

616347

COMMONWEALTH of AUSTRALIA
Patents Act 1952

APPLICATION FOR A STANDARD PATENT

I/We

BICC Public Limited Company

of

Devonshire House, Mayfair Place, London, W1X 5FH, United Kingdom

hereby apply for the grant of a Standard Patent for an invention entitled:

Optical cable

which is described in the accompanying complete specification.

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Details of basic application(s):-

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•••••

•••••

<u>Number</u>	<u>Convention Country</u>	<u>Date</u>
8908446.1	United Kingdom	14 April 1989

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

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DATED this SEVENTEENTH day of APRIL 1990

To: THE COMMISSIONER OF PATENTS

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.....
a member of the firm of
DAVIES & COLLISON for
and on behalf of the
applicant(s)

Davies & Collison, Melbourne

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

DECLARATION IN SUPPORT OF CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT

Insert title of invention

In support of the Application made for a patent for an invention entitled: 'OPTICAL CABLE'

Insert full name(s) and address(es) of declarant(s) being the applicant(s) or person(s) authorized to sign on behalf of an applicant company.

XX I, George Renton of BICC Public Limited Company of Devonshire House, Mayfair Place, London, W1X 5FH, United Kingdom

Cross out whichever of paragraphs 1(a) or 1(b) does not apply

1(a) relates to application made by individual(s) 1(b) relates to application made by company; insert name of applicant company.

do solemnly and sincerely declare as follows:-

1. (a) ~~XXXXXX the applicant for the patent~~

or (b) I am authorized by BICC Public Limited Company

Cross out whichever of paragraphs 2(a) or 2(b) does not apply

2(a) relates to application made by inventor(s) 2(b) relates to application made by company(s) or person(s) who are not inventor(s); insert full name(s) and address(es) of inventors.

the applicant..... for the patent to make this declaration on its behalf.

2. (a) ~~XXXXXX the actual inventor of the invention~~

or (b) Stephen Thomas SPEDDING 13, Lealholme Avenue, Aspall, Wigan, WN2 1EH United Kingdom

~~XXXX~~ is the actual inventor..... of the invention and the facts upon which the applicant..... ~~XXXX~~ is entitled to make the application are as follows:-

State manner in which applicant(s) derive title from inventor(s)

The Applicant is, and was at the date of the basic application, the Assignee of the actual inventor, in respect of the invention.

Cross out paragraphs 3 and 4 for non-convention applications. For convention applications, insert basic country(s) followed by date(s) and basic applicant(s).

3. The basic application..... as defined by Section 141 of the Act ^{was} ~~XXXX~~ made in United Kingdom on the 14th April, 1989 by BICC Public Limited Company in on the by in on the by

Insert place and date of signature.

4. The basic application..... referred to in paragraph 3 of this Declaration ^{was} ~~XXXX~~ the first application..... made in a Convention country in respect of the invention the subject of the application

Signature of declarant(s) (no attestation required)

Declared at London, U.K. this 13th day of April, 1990
George Renton
Dr. George Renton
Group Manager
Patents & Licensing

Note Initial all alterations.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-53291/90
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 616347

(54) Title
OPTICAL CABLE

International Patent Classification(s)
(51)⁵ G02B 006/44

(21) Application No. : 53291/90

(22) Application Date : 17.04.90

(30) Priority Data

(31) Number	(32) Date	(33) Country
8908446	14.04.89	GB UNITED KINGDOM

(43) Publication Date : 18.10.90

(44) Publication Date of Accepted Application : 24.10.91

(71) Applicant(s)
BICC PUBLIC LIMITED COMPANY

(72) Inventor(s)
STEPHEN THOMAS SPEDDING

(74) Attorney or Agent
DAVIES & COLLISON , 1 Little Collins Street, MELBOURNE VIC 3000

(56) Prior Art Documents
AU 554844 21965/83 G02B 6/44

(57) Claim

1. An optical cable comprising a central flexible elongate member of plastics material having in its outer surface a plurality of circumferentially spaced slots which extend lengthwise of the member, each of which slots is of substantially uniform width throughout its depth and is so disposed within the central member that a plane substantially midway between and parallel to the side walls of the slot extends substantially radially of the longitudinal axis of the central member, a plurality of optical fibre ribbons stacked one on top of another in at least some of the slots and, surrounding the central member, an overall outer protective sheath, wherein the circumferentially spaced slots comprise two groups of slots, the slots of each group being of substantially the same depth as one another and the depth of each of the slots of one group being substantially greater than the depth of each of the slots of the other group and each slot of one of said

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groups being disposed between two slots of the other of said groups, and wherein each of said slots has a plurality of optical fibre ribbons stacked one on top of another in the slot, the number of optical fibre ribbons in each of the slots of greater depth being substantially greater than the number of optical fibre ribbons in each of the slots of smaller depth.

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PATENTS ACT 1952

COMPLETE SPECIFICATION

6 1 6 3 4 7

NAME & ADDRESS
OF APPLICANT:

BICC Public Limited Company
Devonshire House
Mayfair Place
London W1X 5FH
United Kingdom

NAME(S) OF INVENTOR(S):

Stephen Thomas SPEDDING

ADDRESS FOR SERVICE:

DAVIES & COLLISON
Patent Attorneys
1 Little Collins Street, Melbourne, 3000.

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

Optical cable

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

This invention relates to optical cables of the kind comprising a central flexible elongate member of plastics material having in its outer surface a plurality of circumferentially spaced slots which extend
 5 lengthwise of the member and in at least some of which is housed at least one optical fibre and, surrounding the member, an overall outer protective sheath. Usually, but not necessarily, the circumferentially spaced slots follow helical paths around the
 10 longitudinal axis of the central member.

As optical communications systems have become more widely used, the number of optical fibres required in an optical cable of the aforesaid kind has increased very substantially and it is now not unusual for a need for
 15 an optical cable of the aforesaid kind incorporating several hundred optical fibres. To this end, an optical cable of the aforesaid kind has been proposed and used in which each slot is of substantially uniform width throughout its depth and is so disposed within the
 20 central member that a plane substantially midway between and parallel to the side walls of the slot extends substantially radially of the longitudinal axis of the central member and in which a plurality of optical fibre ribbons, each comprising a plurality of optical fibres
 25 disposed side by side with their axes lying in a substantially common plane, are stacked on one top of another in each of the circumferentially spaced slots.

By way of example, an optical cable of the aforesaid kind currently available has in each of five circumferentially spaced slots in its central member, ten optical fibre ribbons stacked one on top of another, each of which ribbons includes eight optical fibres, so that the optical cable incorporates four hundred optical fibres.

Whilst, from the point of view of an optical communications system in which an optical cable of the aforesaid kind incorporating a multiplicity of optical fibres is to be used, optical cables of the aforesaid kind hitherto proposed and used have proved to be wholly satisfactory, such optical cables have disadvantages which render the cables costly to manufacture.

We have found that where each of a plurality of slots in the central member of an optical cable of the aforesaid kind is to house a plurality of optical fibre ribbons, the cross-sectional area of the central member required to accommodate these slots must be such that manufacture of the optical cable becomes undesirably expensive because of the large quantity of plastics material required to form the central member and because of the difficulty of efficiently cooling the large mass of plastics material, after the central member with the circumferentially spaced slots in its outer surface has been extruded and before the optical fibre ribbons are introduced into the slots, without distortion of the

central member occurring. In practice, we have found there is an upper limit of the diameter of the central member above which it is not possible to cool the extruded central member without distortion of the central member taking place.

It is an object of the present invention to provide an improved optical cable of the aforesaid kind which is of such a construction that the disadvantages hereinbefore described are substantially reduced.

According to the invention the improved optical cable of the aforesaid kind has a central flexible elongate member of plastics material having in its outer surface a plurality of circumferentially spaced slots which extend lengthwise of the member, each of which slots is of substantially uniform width throughout its depth and is so disposed within the central member that a plane substantially midway between and parallel to the side walls of the slot extends substantially radially of the longitudinal axis of the central member, a plurality of optical fibre ribbons stacked one on top of another in at least some of the slots and, surrounding the central member, an overall outer protective sheath, wherein the circumferentially spaced slots comprise two groups of slots, the slots of each group being of substantially the same depth as one another and the depth of each of the slots of one group being substantially greater than the depth of each of the slots of the other group and each slot of one of said groups being disposed between two slots of the other of said groups, and wherein each of said slots has a plurality of optical fibre ribbons



stacked one on top of another in the slot, the number of optical fibre ribbons in each of the slots of greater depth being substantially greater than the number of optical fibre ribbons in each of the slots of smaller
5 depth.

By virtue of this construction, the improved optical cable having a multiplicity of optical fibres approximating in number to an optical cable of the aforesaid kind hitherto proposed and used will have a
10 diameter and weight per unit length which are substantially less than said known optical cable. As a consequence of the reduction in diameter of the central member - and hence in the mass per unit length of the plastics material of the central member - cooling of the
15 extruded central member can be readily effected without distortion of the central member occurring.

Preferably, the depth of the slots of greater depth is approximately twice that of the slots of smaller depth.

20 As in optical cables of the aforesaid kind hitherto proposed and used, preferably each of the circumferentially spaced slots follows a helical path around the longitudinal axis of the central member.

Preferably, also, the central member has
25 encapsulated within the plastics material of the member a central flexible elongate reinforcing element of a metallic or non-metallic material of high tensile

strength. Where the central flexible elongate reinforcing element is of metal or metal alloy, preferably it is of steel; where it is of a non-metal, preferably it is of an aromatic polyamide. The central flexible elongate reinforcing element may be a single elongate element or it may be a plurality of elongate elements stranded or otherwise assembled together.

The central member may be surrounded by a single overall outer protective sheath, preferably of plastics material, but, in some circumstances, the overall protective sheath may be of composite form comprising an inner sheath of polyethylene or other plastics material and an overshath of termite-resistant or flame-retardant material. A circumferentially continuous moisture barrier of metal or metal alloy may underlie the overall protective sheath.

The invention is further illustrated by a description, by way of example, a preferred optical cable of the aforesaid kind with reference to the accompanying drawing which shows a transverse cross-sectional view of the preferred cable drawn on an enlarged scale.

Referring to the drawing, the preferred optical cable comprises a central flexible elongate member 1 of plastics material in which is embedded a central flexible elongate reinforcing element 2 of an aromatic polyamide. The central flexible plastics member 1 has

in its outer surface a plurality of circumferentially spaced slots which follow helical paths around the longitudinal axis of the central member and which comprise one group of four slots 3 of the same cross-sectional shape and size as one another and one group of four slots 4 of the same cross-sectional shape and size as one another. The slots 3 and 4 are of the same uniform width throughout their depth and are so disposed within the central member 1 that a plane midway between and parallel to the side walls of each slot extends radially of the longitudinal axis of the central member. Each of the slots 3 has a depth which is approximately twice that of each of the slots 4. As will be seen on referring to the drawing, each slot 3 is disposed between two slots 4. Each slot 3 has nine optical fibre ribbons 5 stacked one on top of another in the slot, each of the ribbons consisting of eight optical fibres. Each slot 4 has three optical fibre ribbons 5 stacked one on top of another in the slot. As a consequence, the preferred optical cable incorporates 384 optical fibres. The central member 1 is surrounded by an overall outer protective sheath 6 of composite form comprising an inner sheath 7 of polyethylene and an outer sheath 8 of flame-retardant material.

By way of comparison with the known optical cable hereinbefore described incorporating 400 optical fibres, the preferred optical cable illustrated in the accompanying drawing has a central member of a diameter which is approximately 93.6% of that of the central member of the known cable and a cross-sectional area which is approximately 87.6% of that of the central member of the known optical cable and the preferred optical cable has a cable weight per unit length which is approximately 92% of that of the known optical cable and a strength/weight ratio which is approximately 109% of that of the known cable.

It will be appreciated that, as a consequence of the reduction in cable diameter and cable weight per unit length as compared with those of a known optical cable having a multiplicity of optical fibres approximating in number to those of the improved optical cable, a substantial reduction in cost of the cable is achieved and, during manufacture of the improved optical cable, cooling of the central member emerging from the extruder can be more easily effected and more precisely controlled.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS.

1. An optical cable comprising a central flexible elongate member of plastics material having in its outer surface a plurality of circumferentially spaced slots which extend lengthwise of the member, each of which slots is of substantially uniform width throughout its depth and is so disposed within the central member that a plane substantially midway between and parallel to the side walls of the slot extends substantially radially of the longitudinal axis of the central member, a plurality of optical fibre ribbons stacked one on top of another in at least some of the slots and, surrounding the central member, an overall outer protective sheath, wherein the circumferentially spaced slots comprise two groups of slots, the slots of each group being of substantially the same depth as one another and the depth of each of the slots of one group being substantially greater than the depth of each of the slots of the other group and each slot of one of said groups being disposed between two slots of the other of said groups, and wherein each of said slots has a plurality of optical fibre ribbons stacked one on top of another in the slot, the number of optical fibre ribbons in each of the slots of greater depth being substantially greater than the number of optical fibre ribbons in each of the slots of smaller depth.

2. An optical cable as claimed in Claim 1, wherein the depth of the slots of greater depth is approximately twice that of the slots of smaller depth.

3. An optical cable as claimed in Claim 1 or 2, wherein each of the circumferentially spaced slots follows a helical path around the longitudinal axis of the central member.

4. An optical cable as claimed in any one of the preceding Claims, wherein the central member has encapsulated within the plastics material of the member a central flexible elongate reinforcing element of a metallic or non-metallic material of high tensile strength.

5. An optical cable as claimed in Claim 4, wherein the central flexible elongate reinforcing element is of an aromatic polyamide.

6. An optical cable as claimed in Claim 4 or 5, wherein the central flexible elongate reinforcing element comprises a plurality of elongate elements stranded or otherwise assembled together.

7. An optical cable as claimed in any one of the preceding Claims, wherein the overall outer protective sheath is of composite form comprising an inner sheath of plastics material and an oversheath of termite-resistant or flame-retardant material.

10. The steps, features, compositions and compounds disclosed herein or referred to or indicated in the specification and/or claims of this application, individually or collectively, and any and all combinations of any two or more of said steps or features.

DATED this SEVENTEENTH day of APRIL 1990

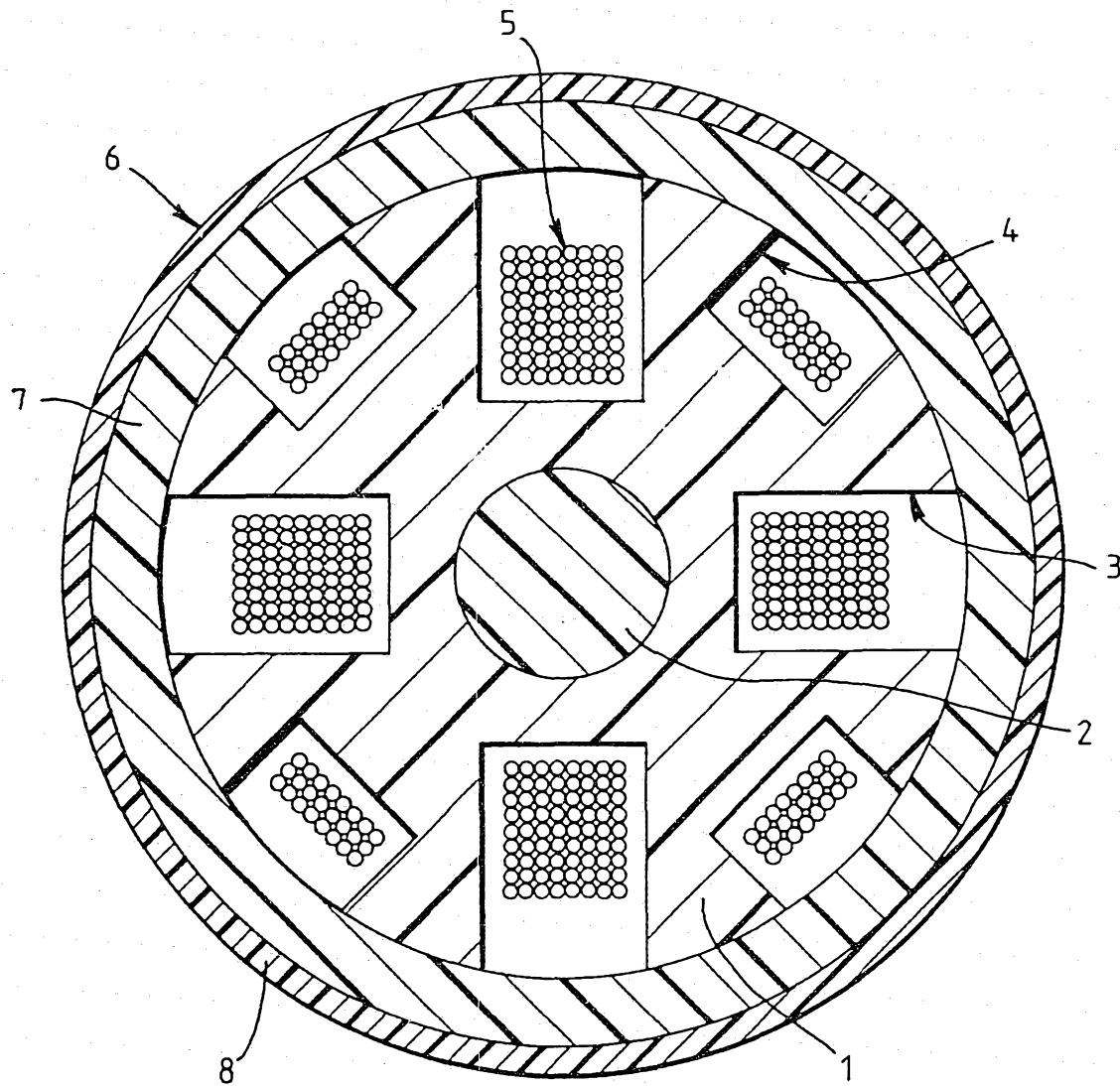
BICC Public Limited Company

by DAVIES & COLLISON

Patent Attorneys for the applicant(s)



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