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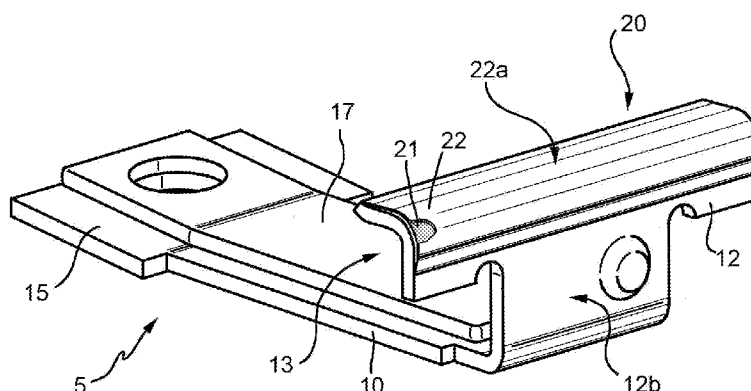


FIG. 4

(57) Abstract: A supporting member for thermoinsulating tiles of gas turbine combustion chambers comprises an elongated plate (10), having a coupling head (12) at a first end, the coupling head (12) being structured to couple with a thermoinsulating tile (4) and having an inner coupling surface (12a) and an outer surface (12b). The outer surface (12b) of the coupling head (12) is at least partly coated with a protective coating (20).

**"SUPPORTING MEMBER FOR THERMOINSULATING TILES OF GAS TURBINE
COMBUSTION CHAMBERS"**

TECHNICAL FIELD

5 The present invention relates to a supporting member for thermoinsulating tiles of gas turbine combustion chambers.

BACKGROUND ART

10 As known, the combustion chamber of a gas turbine must be internally provided with a thermoinsulating coating of refractory material, due to the high temperatures reached during the machine operation. The thermoinsulating coating generally consists of a plurality of tiles of refractory material arranged in contiguous rows on the inner surface of
15 the casing of the combustion chamber, so as to define a substantially continuous surface. In the combustion chambers of toroidal type, the tiles are arranged on circumferences around the rotor axis.

20 Normally, the tiles are fastened to the casing by supporting members which couple to seats on the sides of the tiles themselves. More precisely, the supporting members comprise a plate having, at one end, a coupling head which couples to a respective tile and, at the opposite end, a connection area
25 that is connected to a guide on the casing. The supporting members are elastic and, once the tiles are placed in the seat, are loaded to ensure a stable mounting.

The connection elements are subject to important wear because
30 of the hot gases that penetrate between adjacent tiles of the same row or of contiguous rows. The gaps between adjacent tiles are not in fact sealed and hot gases may permeate, reaching the supporting members.

In particular, the coupling heads of the supporting members tend to oxidize and may undergo premature breaking. Also, the excessively high temperature may cause phenomena of hot viscous creeping and relaxation of the material forming the supporting members, which tend to lose the loading state.

DISCLOSURE OF INVENTION

The object of the present invention is therefore to provide a supporting member for thermoinsulating tiles of gas turbine combustion chambers, which allows to overcome or at least reduce the limitations described above and, in particular, allows to mitigate the harmful effects of leakage of hot gases from the combustion chamber.

According to the present invention, a supporting member for thermoinsulating tiles of gas turbine combustion chambers as defined in claim 1 is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described with reference to the accompanying drawings, which illustrate some examples of non-limiting embodiments, wherein:

- Figure 1 is a side view, sectioned along a vertical axial plane, of a combustion chamber for gas turbines;
- Figure 2 is a front view of the combustion chamber of Figure 1, sectioned along the plane II-II of Figure 1, with parts removed for clarity;
- Figure 3 shows an enlarged detail of the combustion chamber of Figure 1, partly exploded and with parts removed for clarity;
- Figure 4 is a rear perspective view of a supporting member for thermoinsulating tiles of gas turbine combustion chambers according to an embodiment of the present invention;
- Figure 5 is a front perspective view of the supporting member of Figure 4;

- Figure 6 shows an enlarged detail of the supporting member of Figure 4; and
- Figure 7 is a rear perspective view of a supporting member for thermoinsulating tiles of gas turbine combustion chambers according to a different embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Figures 1 and 2 illustrate a combustion chamber 1 of a gas turbine (not fully shown). The combustion chamber 1 comprises a toroidal casing 2 extending around an axis A and is provided with a thermoinsulating coating 3 that covers internally the casing 2. The thermoinsulating coating 3 comprises a plurality of thermoinsulating tiles 4 of refractory material, arranged in adjacent rows, along circumferences, around the axis A of the combustion chamber 1.

With reference to Figure 3, the thermoinsulating tiles 4 are fastened to the casing 2 by supporting members 5. More in detail, the thermoinsulating tiles 4 have a quadrangular shape and have, on opposite sides, respective grooves 7 and ribs 8 for coupling with the supporting members 5.

The supporting members 5 engage circumferential guides 9, which are formed on an inner face of the casing 2 and extend around the axis A.

Once the supporting members 5 for a side of a thermoinsulating tile 4 have been housed in the circumferential guides 9 and fastened to the casing 2 by grub screws 6, the thermoinsulating tile 4 is arranged in the seat and the supporting members 5 for the other side of the insulating tile 4 are fitted.

One of the supporting members 5 is illustrated with more detail in Figures 4-7. It is understood that the supporting members can be made all in the same way or, according to

necessity, some supporting members may have a different structure.

The supporting member 5 comprises an elongated plate 10, having a coupling head 12 at a first end. In one embodiment, the elongated plate 10 and the coupling head 12 are made en bloc. The coupling head 12 is shaped to couple with a rib 8 of one of the thermoinsulating tiles 4. More precisely, the coupling head 12 is T-shaped, with arms extending transversely to the elongated plate 10, and is bent to form a coupling seat 13 for the thermoinsulating tiles 4. In addition, the coupling head has an inner coupling surface 12a and an outer surface 12b.

A second end of the elongated plate 11 is provided with a connection area 15, formed so as to engage one of the circumferential guides 9 of the casing 2 of the combustion chamber 1.

The supporting member 5 further comprises a leaf spring 17, superimposed in longitudinal direction to the elongated plate 10 and fastened thereto, for example by spot welding. The leaf spring 17 is connected for being loaded by the bending of the elongated plate 10, for example when the supporting member 5 is mounted to connect one of the thermoinsulating tiles 4 to the casing 2.

In a non-limiting embodiment, the elongated plate 10, including the coupling head 12, and the leaf spring 17 are made of the same material, for example a γ' phase precipitation hardening nickel alloy. In one embodiment, the alloy contains molybdenum, which helps to increase the alloy heat characteristics by means of the hardening mechanism by solid solution. By way of non-limiting example, the composition of the alloy forming the elongated plate 10 and

the leaf spring 17, expressed in percentage by weight, may be the following:

	Ni	57% by weight
	Cr	20% by weight
5	Co	10% by weight
	Mo	8.5% by weight
	Ti	2.1% by weight
	Al	1.5% by weight
	Fe	1.5% by weight
10	Mn	0.3% by weight
	Si	0.15% by weight
	C	0,06% by weight
	B	0.005% by weight

15 Once the leaf spring 17 has been welded to the elongated plate 10, the two together may be subjected to aging treatment, in order to precipitate the γ' phase which strengthens the alloy.

20 The outer surface 12b of the coupling head 12 is coated with a protective coating 20, which comprises a protective metal layer 21 having a thickness comprised between 17 μm and 270 μm and a thermal barrier layer 22 of ceramic material having a thickness comprised between 350 μm 550 μm .

25 The protective metal layer 21 is applied directly to the outer surface 12 of the coupling head and is made of a MCrAlY alloy, where M is cobalt or nickel, or a combination of cobalt and nickel.

30 For example, the MCrAlY alloy may have a composition selected from the following:

Ni between 29% and 31% by weight, Cr between 27% and 29% by weight, Al between 7.5% and 7.8% by weight, Y between 0.5% and 0.7% by weight, Si between 0.3% and 0.7% by weight, balance
35 Co;

Ni between 30% and 37% by weight, Cr between 18% and 25% by weight, Al between 7% and 9% by weight, Y between 0.1% and 0.7% by weight, balance Co;

5 Co between 21% and 23% by weight, Cr between 16% and 18% by weight, Al between 12% and 13% by weight, Y between 0.5% and 0.7% by weight, Si between 0.3% and 0.5% by weight, Hf between 0.2% and 0.3% by weight, balance Ni;

10 Co between 11% and 13% by weight, Cr between 20% and 22% by weight, Al between 10.5% and 11.5% by weight, Y between 0.3% and 0.5% by weight, Re between 1.5% and 2.5% by weight, balance Ni;

Co between 24% and 26% by weight, Cr between 16% and 18% by weight, Al between 9.5% and 11% by weight, Y between 0.3% and 0.5% by weight, Re between 1% and 1.8% by weight, balance Ni;

15 Co between 23% and 25% by weight, Cr between 16% and 18% by weight, Al between 9.5% and 11% by weight, Y between 0.3% and 0.5% by weight, Ir between 1.1% and 1.5% by weight, balance Ni.

20 The protective metal layer 21 may be deposited by a HVOF (High Velocity Oxygen Fuel), LPPS (Low-Pressure Plasma Spray), VPS (Vacuum Plasma Spray) or APS (Air Plasma Spray) process and has the dual function of preventing the oxidation of the coupling head 12, which is the hottest part of the supporting member 1, and to allow the anchorage of the thermal barrier layer 22. As a result of its composition, in fact, the MCrAlY alloy of the protective metal layer 21 has intermediate thermal expansion coefficient between the γ' phase precipitation hardening nickel alloy of the elongated plate 11 and the ceramic material of the thermal barrier layer 22. The protective metal layer 21 can then accommodate the different expansion of the elongated plate 11 and of the thermal barrier layer 22 and avoid the detachment of the latter.

35 The thermal barrier layer 22 is applied to the protective metal layer and is made of a ceramic material. In one

embodiment, the thermal barrier layer 22 is a single layer of homogeneous ceramic material and has an exposed surface 22a. In addition, the thermal barrier layer 22 is made of yttria stabilized zirconia. For example, the thermal barrier layer 22

5 may contain:

	Y ₂ O ₃	from 6.0% to 8.0% by weight
	HfO ₂	<2.50% by weight
	MgO	<0.20% by weight
	U and Th	<0.05% by weight
10	CaO	<0.20% by weight
	Al ₂ O ₃	<0.20% by weight
	Fe ₂ O ₃	<0.20% by weight
	SiO ₂	<0.70% by weight
	TiO ₂	<0.40% by weight
15	ZrO ₂	balance.

The thermal barrier layer 22 may be obtained by APS (Air Plasma Spray) deposition. Thanks to the reflective properties of the ceramic material, the exposed surface 22a of the thermal barrier layer 22 allows to keep the temperature of the coupling head within values for which the phenomena of hot viscous creeping and relaxation will not occur, or are restricted. The effect is further favored by the low thermal conductivity of the ceramic material.

25

According to a different embodiment of the invention, illustrated in figure 7, in a supporting member 105, the protective coating comprises only the protective metal layer 21 made of MCrAlY alloy. The protective metal layer 21, even in the absence of ceramic coating, is anyway able to effectively prevent the oxidation of the coupling head 12 and thus to substantially reduce the wear of the component, to the benefit of its useful life.

35 This solution can be used for example for portions of the combustion chamber 2 where the high temperature is less, while

elsewhere the supporting members 5 of the Figures 4-6 are used.

5 Finally, it is evident that to the supporting member described modifications and variations can be made, without departing from the scope of the present invention, as defined in the appended claims.

10 In particular, the protective coating can cover entirely or only in part, the coupling head 12, or extend to further portions of the elongated plate 11, according to specifications.

CLAIMS

1. A supporting member for thermoinsulating tiles of gas turbine combustion chambers, comprising an elongated plate (11), having a coupling head (12) at a first end, the coupling head (12) being structured to couple with a thermoinsulating tile (4) and having an inner coupling surface (12a) and an outer surface (12b);

wherein the elongated plate (11) and the coupling head (12) are made of γ' phase precipitation hardening nickel alloy;

and wherein the outer surface (12b) of the coupling head (12) is at least partly coated with a protective coating (20) comprising:

a protective metal layer (21) made of MCrAlY alloy applied to the coupling head (12), M being cobalt or nickel, or a combination of cobalt and nickel; and

a thermal barrier layer (22), applied to the protective metal layer (21) and made of a ceramic material.

2. The supporting member according to claim 1, wherein the MCrAlY alloy has a composition selected from the group consisting of:

Ni between 29% and 31% by weight, Cr between 27% and 29% by weight, Al between 7.5% and 7.8% by weight, Y between 0.5% and 0.7% by weight, Si between 0.3% and 0.7% by weight;

Ni between 30% and 37% by weight, Cr between 18% and 25% by weight, Al between 7% and 9% by weight, Y between 0.1% and 0.7% by weight;

Co between 21% and 23% by weight, Cr between 16% and 18% by weight, Al between 12% and 13% by weight, Y between 0.5% and 0.7% by weight, Si between 0.3% and 0.5% by weight, Hf between 0.2% and 0.3% by weight;

Co between 11% and 13% by weight, Cr between 20% and 22% by weight, Al between 10.5% and 11.5% by weight, Y between 0.3% and 0.5% by weight, Re between 1.5% and 2.5% by weight;

Co between 24% and 26% by weight, Cr between 16% and 18% by weight, Al between 9.5% and 11% by weight, Y between 0.3% and 0.5% by weight, Re between 1% and 1.8% by weight;

5 Co between 23% and 25% by weight, Cr between 16% and 18% by weight, Al between 9.5% and 11% by weight, Y between 0.3% and 0.5% by weight, Ir between 1.1% and 1.5% by weight, balance Ni.

10 3. The supporting member according to any one of the preceding claims, wherein the thermal barrier layer (22) is a single layer of homogeneous ceramic material and has an exposed surface (22a).

15 4. The supporting member according to any one of the preceding claims, wherein the protective metal layer (21) has intermediate thermal expansion coefficient between the coupling head (12) and the thermal barrier layer (22).

20 5. The supporting member according to any one of the preceding claims, wherein the thermal barrier layer (22) is made of yttria stabilized zirconia.

6. The supporting member according to any one of the preceding claims, wherein the thermal barrier layer (22) contains:

25 Y₂O₃ from 6.0% to 8.0% by weight

HfO₂ < 2.50% by weight

MgO < 0.20% by weight

U and Th < 0.05% by weight

CaO < 0.20% by weight

30 Al₂O₃ < 0.20% by weight

Fe₂O₃ < 0.20% by weight

SiO₂ < 0.70% by weight

TiO₂ < 0.40% by weight

ZrO₂ balance.

35

7. The supporting member according to any one of the preceding claims, wherein the γ' phase precipitation hardening nickel alloy contains molybdenum.

5 8. The supporting member according to claim 7, wherein the γ' phase precipitation hardening nickel alloy contains:

	Ni	57% by weight
	Cr	20% by weight
	Co	10% by weight
10	Mo	8.5% by weight
	Ti	2.1% by weight
	Al	1.5% by weight
	Fe	1.5% by weight
	Mn	0.3% by weight
15	Si	0.15% by weight
	C	0.06% by weight
	B	0.005% by weight

9. The supporting member according to any one of the preceding
20 claims, comprising a leaf spring (17) fastened to the elongated plate (11) and superimposed in the longitudinal direction.

10. The supporting member according to claim 9, wherein the
25 elongated plate (11) and the leaf spring (17) are made of the same material.

11. The supporting member according to any one of the preceding claims, wherein the coupling head (12) extends
30 transverse to the elongated plate (11) and is bent to form a coupling seat (13) for a thermoinsulating tile (4).

12. The supporting member according to any one of the preceding claims, wherein a second end of the elongated plate
35 (11) is provided with a connection area (15), for connection

to a guide (9) of a casing (2) of a combustion chamber (1) of a gas turbine.

13. Gas turbine comprising:

- 5 a combustion chamber (1);
a thermoinsulating coating (3), including a plurality of thermoinsulating tiles (4) fastened to a casing (2) of the combustion chamber (1);
at least one supporting member (5; 105) according to any one
10 of the preceding claims, connecting a respective thermoinsulating tile (4) to the casing (2) of the combustion chamber (1).

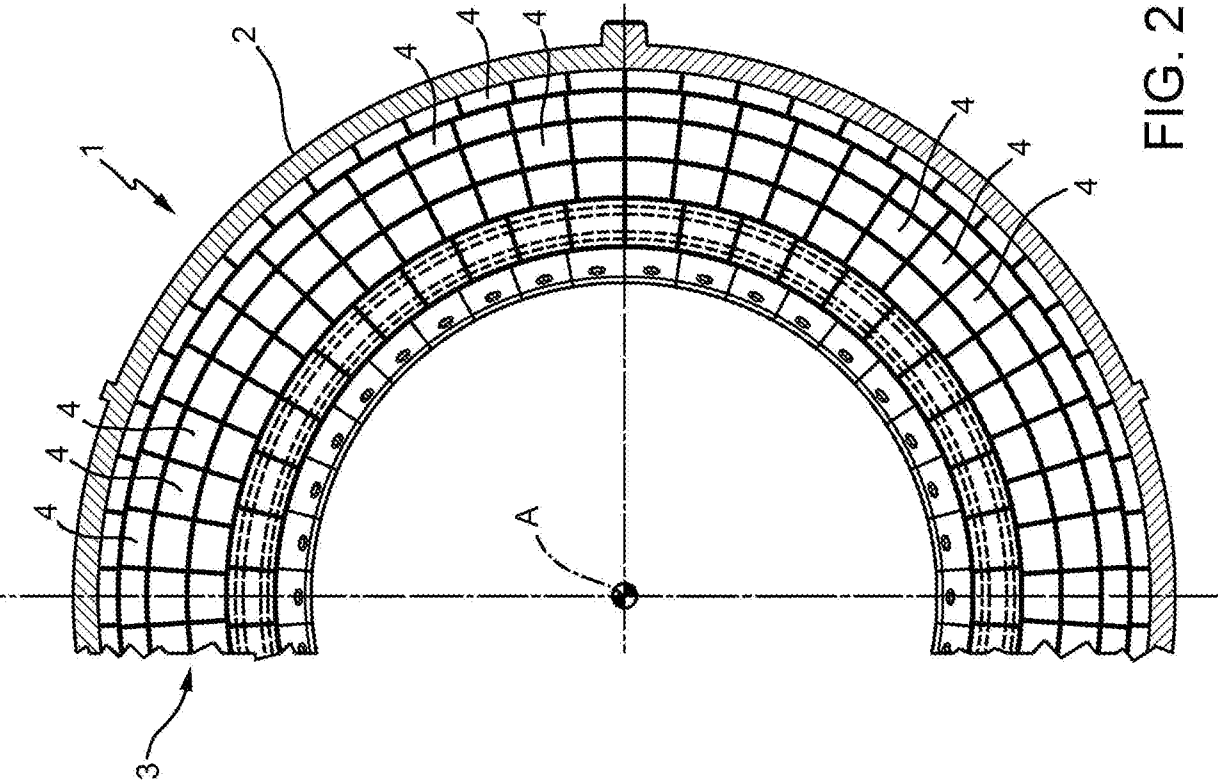


FIG. 2

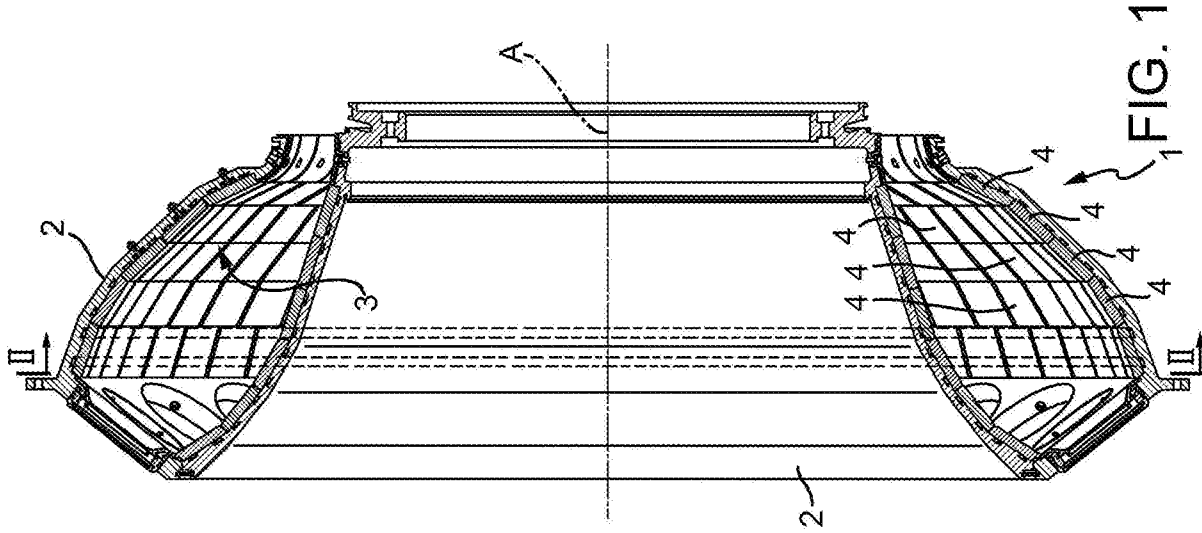
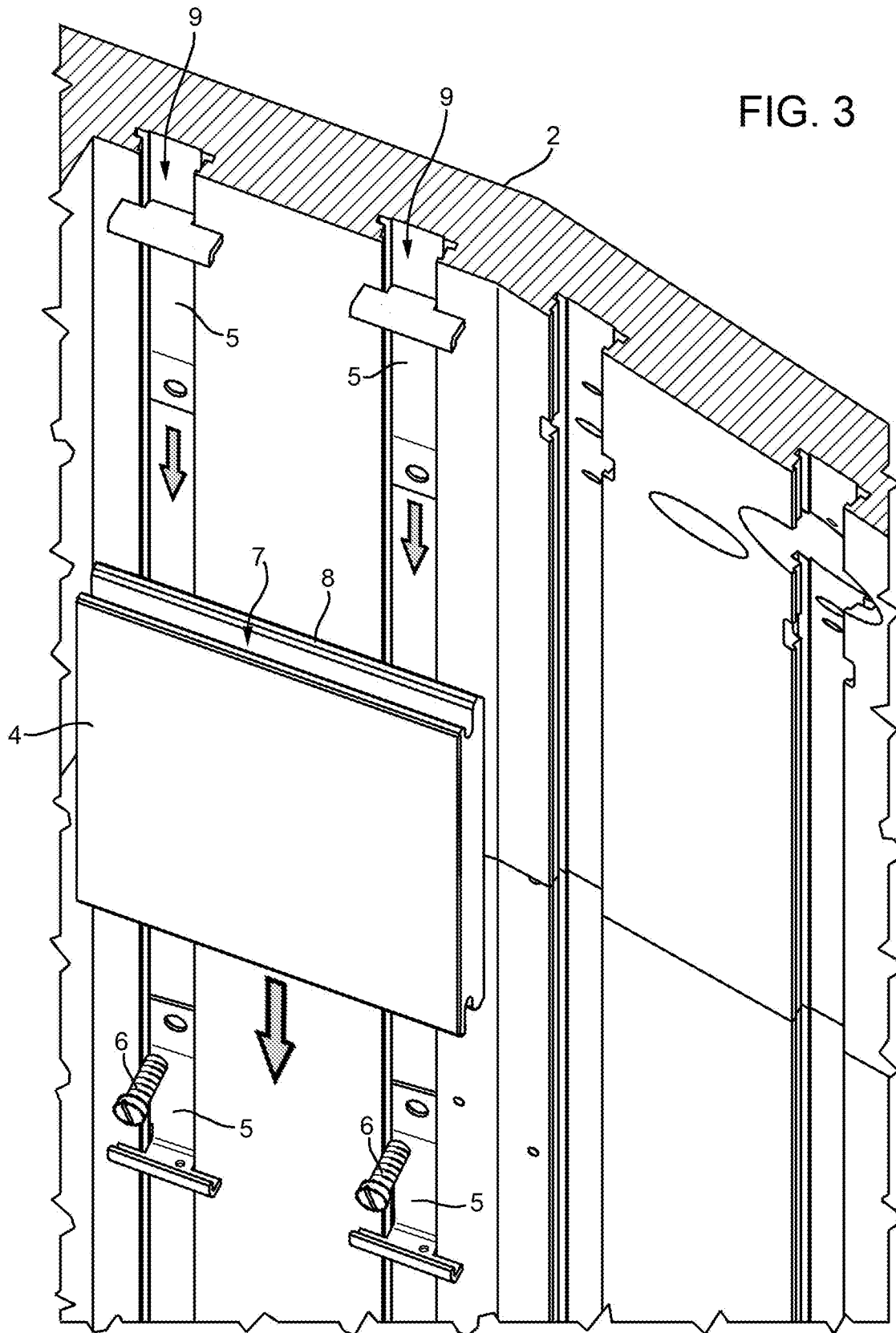


FIG. 1



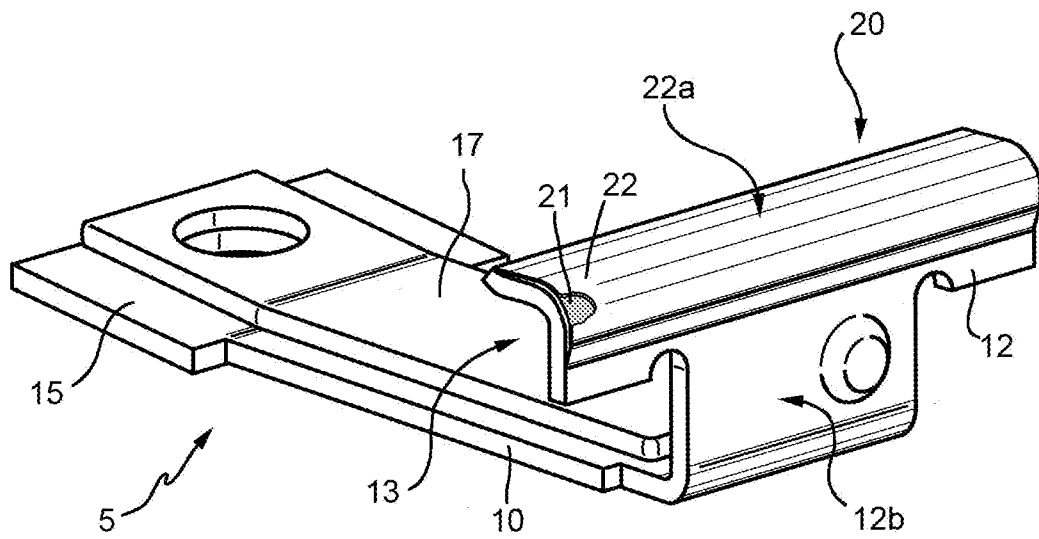


FIG. 4

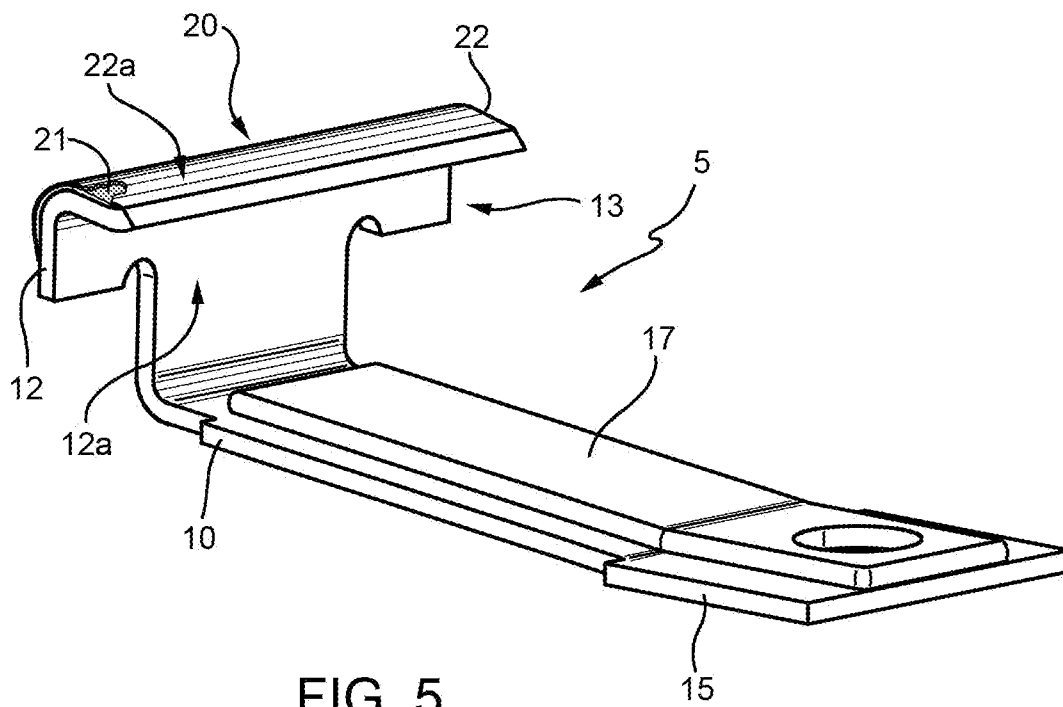


FIG. 5

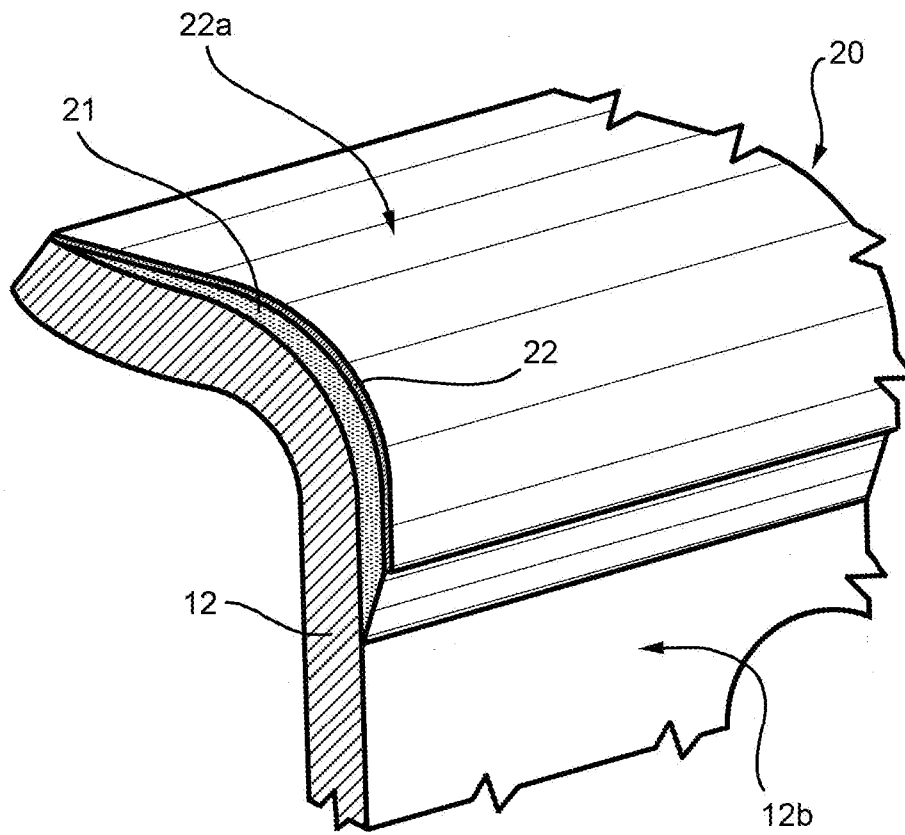


FIG. 6

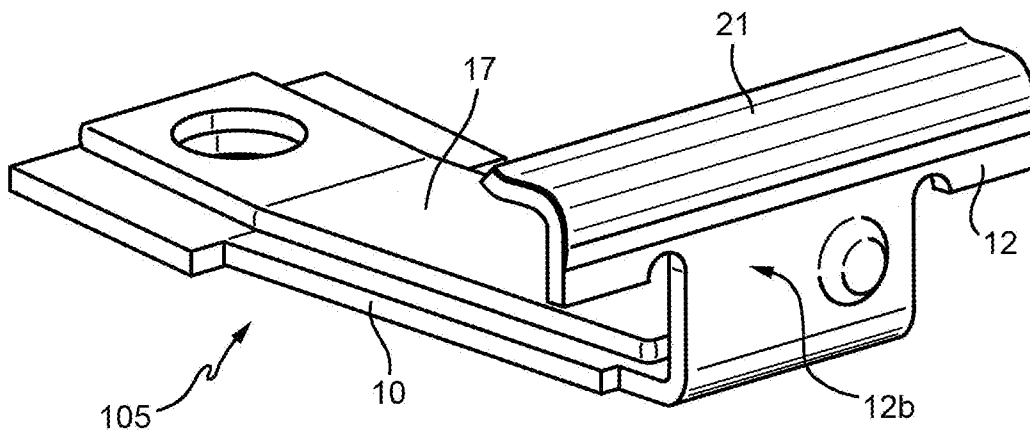


FIG. 7