(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 077 287 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.02.2001 Bulletin 2001/08

(51) Int Cl.[7]: **E01B 9/68**

(21) Application number: **00500180.5**

(22) Date of filing: **04.08.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **19.08.1999 ES 9901909**

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(54) Elastic tie plate for railway track

(57) Elastic tie plate for railway track, of a generally rectangular shape moulded with an ether-ester thermoplastic elastomer. On its upper face it has projections (1) arranged in rows and columns, positioned in the direction of the rail and with its upper face coplanar, said plane reaching as far as the plate edges (2) perpendicular to the rail, whilst the edges (3) parallel to it are situated in a slightly lower plane, forming rectangular bands (4) parallel to each side. On its lower face it has projections slightly smaller than projections (1), as well as discontinuous lips of truncated pyramid shape, on the sides perpendicular to the rail, which fit externally over the crosstie. The upper plane of the power face projections reaches as far as the four sides of the plate and extends on each of the sides parallel to the rail in corresponding flat lips (7), whilst on the perpendicular sides corresponding rectangular bands appear, on the inside and on an intermediate plane.

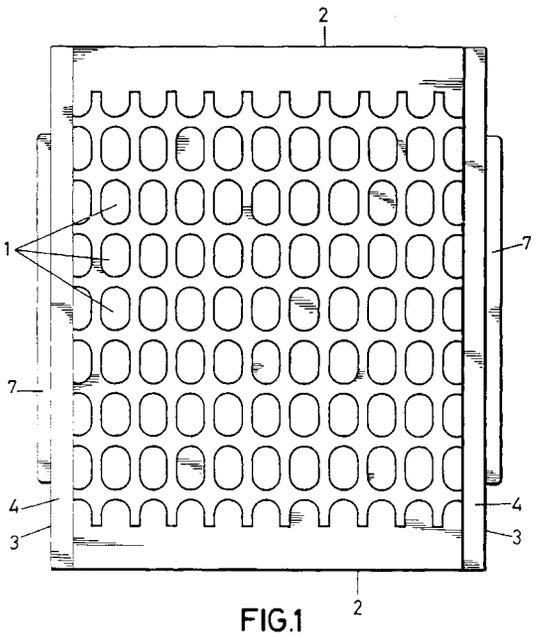

FIG.1

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Description

OBJECT OF THE INVENTION

[0001] The object of reference in the invention covered by this Patent, comprises an "Elastic tie plate for railway track".

[0002] In its preferred application it is envisaged as a plate of special plastic having a specific design, collocated between the rail and the concrete crosstie, forming part of an elastic fastening system.

BACKGROUND TO THE INVENTION

[0003] The supporting structure for railway lines comprises generally, from bottom to top: a layer of ballast (crushed stone) which is extended over the roadbed for laying and supporting upon it the crossties; the crossties themselves (of wood, iron, concrete or mixture thereof) on which the rail rests; and the latter, whose shape is defined by the head (upper widening on which sits the rim of the wheels and is guided by its flange), web (vertical union between head and foot) and base (horizontal plane seated on the crosstie).

[0004] The fastening of the rail to the crosstie is done according to a great many systems and with different means however, in general, it can be considered to consist of: an element for tightening on the base which can be of the plate or clip type; an element for anchoring on the crosstie into which element is inserted a bolt or screw spike (large screws which are mounted in pairs, running through symmetrically arranged holes made for this purpose in the flanges of the base, on both sides, and which are inserted or removed with large box spanners); and a butt element or piece, generally at the side, to withstand the forces produced in this direction through the guidance of the wheel flanges by the rail head.

[0005] The rail-crosstie fastening described above, would give rise to a rigid attachment between the two elements and, as a consequence thereof, to the transmission of vibrations and chatter to the railway cars, particularly disturbing to the passengers, as well as to increased maintenance requirements on the support structure, due to the wear on the crossties and to the splitting and settling of the road ballast.

[0006] For this reason, a variety of means have been conceived for complementing said fastening, conferring upon it elasticity and absorbing the greater part of the vibrations produced by railway traffic, their removal being completed by the elastic suspension incorporated in the cars themselves.

[0007] Among said complementary elastic means mention can be made of: springs inserted between the head of the screw spike and the base of the rail; clips with extra elasticity due to their shape or constitution; and seating plates inserted between the base of the rail and the top side of the crosstie, in the retention area.

[0008] The elasticity of the latter also depends on their shape (geometry of their design) and their constitution (technical properties of the material employed in their manufacture).

[0009] In all cases the effectiveness of the elastic tie plates is of major importance, not only for the better performance of their primary function of damping vibrations but also because, through this action, they contribute to the conservation, on one hand of the roadbed, by reducing the forces applied to it, and on the other hand of the crosstie, through the same damping action of the fastening clips or plates, by removing to a great extent or at least reducing the fatigue they suffer from the cyclic forces produced by the movement of the rolling stock, especially from high speed convoys.

DESCRIPTION OF THE INVENTION

[0010] The purpose of the invention which constitutes the object of this Patent, consists in obtaining a tie plate for railway track whose technical properties, and particularly its elasticity, improve the features of those known and employed to date.

[0011] Notwithstanding, the technical specifications which are required of tie plates in order that they comply satisfactorily with the functions assigned to them, are fuller and more numerous, noteworthy among these being:

- To result highly durable through their mechanical properties: offer high resistance to wear and abrasion.
- To perform well at both high and low temperatures, with a range extending from -10 °C to +75 °C.
- To assure protection for the crosstie, by damping vertical loads, both those of a dynamic nature due to high speed and those resulting from the operational loads; and by reducing the transmission of vibrations from the rail to the crosstie.
- To work as a spring in the longitudinal direction to withstand braking forces.
- To contribute to the electrical insulation of the fastening system from the rail.
- To permit longitudinal creeping of the rail for thermal expansion and contraction, particularly in the case of long welded bars.
- To withstand weather conditions without ageing: humidity, ozone, ultraviolet rays, chemical agents.
- To reduce the noise produced by wheel action, as railway convoys pass.

[0012] To achieve all the foregoing, action has been taken on two essential aspects which condition their performance: their shape and their constitution.

[0013] With respect to this last item, it was decided after numerous trials to employ in its manufacture an ether-ester thermoplastic elastomer, of determined physical properties (Shore hardness D47; bending mod-

ulus of approximately 117 MPa; softening point, 174 °C; density, 1.22), considered optimum for the application.

[0014] Regarding its shape, the plate has a thickness of 7 mm and is generally rectangular in form, which is necessary for its application, having the following geometrical and functional characteristics:

a) On the upper face:

- A series of projections with the shape of an irregular quadrilateral, whose longer sides are equal, straight and parallel, the other two sides being also equal and forming diametrically opposing semicircles.

The projections are arranged in order in rows and columns, having their upper face coplanar and positioned in the longitudinal direction of the rail, the base of which rests upon them.

The plane defined by the upper faces of the projections extends to the opposite edges of the plate perpendicular to the rail, whilst the other two parallel to it, are situated in a slightly lower plane, forming rectangular bands parallel to each side, which contribute to improving the rated pressure when, through live loading on the rail, elastic deformation occurs of the upper plane of the projections.

b) On the lower face:

- A series of projections with equal shape, order and position, as those of the upper face, though slightly smaller, arranged with respect to them in a manner such that their geometric centre coincides with the centre of the spacing between every four projections on the upper face.

As a consequence of the characteristics in form described above, the transverse section of the plate has a toothed shape which facilitates the distribution of stresses between the zone of contact with the rail and the neutral zone corresponding to the bending of the plate, when it is subjected to vertical loads transmitted by the rail when the rolling stock passes over the fastening.

The sides of the plate, perpendicular to the rail, extend below it, on both sides, in discontinuous lips in the form of a truncated pyramid, said lips fitting over the crosstie externally to prevent the plate being displaced in the longitudinal sense of the rail and facilitate the central mounting thereof.

The plane defined by the upper faces of the projections, reaches as far as the four edges of the plate forming a rectangular frame which on each of the sides parallel to the rail is extended as a flat lip, whilst on the sides perpendicular to it and inside the frame, rectangular bands appear, on a plane lying between that of the upper faces of the projections and that on which they rest, said bands serving the same mechanical purpose as those of the upper face.

The lower face of the plate lies against the upper face of the crosstie, though the surface contact area is limited because of the grooves between the projections, the reduction of which, of approximately 50% of the total surface area, permits its wear to be diminished in the area of contact with the crosstie.

The discontinuous nature of said contact also contributes to the damping of vibrations, particularly when relatively low loads are being applied (up to 20 kN).

DESCRIPTION OF THE DRAWINGS

[0015] To complete the description of the invention and facilitate the understanding of the characteristics in form, structure and function, of its object, drawings are attached in which different aspects are shown schematically of a preferred embodiment of the flexible tie plate for railway track which constitutes the object of this Patent.

[0016] In said figures:

- Figure 1 is a plan view at the upper face of the plate and Figure 2 is a plan view of the plate at the lower face.
- Figure 3 shows a section of the plate on the plane marked by the line A-A in figure 2.
- Figure 4 is a side elevation of the plate, viewed from one of the sides parallel to the rail.
- Figure 5 is a front elevation of the plate, viewed from one of the sides parallel to the rail.

DESCRIPTION OF PREFERRED FORM OF EMBODIMENT

[0017] To show clearly the nature and scope of the beneficial application of the elastic tie plate for railway track which constitutes the object of the invention, its structure and its configuration are described hereunder, reference being made to the drawings which, by representing a preferred embodiment of said object and being informative in character, are to be considered in their broadest sense and not as limitations to the application and content of the invention.

[0018] The flexible tie plate for railway track, which is the object of the Patent, is of a generally rectangular shape and is moulded using an ether-ester thermoplastic elastomer.

[0019] On its upper face it has a number of projections (1) with an irregular quadrilateral form, the longer sides of which are equal, straight and parallel, and whose oth-

er two sides, also equal, are diametrically opposing semicircles.

[0020] Said projections (1) are arranged in order in rows and columns, with their upper face coplanar with and positioned in the longitudinal direction of the rail, the base of which rests on them.

[0021] The plane defined by the upper faces of the projections (1) reaches as far as the plate edges (2) perpendicular to the rail, whilst the other two edges (3), parallel to it, are situated in a slightly lower plane, forming rectangular bands (4) parallel to each side, which contribute to the reduction of rated pressure when, through live loading on the rail, elastic deformation takes place of the upper plane of the projections (1).

[0022] On its lower face there are a number of projections (5) of like shape, arrangement and positioning as the projections (1) on the upper face, though slightly smaller, arranged with respect to them so that their geometric centre coincides with the centre of the spacing between every four projections (1).

[0023] The plate sides perpendicular to the rail, extend below said plate, on both sides, forming discontinuous lips (6), in the form of a truncated pyramid, said lips fitting externally over the crosstie to prevent the plate being displaced in the longitudinal direction of the rail, and facilitate its being centrally mounted.

[0024] The plane defined by the upper faces of the projections (5), reaches the four edges of the plate, forming a rectangular frame which, on each of the sides parallel to the rail, is extended in the form of a flat lip (7), whilst on the sides perpendicular to it and on the inside of the frame, corresponding rectangular bands (8) appear on an intermediate plane between that of the upper faces of the projections (5) and that on which they rest, said bands complying with the same mechanical objective as the bands (4) of the upper face.

Claims

1. Elastic tie plate for railway track, of a generally rectangular shape, essentially characterised in that on its upper face it has a series of projections (1) having an irregular quadrilateral form, the longer sides of which are equal, straight and parallel, and whose other two sides, also equal, are diametrically opposing semicircles, said projections (1) being arranged in order in rows and columns, with their upper face coplanar with and positioned in the longitudinal direction of the rail, the base of which rests on them; and in that the plane defined by the upper faces of the projections (1), reaches as far as the plate edges (2) perpendicular to the rail, whilst the other two edges (3), parallel to it, are situated in a slightly lower plane, forming rectangular bands (4) parallel to each side, which contribute to the reduction of rated pressure when, through live loading on the rail, elastic deformation takes place of the upper plane of the projections (1).

2. Elastic tie plate for railway track, in accordance with Claim 1, essentially characterised in that on its lower face it has a series of projections (5) of equal shape, arrangement and positioning as the projections (1) on the upper face, though slightly smaller, arranged with respect to them so that their geometric centre coincides with the centre of the spacing between every four projections (1); in that the sides of the plate perpendicular to the rail, extend below said plate, on both sides, as discontinuous lips (6), in the form of a truncated pyramid, said lips fitting externally over the crosstie to prevent the plate being displaced in the longitudinal direction of the rail, and facilitate its being centrally mounted; and in that the plane defined by the upper faces of the projections (5), reaches as far as the four edges of the plate, forming a rectangular frame which, on each of the sides parallel to the rail, is extended in the form of a flat lip (7), whilst on the sides perpendicular to it and on the inside of the frame, corresponding rectangular bands (8) appear on an intermediate plane between that of the upper faces of the projections (5) and that on which they rest, said bands complying with the same mechanical objective as the bands (4) of the upper face.

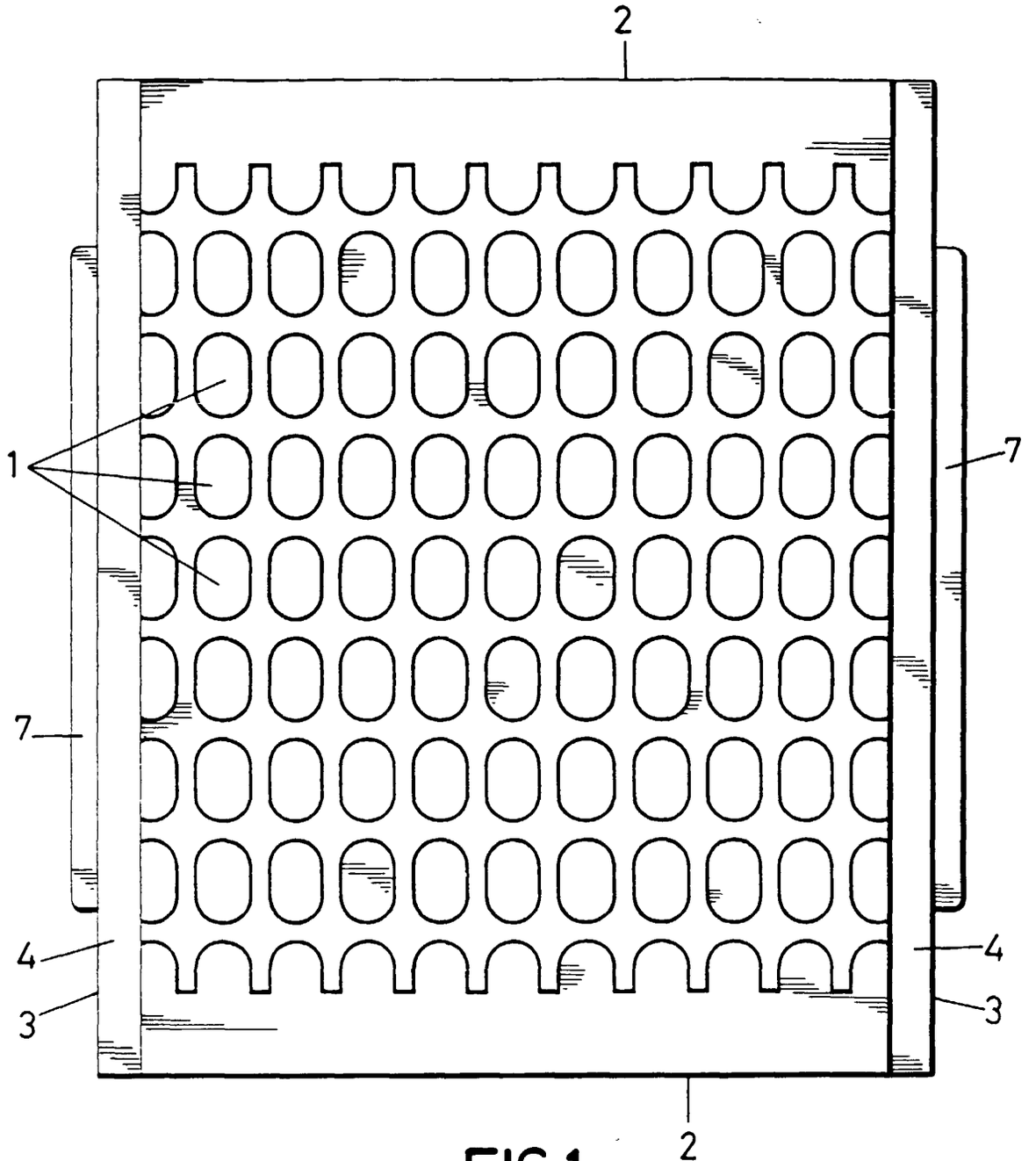

FIG.1

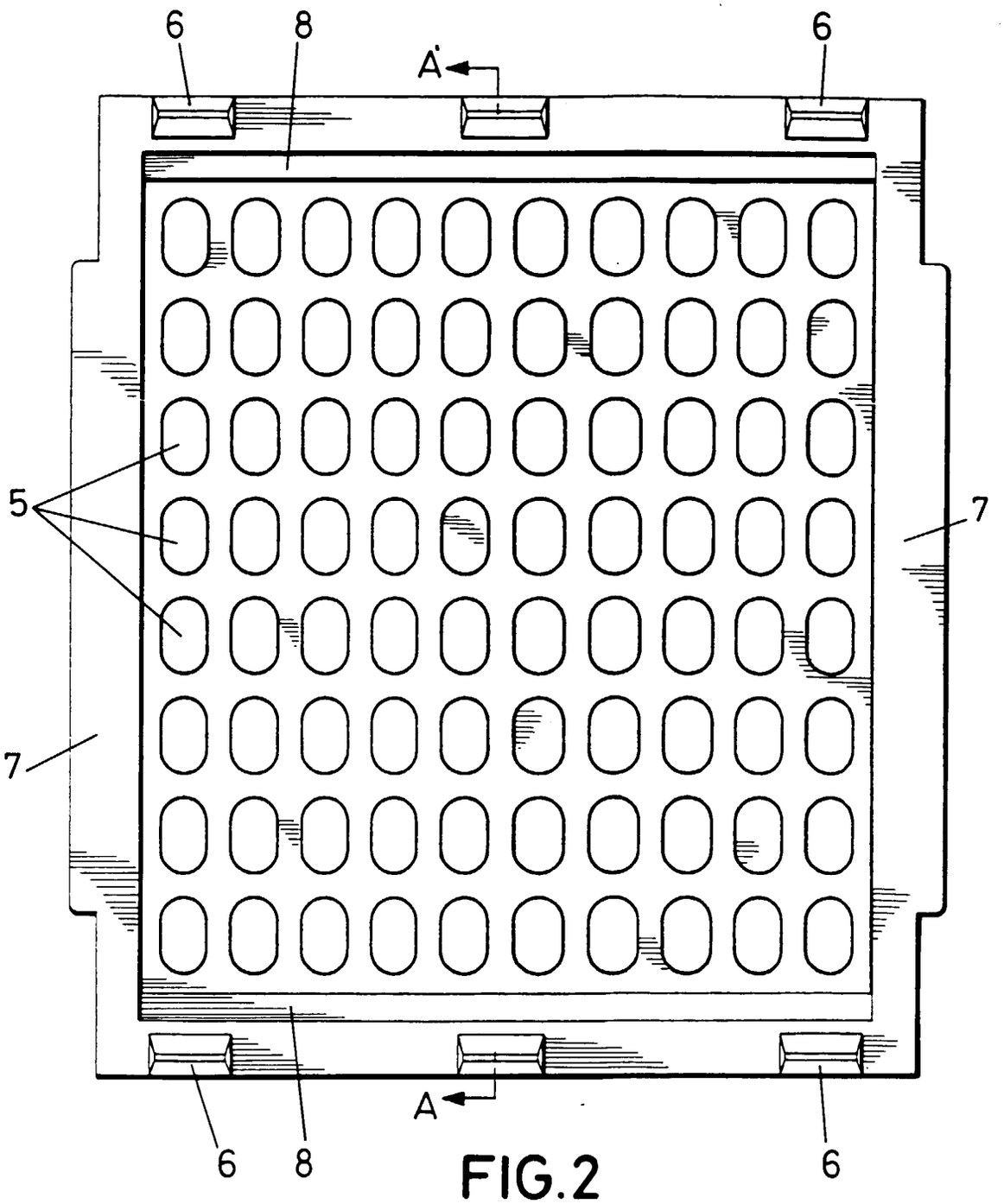

FIG.2

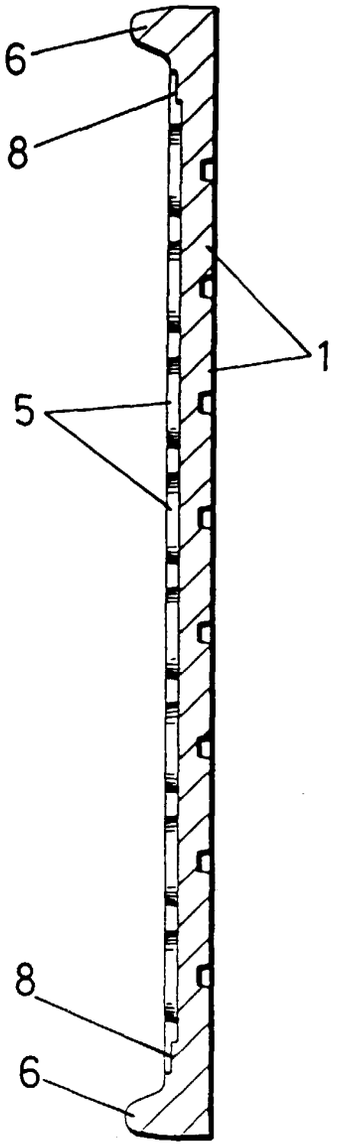

FIG.3

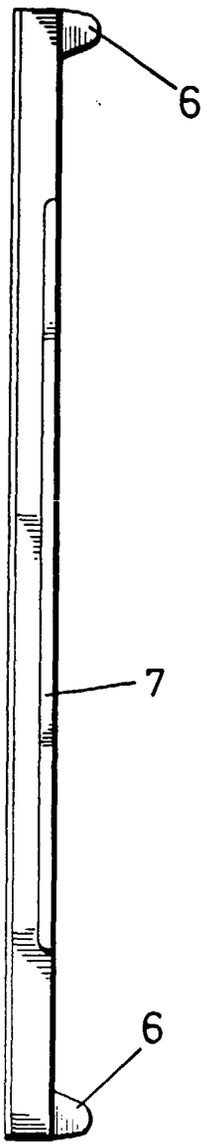

FIG.4

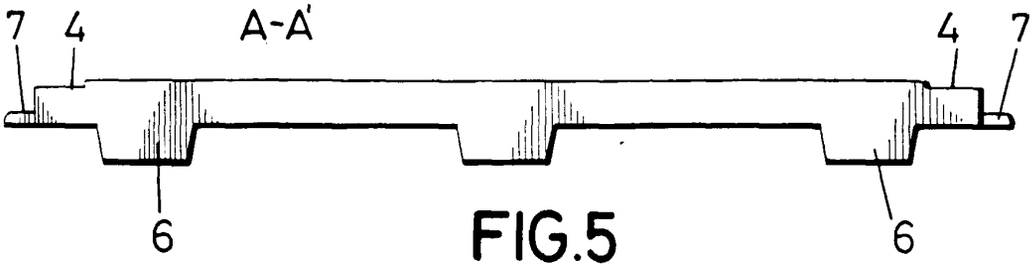

FIG.5