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(71) Applicant: **D.L.C. S.r.l.** [IT/IT]; Via Tiziano, 19, I-20145 Milano (IT).

(72) Inventor: **DAL LAGO, Alberto**; Corso Plebisciti, 9, I-20129 MILANO (IT).

(74) Agent: **MARTEGANI, Franco**; Franco Martegani S.r.l., Via Carlo Alberto, 41, I-20900 Monza (IT).

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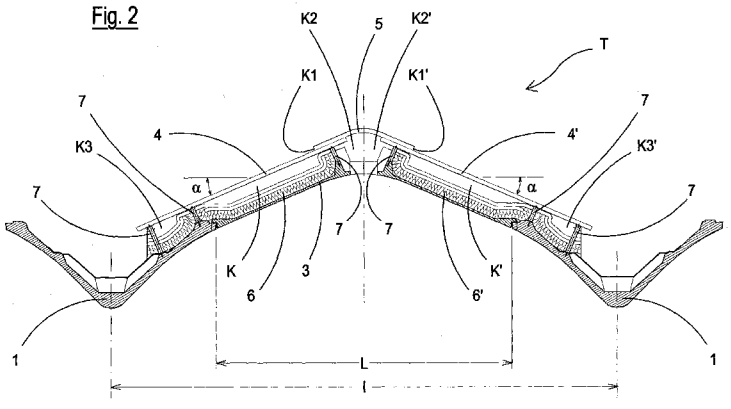
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(54) Title: STRUCTURE WITH PERFECTED CUPELS ALTERNATING WITH ROOF-TILES FOR PREFABRICATED INDUSTRIAL COVERINGS

Fig. 2




(57) Abstract: Cupels (T;SH), interposed between roof-tiles (1) form a covering (C) structure (SC) of a building, and support a superstructure composed of flat grecque plates (3',3"; 8) fixed with self-threading screws to a particular insulating strip. The cupels assembled in a tilted position with respect to the horizontal, form interspaces (K1, K3; K2, K4; K1', K2') between the grecque plates and insulating panels, whereby : - the accumulation of heat beneath the covering sheets is removed during the summer, with air ventilation the formation of internal condensates is avoided during the winter - fire fumes are expelled through the top slit of the cupels - the internal air exchange through the slit of the cupels is effected by remote control - a diffused lighting is obtained by closing the slit on the tympan cupel with a polycarbonate plate surmounted by a top translucent plate.

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STRUCTURE WITH PERFECTED CUPELS ALTERNATING WITH ROOF-TILES FOR PREFABRICATED INDUSTRIAL COVERINGS

The present invention relates to a prefabricated concrete covering structure produced with special cupels alternating with roof-tiles.

The present invention is advantageously used by adopting special cupels alternating with roof-tiles, in order to produce a particular covering for industrial buildings, to which the following description will make explicit reference, at the same time maintaining its generic characteristics.

In the production of coverings for prefabricated industrial buildings, the use of structures with cupels interposed between roof-tiles is known and frequent, obtaining a configuration in which, whereas the roof-tiles are fixed, there can be various types of cupels having different functionalities.

The objective of the present invention is to provide particular cupels which allow numerous advantages to be obtained.

In particular, a first objective of the present invention is to provide cupels which support the waterproofing layer consisting of grecque plates so that, due to its inclination, with an angle ranging from 20° to 25° with respect to the horizontal, an

insulator having a significant thickness can be positioned between cupels and grecque plates, with the formation of an air chamber above the insulator, naturally ventilated, which, during the summer, is capable of expelling overheated air from above and substituting it below with fresh air coming from the outside and, during the winter, is capable of preventing condensates inside the insulator.

A second objective of the present invention is to be able to modify the standard dimensions of the cupels to allow them to be adapted to the dimensions of the end roof-tiles, out of module.

A third objective of the present invention is to provide a particular strip, highly insulating, with a significant height, perforated for the passage of air and capable of allowing the grecque plates to be fixed with self-threading screws.

A fourth objective of the present invention is to provide slits in the upper part of the cupels, which can be opened by remote-control to allow the exchange of internal air.

A fifth objective is to apply devices to the cupels, which have a high flame-resistance, whereby, in the case of fire, the slits can serve to evacuate the fumes.

A sixth objective is to create light sockets for soft lighting, using the slits provided for the exchange of air.

A seventh objective, in order to have more consistent lighting, is to produce openings in the cupels to create roof-windows which however prevent anyone who is carrying out maintenance interventions on the roof from falling from a height.

An eighth objective is to provide shed cupels which have a cantilever above the windows, which prevents the entrance of solar rays also for various orientations of up to 30° with respect to the North.

A ninth objective is to create, with shed cupels, an extensive flat surface tilted by 20° to 25° with respect to the horizontal, on which solar panels can be positioned (photovoltaic or for hot water).

The above objectives are achieved by cupels having the characteristics specified in the enclosed claims.

The structural and functional characteristics of the present invention and its advantages with respect to the known art will appear even more evident from the enclosed claims, and in particular from the following description, referring to the enclosed drawings, which show the schematizations of some preferred but non-limiting embodiments of the cupels, in which:

- figure 1 represents a perspective view of a covering for an industrial building with roof-tiles alternating with various types of cupels;

- figure 2 is a transversal section of a first type of cupel alternating with roof-tiles which is called "tympan cupel";

- figure 3 is an enlarged detail of the section of figure 2;

- figure 4 is a transversal section of a second type of cupel alternating with roof-tiles which is called "shed cupel";

- figure 5 is an enlarged detail of the section of figure 4;

- figure 6 is a perspective view of construction elements common to the two types of cupels;

- figures 7 to 13 are transversal sections which show a series of advantages according to the present invention.

With reference to figure 1, C indicates as a whole a prefabricated structure for the covering of a building for industrial use (known and not illustrated) with module mesh M and interaxis I.

The covering C structure SC is of the type comprising a plurality P of roof-tiles 1 (in this case with a common "V" section) having a length which is

such as to satisfy the module M and beams (2) on which the same roof-tiles 1 are fixed, in a known way and with an interaxis I.

According to what is illustrated in the enclosed figures from 1 to 5, either a tympan cupel T or alternatively a shed cupel SH is envisaged, with a concrete structure 3, between two roof-tiles 1 for covering the span L.

In the embodiment illustrated in figures 2 and 3, the tympan cupel T has two flat metallic grecque plates 4 and 4' tilted with respect to the horizontal by an angle $\alpha$ ranging from 20° to 25°, fixed to supporting strips 7.

Two ventilated interspaces K, K' are created between the two flat metallic grecque plates 4, 4' and the insulator 6,6' (polystyrene) resting on the tympan cupel T.

Said two flat metallic grecque plates 4, 4' are surmounted at the top by a third metallic grecque plate 5 having a curved profile with a superimposed grecque offset with respect to the grecques of the two plates 4, 4' themselves.

The offsetting allows a double volume of air to be emitted with respect to that which would pass through the bends of the grecque if the overlapping were

produced with a flat sheet. In this way, "vents" K1 and K1' are formed between the top plate 5 and the plates 4, 4', from which, in the summer, the air heated in the ventilated interspaces K, K' is able to rise to the higher points K2 and K2' to be vented through K1 and K1' following the trajectory of the arrows F and F' towards the outside, drawing fresh air from the lower points K3 and K3'.

In the winter, any danger of internal condensates, due to the low outside temperatures, is prevented in the insulator 6,6' in contact with the air in the interspaces K, K'.

The plate 5 can also be produced, not only with grecque sheets, but also with translucent grecque plates made of fiberglass.

A special high-density polystyrene strip 7, figure 6, surmounted by an omega-shaped metallic profile 8, is perforated with pass-through holes 9 for the whole of its length and is firmly anchored with pegs 10 to the concrete structure 3 of the tympan cupel T.

Each flat grecque plate 4, 4' is fixed to the metallic profile 8 of the strip 7 with self-threading screws 11, figure 3.

In the embodiment illustrated in figures 4 and 5, the shed cupel SH comprises, analogously to the tympan

cupel T, a flat metallic grecque plate 12 fixed to strips 13 completely identical to those (7) previously described for the tympan cupel T.

The flat metallic grecque plate 12 has the same inclination $\alpha$ as the plates 4, 4' which surmount the tympan cupel T.

A ventilated interspace K4 is created between the flat metallic grecque plate 12 and the insulator 14 resting on the shed cupel SH.

Said flat metallic grecque plate 12 is surmounted at the top by a second metallic grecque plate 16 having a curved profile with a superimposed grecque offset with respect to the grecque of the plate 12 analogously to the top late 5 and plates 4,4' of the tympan cupel T.

In this way, a "vent" K5 is formed between the top plate 16 and the metallic plate 12, from which, in the summer, the air heated in the ventilated interspaces K4, is able to rise to the higher point K6 to be vented through K5 following the trajectory of the arrows F1 towards the outside, drawing fresh air from the lower point K7.

In the winter, any danger of internal condensates, due to the low outside temperatures, is prevented in the insulator 14 in contact with the air in the

ventilated interspace K4.

According to what is better illustrated in figures 2 to 5, the same advantages previously analyzed can be obtained with the cupels T and SH of the present invention, surmounted by flat grecque plates 4,4',12 with a certain inclination α, with the above-mentioned ventilated interspaces K,K',K4.

The following functional variants to the standard cupels of module M m 6 in order to respect the interaxis I of the roof-tiles 1 and span L m 3.50 can be obtained from the enclosed figures and above description:

- compensation tympan cupel T, obtained from the same caisson as the standard tympan cupel T of module M m 6, for end roof-tiles, with outer modules ranging from 1.50 m to 3.50 m which concentrate the outer module at the heads of the building.
- tympan cupel T and shed cupel SH, with an air chamber tilted at an angle α for the ventilation of the covering.
- tympan cupel T, figure 7, with a top slit 16 which can be opened and closed by remote control for creating internal air exchange.
- shed cupel SH, figure 8, with a top slit 17 which can be opened and closed by remote control for creating

internal air exchange.

- the windows of the shed cupel can therefore be produced with fixed frames, avoiding openable frames for providing ventilation.

- tympan cupel T, figure 9, with a top slit 18 which, in the case of fire, automatically opens to become a fume evacuator.

- shed cupel SH, figure 10, with a top slit 19 which, in the case of fire, automatically opens to become a fume evacuator.

- tympan cupel T, figure 11, with a top slit 20 with opening and closing produced with a transparent and insulating polycarbonate plate 21, surmounted by a top translucent plate made of fiberglass 22, so as to obtain a reduced natural lighting but with a minimum heat dispersion.

- tympan cupel T, figure 12, with inserted roof-lighting obtained by substituting the grecque sheets 3,3' with translucent plates 23,23' and positioning, in the intrados of the cupel, polycarbonate plates 24 in the blind concrete part which is no longer produced, leaving however the normal reinforcing net 25 for safety purposes to prevent falling from a height.

- shed cupel SH, figures 4 and 5, having the same inclination $\alpha$ as the tympan cupel T and with a

cantilever 26 which protects the frame applied to the cupel from rain and hail, and prevents the direct entry of solar rays also for orientations other than the South, of up to ±30°.

- shed cupel SH, figure 13, suitable for having an extensive flat surface over 6 meters of interaxis of the roof-tiles, which covers 80% of the covering, where three modular elements of 1.60 m of photovoltaic solar panels 27 correctly oriented towards the South, and with an optimum inclination, ranging from 20° to 25° with respect to the horizontal, can be positioned.

CLAIMS

1) Cupels (T;SH) alternating with roof-tiles (1) of a covering (C) structure (SC) of a building, surmounted by a flat grecque plate (3',3";8), positioned, with a certain inclination with respect to the horizontal, above an insulator (5;9) for forming ventilated interspaces (K1,K3;K2,K4;K1',K2') through which the outside air flows.

2) The structure according to claim 1, characterized in that it comprises a tympan cupel (T), said tympan cupel (T) being defined by two of said grecque plates (3',3") rectilinear and tilted with respect to each other, each with an inclination with respect to the horizontal; said two plates (3',3") being connected to each other by a sheet (4) having a curved profile, partially superimposing the two sheets (3',3") but with offset grecques so as to double the volume of air flowing in the interspace.

3) The structure according to claim 1, characterized in that it comprises a shed cupel (SH); said shed cupel (SH) being defined by one of said grecque plates (8) surmounted at the upper end by a sheet with offset grecques so as to double the volume of air flowing in the interspace.

4) The structure according to claim 2, characterized in that said sheet (4) is made of polycarbonate.

5) The structure according to claim 2, characterized in that a particular tympan cupel (T) can be produced, out of module, i.e. having a variable light, with which it is possible to obtain compensation cupels between the end roof-tiles (1).

6) The structure according to any of the previous claims, characterized in that it comprises, in combination, tympan cupels (T) and shed cupels (SH) alternating with roof-tiles (1) on which a special insulating strip (7) of high-density polystyrene is fixed, surmounted by an omega-shaped plate (8), having pass-through holes (9) for ventilation, on which the covering grecque plates are fixed by means of self-threading screws (11).

7) The structure according to any of the previous claims, characterized in that it comprises tympan cupels (T) or shed cupels (SH) alternating with roof-tiles (1), wherein a ventilated air chamber is situated under the covering plates, tilted and sustained by the insulating strip, which, in the summer, expels hot air from above drawing fresh air from below, and, in the winter, prevents the formation of internal condensates.

8) The structure according to any of the previous claims, characterized in that it comprises tympan cupels (T) or shed cupels (SH) alternating with roof-tiles (1), characterized by a slit which, positioned in the upper part, can be opened and closed by remote control to ensure the exchanging of internal air.

9) The structure according to any of the previous claims, characterized in that it comprises tympan cupels (T) or shed cupels (SH) alternating with roof-tiles (1), characterized by a slit positioned in the upper part, which, in the case of fire, opens for evacuating the fumes.

10) The structure according to claim 9, characterized in that it comprises shed cupels (SH) alternating with roof-tiles (1), wherein the slit for

exchanging the internal air allows much more economical permanent fixtures, i.e. not openable, to be asembled.

11) The structure according to any of the previous claims, characterized in that it comprises tympan cupels (T) alternating with roof-tiles (1), characterized by a slit at the top with a closure obtained with an insulating polycarbonate sheet, surmounted by a translucid sheet made of fibreglass which connects with the grecque plates ensuring a diffused zenithal surface illumination of about 4% of the surface covered.

12) The structure according to any of the previous claims, characterized in that it comprises tympan cupels alternating with roof-tiles, for inserted illumination, characterized by having four perforated surfaces in each cupel, with a galvanized net incorporated in the casting for safety purposes against falling from above, with polycarbonate sheets in the intrados having various air chambers for ensuring good insulation, and flat translucid grecque plates made of fibreglass, in the extrados, in substitution of the grecque plates.

13) The structure according to any of the previous claims, characterized in that it comprises cantilever shed cupels, alternating with roof-tiles, to which a fixture with structural uprights is applied, produced with polycarbonate sheets having various air chambers to ensure good insulation. The cantilever protects the fixture from rain and hail and avoids the direct entrance of the sun, also for orientations of the shed having angulations of up to ±30° with respect to the North.

14) The structure according to any of the previous claims, characterized in that it comprises shed cupels, alternating with roof-tiles, which, with the cantilever on one side and the extension of the grecque plate on the other, allow a significant flat surface facing South to be obtained, with an inclination of 20° to 25° on the horizontal and on which solar panels can be positioned which can occupy as much as 80% of the total surface covered.

15) A tympan cupel when used for producing a structure according to any of the claims 1-14.

16) A shed cupel when used for producing a structure according to any of the claims 1-14.

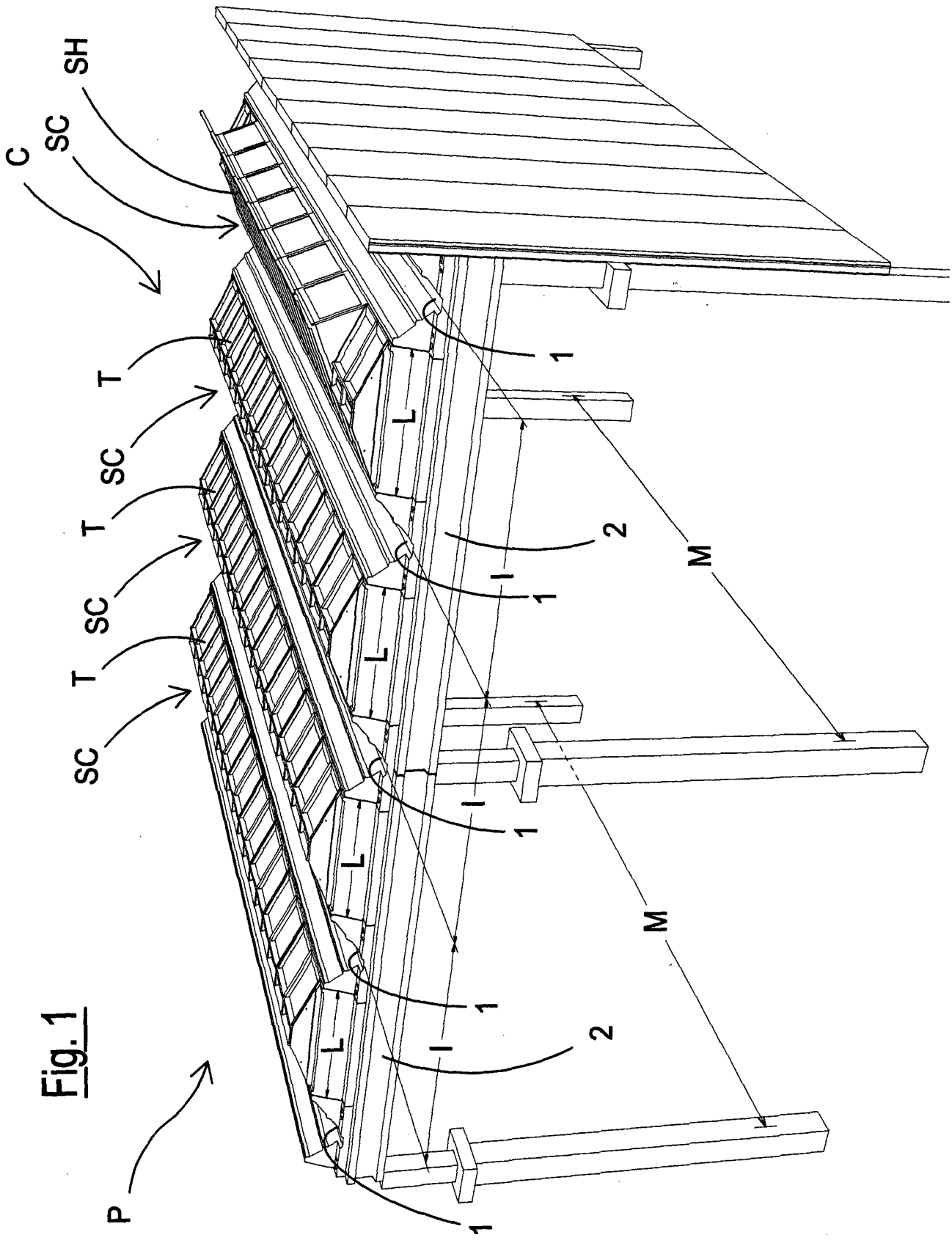



Fig. 1

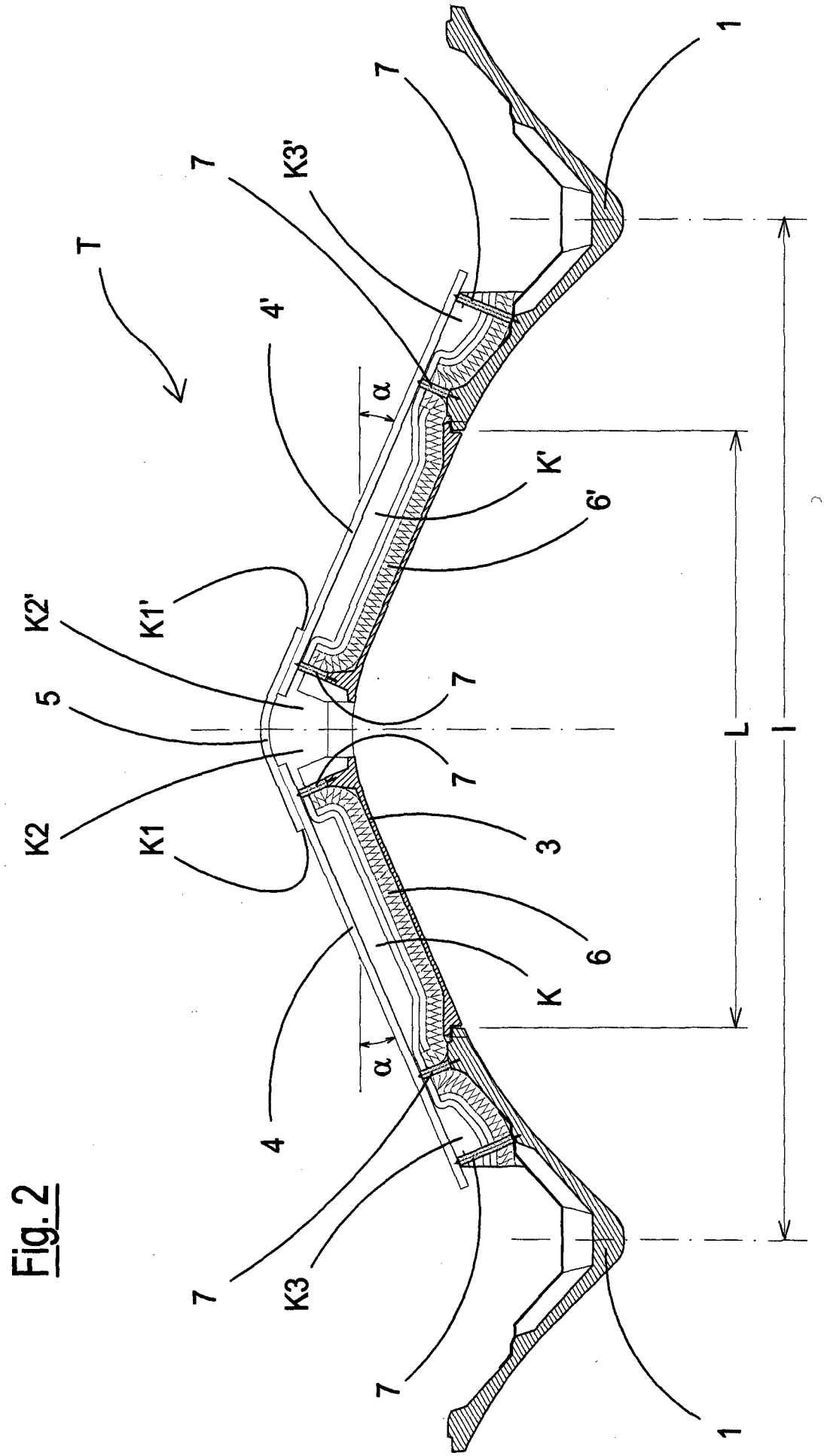



Fig. 2

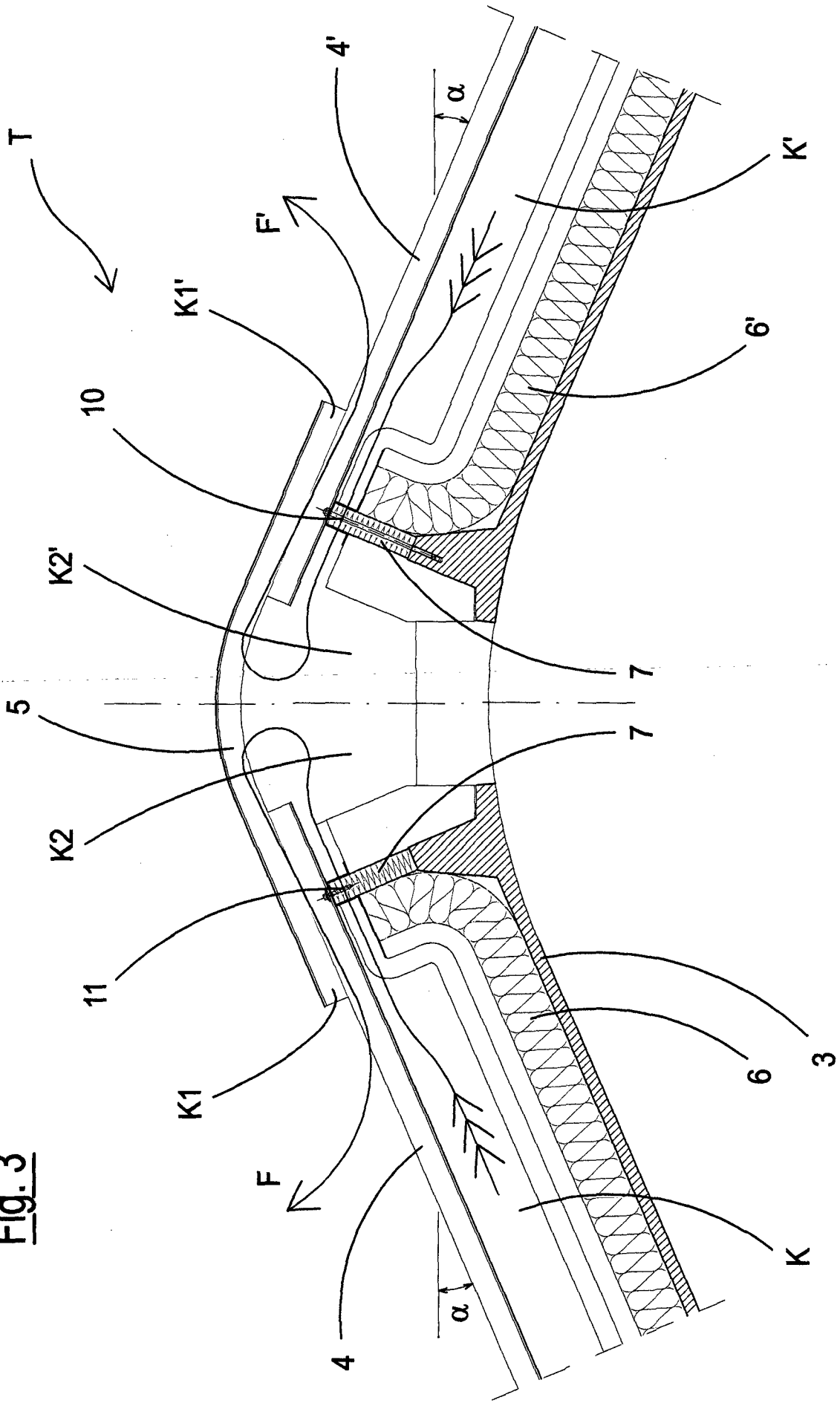



Fig. 3

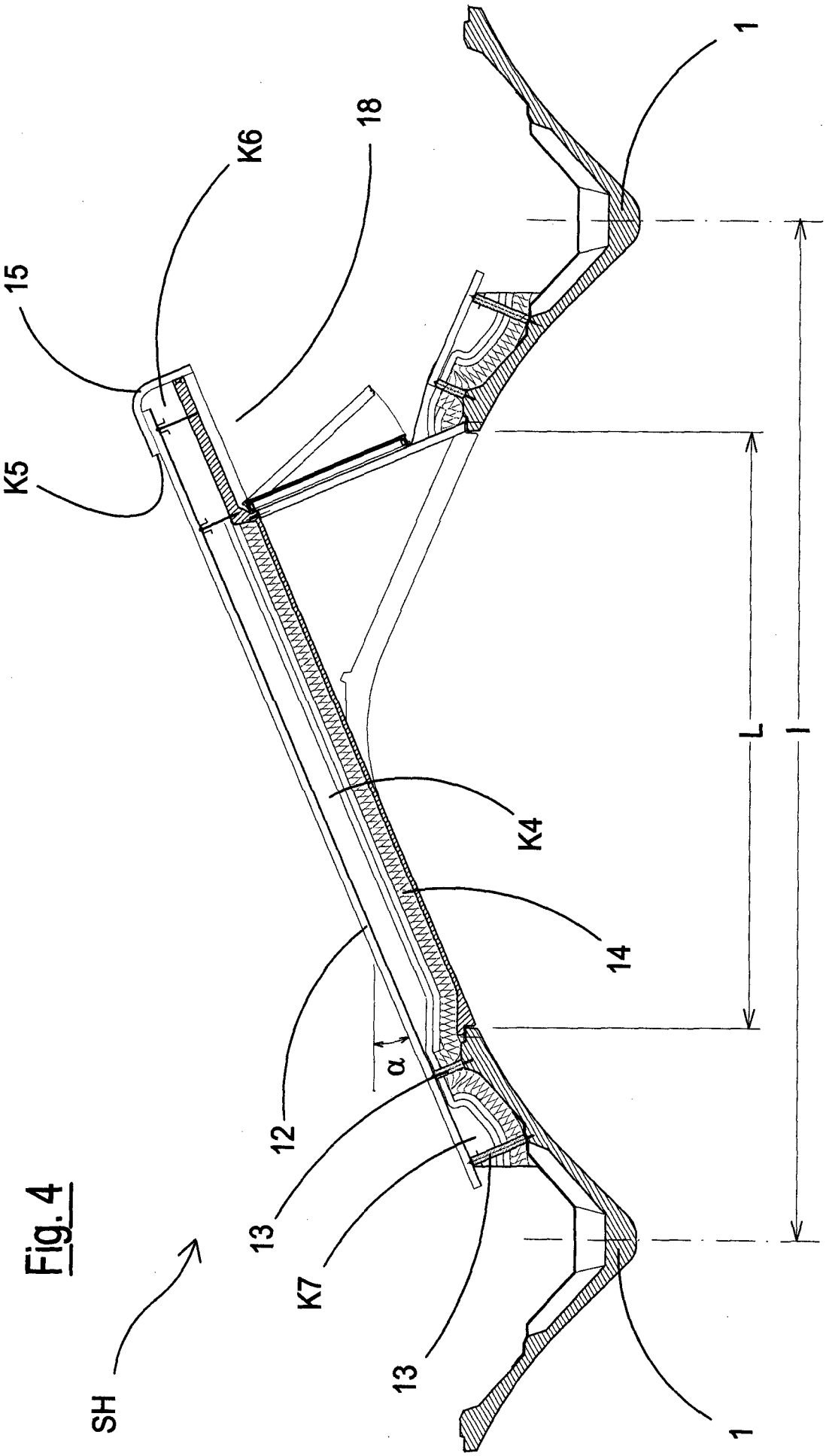



Fig. 4

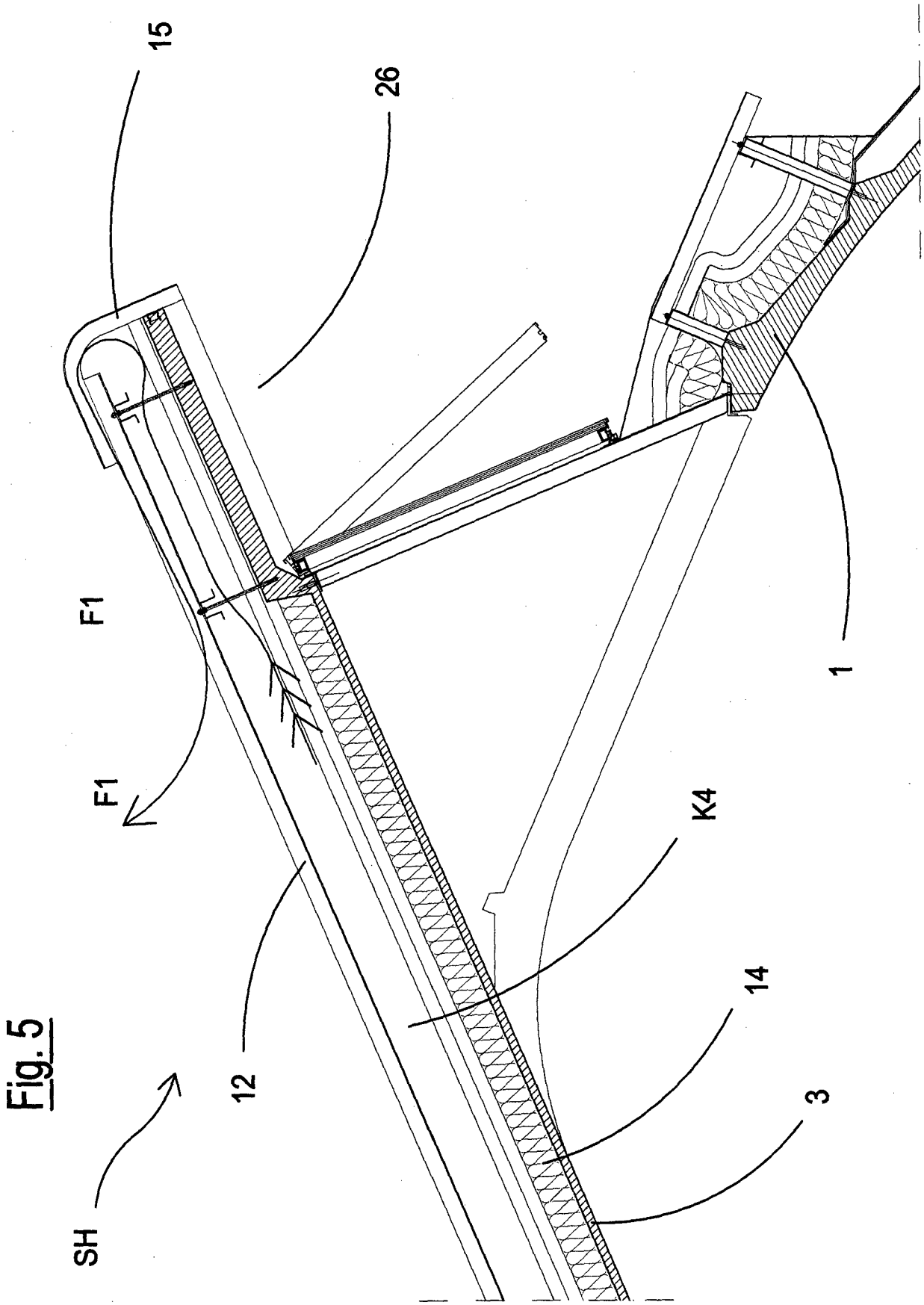



Fig. 5

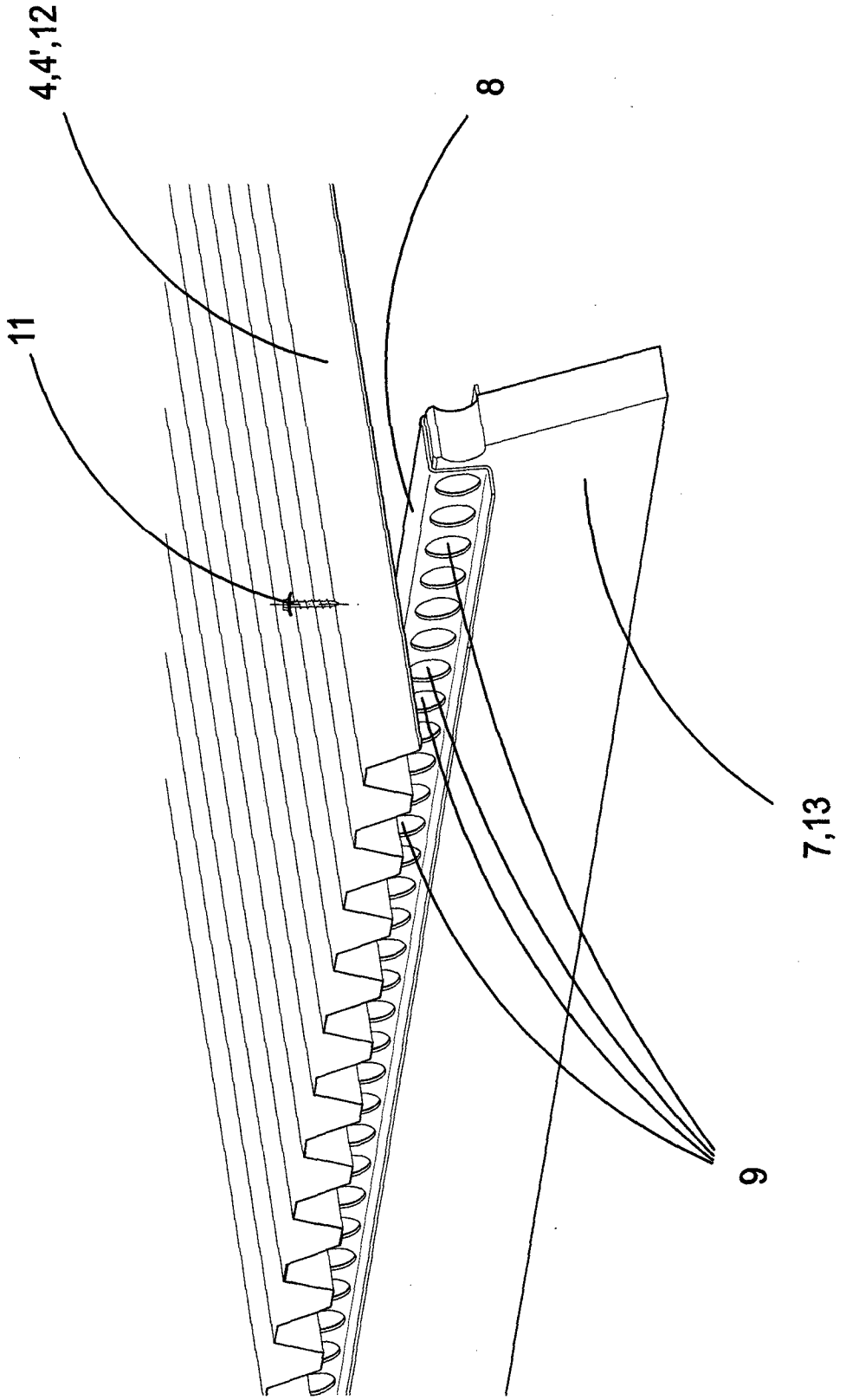



Fig. 6

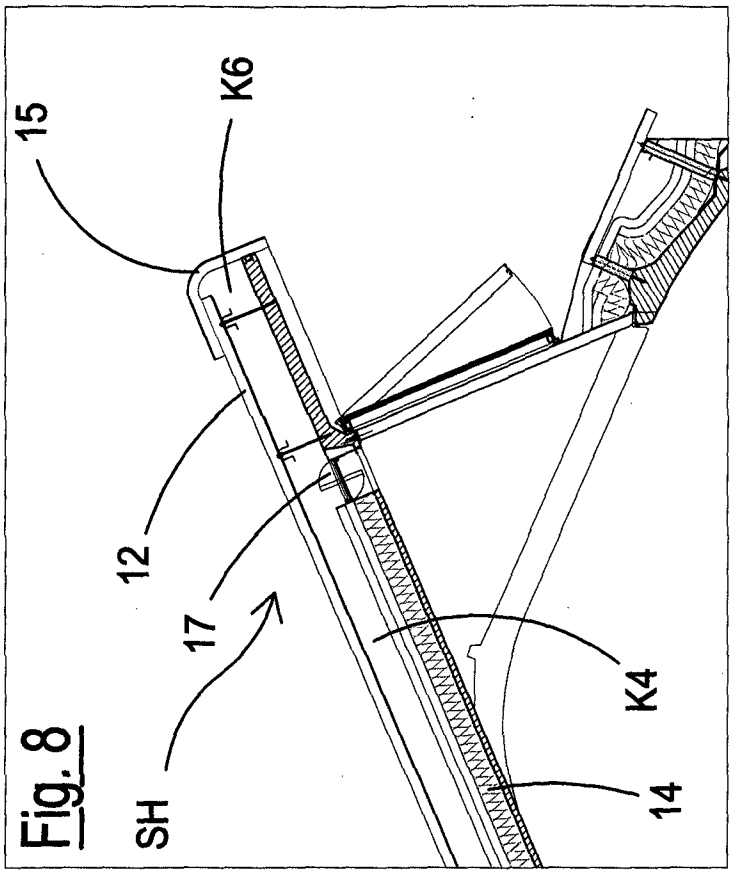



Fig. 8

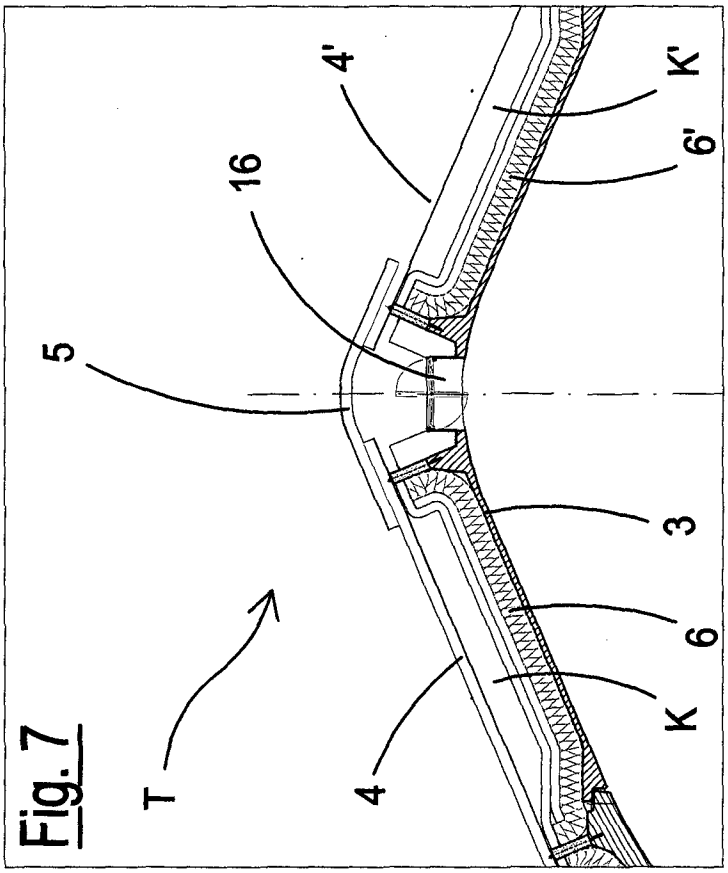



Fig. 7

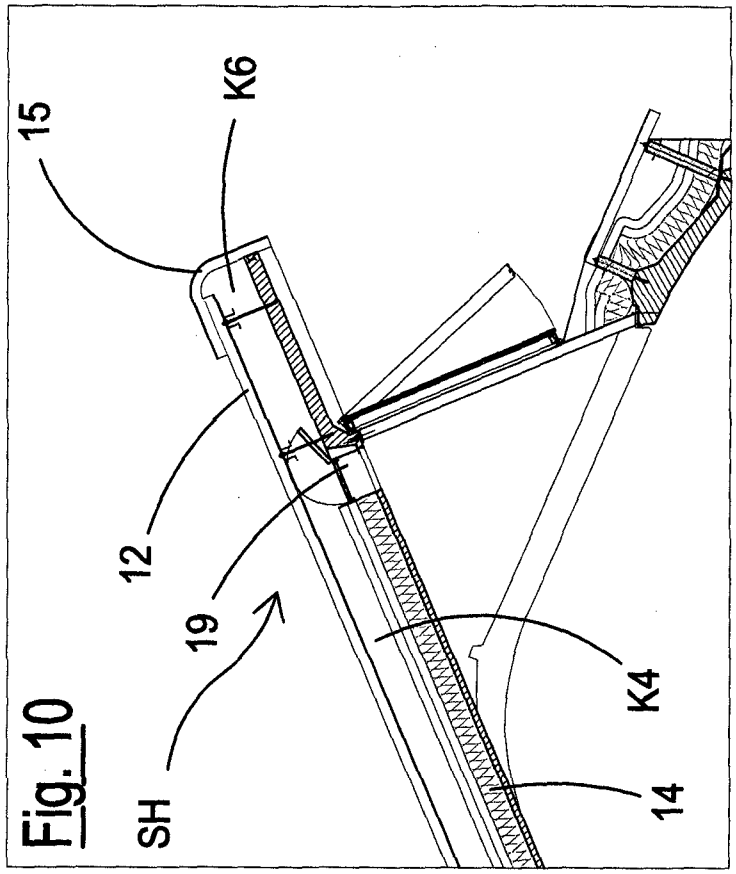



Fig. 10

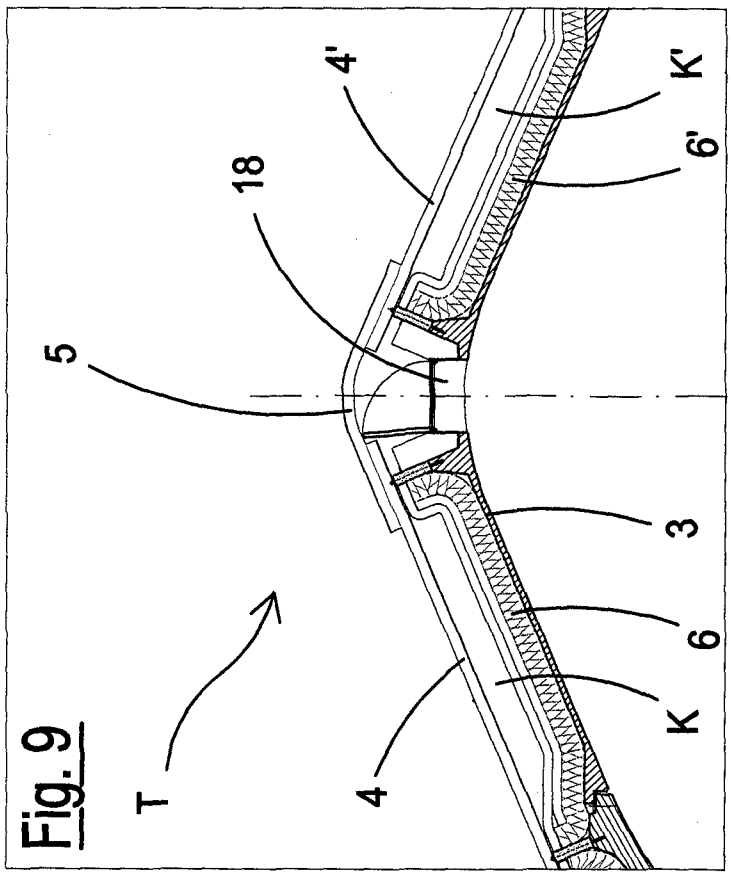



Fig. 9

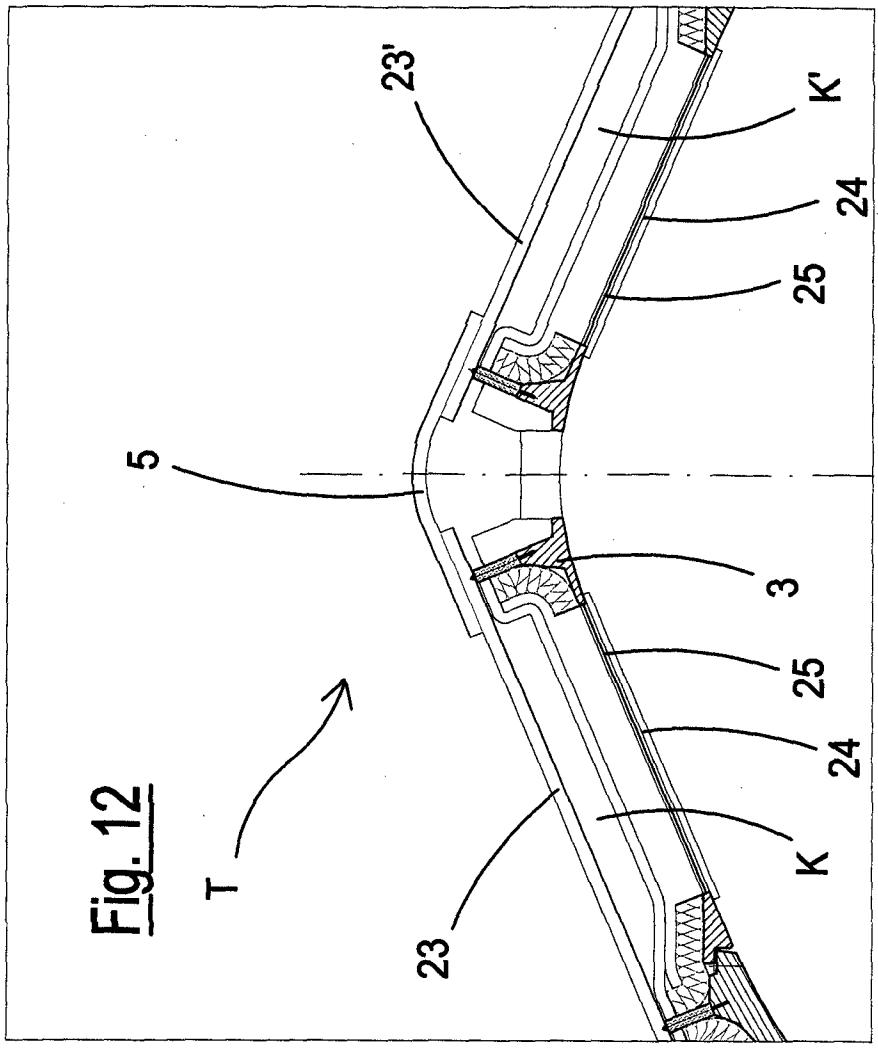



Fig. 12

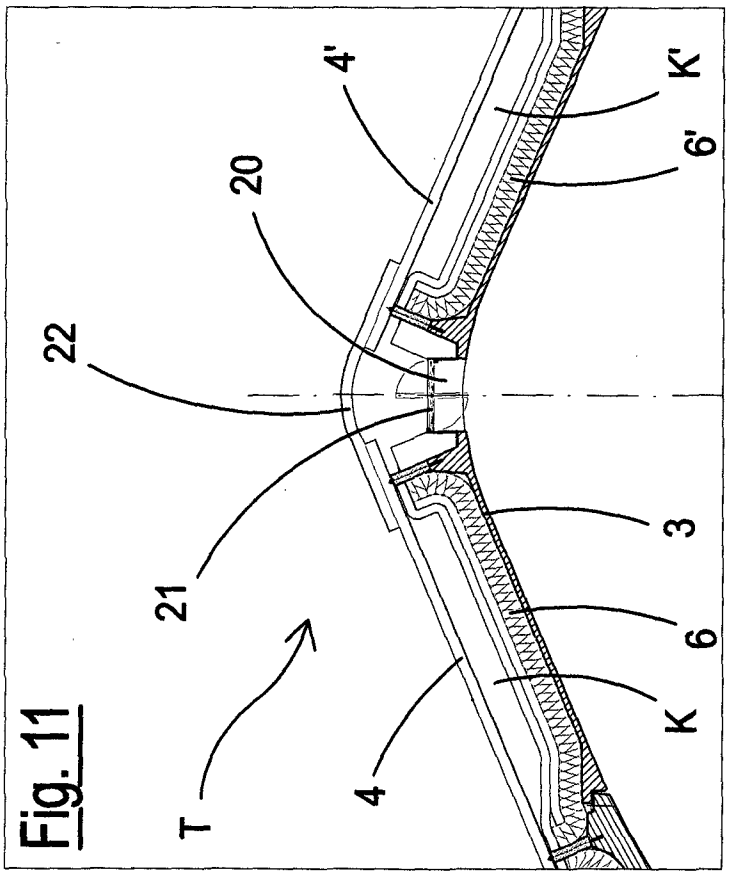



Fig. 11

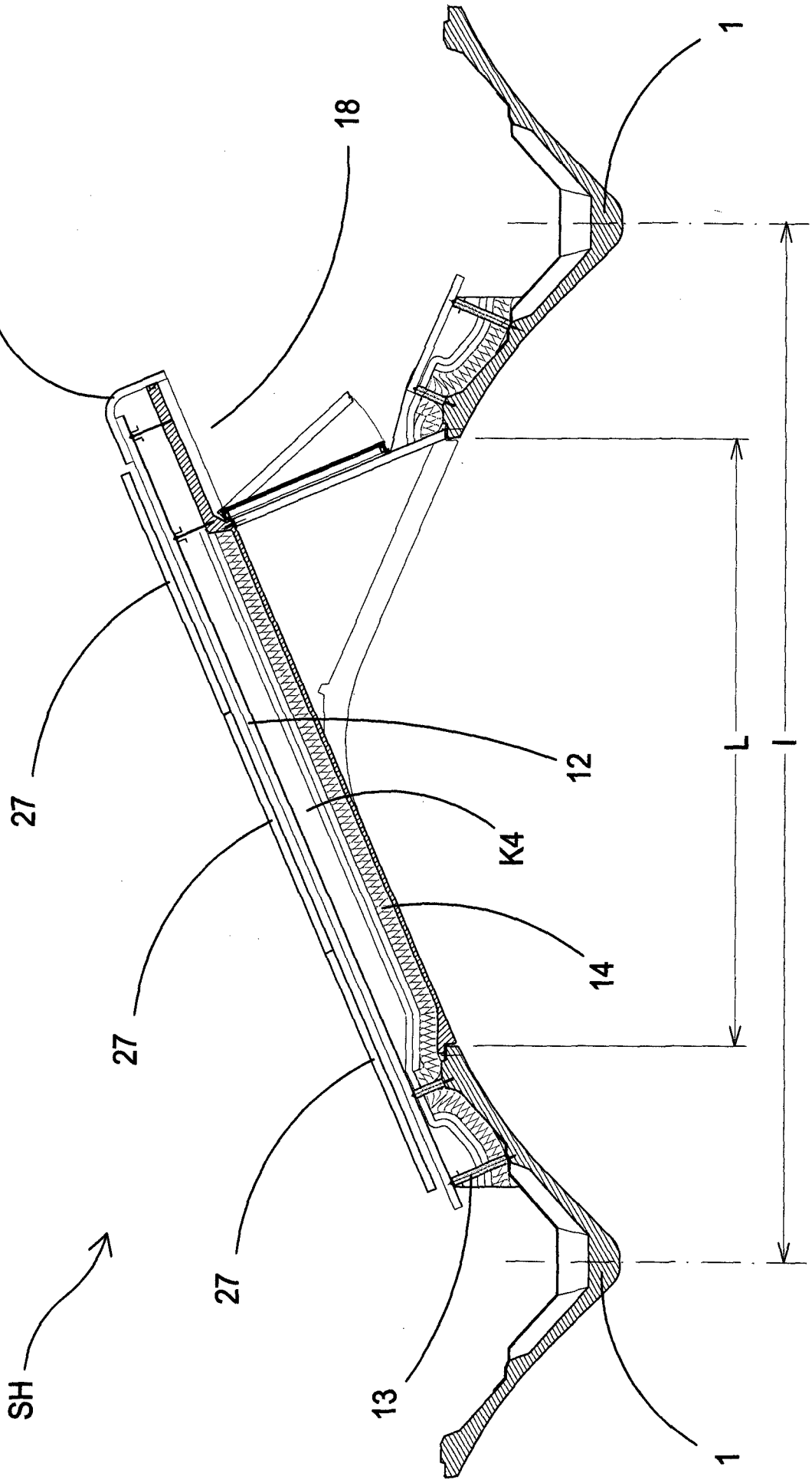



Fig. 13