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

(11) EP 1 005 003 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.05.2000 Bulletin 2000/22

(51) Int. Cl.[7]: **G08B 13/10**

(21) Application number: **99203806.7**

(22) Date of filing: **15.11.1999**

(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: **24.11.1998 IT MI982545**

(71) Applicants:
- **Tonelli, Augusto**
  54011 Aulla (IT)
- **Tonelli, Aldo**
  54100 Massa (IT)
- **Tonelli, Giorgio**
  54010 Castagnetola (IT)

(72) Inventors:
- **Tonelli, Augusto**
  54011 Aulla (IT)
- **Tonelli, Aldo**
  54100 Massa (IT)
- **Tonelli, Giorgio**
  54010 Castagnetola (IT)

(74) Representative:
Perani, Aurelio et al
c/o JACOBACCI & PERANI S.p.A
Via Senato 8
20121 Milano (IT)

(54) Security equipment, particularly for the protection of locations

(57) Security equipment (1), particularly for the protection of paved (4) locations (2), capable of warning of approaches, intrusions and the like, with great sensitivity and reliability, comprises a plurality of piezoelectric transducers (12) intended to be embedded in the pavement (4) of the location (2) to be protected, each transducer (12) comprising a flat body (14) and a flexible region (33) of predetermined area in a closed ring about the flat body (14).

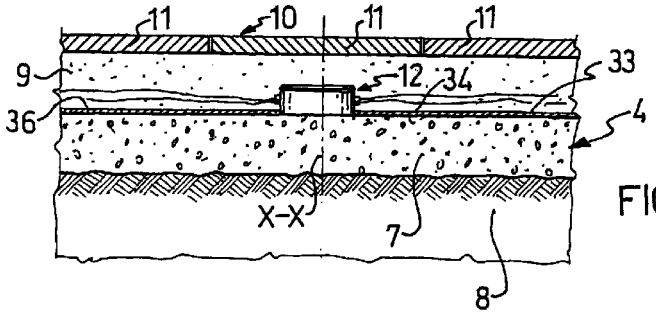

FIG.3

EP 1 005 003 A2

Description

[0001] The present invention relates to security equipment, particularly for the protection of paved locations, capable of warning of approaches, intrusions and the like, of the type that comprises at least one transducer with a flat body intended to be embedded in the pavement.

[0002] As is known, there has long been a need felt for the protection of the perimeters of paved locations, with immediate warning by the emitting of suitable alarms of the intrusion of an extraneous person or even only of his or her approach.

[0003] Known equipment, although satisfactory in many respects and widely used, usually has poor sensitivity. In a word, they are deaf to the approach or intrusion of unauthorized persons.

[0004] It has been suggested that the sensitivity be increased by increasing the number of transducers and embedding them in the pavement as close as possible to its surface. However, this increases the complexity of the equipment and also exposes the transducers to breakage.

[0005] The problem addressed by the present invention is that of providing security equipment of the type specified, which has structural and functional characteristics such as to satisfy the abovementioned need, while at the same time overcoming the problems of the prior art.

[0006] This problem is solved with security equipment of the type specified which is characterized in that it includes a flexible region of predetermined area in a closed ring around the flat body and intended to be embedded with the flat body in the pavement.

[0007] Other features and the advantages of the security equipment according to the present invention will be made apparent in the course of the description given below of a preferred embodiment thereof, provided by way of non-restrictive indication, with reference to the enclosed drawings, in which:

- Fig. 1 is a diagrammatic plan view of the security equipment according to the invention,
- Fig. 2 is a diagrammatic plan view on a larger scale of the security equipment shown in Fig. 1,
- Fig. 3 is a side view in partial section of a detail of the security equipment shown in Figs. 1 and 2,
- Fig. 4 is a side view on a larger scale of the detail shown in Fig. 3,
- Fig. 5 is a cross section on a larger scale of the detail shown in Fig. 4,
- Fig. 6 is a perspective view of a detail of the security equipment shown in Figs. 1 and 2, and
- Figs. 7, 8 and 9 are perspective views of the detail shown in Fig. 6, in accordance with respective alternative embodiments.

[0008] With reference to the enclosed figures, the number 1 is a general reference for security equipment, particularly for protecting a location 2. It warns of the approach or the intrusion or the like of an intruder or unauthorized person.

[0009] In the example the location 2 is an area of footway provided with a pavement 4 and extending in front of a window or door 5 of a building 6.

[0010] The pavement 4 is of the type comprising a first layer 7 of cast concrete resting on soil 8, a second layer 9 of cast mortar, and finally a covering 10 of paving flags 11.

[0011] The security equipment 1 comprises a plurality P of piezoelectric transducers (12), of which there are five in the example, distributed in the area of each location 2 to be protected.

[0012] The five transducers 12 are arranged in a zigzag line 13, being positioned at its angular points and separated from each other by a distance I of between 50 cm and 1 m, preferably 75 cm in the example.

[0013] Each transducer 12 comprises a flat, basically cylindrical body 14 of vertical axis X-X having an outside diameter D equal to 100 mm and a height H equal to 30 mm.

[0014] The body 14 comprises a base 15, a cylindrical housing 16 and, parallel to the base 15, a partition 17. A depression 18 bounded by an annular edge 19 is formed in the partition 17.

[0015] On top of the body 14 is a disc 20 with a downward projection 20a on its underside. The disc 20 and the projection 20a constitute a receptor 21.

[0016] Two bushings 22 in diametrically opposite positions are present in the cylindrical housing 16.

[0017] A thin flat piezoelectric sensor known per se, with the general reference 23, is mounted inside the body 14.

[0018] More specifically the thin flat piezoelectric sensor 23 takes the form of a metal, e.g. brass, plate 24, and a silvered plate 25 forming an electrode which is bonded to the plate 24 by a ceramic layer 26.

[0019] The thin flat piezoelectric sensor 23 is fixed, e.g. bonded, to the annular edge 19, so defining an upper chamber 27, filled with a resin, and a lower chamber, represented by the depression 18, which is hollow.

[0020] Conducting wires 29 and 30 run from the sensor 23, specifically from the plate 24 and from a plate 25, respectively, to respective conductors 31 and 32 which pass through the body 14 and out through the bushings 22.

[0021] The conductors 31 and 32 lead to an electronic monitoring apparatus of a conventional type and not shown in the figures.

[0022] The security equipment 1, in accordance with the present invention, comprises, for each transducer 12, a flexible region 33. This has a predetermined surface area, forms a closed ring around the flat body and is intended to be embedded with the flat body in the pavement 4.

[0023] More specifically, the flat body 14 and the

flexible region 33 are laid on the layer 7 and are embedded in the pavement 4 when the layer 9 is cast.

[0024] The flexible region 33 comprises a generally annular panel 34 containing a circular hole 35 produced by e.g. punching, the diameter of which is such that the panel is fitted without play, and indeed with a predetermined force fit about the cylindrical housing 16 of the flat body 14. In practice the force required is such that the panel 34 remains tightly closed about the cylindrical housing 16 and such that it is therefore impossible for the mortar of the layer 9 to infiltrate between the panel 34 and the cylindrical housing 16 of the flat body 14 during casting.

[0025] In accordance with a preferred embodiment, the panel 34 of each transducer 12 extends as far as the panels of the adjacent transducers in the plurality P and forms with these a single integral carpet 36.

[0026] The panels 34, and the carpet 36, are made from an elastic material, preferably an elastomeric material, particularly natural or synthetic rubber.

[0027] The panels 34 and the carpet 36 are advantageously made from a membrane known as a bitumen polymer membrane BPM comprising a polymer and bitumen. This is well known in the building trade and is of moderate cost.

[0028] The panels 34, as also the carpet 36, have a thickness S of between 3 and 5 mm and preferably have a thickness of 4 mm.

[0029] The panels and the carpet extend in the same plane as the flat body, level with its base.

[0030] In accordance with an alternative embodiment the flexible region 33 takes the form of a panel shaped like an annulus with a circular perimeter, having a diameter A of between 50 cm and 1 m and preferably a diameter of 75 cm.

[0031] In accordance with another alternative embodiment the flexible region 33 takes the form of a panel 38, 39 in the shape of an annulus with a polygonal perimeter with predetermined sides.

[0032] For example, the flexible region 33 takes the form of a panel 38 that has a square perimeter with sides of length B, or a panel 39 that has a hexagonal perimeter with sides of length C, these lengths being selected in such a way that each panel extends as far as the adjacent panels.

[0033] When in operation, if an intruder approaches he will exert a pressure on the surface of the pavement 4 which is transmitted through the covering 10 to the second layer 9. From the second layer 9 the pressure is transmitted to the transducers 12 and to the flexible region 33.

[0034] Precisely because of the presence of the flexible regions 33, which are almost incapable of reacting to the pressure, most of the pressure is concentrated on the transducers 12 and in particular on their respective receptors 21, which transmit the pressure to the piezoelectric sensor 23, which consequently emits a signal.

[0035] The main advantage of the security equipment according to the present invention is its more-than-ordinary sensitivity.

[0036] Another advantage of the security equipment according to the present invention is its reliability, the transducers being distant from the surface of the pavement and therefore protected from accidental impact.

[0037] Finally it should be noted that the security equipment according to the present invention can be installed quickly and easily.

[0038] Clearly, in order to satisfy particular and specific requirements, a person skilled in the art will be able to make numerous modifications and alterations to the security equipment described above, all however contained within the scope of protection of the invention as defined by the following claims.

Claims

1. Security equipment (1), particularly for the protection of paved (4) locations (2), capable of warning of approaches, intrusions and the like, of the type that comprises at least one transducer (12) with a flat body (14) intended to be embedded in the pavement (4), characterized in that it includes a flexible region (33) of predetermined area in a closed ring around the flat body (14) and intended to be embedded with the flat body (14) in the pavement (4).

2. Security equipment (1) according to Claim 1, characterized in that the flexible region (33) comprises a basically annular panel (34, 37, 38, 39) made of a flexible material fitted without play around the flat body (14), with which it is coplanar.

3. Security equipment (1) according to Claim 2, characterized in that the panel (34, 37, 38, 39) is made of a material that includes a polymer.

4. Security equipment (1) according to Claim 3, characterized in that the panel (34, 37, 38, 39) is made of a material that also includes bitumen.

5. Security equipment (1) according to Claim 4, characterized in that the panel (34, 37, 38, 39) is made of a membrane known as bitumen polymer membrane MBP.

6. Security equipment (1) according to Claim 2, characterized in that the panel (34, 37, 38, 39) has a thickness (S) of between 3 and 5 mm, and preferably a thickness (S) of 4 mm.

7. Security equipment (1) according to Claim 2, characterized in that there is a plurality of transducers (12) and in that the respective panels (34, 37, 38,

39) form a single carpet (36) in one piece intended to be embedded in the pavement.

8. Security equipment (1) according to Claim 2, characterized in that the panel (37) is in the shape of a ring with a circular perimeter of predetermined diameter (A) of between 50 cm and 1 m and preferably having a diameter (A) equal to 75 cm.

9. Security equipment (1) according to Claim 2, characterized in that the panel (38, 39) is in the shape of a ring with a polygonal perimeter, and preferably with a square perimeter with sides of predetermined length (B) or hexagonal perimeter with sides of predetermined length (C).

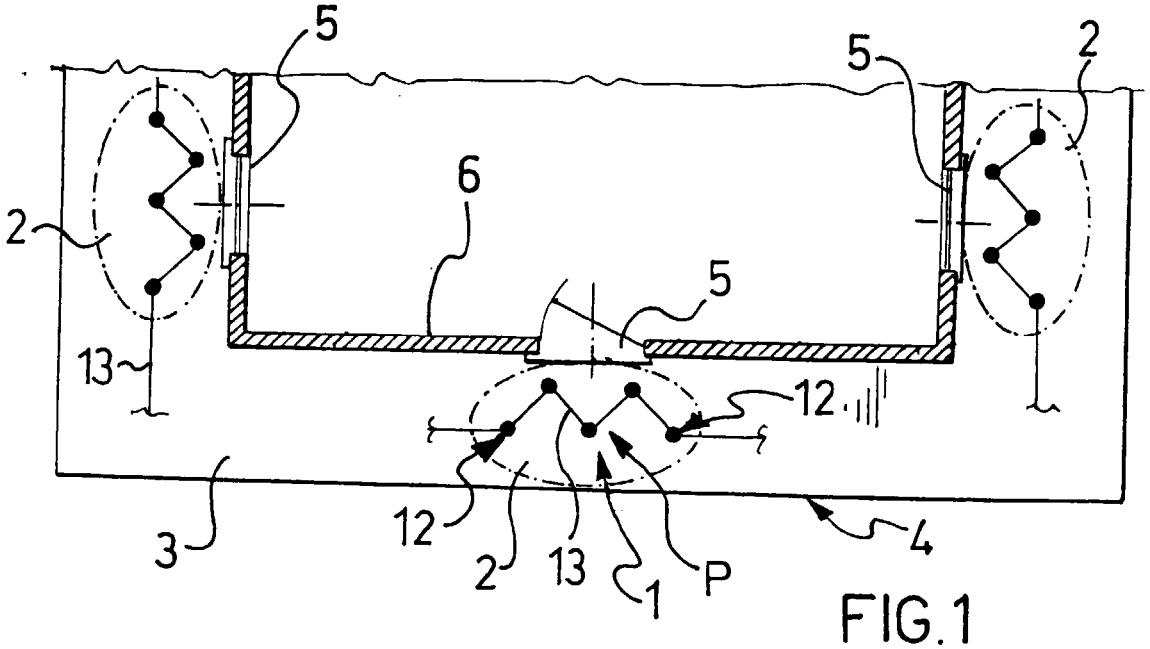

FIG.1

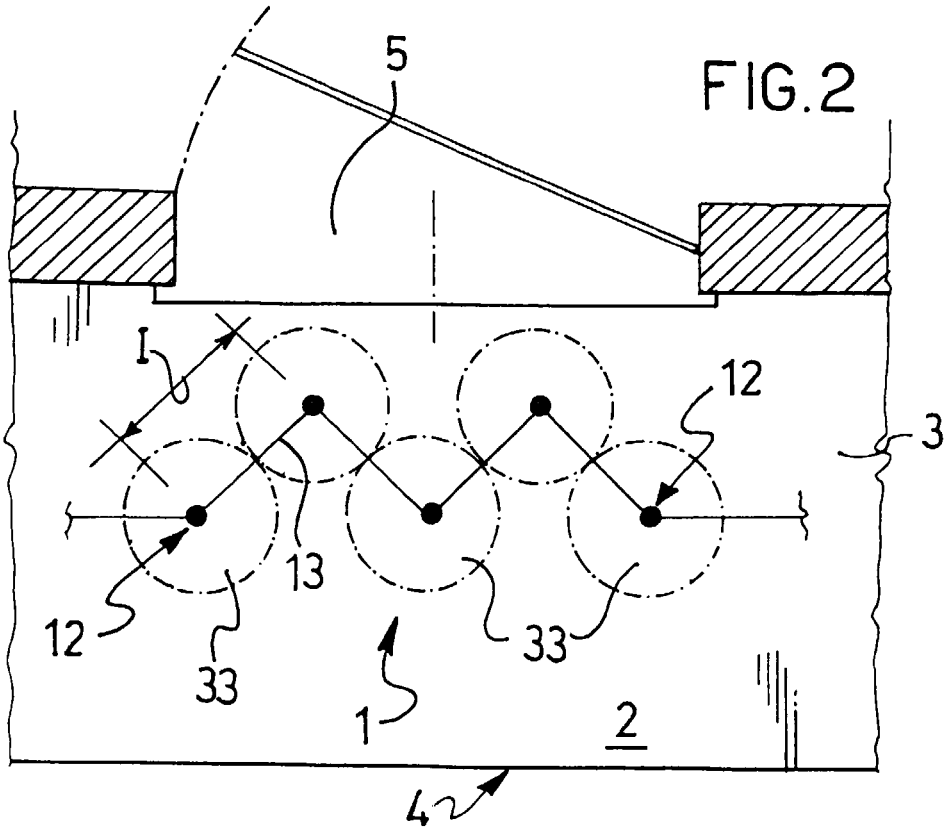

FIG.2

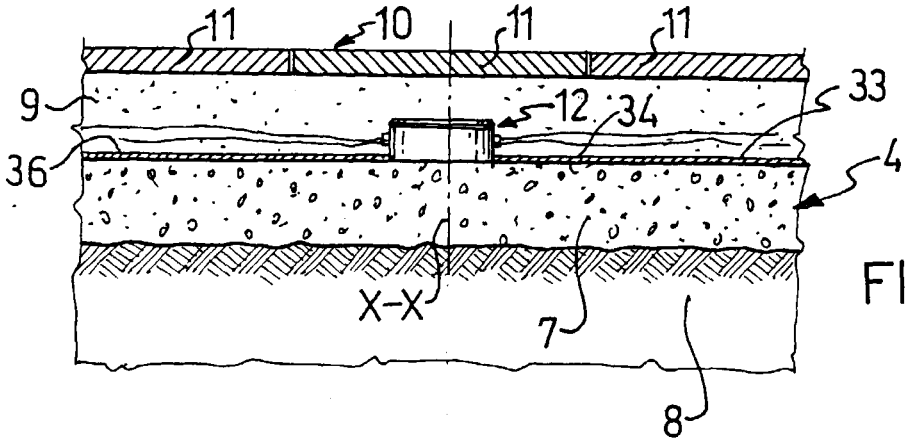

FIG.3

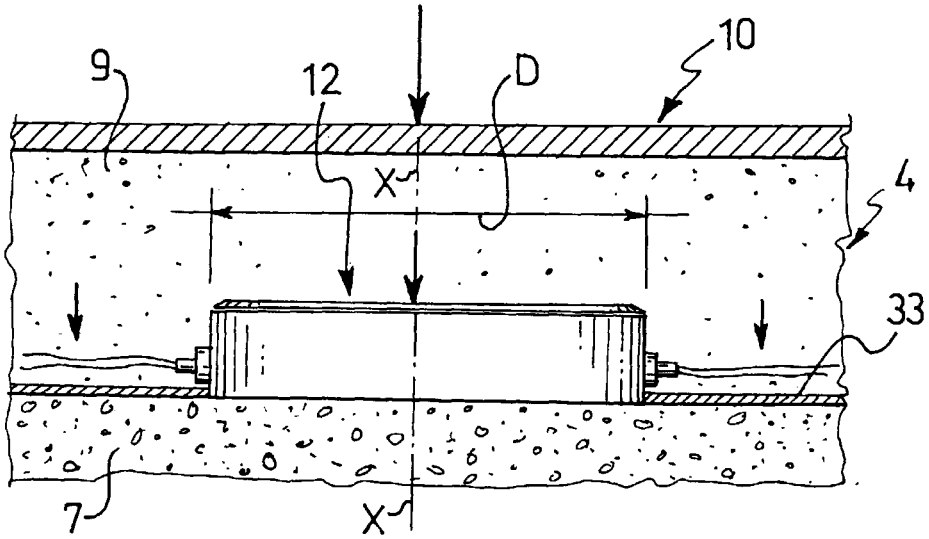

FIG.4

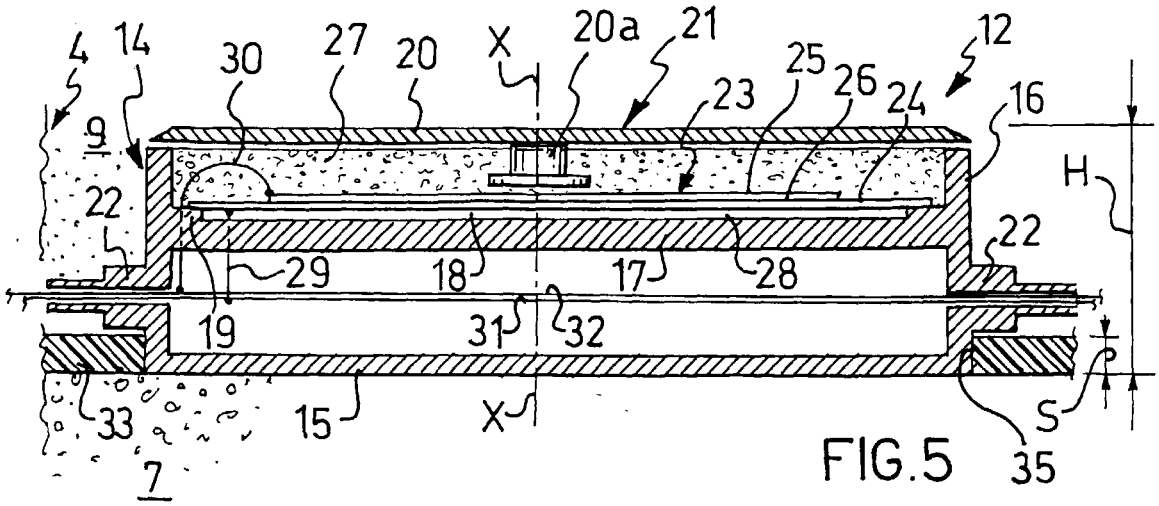

FIG.5

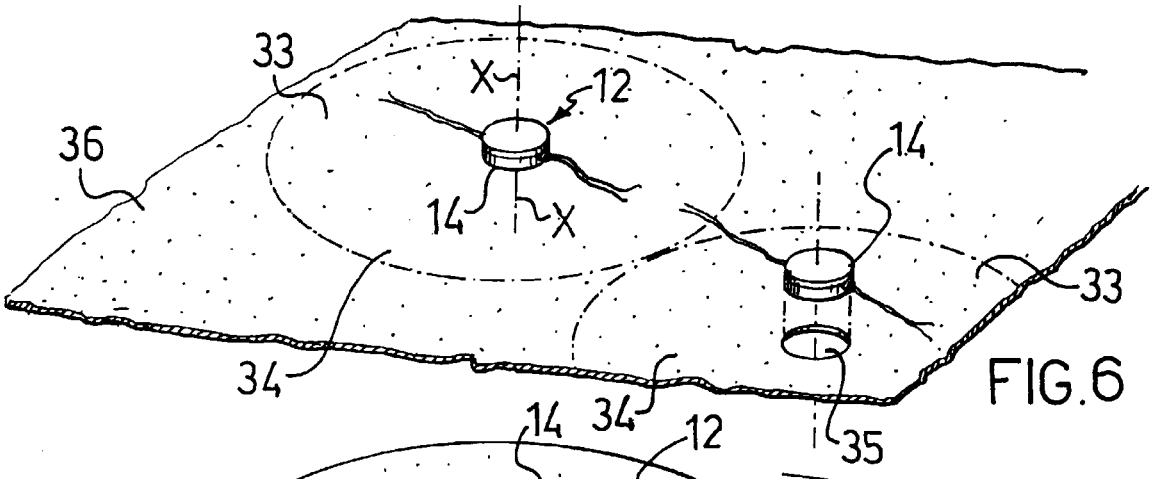

FIG.6

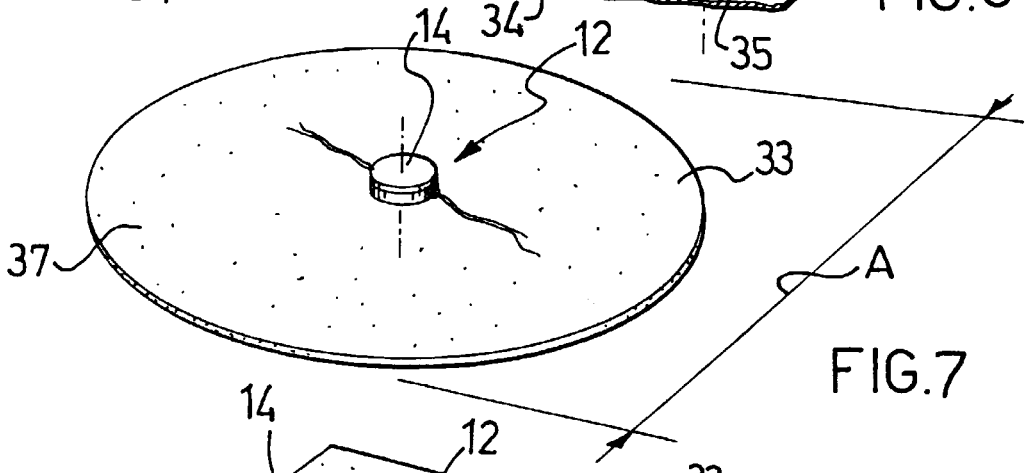

FIG.7

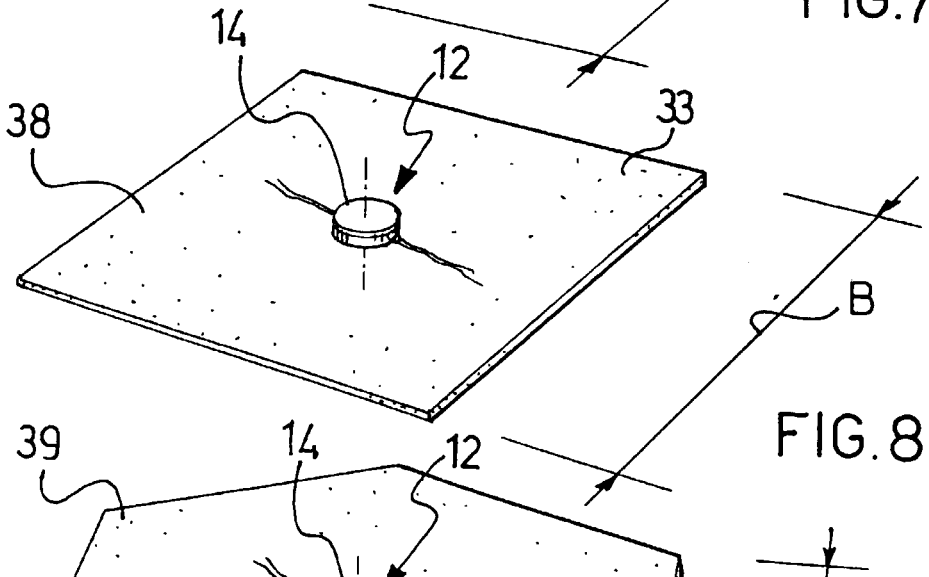

FIG.8

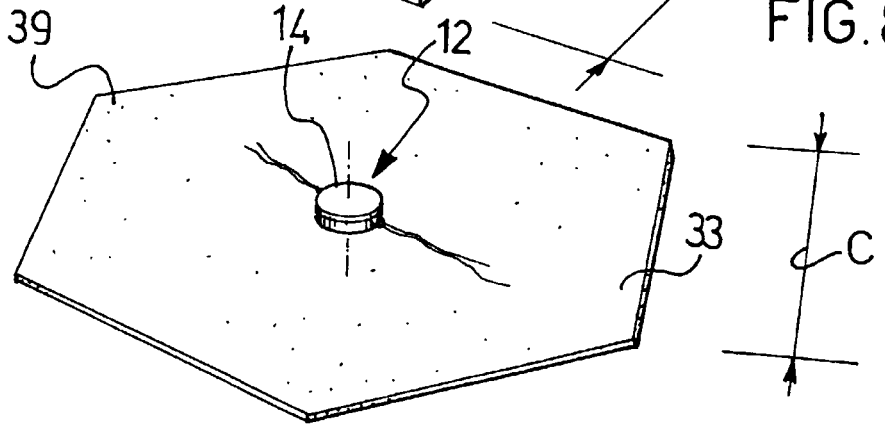

FIG.9