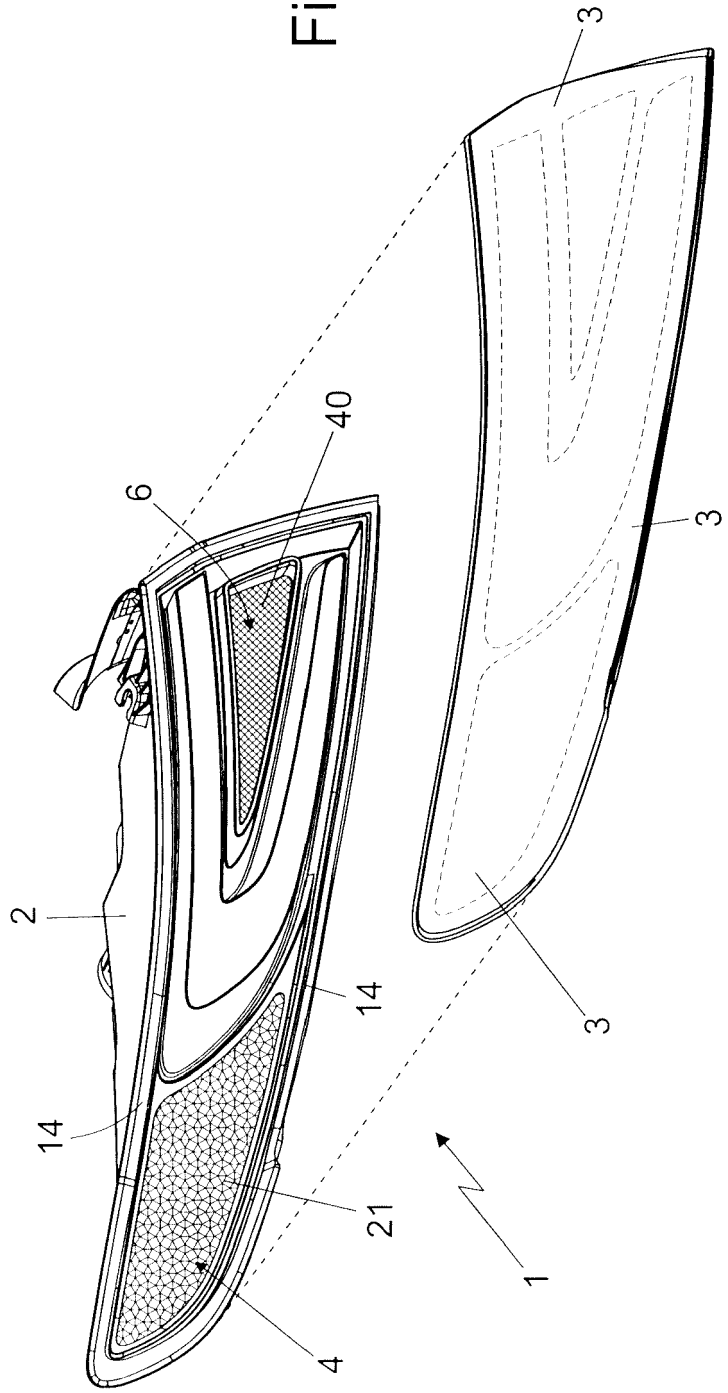



Fig. 4

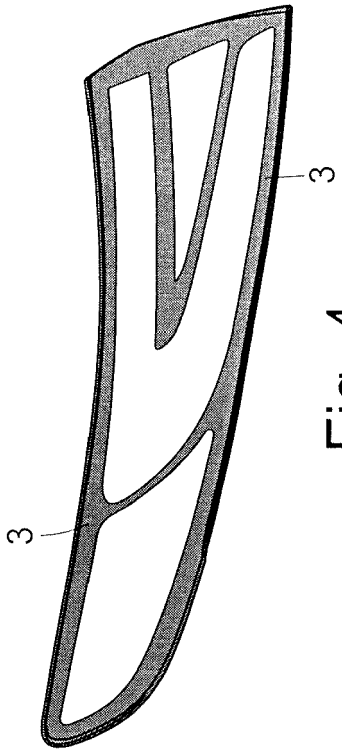
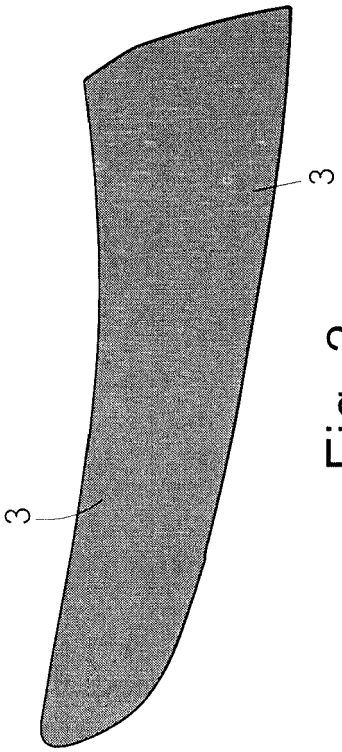



Fig. 3



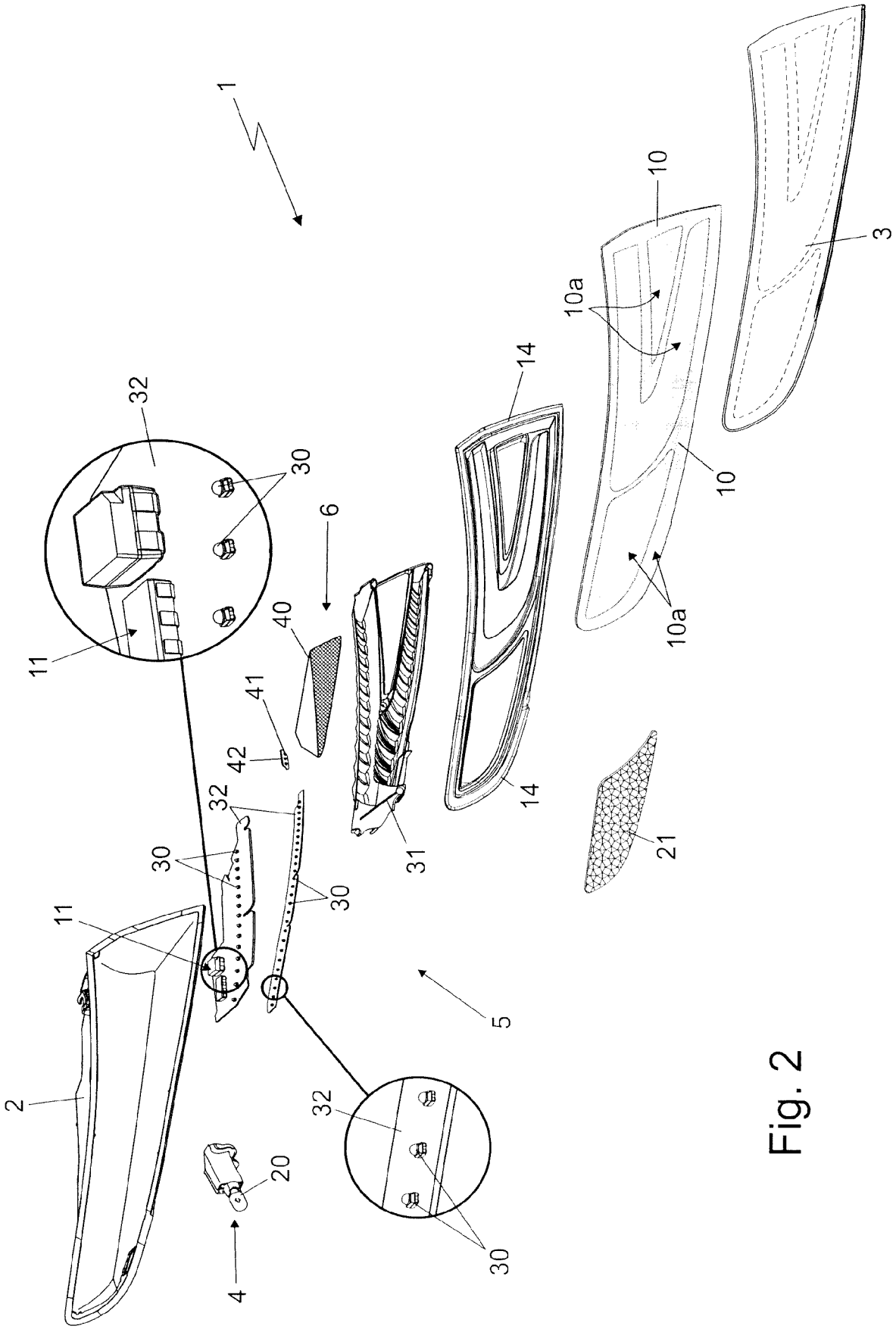

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Fig. 2

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# EUROPEAN SEARCH REPORT

Application Number
EP 18 42 5046

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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 |
|---|---|---|
| Munich | 22 January 2019 | Sarantopoulos, A |

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