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(71) Applicant: **Hewlett-Packard Company**
Palo Alto, California 94304 (US)

(72) Inventor: **Quan, Beverly J.**
Rocklin, California 95677 (US)

(74) Representative: **Jehan, Robert et al**
Williams, Powell & Associates,
4 St Paul's Churchyard
London EC4M 8AY (GB)

(54) Modular connector

(57) An indicator light (44) is positioned within a modular connector (36) such that light emitted from the indicator light (44) may travel through a translucent or transparent modular plug inserted into the modular connector. The indicator light (44) is easily correlated with a modular connector and plug and provides a visually appealing indication of various status conditions.

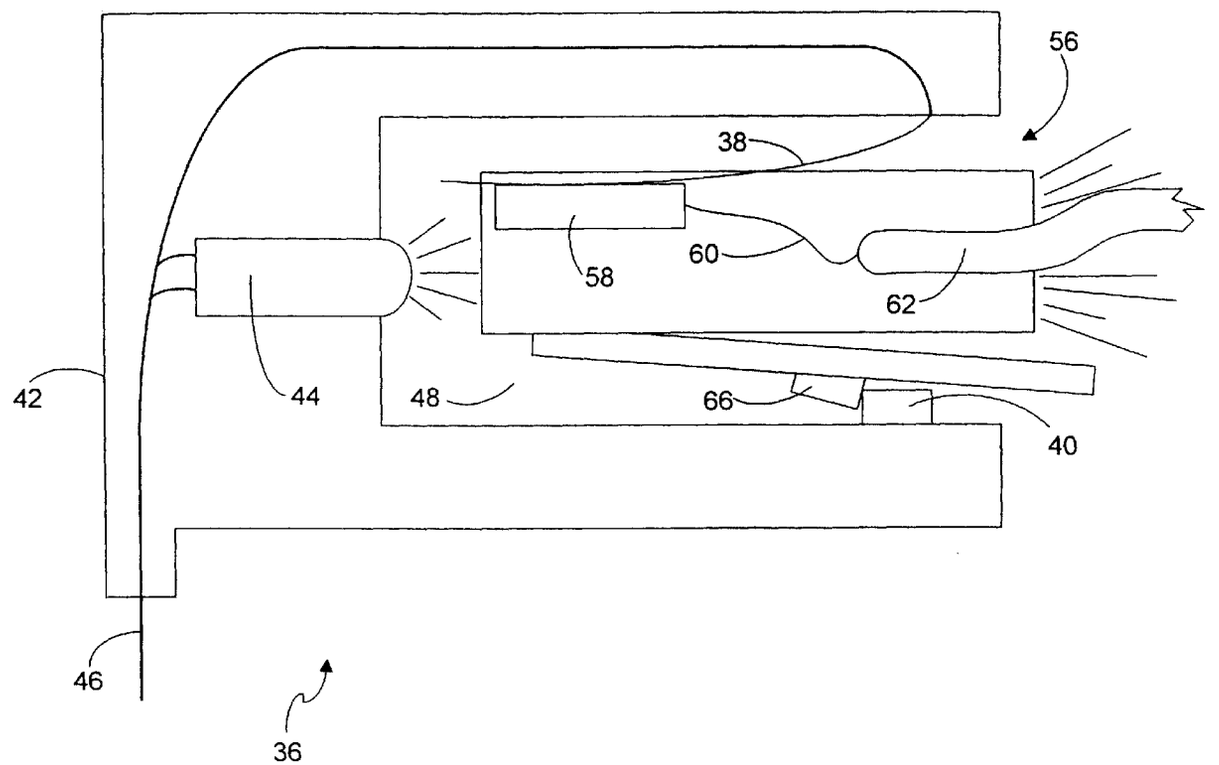

FIG. 6

EP 0 895 318 A2

Description

[0001] The present invention relates to a modular connector including an indicator light that is mounted within the modular connector to transmit light via a translucent or transparent modular plug inserted in the modular connector.

[0002] In the field of electronics, it is common to use a modular plug and a modular connector to complete an electrical circuit. For example, the vast majority of telephones are provided with a cord having a transparent modular plug. Typically, the phone is connected to the telephone company by inserting the modular plug into a modular connector, which is often mounted in a wall.

[0003] In the field of networked communications, it is common to use similar modular plugs and connectors (such as RJ45 connectors) to complete circuits between network hubs, servers, clients, printers and the like. It is known in the art to associate indicator lights with such plugs to indicate various status conditions. For example, such indicator lights may be used to inform an operator whether a port is active, whether a connection has been established, or whether an error has occurred. Typically, the indicator lights are positioned on a panel remote from the connector, or adjacent to the opening in the modular connector.

[0004] The present invention seeks to provide an improved modular connector.

[0005] According to an aspect of the present invention, there is provided a modular connector as specified in claim 1.

[0006] According to another aspect of the present invention, there is provided a network device as specified in claim 5.

[0007] According to another aspect of the present invention, there is provided a method of transmitting a status indication as specified in claim 10.

[0008] The preferred embodiment provides a modular connector having at least one indicator light mounted at the rear of the connector such that when a transparent or translucent modular plug is inserted into the modular connector, the modular plug acts as a light pipe to transmit light emitted hy the indicator light to a user or operator. This modular connector and indicator light is less expensive to manufacture than prior art modular connectors having indicator lights. In addition, it is easier for a user or operator to correlate a particular indicator light with a particular modular connector. This modular connector is more visually appealing than prior art modular connectors having indicator lights. Also, it is easier for a user or operator to quickly spot modular connectors which are not in use, and therefore available to receive a modular plug.

[0009] An embodiment of the present invention is described below, by way of example only, with reference to the accompanying drawings, in which:

[0010] Figure 1 shows a prior art network hub having modular connectors and a prior art modular plug.

[0011] Figure 2 shows a bank of modular connectors shown in Figure 1.

[0012] Figure 3 is a side cutaway view of a prior art modular connector similar to the prior art modular connectors shown in Figures 1 and 2.

[0013] Figure 4 shows a preferred embodiment of modular connector having an indicator light.

[0014] Figure 5 shows a bank of modular connectors having indicator lights.

[0015] Figure 6 shows a modular connector having an indicator light with a modular plug inserted therein.

[0016] Figure 1 shows a prior art network hub 10, and a prior art modular plug 13 connected to cable 15. Network hub 10 has a bank 11 of modular connectors. Bank 11 includes a plurality of individual modular connectors, such as connectors 12, and 14. A modular plug, such as plug 13, may be inserted into each connector. The connectors are typically RJ11 connectors, RJ45 connectors, or other similar connectors known in the art. Associated with each connector are a pair of indicator lights, such as indicator lights 16 and 18. The indicator lights provide a user of the hub with various status conditions, such as whether a port is active, whether a connection has been established, whether the plug is properly inserted, or whether an error or fault has occurred. During normal operation, an indicator light may also be used to display a "link beat", which is a term known in the art of networking and is indicative of normal data flow. One of the problems with prior art indicator lights such as those shown in Figure 1 is that they tend to be close together because there is little room between adjacent modular connectors. Accordingly, when a user wishes to ascertain the status of a particular modular connector, the user most closely examine the connector to correlate the proper indicator light to the connector and plug.

[0017] In another prior art configuration, a separate bank of indicator lights are positioned on a panel remote from the modular connectors. For example, in Figure 1, such a panel might be positioned in separate module above hub 10, or in the area to the left of bank 11. In such a configuration, a user or operator must first observe the position of an indicator light, observe a port number associated with the light, and then find the modular connector associated with the port number.

[0018] Figure 2 shows bank 11 of Figure 1. Within each modular connector, such as connector 14, are a plurality of flexible electrical contacts, such as contacts 20. The contacts form electrical connections with corresponding contacts of a modular plug when a modular plug is inserted into the modular connector. In addition, when bank 11 is mounted within a hub (such as hub 10), electrical leads associated with each modular connector, such as leads 22, are soldered to a circuit board of the hub.

[0019] Figure 3 is a side cutaway view of a prior art modular connector 24, which is similar to the prior art modular connectors show in Figures 1 and 2. Connector

24 includes contacts 26, retainment feature 28, light pipe 30, LED indicator light 34, and channel 31. Light pipe 30 and LED 31 are positioned in channel 31. Contacts 24 make electrical connections with corresponding contacts of a modular plug inserted into connector 24. Connector 24 has a back portion 32 which includes channels that route contacts 24 to leads 36. In most similar prior art connectors, a single wire forms each contact, and lead associated with the contact, and the conductor there between.

[0020] Retainment feature 28 helps retain a modular plug within connector 24 when a modular plug is inserted into connector 24. Leads from LED indicator light 34 are routed to (and may form) the leads of leads 36 that power the LED. Leads 36, in turn, are soldered to a circuit board when connector 24 is assembled into a product.

[0021] Light pipe 30 is arranged to transmit light emitted by LED indicator light 34 to the front exterior of connector 24, where the light emitted by LED indicator light 34 may be observed by a user. In another prior art embodiment, an LED is mounted in the front of connector 24 in place of light pipe 30, and insulated leads travel back to circuit board 32 along the path occupied by light pipe 30, ending at leads 36.

[0022] Figure 4 shows a preferred embodiment of modular connector 36. Connector 36 may be used in place of the connectors and indicator lights shown in Figure 1, and may be used in any application wherein it is desirable to associate an indicator light with a modular connector and plug. Connector 36 includes electrical contacts 38, tab 40, circuit board 42, LED indicator light 44, and leads 46.

[0023] LED indicator light 44 is positioned to emit light into cavity 48, and transmit light through a modular plug when a modular plug is inserted into connector 36. In Figure 4, LED indicator light protrudes through hole 41 back wall 42 of connector 36. However, it is also within the scope of the design to transmit light through a transparent window back wall 42 of connector 36, or arrange an indicator light in any other manner suitable for transmitting light through a translucent or transparent modular plug inserted into a modular connector

[0024] When a modular plug is not inserted into modular connector 36, light emitted from LED indicator light 44 is clearly visible to a user, especially if the interior surface of connector 36 is a light reflective color. When a translucent or transparent modular plug is inserted into connector 36, the light emitted from LED indicator light 44 is clearly visible from the plug. Even if the plug is opaque, the light from LED indicator light 44 will form an outline of light around the plug, thereby allowing the user to easily correlate the indicator light with the modular plug and connector.

[0025] Figure 5 shows a bank 50 of modular connectors .

[0026] In Figure 5, a pair of LED indicator lights, such as lights 52 and 54, are provided at the back wall of each modular connector and arranged to transmit light through a translucent or transparent modular plug. It is within the scope of the design to provide multiple indicator lights within each modular plug. The lights may be different colors, with each color indicative of a different status. Status may also be indicated by flashing the indicator lights at various intervals, or using any other methods known in the art. Of course, any suitable type of light source may be used.

[0027] Figure 6 shows modular connector 36 with modular plug 56 inserted into connector 36. Most prior art plugs of this type, such as plug 13 in Figure 1, are formed from a translucent or transparent plastic.

[0028] Plug 56 has a series ofcontacts that form electrical connections with corresponding contacts of connector 36. For example, in Figure 6, contact 58 ofplug 56 forms an electrical connection with contact 38 of connector 36. Conductors from cable 62 are coupled to the plug contacts. For example, conductor 60 of cable 62 is connected to connects contact 58.

[0029] Tab 64 retains plug 56 within cavity 48 of connector 36, and thereby ensures electrical connections between plug 56 and connector 36. Tab 64 has a retainment feature 66 that cooperates with retainment feature 40 ofconnector 36 to prevent the plug from being unintentionally removed from connector 36.

[0030] As can bee seen from observing Figure 6, light emitted from LED indicator light 44 travels through the translucent or transparent body of plug 56, where the emitted light may be easily observed by a user or operator.

[0031] Prior art indicator lights positioned on a remote panel had to be correlated with a modular connector by observing the port number associated with an indicator light, and finding the port number associated with the appropriate modular connector. With the described connector, the indicator light is instantly and obviously correlated with its associated modular connector. In addition, the connector requires less room on the hub panel, since the same space used to make a connection is used for the indicator lights.

[0032] Even when compared to prior art indicator lights adjacent to connector openings, such as shown in Figure 1, it is easier to correlate an indicator light constructed as taught herein with a modular connector and plug. As can be seen in Figure 1, adjacent indicator lights are close enough that it might be easy to correlate an indicator light with an adjacent modular plug. With the preferred connector, the whole plug is illuminated, so it is impossible to not correlate the indicator light with the proper connector and plug.

[0033] Another advantage is that it is less expensive to produce than prior art indicator lights. As shown in prior art Figure 3, to transmit light to a point adjacent the front opening of the modular connector requires either a light pipe or an LED with long insulated leads. In contrast, the preferred connector provides an LED indicator light that requires neither long leads or a light pipe. In

essence, the light pipe is provided "for free" by the translucent or transparent body of the modular plug. In addition, the LED may be attached to the same circuit board used to couple the connector's electrical contacts with another circuit board in the network hub (or other device provided with modular connectors), so an LED with long insulated leads is not required. The design provides a cost savings of between $0.05 and $0.20 per modular connector.

[0034] Finally, the indicator light provides a unique, eye catching, aesthetically pleasing appearance, especially when a hub stack having a large number of such indicator lights is viewed in a dimmed room. Such aesthetic considerations may often be a deciding factor when a buyer is choosing between two functionally similar and closely priced products.

[0035] The disclosures in United States patent application no. 08/904,061, from which this application claims priority, and in the abstract accompanying this application are incorporated herein by reference.

Claims

1. A modular connector comprising:

   at least one electrical contact for making an electrical connection with at least one corresponding electrical contact of a translucent or transparent modular plug; and
   an indicator light arranged to transmit light through a translucent or transparent modular plug when a translucent or transparent modular plug is inserted into the modular connector.

2. A modular connector as in claim 1, including a cavity into which the translucent or transparent modular plug is inserted, and the cavity is bounded by a back wall having a hole through which the indicator light protrudes.

3. A modular connector as in claim 1 or 2, wherein the indicator light is an LED.

4. A modular connector as in claim 1, 2 or 3, comprising:

   a second indicator light arranged to transmit light through the translucent or transparent modular plug when the translucent or transparent modular plug is inserted into the modular connector.

5. A network device including a plurality of modular connectors, with each connector comprising:

   a cavity into which may be inserted a modular plug;
   at least one electrical contact within the cavity for making an electrical connection with at least one corresponding electrical contact modular plug; and
   an indicator light arranged to emit light within the cavity.

6. A network device as in claim 5. wherein a body of the modular plug is formed from a material that is translucent or transparent, and the indicator light is arranged to transmit light through the body of the modular plug.

7. A network device as in claim 5 or 6, wherein the cavity is bounded by a back wall through which the indicator light protrudes.

8. A network device as in claim 5, 6 or 7, wherein the indicator light is an LED.

9. A modular connector as in any one of claims 5 to 8, comprising:

   a second indicator light arranged to transmit light through the translucent or transparent modular plug when the translucent or transparent modular plug is inserted into the modular connector.

10. A method of transmitting a status indication associated with a modular connector having a cavity into which a modular plug is inserted, the method comprising:

    modulating an indicator light positioned within the cavity to communicate the status indication.

11. A method of transmitting a status indication associated with a modular connector having a cavity into which is inserted a modular plug having a body formed from a translucent or transparent material, the method comprising:

    modulating an indicator light arranged to transmit light emitted by the indicator light through the body of the modular plug, thereby communicating the status indication.

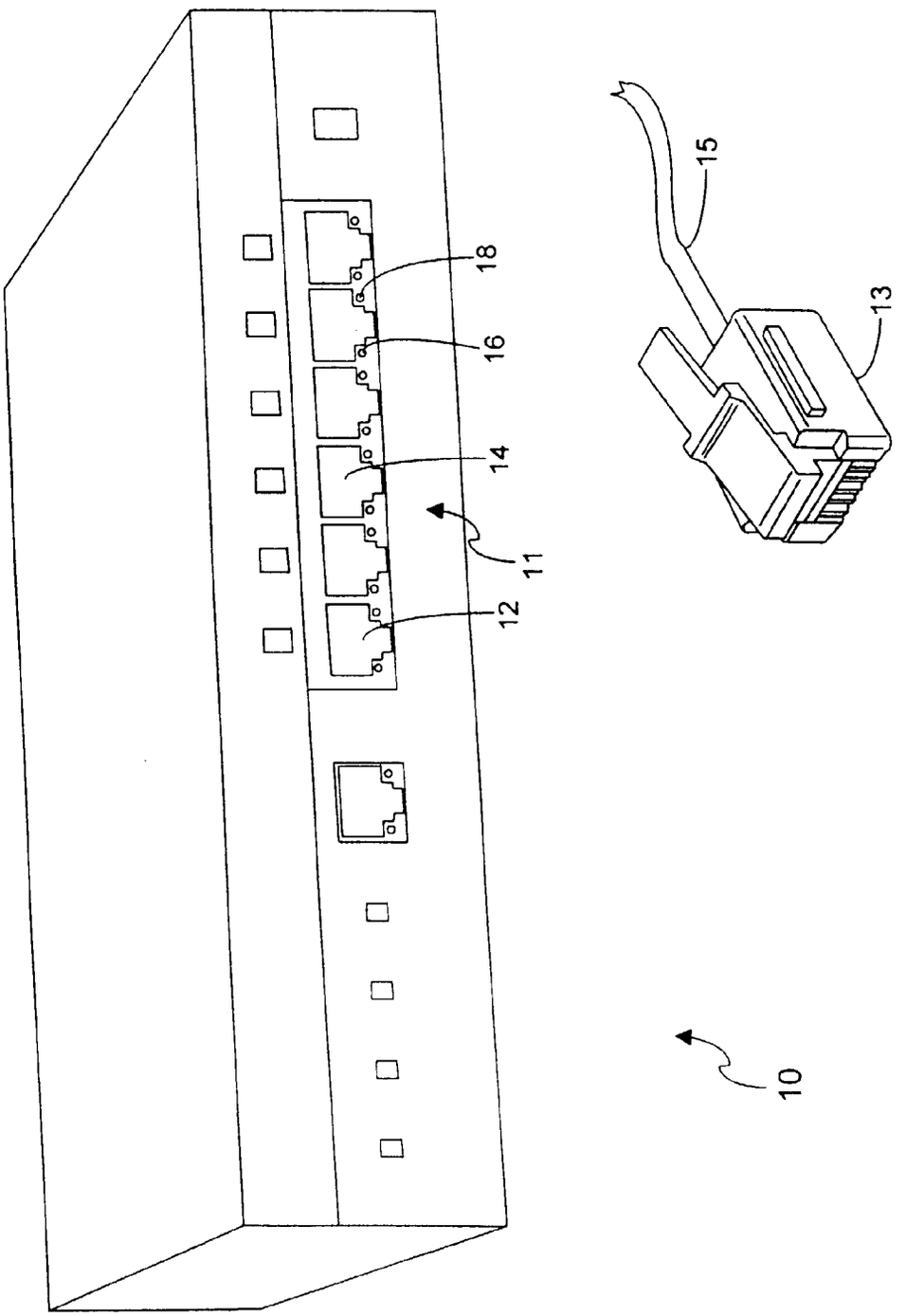

FIG. 1
(PRIOR ART)

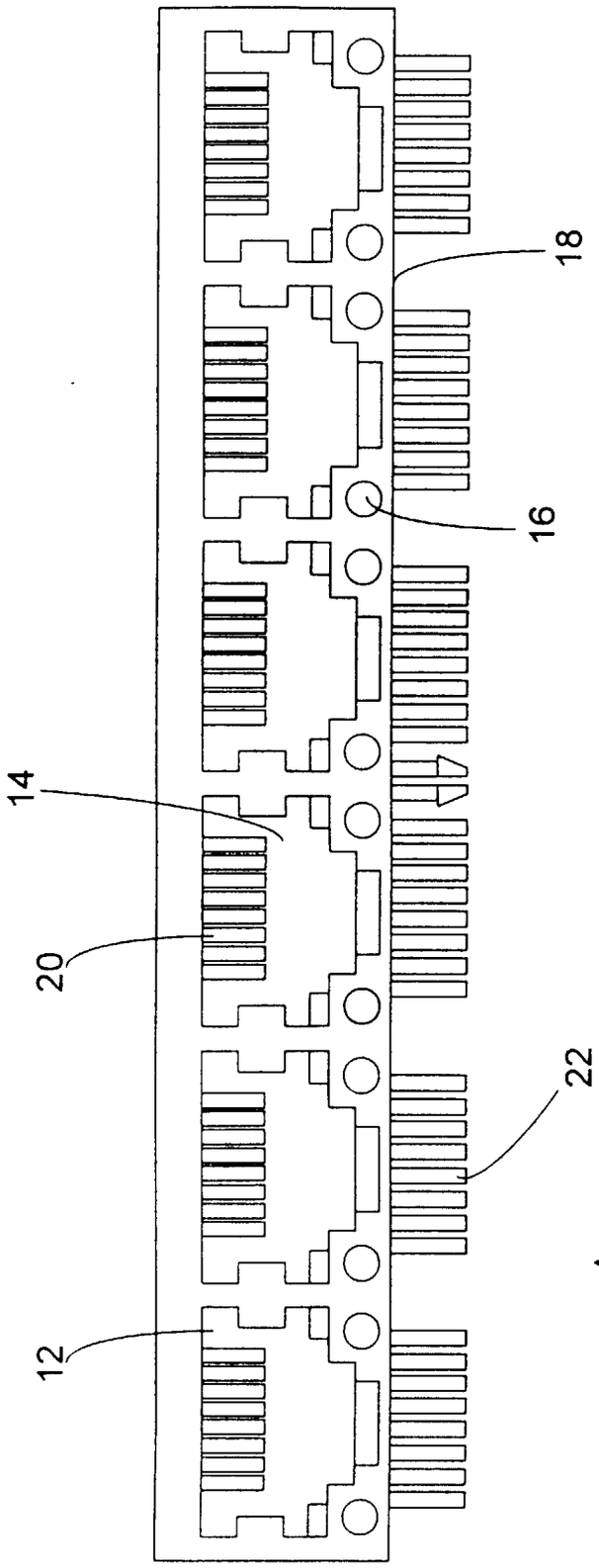

FIG. 2
(PRIOR ART)

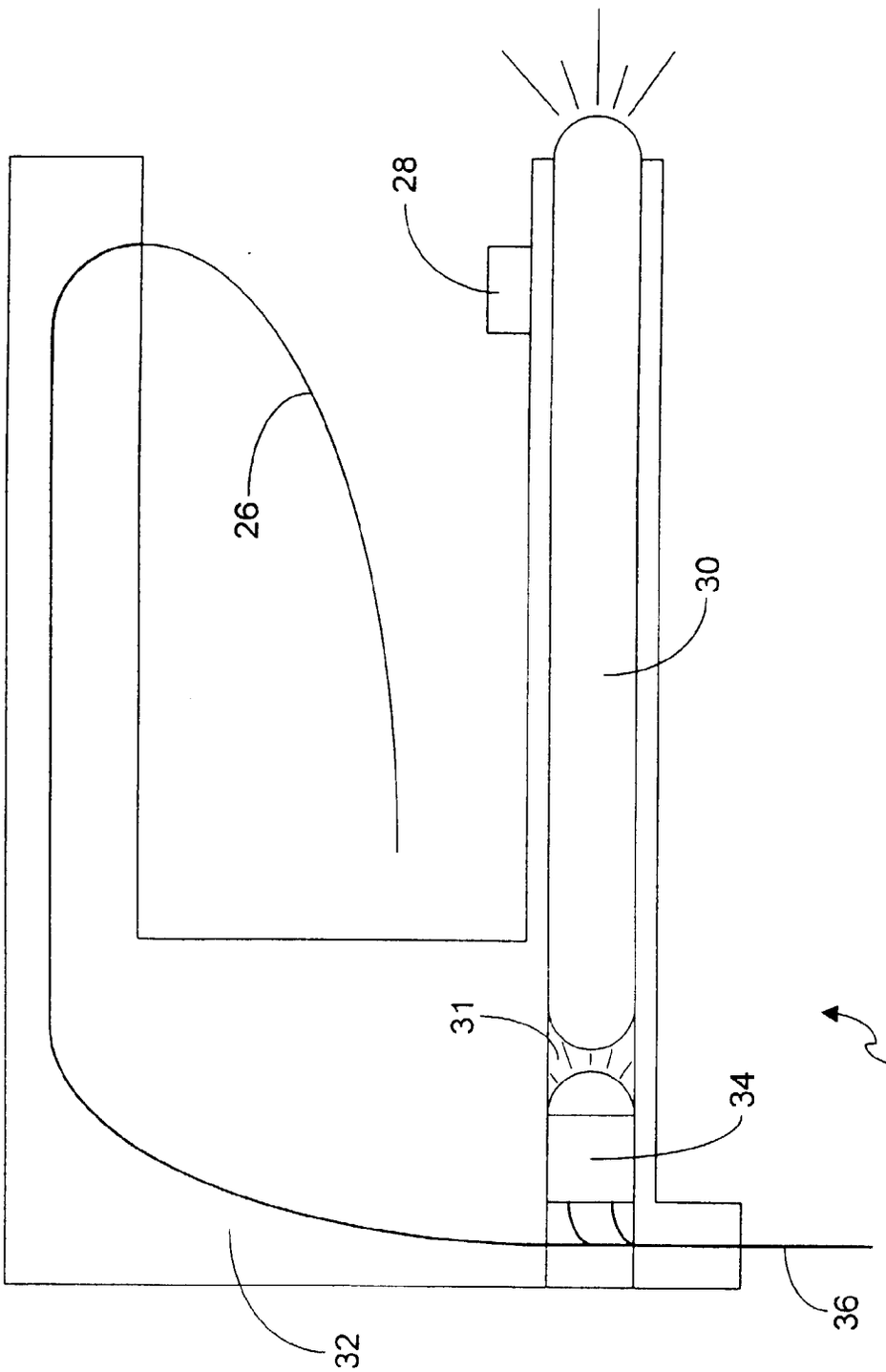

FIG. 3
(PRIOR ART)

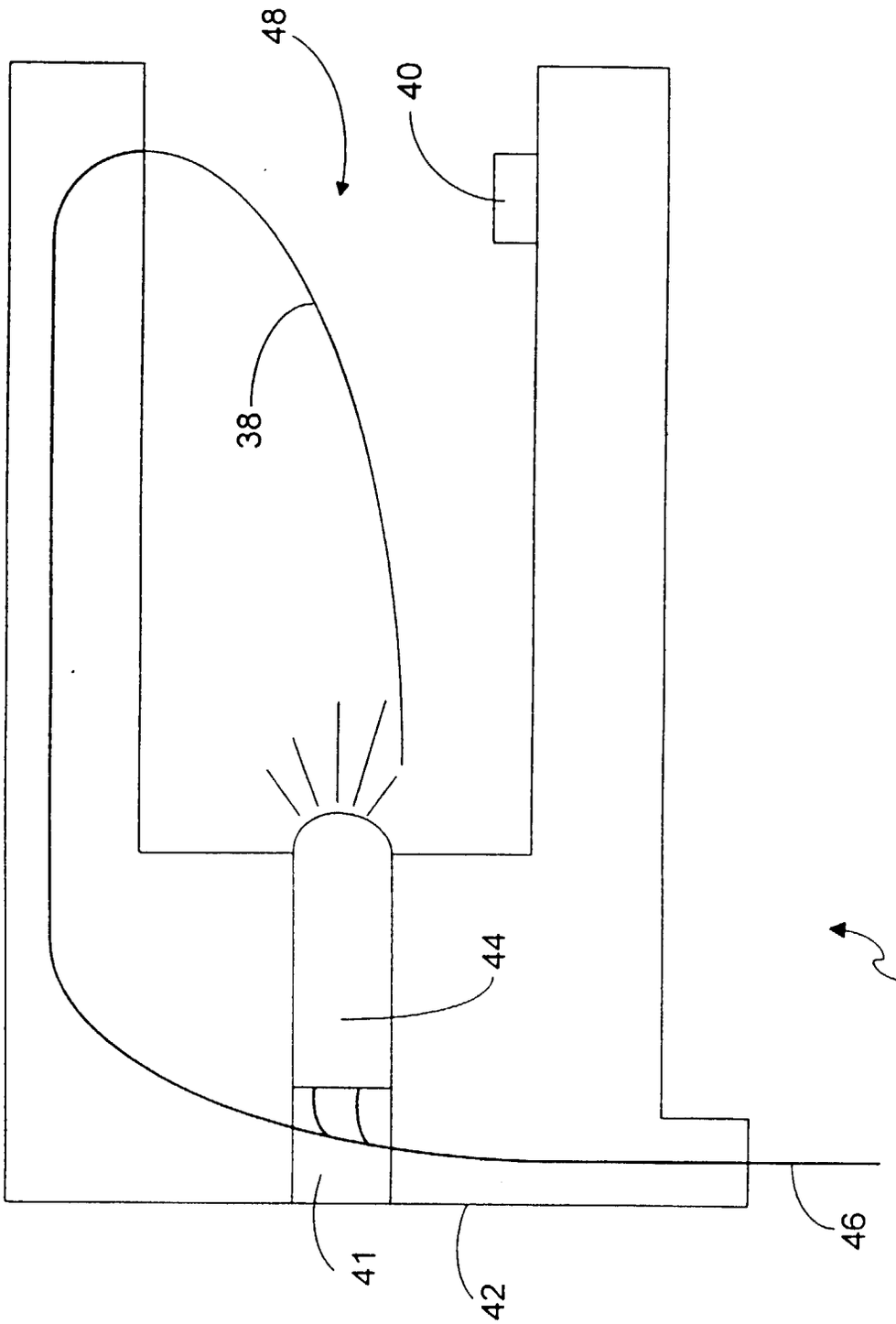

FIG. 4

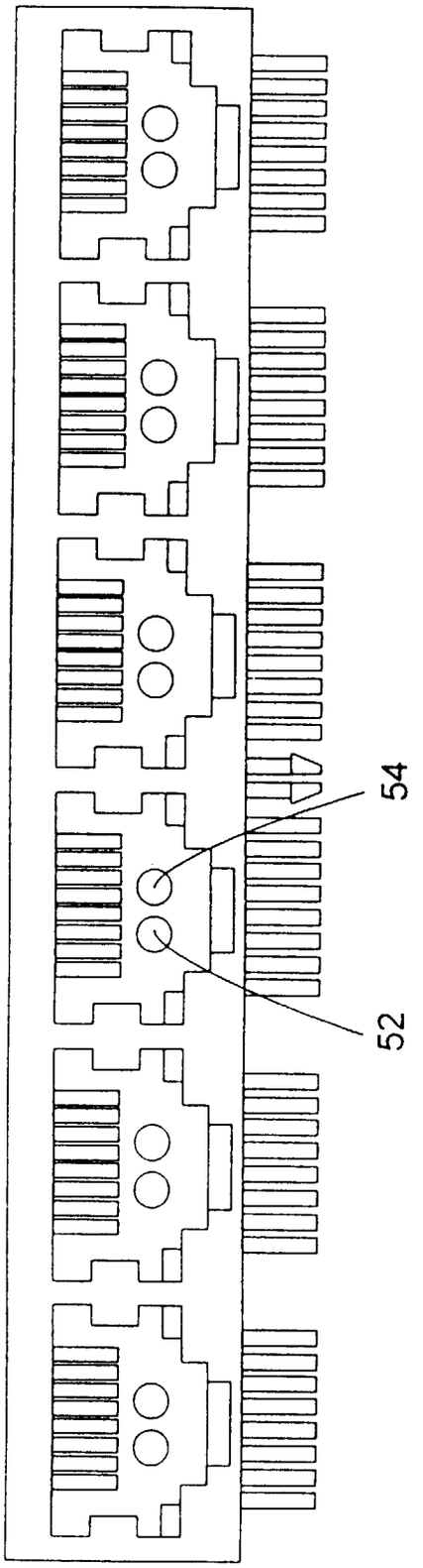

FIG. 5

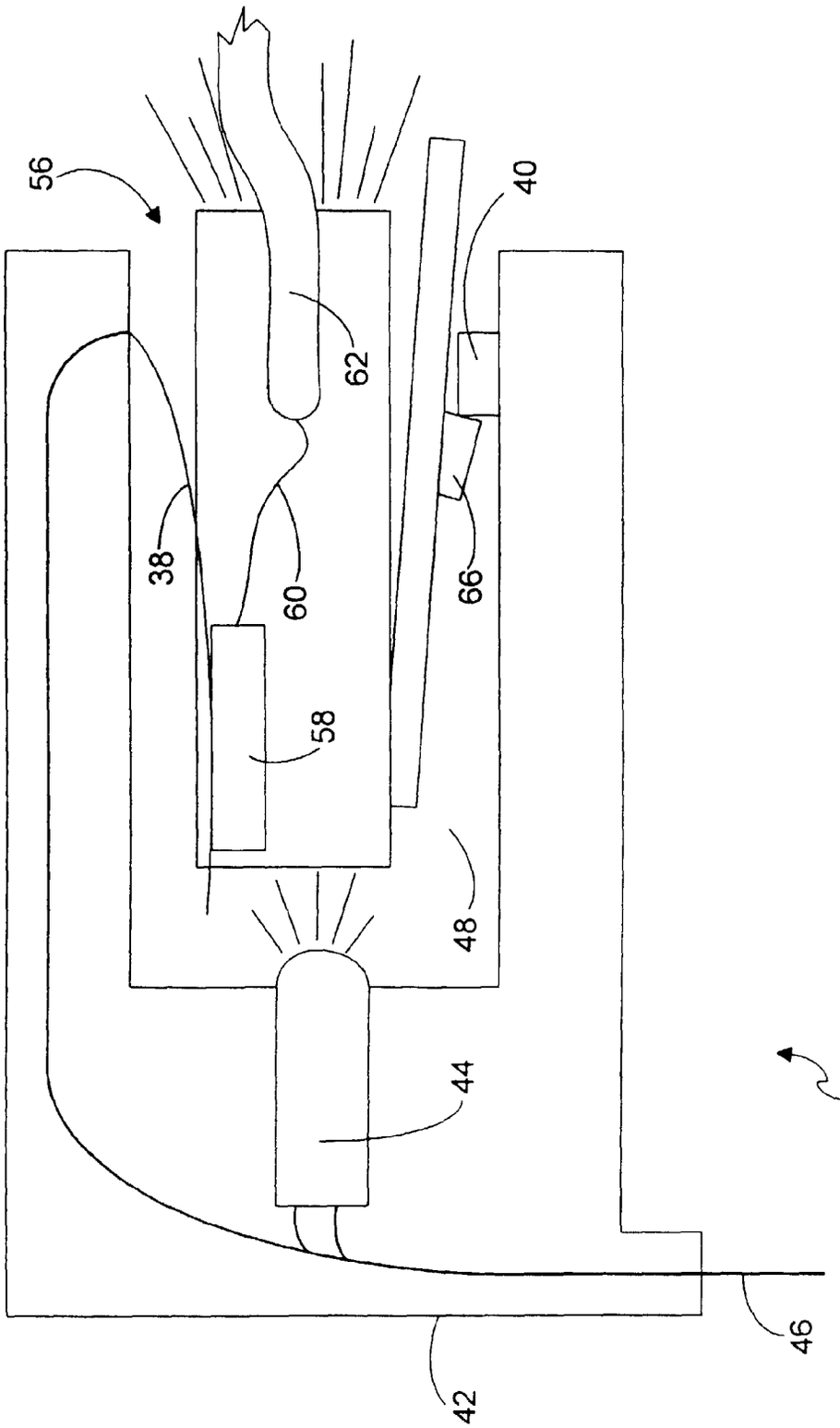

FIG. 6