(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 054 484 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.11.2000 Bulletin 2000/47

(51) Int. Cl.[7]: **H01R 39/64**, H01R 13/646

(21) Application number: **00304177.9**

(22) Date of filing: **17.05.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **17.05.1999 GB 9911457**
05.01.2000 GB 0000085

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(54) Electrical connector

(57) An electrical connector comprises a plug part 2 of rotationally symmetric cross-section and generally cylindrical form, and a socket part 3 adapted to receive the plug part and to allow it to rotate about its axis. The socket part includes at least one electrical contact 20,22 adapted to bear continuously against the plug part as the latter rotates, while the plug part includes an extension member 42 adapted for attachment to a motor in order to perform the said rotation. The socket part has an aperture allowing access to the said attachment means of the plug part, in particular to fix the motor. The connector can be used in suspended ceilings to support rotating illuminated signs.

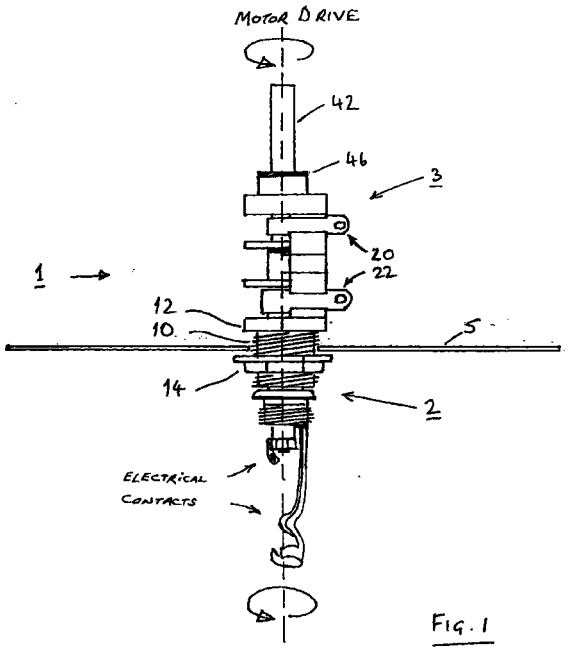

Fig. 1

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Description

[0001] The invention concerns electrical connectors, in particular such connectors which allow rotary movement of the appliance that is to be connected about the axis of the connector.

[0002] For electric lights which have to rotate about an axis, but only over a limited range, the connection between the supporting structure and the light can be made simply by wires, because they can take up the limited twisting necessary. Such an arrangement is fine for theatre lights and search lights, for example. However wires alone clearly cannot provide a connection for a light or other electrical fitting which rotates continuously in the same direction.

[0003] US 4746302 (Charles E. Brown) shows an insulating bolt for fixing signs to walls, with a passage through the bore for an electrical cable, and a grounding strip fitting together with the bolt, but it affords no possibility of rotating. EP 25206 (Merten) describes a rotating display with the possibility of incorporating a light source, but it does not say how power is to be transmitted to the light source.

[0004] It is the aim of the invention to provide an electrical connection which will allow continuous rotation and yet is cheap and can be used for instance for illuminated display signs that rotate.

[0005] According to one aspect of the invention there is provided an electrical connector comprising a plug part of rotationally symmetric cross-section and generally cylindrical form, and a socket part adapted to receive the plug part and to allow it to rotate about its axis, in which the socket part includes at least one electrical contact adapted to bear continuously against the plug part as the latter rotates, the plug part includes means adapted for attachment to a motor in order to perform the said rotation, and the socket part has an aperture allowing access to the said attachment means of the plug part.

[0006] With this design the socket part can be fixed to a stationary structure such as a ceiling, a motor can likewise be mounted on the structure and its spindle can be inserted through the aperture in the socket and attached to the plug when inserted into the socket. This attachment can be either temporary, such as by means of a screw thread, or permanent, such as by gluing. Spring contacts in the socket maintain electrical contact with the relevant parts of the plug as it rotates, thus supplying electrical power to an appliance attached to and turning with the plug.

[0007] In an advantageous form of the invention, the connector can be a modified standard jack plug, in which the end of the plug, which normally includes a groove for retaining the plug in the socket by means of a spring which simultaneously constitutes one of the contacts, is replaced by an extension, preferably threaded, of the central shaft of the jack plug, surrounded by a metal sleeve, which forms part of that one of the two electrical connections. The outer sleeve of the plug part can be unchanged, forming the other electrical connector. In the socket of the standard jack plug connector, the only modification necessary is to form a hole in the end of the socket that is large enough to accommodate the shaft extension. In some sockets even this is not necessary since the socket is open at its end away from the plug.

[0008] A preferred application of the connector is to support a rotating electric light, in particular a low-voltage ceiling spotlight. For this purpose, the plug may be fastened to a stem perhaps 20cm long which descends from the ceiling in which the socket is mounted and to the lower end of which the spotlight is fastened. The motor, mounted in the ceiling space, then rotates the stem with the light, while 12V electric power is supplied to the light via the sliding contacts on the socket. Furthermore, the socket can also support a sign or display board in combination with a light which illuminates it, thus providing a particularly attractive display.

[0009] The invention is therefore further directed to an assembly of such a connector with a motor fixed to the plug, and furthermore to the combination of such an assembly with an electrical appliance, in particular one including a lamp.

[0010] In an advantageous form of the invention the rigid system is replaced by an adjustable hanging mechanism enabling the height of the appliance to be set as required by the user. In particular, the well known "Rise and Fall" mechanism can be used, in which a wire supports the appliance at a set height, rolling up inside a drum as required. This mechanism can simply be hooked on to the bottom of the socket of the rotary connector and electrical contact established by any suitable further connector.

[0011] In a yet further aspect of the invention there is provided a method of converting a jack socket arrangement so as to allow the plug to be rotatably driven within the socket, in which method a shaft extension member is fitted to the end of the plug that is inserted into the socket and, if required, an aperture is made in the corresponding end of the socket through which the shaft member can pass. A motor can then be attached to the shaft member.

[0012] For a better understanding of the invention, reference will be made to the accompanying drawings, in which:

Figure 1 shows a complete plug and socket assembly constituting an embodiment of the invention;

Figure 2 shows a standard jack plug member and, in exploded view, such a plug modified in accordance with the invention;

Figure 3 shows in a similar way a standard jack socket and a modified jack socket in accordance with the invention;

Figure 4 shows a different socket usable with the invention;

Figure 5 shows an adjustable-height mechanism incorporated into the invention; and

Figure 6 shows the ceiling-mounted motor that drives the mechanism of Figure 5.

[0013] In **Figure 1**, a connector in accordance with the invention is shown in partial section fitted in an aperture in a ceiling plate 5.

[0014] The connector 1 consists of a plug 2 protruding downwards from the ceiling plate inserted into a socket 3 mounted in the cavity above the ceiling plate. The socket 3 is held in the plate 5 by a nut 14 screwed onto a lower tubular part 10 of the socket against a flange 12 of the socket. Electrical contacts 20 and 22 on the socket are connected by wires, not shown, to a standard 12-volt AC supply. From the upper end of the socket 3 protrudes a shaft member 42 fixed to the plug as will be explained later. The shaft member 42 is designed to be driven by a motor, as will likewise be explained below.

[0015] As is shown in **Figures 2 and 3** the plug and socket arrangement of the invention can conveniently be made from a standard jack plug because here the plug already has the necessary rotational symmetry. As is apparent from Figure 2, the standard jack plug has an internal elongate shaft part 32 ending in a bulbous end member 33 forming one electrical contact, and an outer sleeve 30 surrounding the inner shaft 32 with a spacing, forming the other electrical contact. The bulbous end 33 is separated axially from the outer sleeve 30 by an insulating bush 34. At the other end of the plug there is a widened screw portion 36 for fitting a housing, for instance. On the right hand side of Figure 2 the modification of the plug is shown in which the central shaft is replaced by a longer shaft ending in an extension 32a. This extension 32a is fitted with a thread onto which are screwed inner and outer internally threaded shaft extension sleeves 40 and 42, effectively replacing the bulbous end member 33. The two extensions are separated by washers 46 for the purpose of closing the aperture in the socket housing and holding the plug within the housing, in a manner to be explained later.

[0016] As shown in Figure 3, the standard jack socket is modified only by drilling an aperture in the end 24 opposite the end into which the plug is inserted. This aperture is slightly wider than the diameter of the internally threaded shaft extensions 40 and 42.

[0017] In order to assemble the connector the inner shaft extension 40 is screwed onto the threaded shaft extension 32a of the plug and the plug is then inserted into the socket, the threaded extension 32a protruding through the aperture in the socket. The washers 46 are placed over the protruding end of the extension 32a and then the outer tubular shaft extension is screwed onto this protruding end. This procedure fixes the plug within the socket. In the standard socket, of course, the plug is releasably held within the socket by the upper spring contact 20 engaging behind the bulbous end 33 but such releasability is not necessary in the present embodiment. The plug-and-socket assembly can then be screwed into the ceiling plate 5 by means of the nut 14. A stem (not shown) can then be screwed onto the lower end of the plug in place of the normal housing, and a 12V dichroic light, or a light and sign assembly, can be fitted to this stem. Meanwhile, a motor shaft can be fixed to the outer shaft extension 42 in order to rotate the plug within the socket. For conventional display purposes the rate of rotation would be perhaps a few times a minute.

[0018] In Figure 3 the socket housing is made largely of plastics and is of closed form. In the variant illustrated in **Figure 4** the socket is made entirely of metal, the upper electrical contact being simply an elongate spring member 20a. No modification needs to be made to the socket in order to allow the plug to be fixed to the motor shaft.

[0019] **Figure 5** shows an alternative version in which, instead of the stem mentioned, the plug 2' supports an adjustable cable known as a Rise and Fall assembly 50. The plug 2' has a hook 60 on which an eye 51 of the cable support is suspended. The weight of the electrical appliance (not shown) is taken by a wire 56 which coils itself up under a restoring force inside a drum 58. Electrical contact is made to the plug 2' via a simple pair of terminals 52, 53, the terminal 53 of the support assembly leading via a coiled flex 54 to the appliance. All that is therefore needed to fit such an assembly is to hang the eye 51 on the hook 60 of the plug 2' and to connect the terminals 52, 53. It has been found that under slow rotation the assembly is entirely stable. Moreover it is robust, as compared to the stem embodiment described previously, because it is not sensitive to being knocked sideways: it simply swings and continues rotating. In addition this embodiment has the advantage that it is not necessary to store and pack various lengths of stem in order to satisfy different height requirements.

[0020] **Figure 6** shows the motor on which the Rise and Fall device is hung. An insulating housing 62 rests on a plate 6, typically of plywood, which spreads the load on the ceiling tile 5. Such an arrangement can support a total weight of around 5 kg without difficulty. Both plate and tile have a 35 mm hole 7 bored in them through which the hook 60 and lead 52 protrude. The motor has 12V leads 63, through in fact it is not necessary to use a low-voltage source because the plastic cup 59 of the Rise and Fall assembly covers the contacts. Hence a mains lamp and motor can be used.

[0021] It is clear that, although the invention was conceived in relation to supporting low-voltage electric lights, it could be used for mounting any electrical appliance that is intended to rotate and preferably, though not exclusively, designed to hang from a ceiling. The motor can share the power supply with the appliance, or have a different supply.

Claims

1. An electrical connector comprising a plug part (2) of rotationally symmetric cross-section and generally cylindrical form, and a socket part (3) adapted to receive the plug part and to allow it to rotate about its axis, in which the socket part includes at least one electrical contact (20,22) adapted to bear continuously against the plug part as the latter rotates, the plug part includes means (42) adapted for attachment to a motor in order to perform the said rotation, and the socket part has an aperture allowing access to the said attachment means of the plug part.

2. An electrical connector according to claim 1, in which the attachment means includes a screw thread.

3. An electrical connector according to claim 1 or 2, in which the connector is a modified standard jack plug, in which the end of the plug, which normally includes a groove for retaining the plug in the socket by means of a spring which simultaneously constitutes one of the contacts, is replaced by an extension (32a), preferably threaded, of the central shaft of the jack plug, surrounded by a metal sleeve (40), which forms part of that one of the two electrical connections.

4. A mounting for an electrical appliance, comprising a connector according to any preceding claim and a descender to which the appliance is to be fastened.

5. A mounting according to claim 4, in which the descender is a rigid stem.

6. A mounting according to claim 4, in which the descender is a height-adjustable hanger.

7. A motorised assembly for a rotating electrical appliance, comprising an electrical connector according to claims 1 to 3, or a mounting according to claims 4 to 6, and a motor arranged to drive the plug part.

8. An assembly according to claim 7, in which the appliance is a spotlight.

9. A ceiling to which are fitted one or more assemblies according to claim 7 or 8.

10. A method of converting a jack socket arrangement so as to allow the plug to be rotatably driven within the socket, in which method a shaft extension member (40,42) is fitted to the end of the plug that is inserted into the socket and, if required, an aperture is made in the corresponding end (24) of the socket through which the shaft member can pass, and a motor is then attached to the shaft extension member.

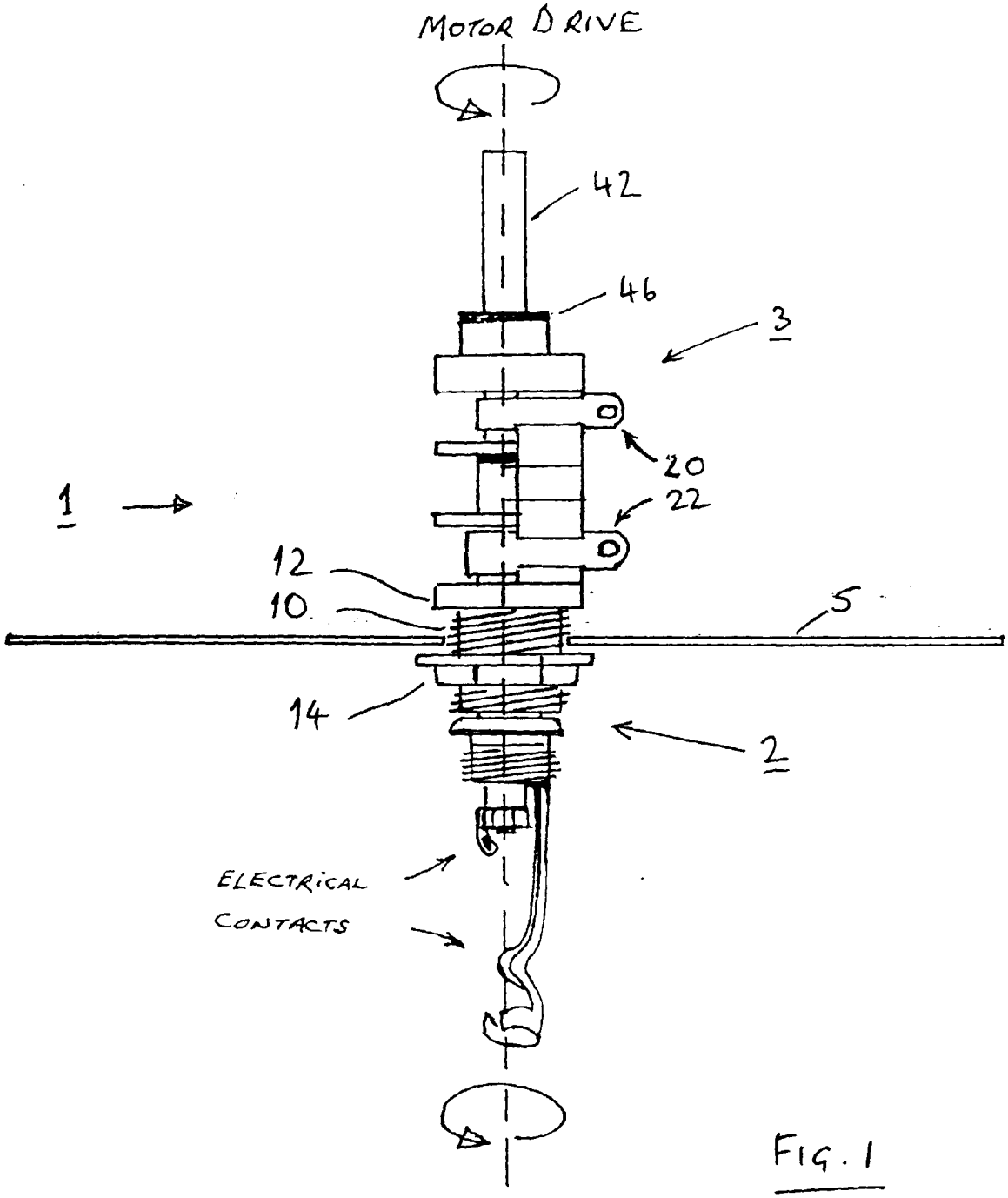

FIG. 1

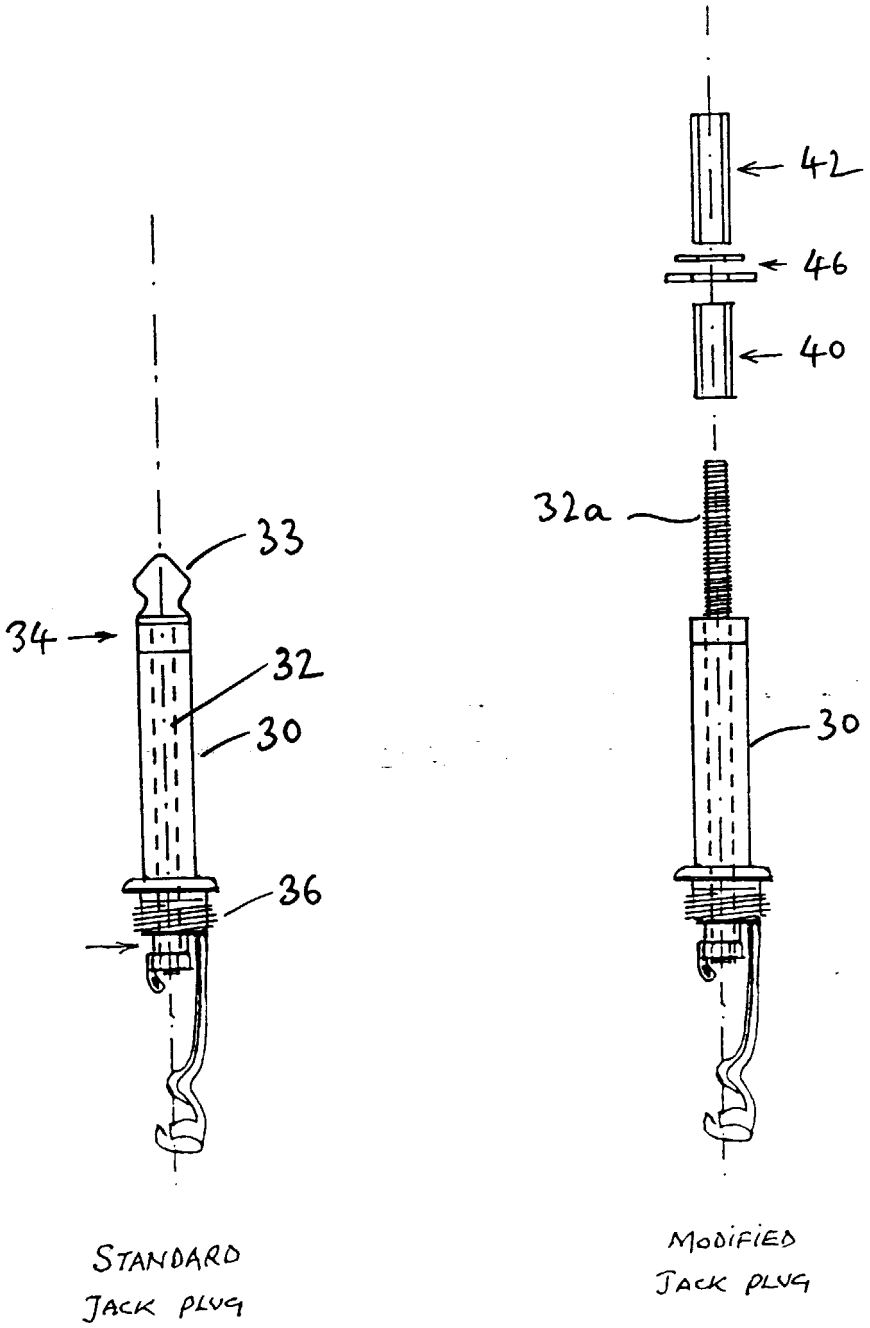
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FIG. 2

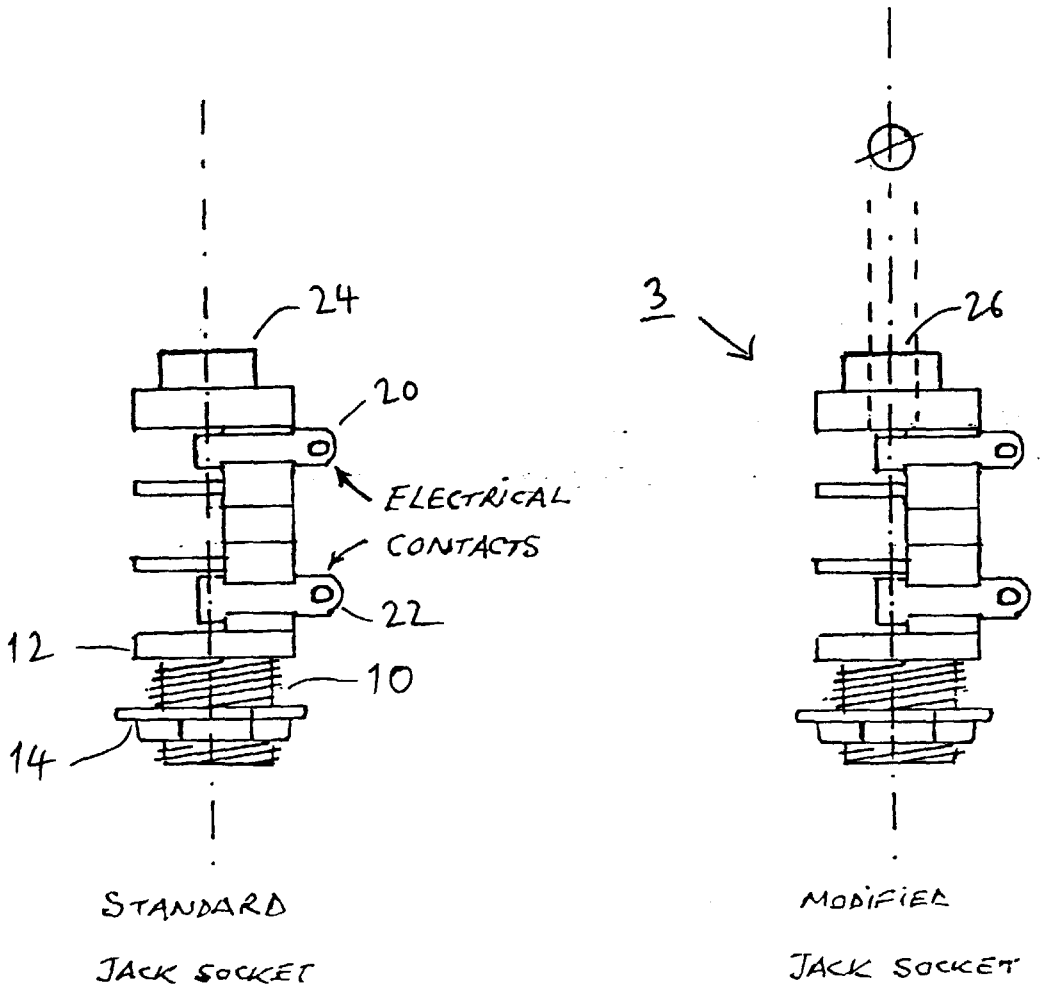
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FIG. 3

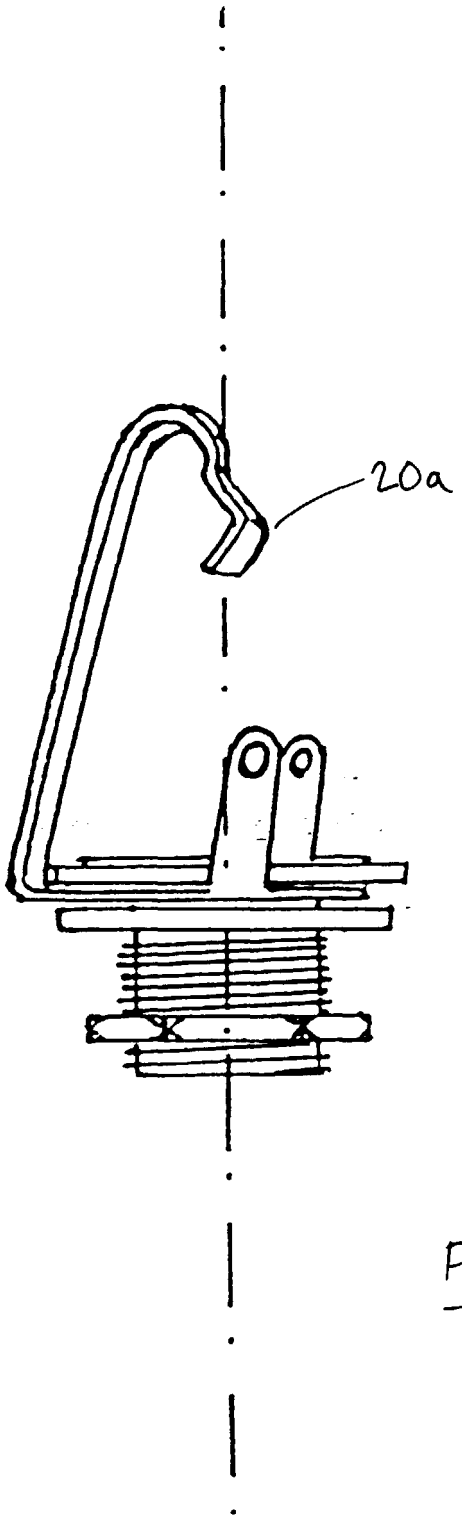
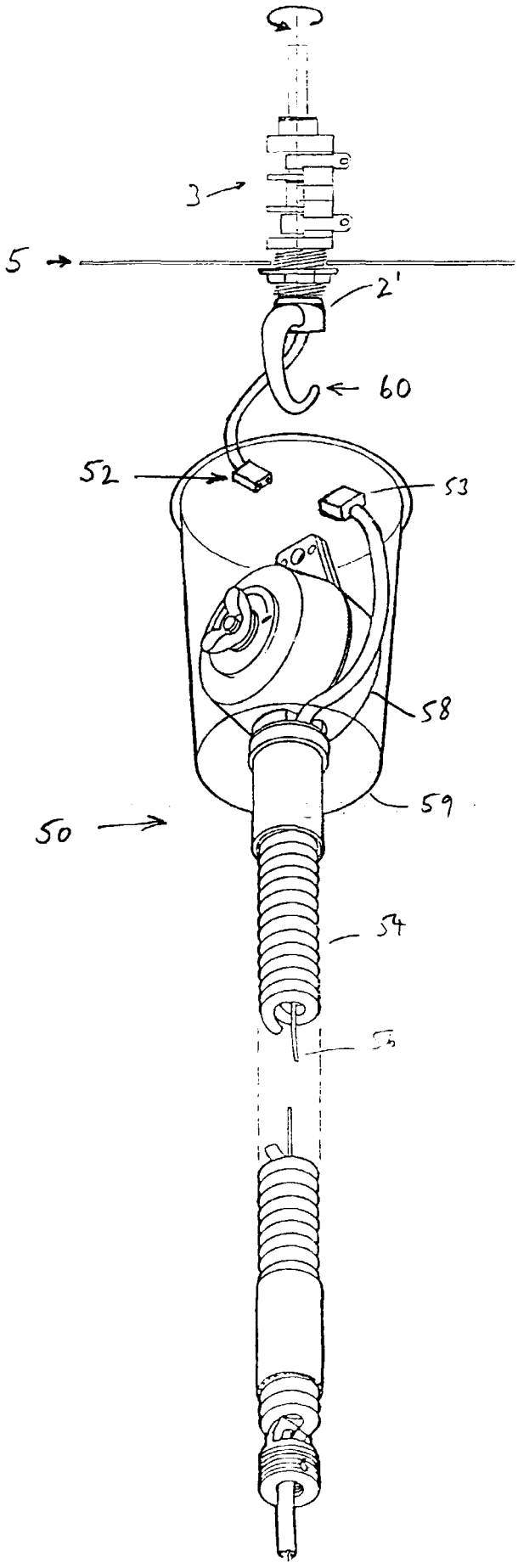


FIG. 4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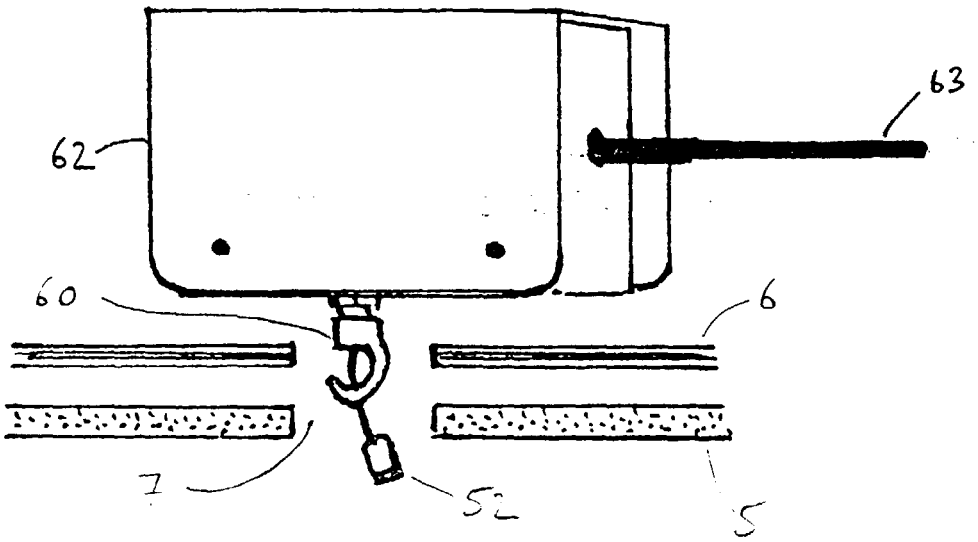
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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 4177

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 August 2000	Waern, G

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08-08-2000

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