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(71) Applicant(s):
ITT Manufacturing Enterprises, Inc.
(Incorporated in USA - Delaware)
1105 North Market Street, Suite 1217,
Wilmington, Delaware 19801,
United States of America

(72) Inventor(s):
Kevin Evans

(74) Agent and/or Address for Service:
Elkington and Fife LLP
Prospect House, 8 Pembroke Road,
SEVENOAKS, Kent, TN13 1XR,
United Kingdom

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US 6309231 B1 **US 5685730 A**

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INT CL⁷ **H01R**
Other: **Online: WPI, EPODOC, JAPIO**

(54) Abstract Title: **Bayonet electrical connector**

(57) A bayonet electrical connector has a spring loaded safety pin 45 for locking the bayonet coupling. The pin projects into a recess 42 when the bayonet is fully engaged. A sleeve 70 surrounds the part having the recess, with a tab 72 projecting into the recess, and the sleeve can slide to make the tab depress the pin against its spring bias to allow disconnection of the coupling. Thus a connector which is intended to require a special tool to be decoupled can be adapted to allow decoupling by hand while still maintaining a locking mechanism to prevent accidental decoupling.

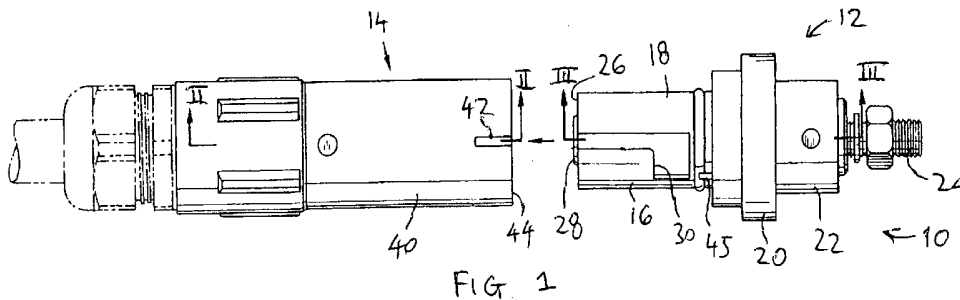


FIG. 1

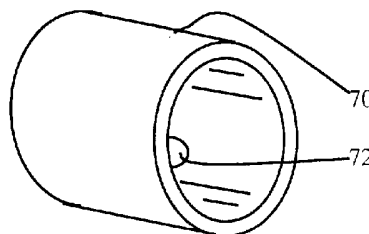


FIG. 6

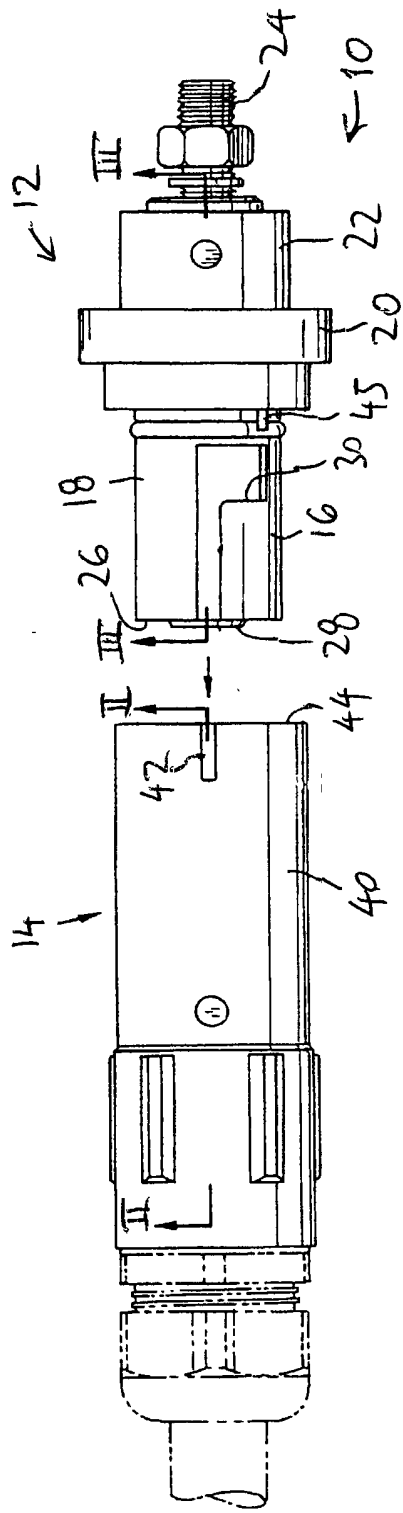


FIG. 1

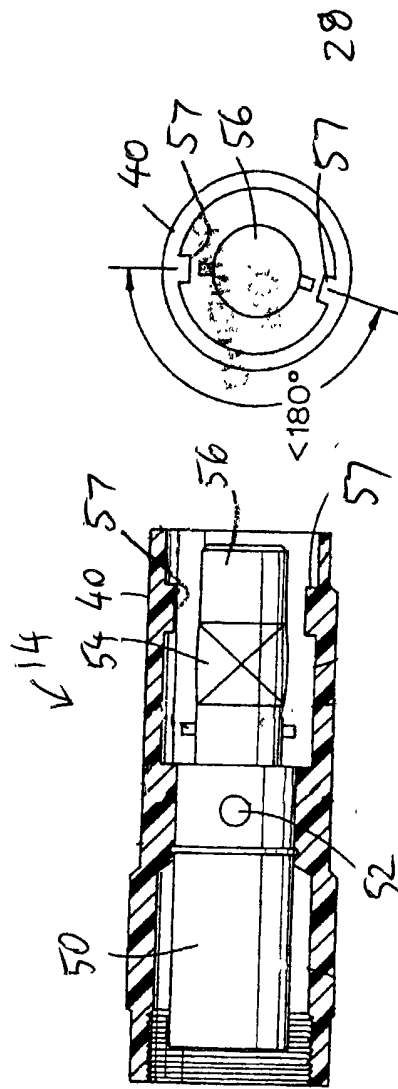


FIG. 2

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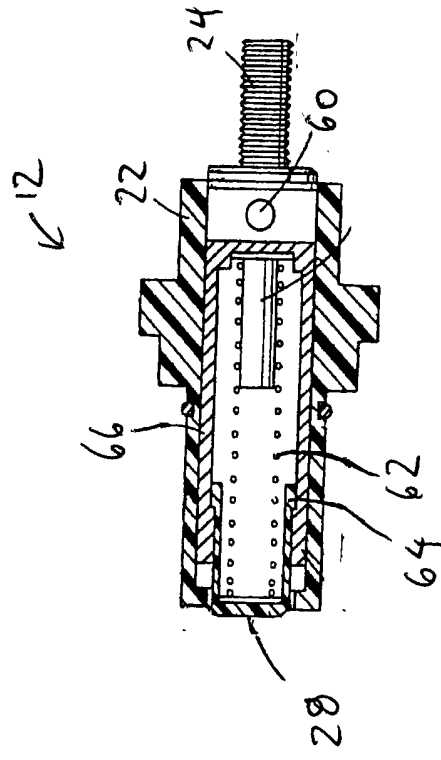


FIG. 3

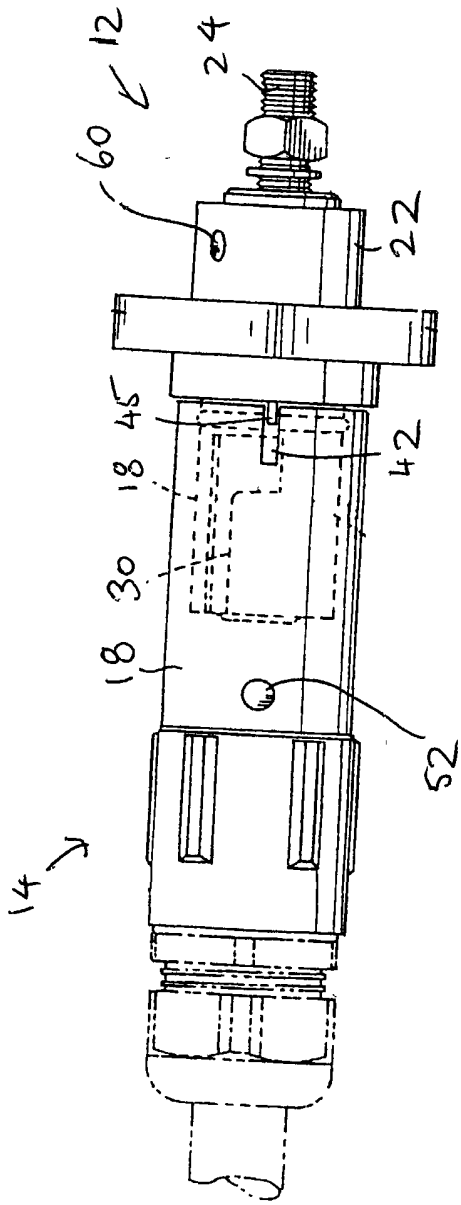


FIG. 4

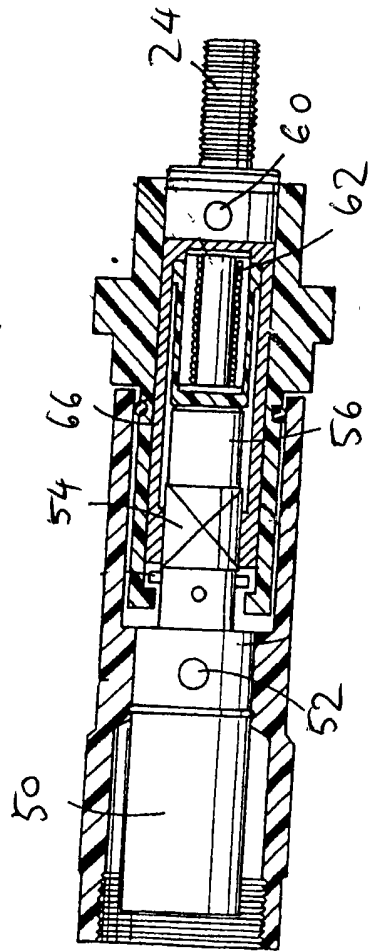


FIG. 5

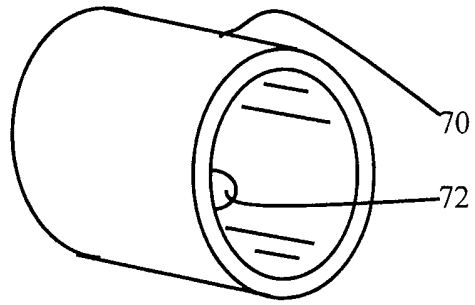


FIG. 6

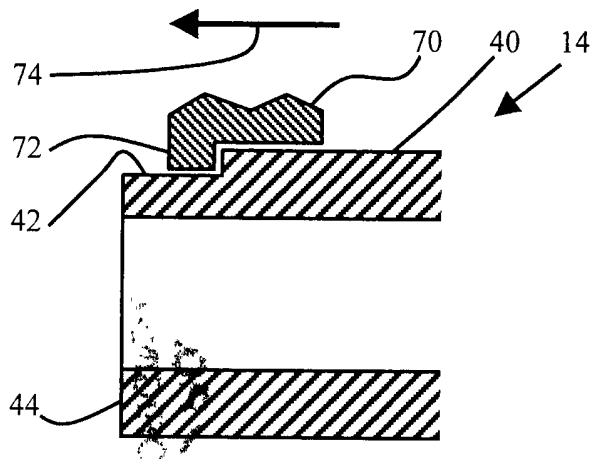


FIG. 7

ELECTRICAL CONNECTOR

This invention relates to electrical connectors, and more particularly to high
5 power safety connectors.

The terminals of high current electrical connectors are typically much larger
than for domestic electrical connectors, and it can be possible for a person to insert a
finger or other object into a socket opening and touch electrically live components
10 within the socket.

There are various designs of electrical connector which provide a safety feature,
to reduce the risk of live contacts being accessible when the connector is disconnected.

US 6 309 231 discloses an electrical connector in which the mating surfaces of
the male and female connectors present only insulating components to the user.
15 Furthermore, to separate the male and female parts of the connector, a tool must be
used in order to depress a release pin. This provides the advantage that accidental
release of the coupling is not easily achieved.

For some applications, the need for an additional release tool is appropriate, and
may be required for insurance or other purposes. For other applications, the need for a
20 release tool may not be appropriate or required, but the other safety advantages of the
connector are still worthwhile. When a release tool is provided, it will often be mislaid,
and users will still attempt to separate the connection, using other implements or using
their fingernails.

There is therefore a need for an improved release mechanism in this type of
25 electrical connector.

According to the invention, there is provided an electrical connector
comprising:

- a male part and a female part;
- 30 a bayonet coupling between the male part and the female part;
- a spring-loaded pin projecting from one of the male part and the female part,
and a recess in the other of the male part and the female part for receiving the pin,

wherein the pin is received in the recess when the bayonet coupling is fully engaged, thereby to limit relative rotation between the male part and the female part and to prevent disconnection of the bayonet coupling while the pin is engaged in the recess,

5 wherein the connector further comprises a sleeve surrounding a portion of the part having the recess, the sleeve having a tab which projects into the recess, the sleeve being slidable to make the tab depress the pin against the spring bias of the pin, thereby to enable subsequent disconnection of the bayonet coupling.

This design maintains a locking mechanism to prevent accidental decoupling of
10 the bayonet connection, but makes the decoupling process simpler, by using a sliding and twisting operation rather than needing a specific additional tool.

The male part preferably has a connection portion comprising an outer insulating sleeve and an inner conducting sleeve, and wherein a spring-loaded insulating cover is mounted within the inner sleeve, which is biased by the spring to
15 substantially block the open end of the outer sleeve.

The contacts are thus inside the sleeve behind the cover, so that no live contacts are exposed when the connector is separated. The inner sleeve defines the electrical connector contact of the male part.

The outer insulating sleeve is preferably provided with at least one channel for
20 defining the bayonet coupling.

The female part preferably comprises a second outer insulating sleeve and a connector pin housed within the insulator sleeve. This receives the connection portion of the male part, and the connector pin acts to depress the insulating cover. An end of the connector pin, proximate to the open end of the second outer insulating sleeve, is
25 formed from an insulator, so that again no live contacts are exposed by the disconnected female part.

The connector pin may also comprise a contact which is radially outwardly spring biased. This presses against the inner sleeve of the male part to define a high current electrical connection. The inner surface of the second outer insulating sleeve
30 preferably comprises at least one projection for defining the bayonet coupling, in conjunction with the channel of the male part.

The sleeve may be releasably connected to the part having the recess, so that the connector can be configured either as a component needing a release tool or as one in which release is simplified.

5 A coupling may be provided between the sleeve and the part having the recess, the coupling comprising a lug in one of the sleeve and the part and a closed channel for receiving the lug in the other of the sleeve and the part. In this way, the sleeve remains attached when the connector parts are separated.

10 The invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 shows a known connector in a separated state;

Figure 2 shows the female part of the connector of Figure 1 in cross section;

Figure 3 shows the male part of the connector of Figure 1 in cross section;

Figure 4 shows the connector of Figure 1 in a connected state;

15 Figure 5 shows the connector of Figure 1 in a connected state in cross section;

Figure 6 shows a component of the invention for use with the connector of Figures 1 to 5; and

Figure 7 is a cross section of the component of Figure 6 in position.

20 Before describing the improved connector of the invention, the operation of the connector of US 6 309 231 will first be described.

Figure 1 shows the power connector assembly of US 6 309 231, generally indicated at 10 in an uncoupled position.

25 The assembly 10 has a male connector 12 and a female connector 14. The male connector 12 has a body 16 formed from an electrically insulating material, such as plastic. The male connector 12 has a cylindrical male portion 18, a flange 20 and a rear part 22. The male connector is for connection to a source of high voltage using a conventional threaded connector 24.

30 The male connector has an end face 26, and an insulating pin 28 projects slightly beyond the end face 26. The male portion 18 has two slots 30, which are used to define a bayonet type coupling with the female connector 14.

The female connector 14 has a cylindrical electrically non-conductive body 40 having a slot 42 extending inwardly from an end face 44 of the housing 40. The female connector 14 is also connected to a source of electrical power.

5 A pin 45 projects from a face at the end of the male portion 18, and as will be described below, this provides a safety locking mechanism.

Figure 2 shows the female connector 14 in cross section. The female connector houses a contact assembly 50 which is pinned to the body 40 using a pin 52 to prevent relative movement. A forward part of the contact assembly 50 includes a louver band 54. The louver band 54 is a single, double or multi-louver spring band depending on the voltage applied. Beyond the louver band 54 is an insulating end piece 56, so that all exposed parts of the female connector 14 are insulating.

The inner surface of the housing 40 has two tabs 57, which engage with the slot 30 to form the bayonet coupling. As shown in the end view of Figure 2, the tabs 57 are not diametrically opposite, so that there is only one relative angular orientation in which the male and female connectors can be joined.

Figure 3 shows the male connector 12 in cross section. The threaded connector 24 is also pinned to the housing 22 using a pin 60 to prevent relative movement. The pin 28 is biased by a compression spring 62 into the projecting position shown, so that all exposed parts of the male connector are insulating. The pin 28 has a rear shoulder 64 to limit outward movement of the pin 28.

The spring biased pin 28 slides back and forth within the male portion 18 to enable the louver 54 to make electrical connection to the conductive inner sleeve 66 of the male portion 12. The electrical connection is thus made between the louver 54 and the inner sleeve 66, by means of the louver spring bands.

25 Figure 4 shows the connected coupling and Figure 5 shows the connected coupling in cross section.

To mate the male and female connectors, the tabs 57 are aligned with the slots 30. The end piece 56 engages with the plunger 28 which is depressed as the male and female parts are moved together. When fully engaged, the end face 44 of the female connector comes into contact with the pin 45. The pin 45 is fully compressed when the male and female connectors are fully pushed together. The male connector 12 is then rotated (clockwise), until the slot 42 reaches the pin which then projects into the slot 42. This prevents any further rotation of the two parts relative to each other. The shape

of the slot 30, having a shaft and a head, ensures that in this relative orientation, the male and female connectors cannot be separated, as the tabs 57 are then trapped in the head portions of the recesses 30.

In order to release the connection, the pin must be depressed, and at the same
5 time, the male and female parts are rotated relatively to each other to release the bayonet coupling.

The pin is housed in a small enclosure defined by the slot 42, so that this depression is deliberately not a straightforward operation. A tool is provided for insertion into the slot 42, and having a width to fill the slot, and thereby depress the pin,
10 so that the male and female parts can rotated and released. While this provides an additional level of safety which may be desirable or required, for example if the connectors are in public areas, it can be a nuisance when the level of safety is not required.

The connector above is described in more detail in US 6 309 231, to which
15 reference is made.

The invention provides a modification to the connector described above, which provides similar levels of safety but without requiring additional tools.

In a first embodiment, the invention provides an extra component which can be added to the design described above to avoid the need for a tool. In this way, the
20 connector can have a single design, and the additional component is then optional, so that use of the connector in some applications will require use of a tool to disconnect the male and female parts, whereas use of the connector in other applications, for example where there is no public access, does not require use of the tool.

Figure 6 shows the additional component, comprising a sleeve 70 having an
25 inwardly projecting tab 72 designed to fit inside the slot 42.

In use, the sleeve 70 is fitted over the end 44 of the female connector 14, with the tab 72 sliding into the slot 42. The engagement of the tab 72 with the slot 42 may be the only coupling between the sleeve and the female connector 14, so that a choice of whether or not to use to sleeve 70 can be made when making the electrical
30 connection, and in dependence on the requirements at that location.

Figure 7 shows how the tab 72 engages with the slot 42 in the housing 40, so that the slot limits the sliding and rotational movement of the sleeve 70.

In order to release the connector, the sleeve is pushed towards the male connector as shown by arrow 74, and the tab 72 pushes the pin 45 inwardly against the spring bias of the pin. When the pin is fully depressed, the male and female connectors can be rotated to release the bayonet coupling.

5 In another version, the sleeve is mounted on the housing 40 with a coupling in addition to the engagement of the tab 72 and slot 42. For example, a lug and slot arrangement between the inside of the sleeve 70 and the outside of the housing 40 may hold the housing 40 and sleeve 70 together even when the male and female connectors are separated. Even with this additional coupling between the sleeve and housing, the
10 sleeve may still be removable from the housing by applying sufficient force, but the additional coupling is sufficient that the sleeve does not fall off when the connector is disconnected.

Alternatively, the sliding sleeve can be securely mounted over the housing, so that the connector is supplied only in the format in which it is to be used.

15 No biasing arrangement for the sleeve is required, as the spring force of the pin 45 is used to push the sleeve away when the male and female connectors are joined.

The connector provided by the invention can be released more easily and without the need for an additional tool. However, the release operation is still a two-stage operation, of axial force and simultaneous rotation. The invention also enables a
20 connector to be formed with two possible levels of safety, so that the connector can be used in different ways for different applications.

The sleeve can have a ribbed or other outer surface to improve grip and to make the release operation easier in confined spaces. An end section of the housing 40 can be recessed to house the sleeve, without increasing significantly the total volume of the
25 connector.

Various other modifications will be apparent to those skilled in the art.

CLAIMS

1. An electrical connector comprising:
 - a male part and a female part;
 - 5 a bayonet coupling between the male part and the female part;
 - a spring-loaded pin projecting from one of the male part and the female part, and a recess in the other of the male part and the female part for receiving the pin, wherein the pin is received in the recess when the bayonet coupling is fully engaged, thereby to limit relative rotation between the male part and the female part and to prevent disconnection of the bayonet coupling while the pin is engaged in the recess,
 - 10 wherein the connector further comprises a sleeve surrounding a portion of the part having the recess, the sleeve having a tab which projects into the recess, the sleeve being slidable to make the tab depress the pin against the spring bias of the pin, thereby to enable subsequent disconnection of the bayonet coupling.
 - 15
2. A connector as claimed in claim 1, wherein the male part has a connection portion comprising an outer insulating sleeve and an inner conducting sleeve, and wherein a spring-loaded insulating cover is mounted within the inner sleeve, which is biased by the spring to substantially block the open end of the outer sleeve.
- 20 3. A connector as claimed in claim 2, wherein the inner sleeve defines the electrical connector contact of the male part.
- 25 4. A connector as claimed in claim 2 or 3, wherein the outer insulating sleeve is provided with at least one channel for defining the bayonet coupling.
5. A connector as claimed in claim 4, wherein the outer insulating sleeve is provided with two channels for defining the bayonet coupling, and which are not symmetrically angularly oriented around the outer sleeve.
- 30

6. A connector as claimed in any preceding claim, wherein the female part comprises a second outer insulating sleeve and a connector pin housed within the insulator sleeve.
- 5 7. A connector as claimed in claim 6, wherein an end of the connector pin, proximate to the open end of the second outer insulating sleeve, is formed from an insulator.
8. A connector as claimed in claim 6 or 7, wherein the connector pin comprises a
10 contact which is radially outwardly spring biased.
9. A connector as claimed in claim 6, 7 or 8, wherein the inner surface of the second outer insulating sleeve comprises at least one projection for defining the bayonet coupling.
- 15 10. A connector as claimed in claim 9, wherein the inner surface of the second outer insulating sleeve comprises two projections for defining the bayonet coupling, and which are not symmetrically angularly oriented around the inner surface of the second outer sleeve.
- 20 11. A connector as claimed in any preceding claim, wherein the sleeve is releasably connected to the part having the recess.
12. A connector as claimed in any preceding claim, wherein a coupling is provided
25 between the sleeve and the part having the recess, the coupling comprising a lug in one of the sleeve and the part and a closed channel for receiving the lug in the other of the sleeve and the part.
13. A connector as claimed in any preceding claim, wherein the male part has the
30 pin and the female part has the recess.



INVESTOR IN PEOPLE

Application No: GB0404280.0

Examiner: Paul Nicholls

Claims searched: 1 - 13

Date of search: 15 July 2004

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular reference
A	1	US 6309231 B1 (GORDON et al)
A	1	US 5685730 A (CAMERON)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^W :

H2E

Worldwide search of patent documents classified in the following areas of the IPC⁰⁷

H01R

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, JAPIO