TOUCH-SENSITIVE INTERFACE

TECHNICAL FIELD

[0001] The invention applies to the field of devices for transmitting tactile information to a user. It relates more particularly to a device comprising a tactile interface formed by a plate having a surface to be modified in a controlled manner, the plate comprising an array of elements for modification of the surface.

[0002] Such plates are especially employed in touch plates or tactile interfaces for communicating information for example in the field of cars or in communicating objects, for example portable telephones or computer mice or in the field of objects for blind people.

[0003] The invention applies also to the field of virtual reality, for example for reproducing the sensation of a texture.

PRIOR ART

[0004] U.S. Pat. No. 6,159,013 describes a portable optic sensor for blind people. The device comprises a touch plate fitted with holes in which surface element modification of the plate constituted in this case by rods are mobile. The position of the rods is controlled electromagnetically.

[0005] An address circuit associated with address control means receiving the tactile data to be displayed determines the circulation of currents in control coils of the position of the rods.

[0006] According to its position, a rod emerges or does not emerge from a touch surface of the touch plate. The control of each of the rods allows forming of patterns on the plate.

[0007] There are also tactile interfaces based on thermal actuators, especially shape memory alloys (SMA) utilising only wires as actuators. The movement of the part actuated by the wire is slight. Various solutions have been put forward for amplifying the movement of the mobile part, especially by using lever arms and return springs. However, as soon as it is preferred to increase the resolution of the touch plate, that is, increase the number of modification elements per surface unit of the plate, the assembly of plate and elements becomes very complicated and the system becomes bulky.

[0008] The shape memory alloys (SMA) are known per se. These are alloys capable of transforming thermal energy provided to them during mechanical work. They can thus give back deformations of the order of 6 to 8% and generate relatively significant efforts when they are heated. In addition, the SMA are in general low in cost and the physical implementation of the heating operation can be carried out simply. When a piece made of SMA passes from a first to a second temperature, its mechanical form changes and passes from a first to a second form. Two-way effects can also be obtained. For this purpose the material is given a first shape. It is heated in this first shape, then cooled; it retains its first shape. It is then subjected to thermal cycle processing in a second shape. After this thermal cycle processing the material has, in the hot state, the first shape and, in the cold state, the second shape.

SHORT DESCRIPTION OF THE INVENTION

[0009] The aim of the present invention is a device comprising a tactile interface formed by a plate. The plate has a surface capable of being modified in a controlled manner. For this purpose the plate comprises an ensemble of mobile parts of the modification element of the surface which is simple to produce and compact. The aim of the present invention is likewise a device comprising a tactile interface having large modification resolution. When it comes to plate, this does not necessarily signify only the plate with a flat shape. It can be for example a cylindrical surface in the geometric sense. It can also be one or more layers deposited on a substrate by technologies used in microelectronics.

[0010] According to the present invention these aims are reached by the fact that in the device comprising the tactile interface the plate is made of a shape memory material, or comprises at least one sub-plate made of such a material. Also, the array of mobile parts of modification elements of the plate is made up of an array of one or more blade(s) solid monolithically with the plate by one or more arms solid monolithically with the blade and the plate, one or more recesses to release blade(s) being present on a part of a perimeter of the blade, the blade having a first position at a first temperature and a second position at a second temperature. The device comprises control means of the surface element modification.

[0011] To pass from the first to the second form, it suffices to apply local heating to the blade or preferably to a linking arm of the blade on the rear of the plate. To return from the second to the first position of the blade, it suffices to let it cool. It can also be cooled actively, for example by means of a Pelletier cell.

[0012] According to a first advantageous embodiment in which the plate is made of a shape memory material, the return to the first form is achieved by the fact that the plate has undergone thermal processing allowing two-way effect. In this case a first heating of a part from the plate causes a change in shape of this part from a first form to a second form. Cooling of this same part causes a return to the first form. This first embodiment allows control of the rest time of a pattern made on the plate.

[0013] According to a second embodiment in which the plate is made of a shape memory material, the blade is attached to the plate by several arms. One (or several) first arm(s) has (have) a memorised form, which it recovers by heating, and one (or more) second arms have not undergone local thermal processing. The return of the blade to the first form is assured or accelerated by the fact that the second arms exert an elastic return force on the first arms for returning the blade to its initial position.

[0014] According to a variant of this second embodiment where the return to the first form is effected by elastic means, the plate is formed with two sub-plates assembled for example by welding or bonding so as to form only a single plate. A first sub-plate is made of a shape memory material A. A second sub-plate is made of an elastic material B. A heated part of the first sub-plate made of material A will cause deformation of this part by deformation of the material causing elastic deformation of the material B. When, due to the fact of natural or active cooling of the material A, the material A is less rigid, the return of the material B to its initial form by elastic effect causes return to the first form of the materials A and B.

[0015] According to a third embodiment, in which the plate is made of shape memory material A, the plate is made