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(54) SEAT OCCUPATION DETECTION MAT

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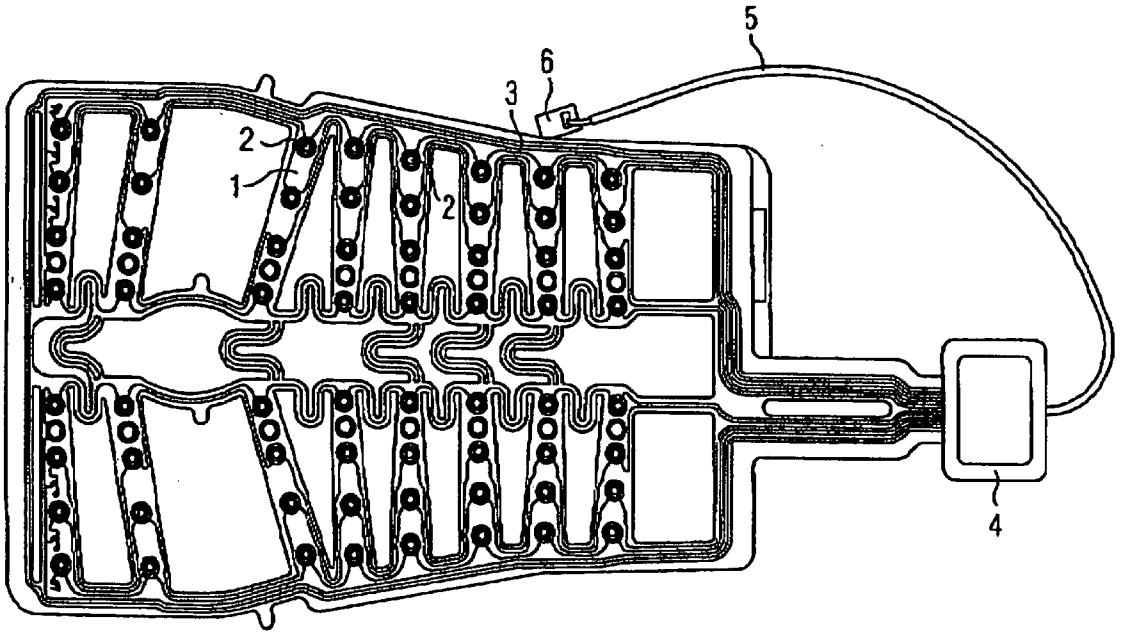
(57) **ABSTRACT**

A seat occupancy detection mat (**1**) is proposed with a number of pressure sensitive sensor elements (**2**) arranged between two mat films (**8**), which is provided with a conductive layer (**7**) for the purpose of shielding from electromagnetic interference radiation, said layer being connected to at least one of the mat films (**8, 9**), or being integrated therein.



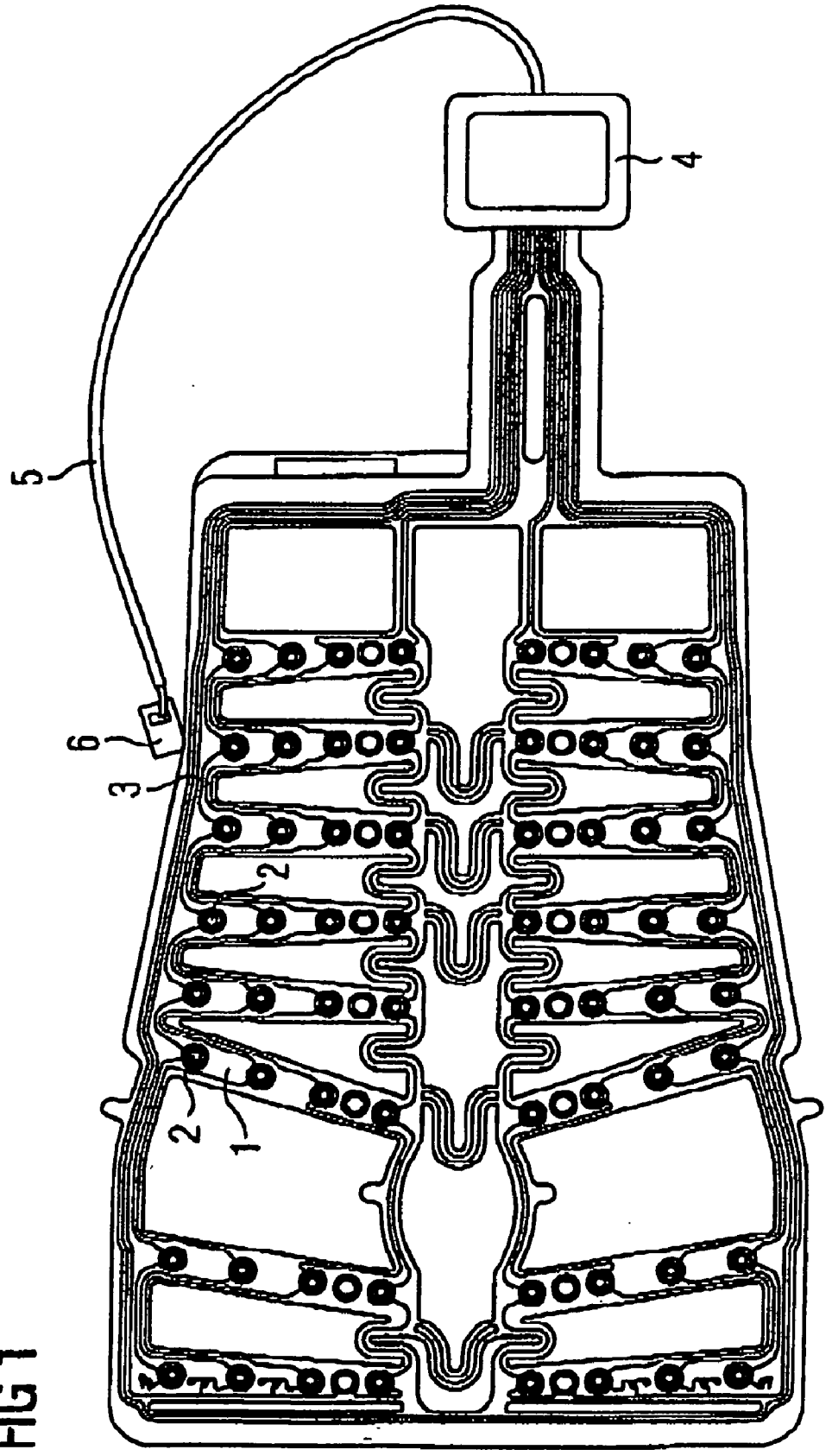


FIG 1

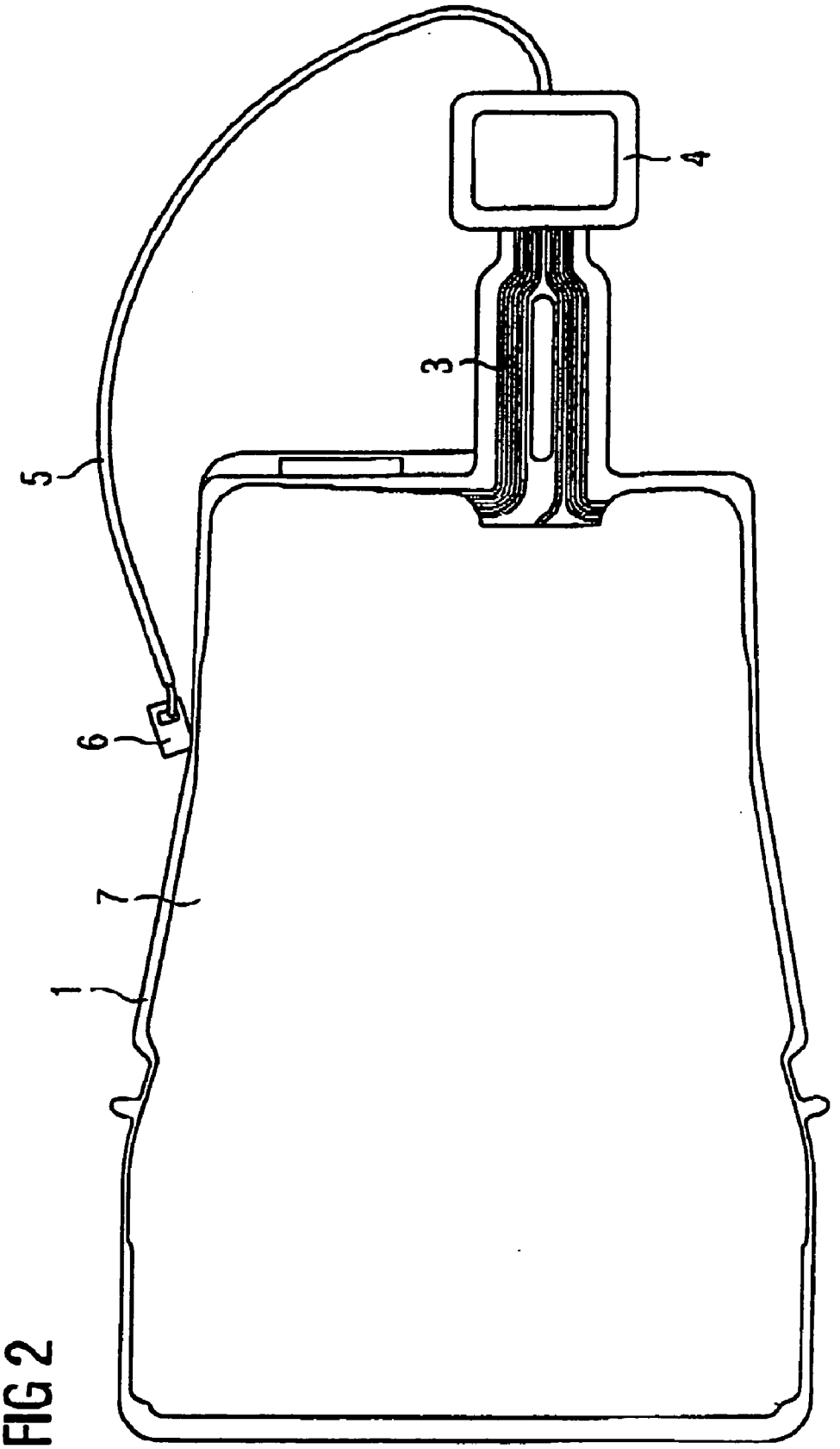


FIG 2

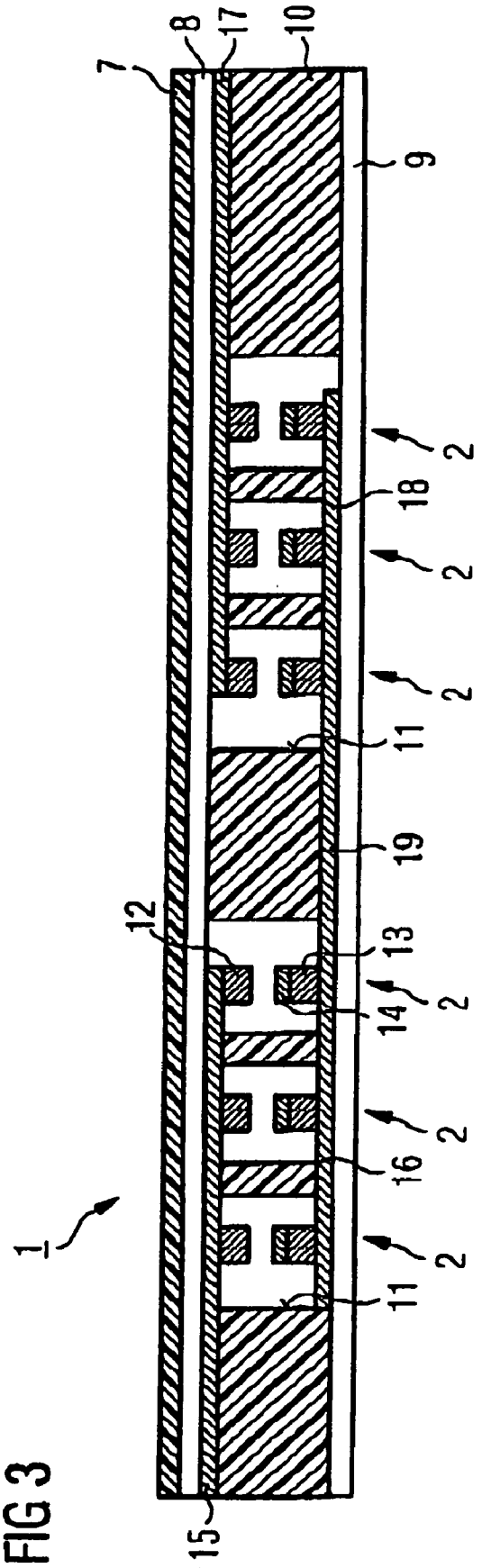


FIG 3

FIG 4

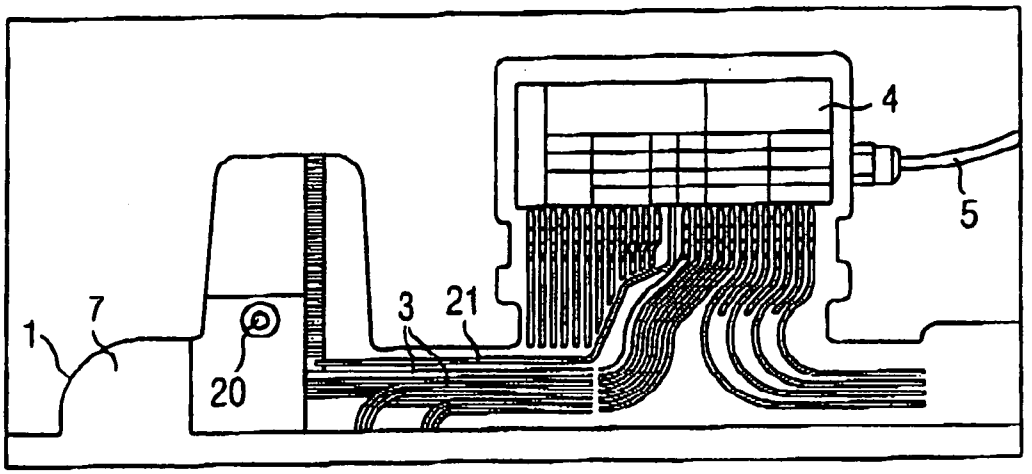
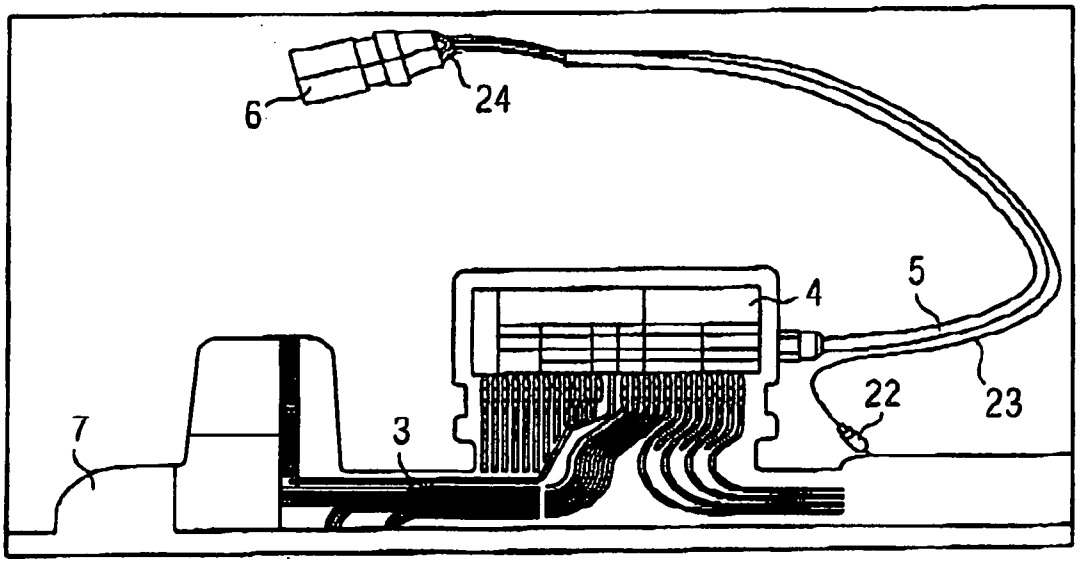


FIG 5



SEAT OCCUPATION DETECTION MAT

[0001] The invention relates to a seat occupancy detection mat with a number of sensor elements, especially pressure-sensitive elements, arranged between two mat films.

[0002] Such seat occupancy detection mats are known from EP 1 491 408 A1 and have been used for some time to control the airbag and/or the seatbelt restraining means, to indicate that the belt is not being worn, to adjust lights or also to control the seat heating in motor vehicles.

[0003] Such a seat occupancy detection mat is integrated into a motor vehicle seat and an occupancy status of a motor vehicle seat is determined by means of the seat occupancy detection mat. This information is transferred to the motor vehicle for further processing in order to trigger necessary responses in the motor vehicle, e.g. if the airbag or the other restraining means assigned to the seat such as the seatbelt for instance, are only activated if the instantaneous occupancy status requires a triggering of this type. The seat occupancy detection mats generally comprise a number of sensor elements arranged between two mat films, e.g. pressure sensors, which are arranged in a distributed manner in or under the seat of the motor vehicle seat. An evaluation unit connected to the seat occupancy detection mat queries the switching status of the individual sensor elements or a group of sensor elements and determines an occupancy status of the seat from the respective switching statuses. If the seat is occupied by a person or an object, a sensor element or a number of sensor elements is triggered as a result of the weight exerted on the seat by the person or the object. The evaluation unit connected thereto detects whether the seat is occupied and forwards the occupancy status to the motor vehicle, in particular the air bag controller.

[0004] Since the seat occupancy detection mats are thus also used in safety-relevant systems, they must satisfy the demand for high quality standards and must undergo suitable qualification processes. They are thus also required to ensure a predetermined qualification in terms of their electromagnetic compatibility (EMC) and/or their electrostatic discharge (ESD) resistance. Previous mats do not adequately fulfill the relevant requirements. The aim of the invention is to overcome this problem.

[0005] This problem is solved inventively in accordance with claim **1** in that at least one of the mat films of the seat occupancy detection mat is provided with a conductive layer. The resistance relating to the electrostatic discharge or the shielding of electromagnetic fields can hereby be improved in a very effective manner.

[0006] As inferred from the subclaims, in the case of an inventive seat occupancy detection mat, the conductive layer is advantageously connected to a mat film, preferably glued thereto. The conductive layer can however also be integrated into the mat film, embedded for instance. In this way, the conductive layer can be formed using a metal wire mesh or a mesh with metallic particles.

[0007] To discharge a potential forming on the conductive layer possibly as a result of electrostatic discharge or electromagnetic radiation, the conductive layer is either connected to the reference potential of the sensor mat or to a motor vehicle potential, in particular the motor vehicle chassis. Such a connection can in this case be a cable connection or a clamping connection, or in the case of a connection to the reference potential of the sensor mat, this can simply be a riveted joint by the sensor mat or a clamping connection on the mat edge, so as to connect the conductive layer to a conductor into or onto the sensor mat, which is connected to the reference potential.

[0008] The invention is described in more detail below with reference to an exemplary embodiment with the aid of figures, in which

[0009] **FIG. 1** shows a seat occupancy detection mat known per se without an inventive conductive layer,

[0010] **FIG. 2** shows a seat occupancy detection mat with an inventive conductive layer,

[0011] **FIG. 3** shows a detailed description of a cross-section through an inventive seat occupancy detection mat

[0012] **FIG. 4** shows a first connection variant of the conductive layer with reference potential and

[0013] **FIG. 5** shows a second connection variant of the conductive layer with reference potential.

[0014] The seat occupancy detection mat **1** shown in **FIG. 1** features a number of sensor elements **2**, which are arranged in a distributed manner over the seat depending on how the seat occupancy detection mat **1** is installed into the motor vehicle seat. The sensor elements **2** are partially connected to one another and to an evaluation unit **4** via conductors **3**. In this way the sensor elements **2** can be individually queried by the evaluation unit in a similar manner to the memory cells in a semi-conductor memory by means of suitable row and column lines. It is however just as possible to interconnect individual sensor elements **2** into groups, in order only to query the response of a sensor element group or of the entire seat occupancy detection mat. The evaluation unit **4** is connected to a plug **6** via a cable **5**, said plug being able to be connected to the motor vehicle wiring harness for instance, so as to make the response of the motor vehicle dependent on the seat occupancy. The evaluation unit **4** can be connected in particular to a control device for a passenger protection system, in order to make the triggering of an airbag for instance dependent on the seat occupancy.

[0015] **FIG. 2** now shows such a seat occupancy detection mat **1**, which is covered, in an inventive manner, with a conductive layer **7** so as to shield electromagnetic radiation.

[0016] **FIG. 3** shows a schematic representation of a cross-section through such an inventive seat occupancy detection mat **1**. The seat occupancy detection mat **1** is formed in this case with an upper and a lower mat film **8**, **9**, between which an intermediate layer **10** comprising recesses is arranged. Sensor elements **2** are arranged in the recesses **11** of the intermediate layer **10**, said sensor elements being formed with a first electrode **12** and a second electrode **13**, with a layer made of pressure sensitive material **14** being formed on one of the electrodes **12**, **13**. Both electrodes **12**, **13** can however also be provided with resistance material. The pressure dependency is then generated by the surface end of the two electrodes, as a function of the force exerted on the sensor element and the compression of the two electrodes **12**, **13**.

[0017] If a force is now exerted on the mat, the layer made of pressure sensitive material **14** is clamped between the

electrodes **12**, **13** and forms a pressure-dependent resistance. In order to detect this pressure-dependent resistance, the electrodes **12**, **13** of the sensor elements **2** are connected to the conductor lines **15** to **18** in the exemplary embodiment illustrated.

[**0018**] In the exemplary embodiment illustrated, the sensor elements **2** are combined to form two groups of three sensor elements each, thereby avoiding the need for conductor paths but providing for a very simple seat occupancy detection. As already detailed, it is similarly possible to separately query each individual sensor element **2** by suitably increasing the number of conductor paths.

[**0019**] To shield the sensor elements **2** and the conductive paths **15** to **19** from electromagnetic interference influences or to protect them from electrostatic discharge, a conductive layer **7** is arranged in an inventive manner onto the at least one of the mat films **8**, **9**, in the exemplary embodiment, onto the upper mat film **8**, said conductive layer being glued to the mat film for instance. It is however similarly possible to integrate the conductive layer **7** into the mat film **8** or **9**, or for instance to embed it therein. It is similarly conceivable to design the conductive layer as a side of a pocket in which the seat occupancy detection mat is located.

[**0020**] To discharge potentials forming on the conductive layer **7** as a result of the electromagnetic inteference radiation, said conductive layer should be suitably connected to a reference potential, the reference potential of the seat occupancy detection mat for instance or also to the motor vehicle potential.

[**0021**] Two connection variants are shown in **FIGS. 4 and 5**.

[**0022**] In **FIG. 4**, the conductive layer **7** is connected to an additional conductor **21** with the reference potential of the evaluation unit **4** via a riveted contact **20** in the seat occupancy detection mat. According to **FIG. 5**, the conductive layer **7** can alternatively also be contacted **5** via a plug contact **22** and be connected to a reference potential contact **24** in the plug **6** via a cable **23**.

[**0023**] Both variants illustrated provide for subsequently equipping of conventional seat occupancy detection mats with a conductive layer and for a suitable connection to the reference potential.

1-7. (canceled)

8. A seat occupancy detection mat, comprising:

two mat films disposed in substantially congruent relationship and a conductive layer provided on at least one of said two mat films; and

a plurality of sensor elements disposed between said two mat films.

9. The seat occupancy detection mat according to claim 8, wherein said plurality of elements are pressure-sensitive sensor elements.

10. The seat occupancy detection mat according to claim 8, wherein said conductive layer is connected to one of said two mat films.

11. The seat occupancy detection mat according to claim 10, wherein said conductive layer is glued to one of said two mat films.

12. The seat occupancy detection mat according to claim 8, wherein said conductive layer is integrated into one of said mat films.

13. The seat occupancy detection mat according to claim 8, wherein said conductive layer is connected to a reference potential of said sensor mat.

14. The seat occupancy detection mat according to claim 13, wherein said conductive layer is connected via a riveted joint.

15. The seat occupancy detection mat according to claim 14, wherein said conductive layer is connected via a cable connection.

16. The seat occupancy detection mat according to claim 8, wherein said conductive layer is connected to a vehicle potential.

17. The seat occupancy detection mat according to claim 8, wherein said conductive layer is connected to a vehicle chassis.

18. In combination with a motor vehicle, the seat occupancy detection mat according to claim 8 having said conductive layer connected to a ground potential of the motor vehicle.

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