

1 DEVICE FOR COMMUNICATING WITH A PORTABLE DATA MEDIUM

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3 The invention relates to a device for communicating with a
4 portable data medium and comprising for this purpose an
5 electrical contact intended to cooperate with at least one
6 electrical contact of the portable data medium through connecting
7 means, in which said connecting means comprise a sheet extending
8 between the electrical contact of the device and the electrical
9 contact of the portable data medium and having at least one area
10 forming a first conducting element running through a thickness of
11 the sheet and disposed so as to cooperate with each of said
12 contacts, and the device comprises force application means for
13 applying a compressing force to the contacts in order to press
14 said first conducting element against each of said contacts, and
15 for discontinuing the application of said force in order to move
16 said first conducting element away from the contacts.

17 The portable data medium is constituted, in particular, by a
18 card of the credit card type equipped, in an intrinsically known
19 way, with a microprocessor chip or a logical circuit chip for
20 processing data, and carrying a plurality of electrical contacts
21 intended to cooperate with an equal number of contacts carried by
22 the device, as described, in particular, in US patent 4,211,919.
23 The device can be any unit intended to exchange information with
24 the portable data medium within the framework of any procedure,
25 such as a financial operation, a verification of a user's access
26 to a site, etc.

27 Conventionally, the connecting means comprise a comb
28 attached to the device and carrying a plurality of juxtaposed
29 flexible metal pins. These pins are connected to the contacts of
30 the device and are intended to cooperate elastically with the
31 contacts of the portable data medium. Other connecting means
32 having metal springs also exist. This type of connecting means
33 has the drawback of being expensive to produce due to the metal
34 cutting operations it involves.

35 The object of the invention is to offer a device of the type
36 mentioned at the beginning of the specification, wherein the



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means for connecting to the portable data medium are less expensive to produce.

To this end, according to the invention, said first conducting element comprises an electrically conductive mass made of elastomer.

Other characteristics and advantages of the present invention will emerge more clearly through the reading of the following description of an exemplary embodiment of the device, illustrated with the aid of the following figures, in which:

Fig. 1 is a top view of the inside of a portable data medium reader in the process of cooperating with a portable data medium;

Fig. 2 is a sectional view along the line II-II of Fig. 1;

Fig. 3 is a top view of the connector with which the reader is equipped;

Fig. 4 is a partial sectional view along the line IV-IV of Fig. 3;

Fig. 5 is a partial sectional view along the line V-V of Fig. 3;

Figs. 6a through 6c are three partial sectional views along the line VI-VI of Fig. 3 when the reader is cooperating with the portable data medium, illustrating three successive phases of a procedure for putting these two devices in contact;

Fig. 7 is a partial sectional view of the printed circuit 4, showing a practical embodiment of any one of its contacts, cooperating with a conducting element;

Fig. 8a is a sectional view along the line VIII-VIII of Fig. 2, showing a refinement of the invention comprised of adding a lip for closing the slot of the reader 1, while Fig. 8b differs from Fig. 8a in that it shows the reader 1 once the card has been inserted.

Figs. 1 and 2 represent a chip card reader 1 capable of receiving a card 2 of the credit card type equipped, in an intrinsically known way, with a microprocessor chip or a logical circuit chip for processing data, and carrying a plurality of electrical contacts intended to cooperate with an equal number of

1 contacts carried by the reader, through a connector 3.

2 In this example, the reader 1 is portable and is so small in
3 size that it receives only one end of the card carrying said
4 chip: in particular, its function is to allow a holder of this
5 card to read an account balance recorded in the card. It
6 comprises a printed circuit 4 carrying on a top side a
7 microprocessor chip 5 and a display 6, and on a bottom side, said
8 connector 3, attached to the printed circuit 4 by suitable means.
9 These means can be constituted by, among other things:

10 - bonding by means of applied glue, or a double-sided
11 adhesive layer;

12 - pins carried by the connector 3, which pass through the
13 printed circuit 4 and are folded down onto it;

14 - a screw connection.

15 The reader 1 also comprises a set of batteries 7. A case
16 encloses the reader 1 and comprises a body 8 that receives the
17 various elements of the reader 1 and a cover 9 that covers the
18 body 8 and creates with it a lateral slot for the card 2 to pass
19 through in such a way that the contacts of the latter line come
20 face-to-face with the connector 3.

21 The connector 3 in Figs. 3 through 5 comprises a body 31
22 constituted by a thick rectangular sheet made of flexible,
23 electrically insulating material. According to a preferred
24 embodiment, the body 31 is made of elastomer. It comprises a
25 plurality of circular through-holes 32, disposed in the same way
26 as the contacts of the card 2 and equal in number to the latter
27 (in this case, eight). In line with each hole 32, and on each
28 side of the connector 3, is a circular recess 33 that reduces the
29 thickness of the body 31 at this point.

30 In each hole 32 is a conducting element formed by a
31 conducting sphere 34 constituted by an elastomer material such as
32 silicone rubber incorporating a filler that renders it
33 electrically conductive. Typically this filler is silver or
34 carbon. Each conducting sphere 34 has a diameter slightly larger
35 than that of the hole 32 so that the latter exerts a certain

1 peripheral pressure on the conducting sphere 34. Thus, each
2 conducting sphere 34 is elastically held in the corresponding
3 hole 32. Each conducting sphere 34 is mounted on the body 32 in
4 such a way that it is set back from one side 35 of the body 31
5 intended to cooperate with the printed circuit 4 of the reader 1,
6 and that, on the other hand, it projects past an opposite side 37
7 of the body 31 intended to cooperate with the card 2.

8 Apart from the holes 32, the body 31 of the connector 3 has,
9 on its side 35 intended to cooperate with the printed circuit 4
10 of the reader 1, a circular recess 36, and on its side 37
11 intended to cooperate with the card and in line with the recess
12 36, a substantially cylindrical projection 38 extending
13 perpendicular to the body toward its exterior. The projection 38
14 is such that it projects past the surface of the body 31.

15 In the recess 36 of the body 31 is a circular conducting pad
16 39 made of a rigid or flexible electrically conductive material.
17 In this example, it is made of the same material as the
18 conducting spheres 34. The disposition is such that the
19 conducting pad 39 is set back from the surface of the body 31.
20 The conducting pad 39 is attached to the body 31 by any suitable
21 means, particularly by bonding or embossing.

22 The operation of the connector 3 will now be explained in
23 reference to Figs. 6a through 6c. Fig. 6a shows the card 2 as it
24 is inserted into the reader 1. The printed circuit 4 of the
25 reader 1 carries, in line with each conducting sphere 34 of the
26 connector 3, a flat and preferably circular contact 44, and in
27 line with the only conducting pad 39 of the connector 3, a pair
28 of flat and preferably circular contacts 49a, 49b disposed side-
29 by-side with a nonconductive space 50 interposed. The space 50 is
30 disposed facing the conducting pad 39 and is smaller in size. All
31 of the contacts 24, 44, 49a, 49b are made of a standard metallic
32 material used in printed circuits; typically, it is a multilayer
33 compound comprising a copper layer covered by a nickel layer,
34 followed by a gold or tin-lead layer. The two contacts 49a, 49b
35 constitute two fixed parts of a switch whose moving part is

1 constituted by the conducting pad 39.; this switch serves to
2 detect the presence of the card in the reader. In the situation
3 of Fig. 6a, given the above-mentioned setbacks or projections of
4 the conducting elements, there is no electrical continuity
5 between the contacts 24 and 44 on the one hand, and between the
6 contacts 49a and 49b on the other hand, since the conducting
7 elements are not touching any electrical contact.

8 Fig. 6b represents an intermediate contact phase in which
9 the card 2 and the printed circuit 4 of the reader 1 are moved
10 toward one another. This was obtained by taking advantage of a
11 certain deformability of the case of the reader 1; the user of
12 the reader 1 must manually exert an average force f from both
13 sides of the case, i.e., on its body 8 and on its lid 9 (see Fig.
14 6b) in order to move them toward one another. This deformability
15 could be obtained in several ways, including the following:

- 16 - providing a case constituted by a deformable material (for
17 example plastic);
- 18 - providing a case whose lid 9 is elastically mounted on the
19 body 8, i.e., by means of deformable intermediate connecting
20 elements, for example elastomer elements.

21 The result of the force f exerted by the user is that
22 electrical continuity is produced by the conducting spheres 34
23 between the contacts 24, 44, though not yet by the conducting pad
24 39, since the projection 38 is not yet being acted on by the card
25 2. This result is obtained by properly adjusting the respective
26 setbacks and projections of the conducting spheres 34 and the
27 conducting pad 39, as well as the height of the projection 38. It
28 may be seen that the conducting spheres 34 have been subject to a
29 compression, producing an increase in their diameter.

30 By exerting a greater force F , the user reaches a final
31 contact phase (Fig. 6c) in which the conducting pad 39 also
32 produces electrical continuity between the two contacts 49a, 49b.
33 In effect, during the larger movement of the card 2 toward the
34 reader 1, the reader exerts a pressure on the projection 38 in
35 such a way that the conducting plate 39 is pushed toward the

printed circuit 4 of the reader 1 until it touches the contacts 49a, 49b.

The sequencing of the two above-mentioned contact phases advantageously makes it possible to meet the requirements of ISO standard 7816-3, which defines the sequence for generating the signals that must be applied to the card, since the reader 1 will only supply power to the card after having determined that the switch 49a, 49b is closed.

Naturally, the progressive release of the force F will result in a disconnection of the contacts in the reverse order from that described for the contact phase, i.e., first the retraction of the conducting pad 39, then the retraction of the conducting sphere 34, again in accordance with the requirements of ISO standard 7816-3.

It must be noted that it is necessary to precisely adjust the force F required to obtain the closing of the switch 49a, 49b, as well as the height of the projection 38, so as not to exceed a maximum force $F_{\max}$ that the chip of the card can withstand without damage. Typically, $F_{\max}$ is on the order of 50 grams. This adjustment can be obtained by acting on the respective dimensions of the parts and the hardness of the elastomer material chosen.

One refinement of the invention is characterized in that at least some of the conducting elements are constituted so as to have a given electrical resistance, in order to advantageously replace resistors ordinarily embodied in the form of discrete components, and are imprinted on the printed circuit 4 of the reader 1. The resistance value thus constituted must be measured while the force F is applied in order to take into account the influence of this force on the resistance value.

Naturally, the conducting elements could exist in any appropriate form other than those described above. For example, the conducting spheres 34, could be replaced by cylinders. Moreover, the conducting elements, instead of being attached to the body 31 of the connector 3, could be embodied in the mass of

1 element such as 34 intended to cooperate simultaneously with the
2 printed circuit 4 and the card 2 must project from each side of
3 the connector 3, in order to guarantee that it will actually come
4 into contact with them.

CLAIMS

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3 1. A device for communicating with a portable data medium
4 (2) and comprising for this purpose at least one electrical
5 contact (44) intended to cooperate with at least one electrical
6 contact (24) of the portable data medium through connecting means
7 (3), in which said connecting means (3) comprise a sheet (31)
8 extending between the electrical contact (44) of the device and
9 the electrical contact (24) of the portable data medium and
10 having at least one area forming a first conducting element (34)
11 running through a thickness of the sheet and disposed so as to
12 cooperate with each of said contacts (24, 44), and the device
13 comprises force application means (8, 9) for applying a
14 compressing force to the contacts (24, 44) in order to press said
15 first conducting element (34) against each of said contacts (24,
16 44) and for discontinuing the application of said force in order
17 to move said first conducting element (34) away from the contacts
18 (24, 44), characterized in that said first conducting element
19 (34) comprises an electrically conductive mass made of elastomer.

1 2. The device according to claim 1, in which said first
2 conducting element (34) is an insert housed in a hole (32) of the
3 sheet (31).

1 3. The device according to claim 2, in which the first
2 conducting element (34) is in the shape of a sphere.

1 4. The device according to claim 1, in which the
2 conducting element (34) has an electrical resistance of
3 predetermined value.

1 5. The device according to claim 1, in which said sheet
2 (31) is made of elastomer.

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1 6. The device according to claim 1, in which said sheet
2 (31) comprises an area forming a second conducting element (39)
3 disposed so as to cooperate with two contacts (49a, 49b) of the
4 device when the force application means (8, 9) are activated.

1 7. The device according to claim 6, in which the second
2 conducting element (39) is in the form of a pad located on a
3 first side of the sheet (31), a projection (38) being located on
4 a second side of the sheet (31) opposite the first side, across
5 from the second conducting element (39), for cooperating with the
6 portable data medium (2).

1 8. The device according to claim 6, in which the first
2 (34) and second (39) conducting elements are disposed so that an
3 activation of the force application means (8, 9) causes a
4 cooperation of each first conducting element (34), then of the
5 second conducting element (39), with the contacts, while a
6 deactivation of the force application means (8, 9) discontinues
7 the cooperation of the second conducting element (39), then of
8 each first conducting elements (34), with the contacts.

1 9. The device according to claim 1, in which the device
2 comprises a case that receives the portable data medium (2), and
3 said force application means comprise walls (8, 9) of said case.

1 10. The device according to claim 1, which has a slot (81)
2 through which the portable data medium (2) can be inserted into
3 the device in order to cooperate with it, said sheet having a lip
4 (80) disposed so as to close said slot in the absence of the
5 portable data medium, and to fold away when the portable data
6 medium is inserted into the slot.

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