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(21) International Application Number: PCT/US89/04901 (22) International Filing Date: 6 November 1989 (06.11.89) (30) Priority data: 284,978 15 December 1988 (15.12.88) US (71) Applicant: HUGHES AIRCRAFT COMPANY [US/US]; 7200 Hughes Terrace, Los Angeles, CA 90045-0066 (US). (72) Inventor: SCHOTTER, Daniel, K. ; 6040 North Camino Padre Isidoro, Tucson, AZ 85718 (US). (74) Agents: HAYS, Robert, A. et al.; Hughes Aircraft Com- pany, P.O. Box 45066, Bldg. C1, MS A126, Los Angeles, CA 90045-0066 (US).		(81) Designated States: AU, CH (European patent), DE (Euro- pean patent), FR (European patent), GB (European pa- tent), IT (European patent), JP, KR, NL (European pa- tent), NO, SE (European patent). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>
(54) Title: A FIBER GUIDE (57) Abstract A fiber guide (10) includes a sleeve (12) having a longitudinal slot (14) therealong, a first member (16) having a notch (26) is fixed in the sleeve with the notch substantially aligned with the slot (14). A second member (20), also having a notch (28), is rotatably disposed in the sleeve (12). Thus, a fiber can be positioned in the notches (26, 28) of the first and second members (16, 20) and secured therein by rotating the second member (20). The fiber can also be readily removed from the guide (10), without damage or impediment, by reversing the rotation of the second member (20).		

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A FIBER GUIDE

BACKGROUND OF THE INVENTION

The present invention generally relates to a fiber guide and, in particular, relates to such a fiber guide having an adjustable fiber aperture.

In many instances, when a fiber is wound upon a mandrel, for example, optical fibers are wound upon mandrels and used as a communication link between a control station and a projectile, some form of an adhesive is applied to the fiber to ensure that the windings upon the mandrel are retained in the proper disposition.

At the present time, the adhesive is usually applied by either one of two different techniques. One technique is to apply, generally by spraying, adhesive after each layer of fiber is wound. For example, when each layer of optical fiber is completed, the adhesive is sprayed upon that layer. Hence, in this technique, the optical fiber is wound without adhesive and the spraying of the previous layer contributes to the position retention of the subsequent layer. The spraying technique has numerous drawbacks. In particular, the mandrel, and hence the winding process, is stopped after each layer is

1 wound so that the adhesive can be sprayed on the exposed
layer. The mandrel is then incrementally rotated to apply
the adhesive completely upon the layer. Thus, the winding
time of a given mandrel is extended due to the need for
5 the stopping and incrementing. Another drawback of this
technique is that, regardless of various safeguards, the
adhesive is difficult to apply uniformly both along and
between each layer. Thus, when being unwound, the optical
fiber may not unwind smoothly and become damaged due to
10 the differing adhesive forces along the entire length
thereof.

Another technique for applying an adhesive to a
fiber being wound upon a mandrel is, effectively, both
pressureless and continuous. These types of techniques
15 substantially overcome the drawbacks of the spraying
techniques. However, other difficulties are encountered.
For example, the optical fiber, once winding has begun,
cannot be removed without breakage or considerable
difficulty. For example, if a flaw is found in the
20 optical fiber being wound it may have to be returned to
the manufacturer for repair. As another example, since
the adhesive is applied prior to the actual winding, if
the winding is interrupted the adhesive will dry and the
optical fiber can become glued in the winding mechanisms.
25 Currently, the more common apparatus utilizing this
adhesive application technique include fiber guides that
can be characterized as the tube/needle or the split die.

In the tube/needle fiber guide, the optical fiber
is threaded through the end of a needle that traps and
30 guides the optical fiber. Consequently, in order to
remove the optical fiber, the optical fiber must either be
broken or completely drawn through the needle opening. If
the optical fiber is broke the fiber must thereafter be
spliced and thus, the communication and/or strength
35 characteristics thereof can be significantly reduced. If

1 the optical fiber is drawn through the needle a
substantial amount of waste can occur. Further, the
needle of such an arrangement has a fixed opening and thus
different apparatus are required for different sizes of
5 optical fiber.

In the split die fiber guide the optical fiber is
secured between the members of the die and drawn
therethrough. However, the die assembly must be
disassembled every time the optical fiber is to be removed
10 or the winding process interrupted for an extended length
of time. Further, the split die has a fixed opening and
thus, different dies are required for different sizes of
optical fiber.

Thus, a fiber guide is needed that not only allows
15 removal of the fiber, without difficulty or detriment
thereto, at any time and enhances uniform adhesive
application but also includes an adjustable aperture to
better compensate for variations in fiber size.

20 SUMMARY OF THE INVENTION

Consequently, it is one object of the present
invention to provide a fiber guide that substantially
overcomes the above-recited deficiencies of current fiber
guides.

25 This object is accomplished, at least in part, by
providing a fiber guide having, inter alia, first and
second members, each having notches for receiving a fiber.
The first and second members being disposed, in one
preferred embodiment, in a sleeve having a longitudinal
30 slot therein. The members being disposed within the
sleeve such that, when the notches thereof are aligned
with the slot, a fiber can be removed from or placed into

1 the guide without disassembly of the guide or breaking the
fiber. Further, in the preferred embodiment, one of the
members is rotatable such that the aperture between the
members is adjustable.

5 Other objects and advantages of the present
invention will become apparent from the following detailed
description read in conjunction with the claims appended
hereto and the attached drawings.

10 BRIEF DESCRIPTION OF THE DRAWINGS

The drawings, not drawn to scale, includes:

FIGURE 1 a perspective view of a fiber guide
embodying the principles of the present invention;

15 FIGURE 2 is a cross-sectional view, taken along
the line A-A, of the fiber guide shown in FIGURE 1;

FIGURE 3 is a cross-sectional view, taken along
the line B-B, of the fiber guide shown in FIGURE 1;

20 FIGURES 4a and 4d are cross-sectional views, taken
along the line B-B, of the fiber guide shown in FIGURE 1
showing different aperture settings therefor; and

FIGURE 5 is a perspective view of an operating
environment for the fiber guide embodying the principles
of the present invention.

25 DETAILED DESCRIPTION OF THE INVENTION

A fiber guide, generally indicated at 10 in FIGURE
1 and embodying the principles of the present invention,
includes a sleeve 12 having a longitudinal opening 14
therealong, a first member 16 fixed within the sleeve 12
30 proximate a first end 18 of the sleeve 12. In addition,
the fiber guide 10 includes a second member 20 rotatably
disposed within the sleeve 12 and having one end 22

1 thereof proximate the second end 24 of the sleeve 12.
Further, the first and second members, 16 and 20,
respectively, include a first and a second notch, 26 and 28,
respectively, therein. The first notch 26 of the first
5 member 16 is substantially aligned with the longitudinal
opening 14 of the sleeve 12. The fiber guide 10 also
includes a means 30 for rotating the second member 20
within the sleeve 12.

In one preferred embodiment, the sleeve 12 is
10 fabricated from a rigid material, such as, for example,
stainless steel tubing and has a length greater than about
an inch. Further, the sleeve 12, in this preferred
embodiment has an outside diameter of about one-quarter
(0.25) of an inch and a wall thickness of about three one-
15 hundredths (0.03) of an inch. In one embodiment, the
longitudinal opening 14 is formed to a width about equal
to an arc that subtends about a forty degree angle.

In one preferred embodiment, the first member 16
includes first and second ends, 32 and 34, respectively,
20 and is fixed within the sleeve 12. Preferably, the first
end 32 of the first member 16 is disposed proximate the
first end 18 of the sleeve 12 with the first notch 26
aligned with the longitudinal opening 14. Preferably, the
first end 32 of the first member 16 is flared to about the
25 inside diameter of the sleeve 12. In such an embodiment,
the unflared diameter of the first member 16 is on the
order of about 0.012 of an inch. The first notch 26 of
the first member 16 is, preferably, on the order of about
20 degrees and includes a rounded bottom having a radius
30 of about the radius of an optical fiber, for example,
about 0.006 of an inch.

1 In the preferred embodiment, the second member 20
includes first and second ends, 36 and 38, respectively,
and is disposed within the sleeve 12 with the first end 36
thereof proximate the second end 24 of the sleeve 12. In
5 one such embodiment, the second end 38 of the second
member 20 abuts and is axially aligned with the second end
34 of the first member 16. Alternatively, the first and
second members, 16 and 20, can also be eccentrically
aligned to provide a preselected aperture. Further, the
10 notch 28 of the second member 20 is substantially
identical to the notch 26 formed in the first member 16.
Preferably, the first end 36 of the second member 30 is
also flared to approximate the inside diameter of the
sleeve 12 without restricting the rotation thereof.

15 In this embodiment, the means 30 for rotating the
second member 20 within the sleeve 12 includes a handle 40
having one end 42 thereof affixed to the second member 20
and extending through a lateral slot in the sleeve 12. In
order to provide the maximum possible variation of the
20 fiber aperture through the first and second members the
lateral slot extends, in this embodiment, about 180
degrees about the periphery of the sleeve 12. Preferably,
the lateral slot is spaced apart from the longitudinal
opening 14 in the sleeve 12. Such an arrangement
25 maintains the structural strength of the sleeve 12.

 As shown in FIGURE 3, the notches of the first and
second members are, in this embodiment, aligned and, since
both are provided with side radii and rounded at the
bottoms thereof, form an aperture through which an optical
30 fiber is guided. By rotating the second member 20, as
shown in FIGURES 4a-4d, the size of the aperture can be
varied to accommodate various sized optical fibers. Pre-
ferably, in operation, the aperture is adjusted so that

1 excess adhesive is removed from the optical fiber prior to
the fiber being wound upon the mandrel. The operation of
the fiber guide 10 is more fully discussed below with
respect to FIGURE 5.

5 A typical operating environment wherein the fiber
guide 10 is particularly useful is shown in FIGURE 5.
Therein the fiber guide 10 is disposed between the
reservoir for retaining the adhesive and the mandrel being
wound. The optical fiber is drawn through the adhesive at
10 a predetermined speed and is thereby coated with adhesive.
The optical fiber is then passed through the fiber guide
10 that, in addition to guiding the fiber to the mandrel,
removes excess adhesive prior to the optical fiber
reaching the mandrel being wound.

15 The fiber guide 10 thus provides a wiping action
that ensures that the adhesive is substantially uniformly
applied to the fiber as it reaches the mandrel. This
uniformity helps prevent damage to the optical fiber when
the fiber is drawn from the mandrel. Further, the optical
20 fiber can be removed, without damage, from the fiber guide
10 to enable correction of a flaw or as to allow extended
interruption of the winding procedure.

Although the present invention has been described
herein with respect to a particular embodiment, those
25 skilled in the art will recognize that other
configurations and variations can be implemented without
departing from the spirit and scope hereof. Hence, the
present invention is deemed limited only by the claims
appended hereto and the reasonable interpretation thereof.

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1 WHAT IS CLAIMED IS:

1. A fiber guide comprises:

5 a sleeve, said sleeve having a longitudinal opening therealong, said opening being sized to allow a fiber to pass therethrough;

10 a first member fixed within said sleeve proximate a first end thereof, said first member having a first notch extending thereinto, said first notch being substantially aligned with said longitudinal opening in said sleeve such that said fiber can be disposed into said first notch through said longitudinal opening;

15 a second member disposed within said sleeve, said second member being rotatable within said sleeve and having a second notch extending thereinto, said second notch being alignable with said longitudinal opening such that said fiber can be disposed into said second notch through said longitudinal opening; and

means for rotating second member.

20

2. The fiber guide as claimed in Claim 1 wherein said first member further comprises:

25 a first flared end, said first flared end of said first member being proximate said first end of said sleeve.

3. The fiber guide as claimed in Claim 2 wherein said first notch comprises:

30 first and second radial sides and a bottom, said bottom having a radius at least equal to the radius of said fiber.

35

1 4. The fiber guide as claimed in Claim 3 wherein
said first member having said first notch is disposed
within said sleeve such that said fiber, when disposed
therein, is substantially coaxial with said sleeve.

5

5. The fiber guide as claimed in Claim 2 wherein
said second member further comprises:

a second flared end, said second flared end of
said second member being proximate the second end of said
10 sleeve.

6. The fiber guide as claimed in Claim 5 wherein
said second notch of said second member comprises:

first and second radial sides and a bottom, said
15 bottom having a radius at least equal to the radius of
said fiber.

7. The fiber guide as claimed in Claim 6 wherein
said second member is disposed within said sleeve having
20 said bottom of said second notch thereof substantially
coaxial with said sleeve such that said fiber, when
disposed therein, is substantially coaxial with said
sleeve.

25 8. The fiber guide as claimed in Claim 7 wherein
said first and said second members abut within said sleeve
distal said first and second ends of said sleeve.

9. The fiber guide as claimed in Claim 8 wherein
30 said first notch and said second notch are substantially
identical.

35

1 10. The fiber guide as claimed in Claim 1 wherein
said means for rotating said second member comprises:

 a lateral slot extending through said sleeve about
a portion of the periphery thereof; and

5 a handle, said handle extending through said
lateral slot and being affixed to said second member.

 11. The fiber guide as claimed in Claim 10
wherein said lateral slot extends at least 180° about said
10 periphery of said sleeve.

 12. The fiber guide as claimed in Claim 11
wherein said lateral slot is disposed about a portion of
said periphery of said sleeve exclusive of said
15 longitudinal slot.

 13. A fiber winding apparatus comprises:
means for applying an adhesive to a fiber;
a mandrel, said mandrel being adapted to rotate;
20 and

 means, disposed between said adhesive applying
means and said mandrel, for guiding said fiber
therebetween, said fiber guiding means including:

 a sleeve, said sleeve having a longitudinal
25 opening therealong, said opening being sized to allow a
fiber to pass therethrough;

 a first member fixed within said sleeve proximate
a first end thereof, said first member having a first
notch extending thereinto, said first notch being
30 substantially aligned with said longitudinal opening in
said sleeve such that said fiber can be disposed into said
first notch through said longitudinal opening;

1 a second member disposed within said sleeve, said
second member being rotatable within said sleeve and
having a second notch extending thereinto, said second
notch being alignable with said longitudinal opening such
5 that said fiber can be disposed into said second notch
through said longitudinal opening; and
 means for rotating second member.

14. The apparatus as claimed in Claim 13 wherein
10 said adhesive applying means includes a reservoir
containing said adhesive.

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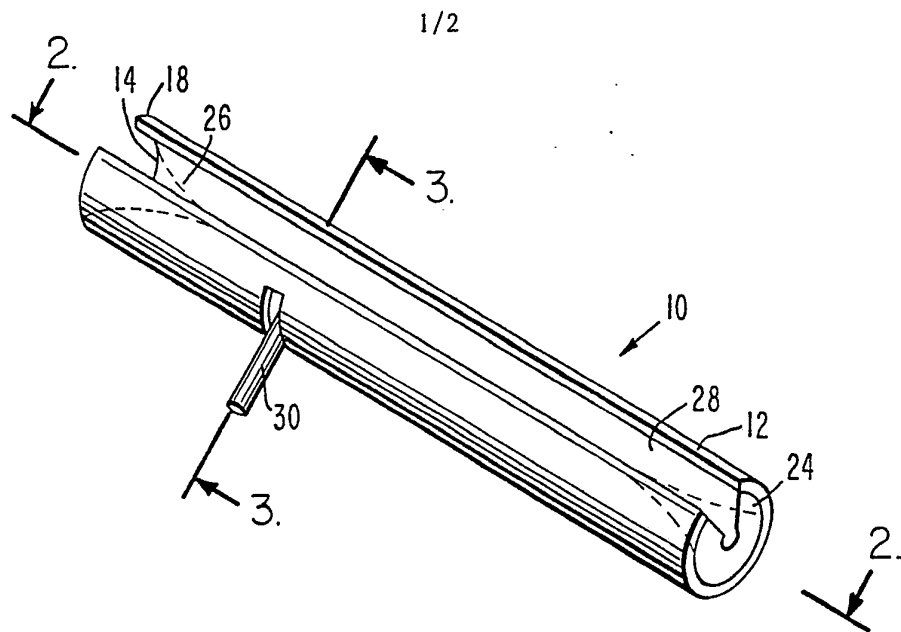


Fig. 1.

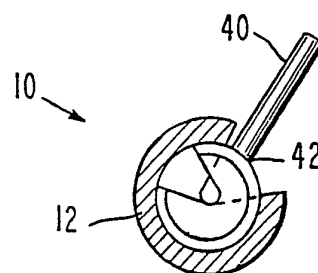
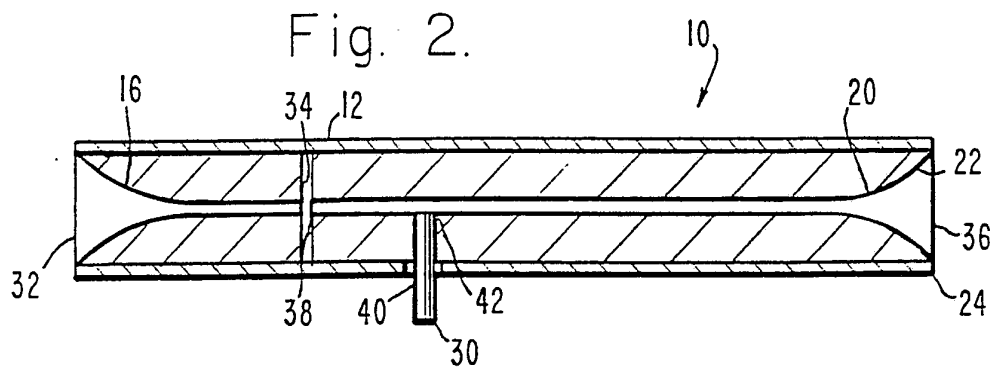
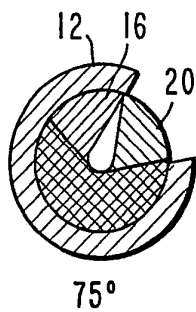


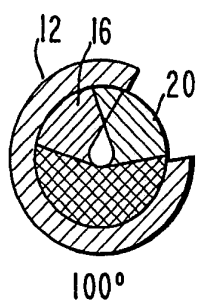
Fig. 3.

2/2



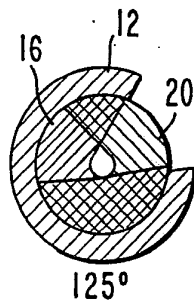
75°

Fig. 4a.



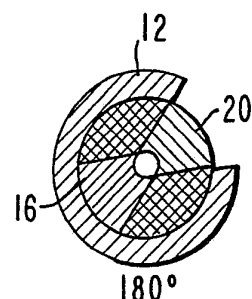
100°

Fig. 4b.



125°

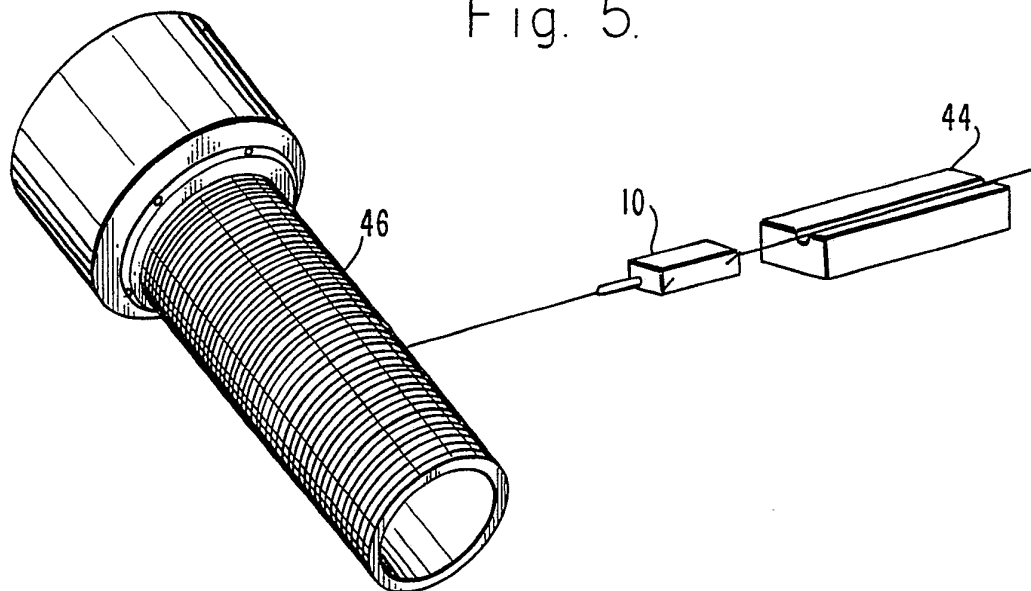
Fig. 4c.



180°

Fig. 4d.

Fig. 5.



SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 89/04901

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 65 H 57/12		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC5	B 65 H	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	FR, A1, 2265654 (SNIA VISCOSA SOCIETA NAZIONALE INDUSTRIA APPLICAZIONI VISCOSA S.P.A) 24 October 1975, see page 4 - page 6; figures 1-11 -- -----	1
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
10th April 1990		27. 04. 90
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