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(54) **Electrical connector**

(57) The present invention relates to a connector (1) which can readily be (un)coupled for electrically or optically coupling a first electrical or optical apparatus or network to a cable or second electrical or optical apparatus, comprising a magnetic coupling which is situated substantially on one side with respect to the electrical or optical coupling of the connector (1), so that the coupling is ensured even when substantially frontal forces smaller than a certain force $F_{min}$ act on the coupling and the coupling is automatically uncoupled when forces greater than a certain force $F_{max}$ occur.

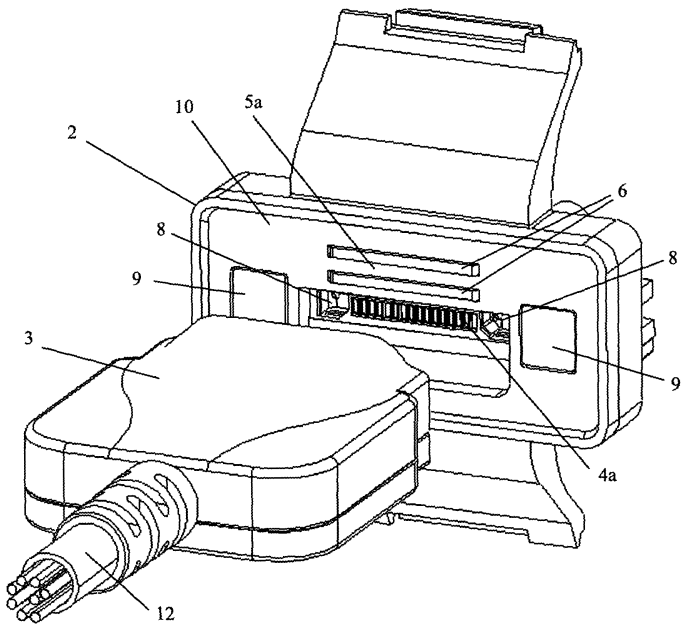


**FIG. 1**

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## Description

**[0001]** The present invention relates to a connector for electrically or optically coupling a first electrical or optical apparatus or network to a cable or second electrical or optical apparatus, comprising:

- a first coupling element which is electrically or optically coupled to the first electrical or optical apparatus or the network;
- a second coupling element, which is electrically or optically coupled to the cable or the second electrical or optical apparatus;
- an electrical or optical coupling for electrically or optically coupling the first coupling element to the second coupling element; and
- a magnetic coupling for magnetically coupling the first coupling element to the second coupling element when these are electrically or optically coupled, comprising one or more magnetic elements which form part of the first coupling element and one or more magnetic elements which form part of the second coupling element, in which these one or more magnetic elements are positioned in such a manner that when the first coupling element is electrically or optically coupled to the second coupling element, the one or more magnetic elements of the first coupling element are situated essentially opposite the one or more magnetic elements of the second coupling element, so that these attract one another, the magnetic coupling being situated essentially on one side with respect to the electrical or optical coupling, and the magnetic elements comprising one or more permanent magnets.

**[0002]** Electrical or optical couplings are currently used in all kinds of possible forms and applications. These can be used to provide electrical power or optical input to an apparatus or to enable data communication between apparatus, or to supply audio signals to an apparatus, etc. By means of such an electrical or optical coupling, an electrical or optical apparatus, such as for example a TV, computer, household appliance, etc. is coupled to a network, such as an electricity network or a data network, etc., or this electrical or optical apparatus is first coupled to a cable, and this cable is subsequently coupled to a network, or an electrical or optical apparatus is coupled directly to a second electrical or optical apparatus, etc.

**[0003]** In general, a number of safety measures have to be observed for such connectors with electrical or optical couplings. For use in certain industries, such as for example the health care industry, the requirements that such a connector would have to satisfy may be much more stringent than the usual requirements.

**[0004]** The present invention relates in particular to such connectors which have to satisfy the following, more stringent requirements. However, obviously such connectors according to the present invention are also useful for other applications.

**[0005]** A connector from the health care industry for which no satisfactory solution has been found to date is a connector for an alarm system with emergency buttons which have to be coupled to a network of the alarm system, for example next to hospital beds. By means of such an emergency button, a patient can alert someone from the nursing staff.

**[0006]** A first major requirement which such a connector for an emergency button has to satisfy is that the electrical or optical coupling should not easily become disconnected under the weight of the cable which is connected to the emergency button and the weight of the call button itself. The reason for this is that passing on an emergency signal may be critical in saving lives and therefore has to be guaranteed as well as possible. In this case, it is then possible to also define a force $F_{min}$ which can act on the connector, and in this case, it should be guaranteed that the coupling is not automatically disconnected under this force. In the case of an application of an emergency button in the health care industry, this force $F_{min}$ corresponds, for example, to a weight between 0.2 kg and 0.5 kg.

**[0007]** On the other hand, the connector does have to be able to readily uncouple under a much greater force, such as occurs, for example, when someone trips over the cable or is caught on said cable, etc. Therefore, it also has to be guaranteed that when a force greater than a certain force $F_{max}$ acts on the connector, said connector automatically uncouples. In the case of an application of an emergency button in the health care industry, this force $F_{max}$ corresponds, for example, to a weight between 2 kg and 2.3 kg.

**[0008]** In order to be able to achieve the (un)coupling of the connector at said forces with the existing connectors, this electrical or optical coupling is of such a solid design, that a great manual force is also required in order to (un)couple it intentionally during normal use. Not only is this not very user-friendly for the nursing staff which has to (un)couple such emergency buttons regularly, but, moreover, this often results in damage to the connector and/or to the surroundings in which a coupling element of this connector has been fitted. In most cases, such a connector consists of a male coupling element which is coupled to the cable which is attached to the emergency button and a female coupling element which is fitted, for example, in the edge of the bed and connected to the network of the alarm system. In many cases, it can be seen that repeatedly coupling the male coupling element to the female coupling element using great force leads to damage to said edge of the bed, which obviously results in significant repair costs. Often, the connector itself is also damaged due to the (un)coupling thereof using great force. More and more often, other functions are added to the alerting function of this emergency button, such as operating the radio/TV, etc. As a result thereof, the male coupling element contains many contact pins on a small surface area (and the female coupling element

contains many corresponding contact sockets). The contact pins of the male coupling element are consequently becoming increasingly thin and therefore more susceptible to damage.

**[0009]** Furthermore, existing connectors of this kind are often also damaged due to the male coupling element being coupled to the female coupling element in an incorrect manner. The reason for that is that with existing connectors of this type, it is often possible to couple them at an angle to their normal position or to couple half of the contact pins of the male coupling element to half of the contact sockets of the female coupling element or even to couple the male coupling element upside down to the female coupling element. Several different kinds of aids already exist to ensure that these coupling elements are coupled to one another correctly. A first aid is the application of a marking on the male coupling element which indicates which side is the top side of the connector in the fitted position thereof. This aid is usually not sufficient, because users do not automatically notice such markings when coupling the connector, or because the female coupling element was not fitted in the corresponding position, etc. More efficient aids are, for example, guide pins which have to be fitted in guide sockets in the corresponding coupling element when the contact pins are coupled to the contact sockets. However, even when such guide pins and guide sockets have been fitted, it is still possible to couple the connector upside down.

**[0010]** It was thought that a solution for ensuring a satisfactory coupling of a connector when forces smaller than $F_{min}$ occur, for ensuring the automatic uncoupling of a connector when forces greater than $F_{max}$ occur without damaging the connector and/or the surroundings, could be found by providing a connector, for electrically or optically coupling a first electrical or optical apparatus or network to a cable or second electrical or optical apparatus, comprising a first coupling element, which is electrically or optically coupled to the first electrical or optical apparatus or the network, a second coupling element, which is electrically or optically coupled to the cable or the second electrical or optical apparatus, an electrical or optical coupling for electrically or optically coupling the first coupling element to the second coupling element and a magnetic coupling for magnetically coupling the first coupling element to the second coupling element when these are electrically or optically coupled, comprising one or more magnetic elements which form part of the first coupling element and one or more magnetic elements which form part of the second coupling element, these one or more magnetic elements being positioned such that when the first coupling element is electrically or optically coupled to the second coupling element, the one or more magnetic elements of the first coupling element are situated essentially opposite the one or more magnetic elements of the second coupling element, so that these attract one another. Such connectors are in fact offered in other industries as safe connectors, for example for coupling a power supply cable to a laptop, in which automatic uncoupling can be ensured if forces greater than a certain force act on said connector. Such connectors are, for example, known from US 2008/0096398 and from US 2003/0045134 A1.

**[0011]** However, in practice, it has been found that these connectors are not suitable for the above-described application, since when selecting magnets which are sufficiently strong to ensure satisfactory coupling of a connector for the occurrence of forces smaller than $F_{min}$, considerable manual force is required to be able to uncouple this connector during normal use. Repeatedly exerting this considerable force during uncoupling again causes damage to the connector and/or its surroundings. In addition, the connector also has to be rather large and is thus less user-friendly.

**[0012]** A more suitable connector is described, for example, in US 2004/0224539 A1, in which the magnetic coupling is situated on one side of the electrical or optical coupling.

**[0013]** A connector in which the magnetic coupling is situated mainly or even completely on one side with respect to the electrical or optical coupling, can be of a more compact and thus user-friendly design than the known symmetrically constructed connectors in which either the electrical or optical coupling surrounds the magnetic coupling, or the magnetic coupling surrounds the electrical or optical coupling.

**[0014]** In addition, this magnetic coupling can also readily be (un)coupled during normal use. When the second coupling element is held at a slight angle with respect to the first coupling element during uncoupling of the connector, the magnetic coupling can be disconnected in a simple manner, in which case the electrical or optical coupling is also uncoupled in a simple manner. With symmetrically constructed couplings, or at least with couplings where the magnetic coupling is situated on several sides with respect to the electrical coupling - possibly divided - this is less readily possible. However, a problem that remains is the presence of a magnetic field which could affect surrounding elements and/or electrical and/or optical elements in the connector.

**[0015]** It is therefore an object of the present invention to provide a connector by means of which the abovementioned problems are solved.

**[0016]** This object is achieved by providing a connector for electrically or optically coupling a first electrical or optical apparatus or network to a cable or second electrical or optical apparatus, comprising:

- a first coupling element, which is electrically or optically coupled to the first electrical or optical apparatus or the network;
- a second coupling element, which is electrically or optically coupled to the cable or the second electrical or optical apparatus;
- an electrical or optical coupling for electrically or optically coupling the first coupling element to the second coupling element;

- a magnetic coupling for magnetically coupling the first coupling element to the second coupling element when these are electrically or optically coupled, comprising one or more magnetic elements which form part of the first coupling element and one or more magnetic elements which form part of the second coupling element, in which these one or more magnetic elements are positioned in such a manner that when the first coupling element is electrically or optically coupled to the second coupling element, the one or more magnetic elements of the first coupling element are situated essentially opposite the one or more magnetic elements of the second coupling element, so that these attract one another;
  the magnetic coupling being situated essentially on one side with respect to the electrical or optical coupling, and the magnetic elements comprising one or more permanent magnets which are flanked by one or more iron plates.

**[0017]** By means of such iron plates, the magnetic field of these permanent magnets can be directed in such a manner that it acts substantially in the direction of the magnetic coupling. Furthermore, they can be used to screen surrounding elements against the magnetic field and/or to screen electrical or optical components which are situated in the connector.

**[0018]** Preferably, this magnetic coupling is in this case situated completely on one side with respect to the electrical or optical coupling.

**[0019]** Just as in the prior art, the magnetic elements of the magnetic coupling can in this case be chosen in such a way that the magnetic coupling is automatically disconnected when forces greater than $F_{max}$ act on the connector. Furthermore, these can also be chosen in such a way that it is possible to guarantee that when a force smaller than $F_{min}$ acts on the connector, the electrical or optical coupling is certainly not disconnected.

**[0020]** Despite the fact that simplified uncoupling of the connector is made possible by providing the magnetic coupling substantially or even completely on one side of the electrical or optical coupling, it is still possible to guarantee that the connector will not be automatically disconnected in case unexpected forces smaller than $F_{min}$ occur. Unexpected forces act substantially frontally on said coupling. When subjected to such a frontal force, the magnetic coupling does not readily disconnect; only at greater forces, which in this case are chosen to be greater than $F_{max}$. In order to readily uncouple the connector, the second coupling element has to be intentionally held at a slight angle with respect to the first coupling element at the location of this coupling element.

**[0021]** Moreover, since the magnetic coupling is situated on only one side of the electrical or optical coupling, the connector can only be coupled in one single direction and mistakes are no longer possible. Therefore, additional markings or aids are no longer required in order to couple the connector in the correct direction. Furthermore, the presence of the magnetic elements forms an additional indication to ensure that the connector is coupled correctly. If the second coupling element is initially held upside down with respect to the first coupling element, no magnetic force of attraction is present between the two. If the second coupling element is fitted slightly displaced or slightly offset with respect to the first coupling element, the magnetic force of attraction between the magnetic elements automatically ensures that the coupling elements are aligned correctly. The coupling itself produces a light clicking sound when the magnetic coupling has been effected. If there is no clicking sound, this is an indication that the coupling has not yet been effected.

**[0022]** An additional advantage of this magnetic coupling is that small movements of the connector are virtually impossible once it has been connected. Should these still occur, then the connector is automatically returned to the correct position. With existing connectors with automatic detection of the coupling thereof, small movements often result in false alarms, indicating that the connector is loose. It could also result in a poor coupling, leading to alarm signals given off by a patient no longer being passed onto nursing staff.

**[0023]** An electrical or optical coupling of this type usually consists of one or more contact elements which form part of the first coupling element and are electrically or optically coupled to the first electrical or optical apparatus or the network, and one or more corresponding contact elements which form part of the second coupling element and are electrically or optically coupled to the cable or the second electrical or optical apparatus. When electrically or optically coupling the first coupling element to the second coupling element, the contact elements of the first coupling element contact the corresponding contact elements of the second coupling element.

**[0024]** In the fitted state of a connector according to the present invention, said magnetic coupling is preferably situated above the electrical or optical coupling.

**[0025]** This is because, due to the weight of a cable which is connected to the second coupling element and/or, optionally, an electrical or optical apparatus which is connected thereto, this second coupling element is pushed down in normal use of the connector. By positioning the magnetic coupling above the electrical or optical coupling, it is possible to counteract the uncoupling action due to the second coupling element being pushed down by this weight by the magnetic force of attraction between the magnetic elements. When the magnetic coupling is positioned under the electrical or optical coupling, the magnetic elements have to be made stronger in order to be able to counteract the uncoupling force.

**[0026]** If the magnetic coupling is positioned above the electrical or optical coupling, the connector can simply be uncoupled by pushing the second coupling element slightly downwards when disconnecting it.

**[0027]** With one particular embodiment of a connector according to the present invention, the permanent mag-

nets form part of the first coupling element. The reason for this is that the first coupling element is coupled to the first electrical or optical apparatus or the network. The permanent magnets are then in a fixed position, making is easier to screen the surrounding elements against the magnetic field. The second coupling element is coupled to a cable or a second electrical or optical apparatus. If this second coupling element is displaceable as a result thereof, it is obviously more difficult to screen any surrounding elements against the magnetic field. In most cases, the presence of such a movable magnetic field is undesired and in the above application in the health care industry, this may even be life-threatening if the operation of vital electrical or optical apparatus is adversely affected thereby.

**[0028]** In addition, a permanent magnet as a magnetic element for the electrical or optical coupling is usually a relatively expensive part of the magnetic coupling. Preferably, this relatively expensive part is then placed in a position which is less at risk from damage. Movable coupling elements are usually at a greater risk of damage than stationary coupling elements.

**[0029]** Furthermore, the magnetic elements of the first coupling element preferably consist of one single permanent magnet. With regards to assembly, such a coupling element is easier to assemble as there are no opposing magnetic forces between the parts of the coupling element.

**[0030]** In a particular embodiment of a connector according to the present invention, the first coupling element comprises a contact surface and the second coupling element comprises a contact surface, these contact surfaces virtually touching one another in the fitted state of the connector and the permanent magnet of the first coupling element essentially having a bar shape, one side of which faces the contact surface and two opposite sides are flanked by an iron plate which is substantially rectangular and one longitudinal side of which ends in the contact surface of the first coupling element.

**[0031]** Due to the iron plates on both sides of the permanent magnet, the magnetic field is substantially directed in one direction, namely the direction of the magnetic coupling. As a result thereof, the magnetic coupling is strongly aligned, which in turn leads to an automatic alignment of the connector itself. In addition, the adverse effect of the magnetic field on surrounding elements and on internal electrical or optical elements in the first coupling element is greatly reduced.

**[0032]** In a more specific embodiment, the permanent magnet of the first coupling element is situated in the first coupling element, just behind the contact surface.

**[0033]** Preferably, in this case a longitudinal side of the iron plates extends partially beyond the contact surface.

**[0034]** If the iron plates extend with respect to the permanent magnet, a contact element which is under voltage in the one coupling element can be prevented from coming into contact with the permanent magnet which forms part of the other coupling element. In this manner, short-circuiting is avoided. Other configurations of the permanent magnet and the iron plates in the one coupling element, on one side, and a contact element which is under voltage in the other coupling element, on the other side, are also conceivable which prevent the contact element which is under voltage from coming into contact with the permanent magnet, thus avoiding short-circuiting.

**[0035]** In a further preferred embodiment of a connector according to the present invention, the magnetic elements comprise one or more elements made of a ferromagnetic material.

**[0036]** These elements made of ferromagnetic material preferably form part of the second coupling element.

**[0037]** As stated above, the second coupling element is usually the coupling element which is displaceable. This second coupling element therefore preferably does not contain any permanent magnets, the magnetic field of which could interfere with surrounding elements. Due to the fact that this coupling element is made to be displaceable, it is more prone to becoming damaged than fixed coupling elements. Preferably, this coupling element does not contain any expensive permanent magnets, but does contain inexpensive elements made of ferromagnetic material instead.

**[0038]** Furthermore, the magnetic elements of the second coupling element preferably consist of one single element made of ferromagnetic material.

**[0039]** In a further particular embodiment of a connector according to the present invention, the element made of ferromagnetic material is designed as a rectangular metal plate and is situated substantially in the contact surface of the second coupling element.

**[0040]** In yet a further particular embodiment of a connector according to the present invention, the first coupling element comprises a contact surface and the second coupling element comprises a contact surface, these contact surfaces virtually touching one another in the fitted state of the connector, the electrical or optical coupling comprises one or more contact elements which form part of the first coupling element and are electrically or optically coupled to the first electrical or optical apparatus or the network and the connector comprises one or more corresponding contact elements which form part of the second coupling element and are electrically or optically coupled to the cable or the second electrical or optical apparatus, in which, when the first coupling element is electrically or optically coupled to the second coupling element, the contact elements of the first coupling element contact the corresponding contact elements of the second coupling element, in which the one or more contact elements are arranged substantially in a rectangle and in which the magnetic elements are also substantially rectangular on the side facing the contact surface of the coupling elements and, on their longitudinal side, extend along one of the longitudinal sides of the rectangle in which the one or more contact elements are substantially arranged.

**[0041]** The present invention will now be explained in more detail with reference to the following detailed description of a preferred connector according to the present invention. This description is solely intended to give illustrative examples and to indicate further advantages and particulars of the present connector, and can therefore by no means be interpreted as a limitation of the area of application of the invention or of the patent rights defined in the claims.

**[0042]** In this detailed description, reference numerals are used to refer to the attached drawings, in which:

- ***Fig. 1*** shows a preferred connector according to the present invention in perspective in the uncoupled state;
- ***Fig. 2*** shows the first, female coupling element of the preferred connector from Fig. 1 in perspective;
- ***Fig. 3*** shows the second, male coupling element of the preferred connector from Fig. 1 in perspective.

**[0043]** The preferred connector (1) illustrated in Fig. 1 comprises a female coupling element (2) which is illustrated separately in Fig. 2 and a male coupling element (3) which is illustrated separately in Fig. 3.

**[0044]** This connector (1) is provided for electrically coupling an emergency button to a network of an alarm system. By means of this emergency button, a patient in a hospital can alert the nursing staff via the alarm system. However, this connector (1) could be equally useful in other applications.

**[0045]** The emergency button, which is not illustrated here, is electrically coupled to a cable (12), which in turn is electrically coupled to the male coupling element (3) of the illustrated connector. The female coupling element (2) of the illustrated connector is electrically coupled to the network of the alarm system, which is not illustrated either. To this end, the female coupling element (2) is fitted in the surroundings of the hospital bed of the patient into the external or internal wall or the edge of the bed, etc.

**[0046]** This connector (1) comprises an electrical coupling and a magnetic coupling. Alternatively or additionally, this could equally well comprise an optical coupling for the electrical coupling.

**[0047]** The electrical coupling comprises various contact sockets (4a) which form part of the female coupling element (2) and which are electrically coupled to the network of the alarm system. The electrical coupling furthermore comprises various contact pins (4b) which match said contact sockets (4a) which form part of the male coupling element (2) and are electrically coupled to the cable (12). With the electrical coupling, the contact pins (4b) are fitted in the corresponding contact sockets (4a) in order to ensure electrical contact. The contact sockets (4a) of the female coupling element (4a) are arranged in a rectangle. The contact pins (4b) of the male coupling element (4b) are arranged in a matching rectangle.

**[0048]** On either side of the contact pins (4b), the male coupling element (3) comprises a guide pin (7). The female coupling element (2) accordingly comprises a guide bus (8) on both sides. When coupling the connector (1), the guide pins (7) are fitted in the corresponding guide buses (8), so that these guide the coupling movement.

**[0049]** The magnetic coupling comprises a permanent magnet (5a) which forms part of the female coupling element (2). In the figures, this permanent magnet (5a) is not visible, but the position thereof is indicated.

**[0050]** The female coupling element (2) and the male coupling element (3) each comprise a contact surface (10 and 11, respectively) which virtually, but not completely, touch one another in the fitted state of the connector (1). The permanent magnet (5a) of this female coupling element (2) is of a bar-shaped design and is rectangular on the side facing the contact surface (10). On its longitudinal side, this magnet (5a) extends along a longitudinal side of the rectangle in which the contact sockets (5a) are arranged. This magnet (5a) is situated just behind the contact surface (10) of the female coupling element (2). On its two longitudinal sides, this magnet (5a) is flanked by an iron plate (6). Both iron plates (6) are rectangular and on one longitudinal side partially extend beyond the contact surface (10). Due to this arrangement of the magnet (5a) and the iron plates (6), short-circuiting is avoided, since the iron plates (6) prevent a contact pin (4b) which is under voltage from coming into contact with the magnet (5a). Other configurations of said iron plates (6) and the magnet (5a) on one side and a contact pin (4b) which is under voltage on the other side are conceivable, in which this contact pin (4b) can be prevented from contacting the magnet (5a). In addition to avoiding short-circuiting, the iron plates (6) in this case also ensure that the magnetic field of the magnet (5a) extends essentially from this magnet (5a) on the side of the contact surface (10) to the front. In this way, the magnetic field is directed only towards the male coupling element (3). In this way, further internal electrical elements of the female coupling element (2) are also screened against this magnetic field. Providing only one permanent magnet (5a) prevents opposing magnetic forces from occurring in the component parts of the coupling element during fitting of the coupling element (2).

**[0051]** In addition to the permanent magnet (5a), the magnetic coupling also comprises an element made of ferromagnetic material (5b) which forms part of the male coupling element (3). This element made of ferromagnetic material (5b) is designed as rectangular metal plate which is situated inside the contact surface (11) of the second coupling element (3) and which, on its longitudinal side, extends along a longitudinal side of the rectangle in which the contact pins (5) are arranged. When the connector (1) is connected, the permanent magnet (5a) and this element made of ferromagnetic material (5b) are situated opposite one another, as a result of which they are attracted to one another magnetically. This magnetic force ensures an automatic alignment of the coupling elements (2, 3) with respect to one another.

**[0052]** By fitting the permanent magnet (5a) in the fe-

male coupling element (2) and the element made of ferromagnetic material (5b) in the male coupling element (3), the relatively expensive part of the magnetic coupling is situated in the coupling element (2) which is fixedly arranged and the relatively inexpensive part of the magnetic coupling is situated in the coupling element (3) which can be moved about freely when the connector (1) is uncoupled. By fitting the permanent magnet (5a) in a fixed location, it is simpler to screen surrounding elements against its magnetic field. In addition, the risk of damage to said permanent magnet is smaller than if this were to form part of a coupling element (3) which can be moved about freely in the uncoupled state of the connector (1).

**[0053]** In the fitted state of the connector (1), the magnetic coupling of this preferred embodiment of a connector (1) is situated above the electrical coupling.

**[0054]** As a result thereof, it is not only possible to make the connector (1) compact, but it is also simple to uncouple the connector (1) during normal use by pushing the male coupling element (3) downwards slightly during uncoupling. In addition, as the magnetic coupling is situated above the electrical coupling, the connector can only be coupled in one direction and as a result mistakes are no longer possible. Moreover, the 'clicking' of the magnetic elements (4a, 4b) during magnetic coupling provides an additional indication for the correct coupling of the connector (1).

**[0055]** By providing the magnetic coupling above the electrical coupling, the magnetic coupling can also readily withstand the uncoupling action on the male coupling element (3) due to the weight of the cable (12) and possibly the emergency button, without having to be made very strong.

**[0056]** The permanent magnet (4a) is chosen such that the magnetic coupling is not uncoupled automatically when substantially frontal forces smaller than a certain force $F_{min}$ - corresponding in this case to a weight between 0.2 kg and 0.5 kg - act on the connector and that the magnetic coupling is uncoupled when forces greater than a certain force $F_{max}$ - corresponding in this case to a weight between 2 kg and 2.3 kg - act on the connector.

**[0057]** Instead of such a permanent magnet (4a), it would, for example, also be possible to provide an electromagnet in the female coupling element (2). In this case, it is for example also possible to incorporate a switching mechanism in the male coupling element (3) in order to switch the magnetic action of the electromagnet on or off in order to (un)couple the connector in a simple manner.

**[0058]** On either side of the electrical coupling, the female coupling element (2) of the illustrated connector is furthermore provided with LEDs (9). These LEDs (9) can be used purely as night lights for the nursing staff. Preferably, however, they are also used as an indication to show if the connector (1) has been uncoupled. The indication then remains active until the alarm has been switched off. Such an indication can be produced in the known manner. Equally, such an indication using an LED light can be incorporated into the male coupling element (3).

## Claims

1. Connector (1) for electrically or optically coupling a first electrical or optical apparatus or network to a cable or second electrical or optical apparatus, comprising:

   - a first coupling element (2) which is electrically or optically coupled to the first electrical or optical apparatus or the network;
   - a second coupling element (3) which is electrically or optically coupled to the cable or the second electrical or optical apparatus;
   - an electrical or optical coupling for electrically or optically coupling the first coupling element (2) to the second coupling element (3);
   - a magnetic coupling for magnetically coupling the first coupling element (2) to the second coupling element (3) when these are electrically or optically coupled, comprising one or more magnetic elements (5a) which form part of the first coupling element (2) and one or more magnetic elements (5b) which form part of the second coupling element (3), in which these one or more magnetic elements (5a, 5b) are positioned in such a manner that when the first coupling element (2) is electrically or optically coupled to the second coupling element (3), the one or more magnetic elements (5a) of the first coupling element (2) are situated essentially opposite the one or more magnetic elements (5b) of the second coupling element (3), so that these attract one another, the magnetic coupling being situated essentially on one side with respect to the electrical or optical coupling, and the magnetic elements (5a, 5b) comprising one or more permanent magnets (5a).

   **characterized in that** the permanent magnets (5a) are flanked by one or more iron plates (6).

2. Connector (1) according to Claim 1, **characterized in that** the magnetic coupling is situated completely on one side with respect to the electrical or optical coupling.

3. Connector (1) according to Claim 1 or 2, **characterized in that** the magnetic coupling is situated above the electrical or optical coupling, in the fitted state of the connector (1).

4. Connector (1) according to one of the preceding claims, **characterized in that** the permanent magnets (5a) form part of the first coupling element (2).

5. Connector (1) according to Claim 4, **characterized in that** the magnetic elements (5a) of the first coupling element consist of one single permanent magnet (5a).

6. Connector (1) according to Claim 5, **characterized in that** the first coupling element (2) comprises a contact surface (10) and **in that** the second coupling element (3) comprises a contact surface (10), these contact surfaces (10, 11) virtually touching one another in the fitted state of the connector (1), and **in that** the permanent magnet (5a) of the first coupling element (2) essentially has a bar shape, one side of which faces the contact surface (10) of the first coupling element (2) and two opposite sides are flanked by an iron plate (6) which is substantially rectangular and one longitudinal side of which ends in the contact surface (10) of the first coupling element (2).

7. Connector (1) according to Claim 6, **characterized in that** the permanent magnet (5a) of the first coupling element (2) is situated in the first coupling element (2), just behind the contact surface (10).

8. Connector (1) according to Claim 6 or 7, **characterized in that** a longitudinal side of the iron plates (6) extends partially beyond the contact surface (10).

9. Connector (1) according to one of the preceding claims, **characterized in that** the magnetic elements (5a, 5b) comprise one or more elements made of a ferromagnetic material (5b).

10. Connector (1) according to Claim 9, **characterized in that** the elements made of ferromagnetic material (5b) form part of the second coupling element (3).

11. Connector (1) according to Claim 10, **characterized in that** the magnetic elements (5b) of the second coupling element (3) consist of one single element made of ferromagnetic material (5b).

12. Connector (1) according to one of Claims 6 to 9 and Claim 11, **characterized in that** the element made of ferromagnetic material (5b) is designed as a rectangular metal plate and is situated substantially in the contact surface (11) of the second coupling element (3).

13. Connector (1) according to one of the preceding claims, **characterized in that** the first coupling element (2) comprises a contact surface (10) and **in that** the second coupling element (3) comprises a contact surface (11), these contact surfaces (10, 11) virtually touching one another in the fitted state of the connector (1), **in that** the electrical or optical coupling comprises one or more contact elements (4a) which form part of the first coupling element (2) and are electrically or optically coupled to the first electrical or optical apparatus or the network and comprises one or more corresponding contact elements (4b) which form part of the second coupling element (3) and are electrically or optically coupled to the cable or the second electrical or optical apparatus, **in that**, when the first coupling element (2) is electrically or optically coupled to the second coupling element (3), the contact elements (4a) of the first coupling element (2) contact the corresponding contact elements (4b) of the second coupling element (3), **in that** the one or more contact elements (4a, 4b) are arranged substantially in a rectangle, and **in that** the magnetic elements (5a, 5b) are also substantially rectangular on the side facing the contact surface (10, 11) of the coupling elements (2, 3) and, on their longitudinal side, extend along one of the longitudinal sides of the rectangle in which the one or more contact elements (4a, 4b) are substantially arranged.

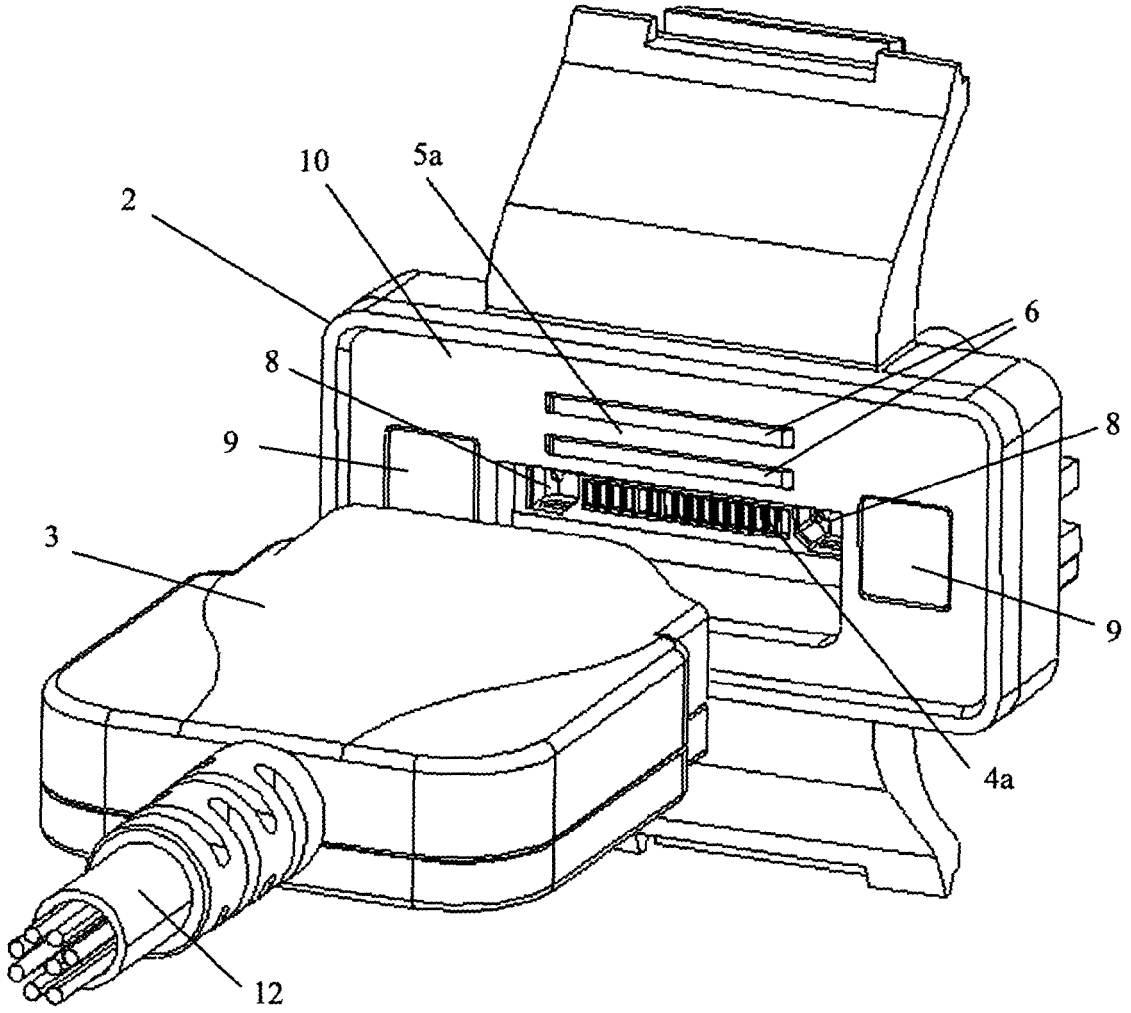


FIG. 1

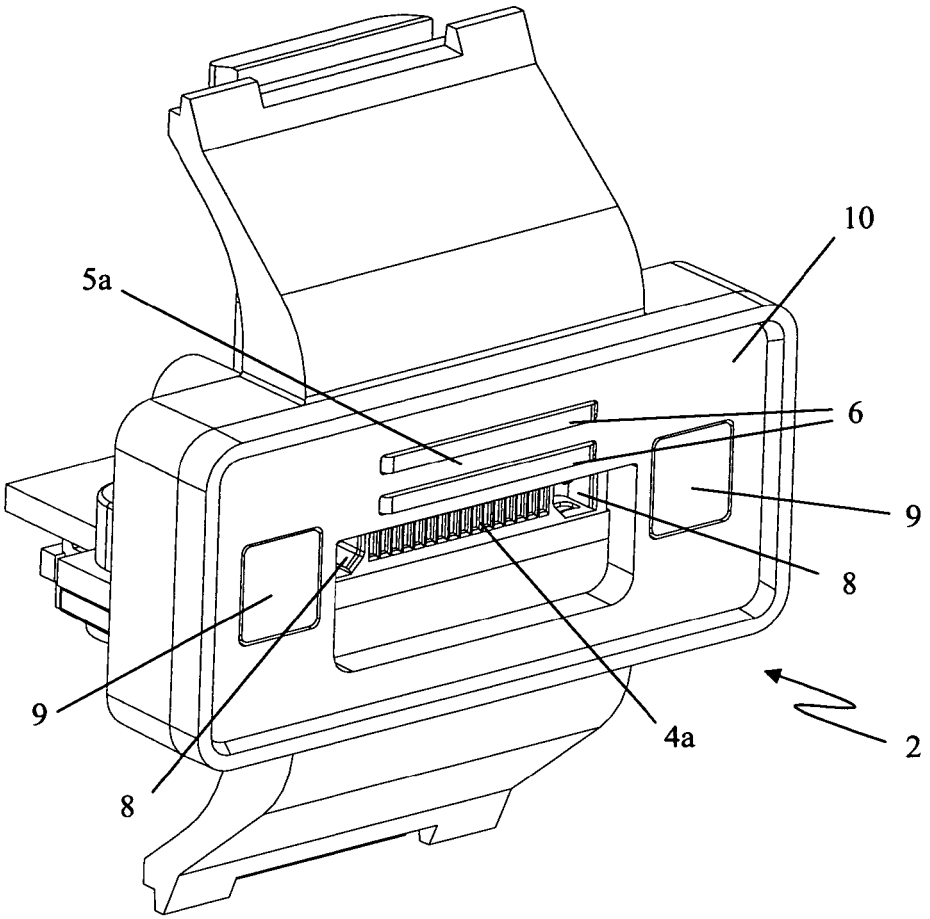


FIG. 2

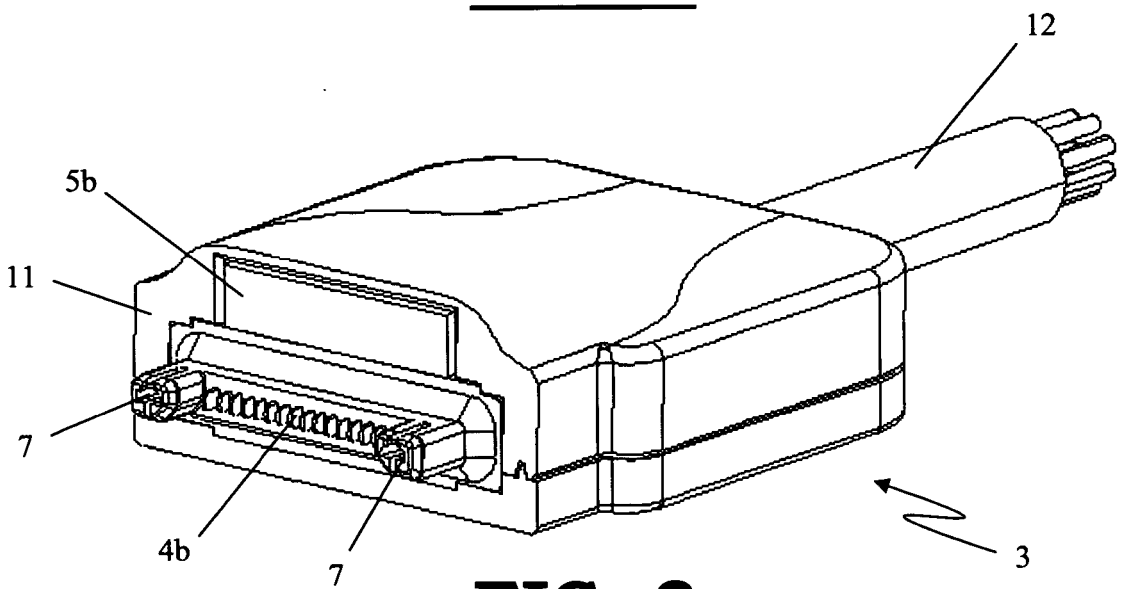


FIG. 3

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# EUROPEAN SEARCH REPORT

Application Number
EP 10 17 2589

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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TECHNICAL FIELDS SEARCHED (IPC)

H01R

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 16 November 2010 | Corrales, Daniel |

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16-11-2010

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