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(56) Fremdragne publikationer:
**DE-A1- 10 247 261**
**DE-U1- 7 732 584**
**FR-A1- 2 988 923**
**US-A- 3 809 798**

# DESCRIPTION

## FIELD OF THE INVENTION

**[0001]** The present invention relates to passthroughs (feedthroughs) and more particularly, although not necessarily exclusively, to assemblies allowing wire, cable, or other structures to enter or exit vehicles in manners mitigating vulnerability of the vehicles to ballistics or other projectiles while being environmentally sealed.

## BACKGROUND OF THE INVENTION

**[0002]** U.S. Patent No. 2,434,638 to Bryers illustrates a feedthrough for an antenna. To utilize the feedthrough, "an opening is cut through the skin of [an airplane] of the same size as the greater interior diameter of [a] cone." *See* Bryers, col. 3, 11. 8-10. A threaded rod extends centrally through the opening perpendicular to the plane thereof. Nuts and washers may be placed about the rod, with an antenna tightened between them so as to connect the antenna and the rod electrically. *See id.,* 11. 15-37; Figs. 1-3.

**[0003]** By contrast, U.S. Patent No. 4,184,160 to Affronti discloses a surface mounting assembly intended to position an antenna on a roof of a vehicle without creating a hole in the roof. The assembly clamps to edges of the roof. Bolted to the assembly is a housing having an opening through which an antenna extends upwardly, again perpendicular to the plane of the opening. The housing also contains another feedthrough permitting a cable associated with the antenna to pass. After exiting the housing, the cable is hooked to the assembly and continues into the vehicle in an unspecified manner. *See* Affronti, col. 2, 11. 27-31; col. 3, 1. 33 to col. 4, 1. 16.

**[0004]** Neither the feedthrough of the Bryers patent nor the assembly of the Affronti patent appears intended for use in hostile environments. Consequently, neither structure is concerned with mitigating vulnerability of the associated vehicle to projectiles striking in the area of either the opening in the aircraft skin, as in the Bryers patent, or whatever (unspecified) opening allows the cable to enter the vehicle of the Affronti patent. Moreover, neither patent discusses possible adverse effects of turning a cable through a ninety-degree angle: Indeed, Fig. 1 of the Affronti patent illustrates the cable turning through ninety degrees while retained on the surface mounting assembly, and the Bryers patent contemplates use of a separate rod to avoid any ninety-degree turn of the antenna.

**[0005]** From the French patent application FR 2 988 923 A1 a further feedthrough is known, which provides a water and dust impermeable passage of a cable through an outer vehicle wall.

## SUMMARY OF THE INVENTION

**[0006]** The present invention provides innovative feedthroughs. The feedthroughs are especially (although not exclusively) beneficial for passing antenna (or other) cables through hulls of vehicles configured for use in hostile environments. At least some versions of the feedthroughs may be employed as part of passive armor systems for lightweight vehicles used by, for example, special operations forces of the United States military.

**[0007]** In particular, the inventive feedthroughs provide non-linear cable paths in areas near openings of vehicle hulls. Rather than causing a cable or rod to exit an opening perpendicular to the plane thereof, the present feedthroughs cause cables to exit generally parallel to these planes--*i.e*. generally along exterior hull surfaces. No direct pathway thus exists for a bullet to enter an opening of the vehicle hull, reducing ballistic vulnerability of the vehicle caused by the existence of the feedthrough. Moreover, the curved path followed by the cable through the inventive feedthrough prevents the cable from making any sharp ninety-degree turn, avoiding adverse conductivity or other consequences sometimes associated with such sharp turns.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]**

FIG. 1A is an exploded perspective view of an exemplary feedthrough of the present invention.

FIG. 1B is a perspective view of the feedthrough of FIG. 1A.

FIG. 1C is a plan view of a plate of the feedthrough of FIG. 1A.

FIG. 2 are perspective, plan, and side views of a cover plate of the feedthrough of FIG. 1A.

FIG. 3 are perspective, plan, and side views of a guide of the feedthrough of FIG. 1A.

## DETAILED DESCRIPTION

**[0009]** FIGS. 1A-C, 2, and 3 illustrate an exemplary type of feedthrough 10. As shown especially in the exploded view of FIG. 1A, feedthrough 10 may comprise at least plate 1, guide 3, and cover plate 4. Plate 1 is depicted as having a planar, triangular section 14 including an opening 18. In use, section 14 preferably is configured to attach to an external surface of a vehicle hull, with environmentally-sealed opening 18 aligned with a corresponding opening through the hull to permit passage of antenna cable or another (elongated, flexible) structure. Section 14 need not necessarily be either planar or triangular, however; in certain

situations, moreover, plate 1 need not necessarily even be present. Indeed, plate 1 could itself represent a portion of an external surface of the vehicle hull, in which case feedthrough 10 would include guide 3 and cover plate 4.

**[0010]** FIGS. 1A-B and 3 show a sample of guide 3. According to the invention and as detailed in FIG. 3, guide 3 has a cross-section in the form of a spiral curve. In some versions, first portion 22 of guide 3 has diameter approximately equal to the diameter of opening 18. Guide 3 may be fastened to external surface 26 of plate 1 so that first portion 22 aligns with, and thereby surrounds, much of opening 18.

**[0011]** Cover plate 4 may be attached atop anti-ballistic guide 3. Cover plate 4 also may be anti-ballistic, preferably is generally planar and solid, and may be positioned generally parallel to plate 1. However, because guide 3 is not of circular cross-section, space 30 exists covered by plate 4. Cable passing into space 30 thus may be guided by guide 3 in a somewhat-circular path and thence pass through opening 18 into the vehicle. This passage occurs without the cable making any sharp, ninety-degree turn.

**[0012]** By contrast, a bullet or other projectile cannot directly enter opening 18 because of the presence of cover plate 4. Furthermore, any bullet or projectile entering space 30, because of its linear velocity, is unlikely to be able to turn so as to pass through opening 18. Consequently, feedthrough 10 has anti-ballistic effect, reducing the likelihood of a bullet entering a vehicle through an opening intended for passage of an antenna or other cable.

**[0013]** Also shown in FIG. 1A are optional lower and upper foam strips 5C and 5B, respectively. If present, they may be shaped similar to the cross-sectional shape of guide 3. Strips 5A and 5B may be placed immediately beneath and atop guide 3 to facilitate assembly of feedthrough 10, for shock-absorbing purposes, for environmental sealing, or otherwise. Foam tape 2 also optionally may be used to facilitate attachment of feedthrough 10 to a vehicle.

# REFERENCES CITED IN THE DESCRIPTION

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**Patent documents cited in the description**


- US2434638A **[0002]**

- US4184160A **[0003]**
- FR2988923A1 **[0005]**

## Patentkrav

1. Gennemføring (10), som er således udformet, at den kan lette et kabels passage gennem en åbning i et skibsskrog, og som omfatter:

a. en føringsdel (3), som er således udformet, at den kan omgive i det mindste en del af åbningen og (ii) føre kablet ad en ikke-lineær bane til og fra åbningen; og

b. en dækplade (4), som er således udformet, at den kan tilsluttes til føringsdelen (3);

**kendetegnet ved,**

at føringsdelen (3) har et spiralagtigt krumt tværsnit.

2. Gennemføring (10) ifølge krav 1, som yderligere omfatter en plade (1) til tilslutning til (i) skibsskroget og (ii) føringsdelen (3).

3. Gennemføring (10) ifølge krav 2, hvor pladen (1) har et massivt tværsnit med en åbning (18), som kan bringes på linje med åbningen i skibsskroget.

4. Gennemføring ifølge krav 3, hvor føringsdelen omfatter en første del (22), som ligger på linje med åbningen (18) i pladen (1).

5. Gennemføring (10) ifølge krav 4, hvor åbningen (18) i pladen (1) har en diameter, og den første del (22) af føringsdelen (1) har en diameter, som er tilnærmelsesvis lig med diameteren af åbningen (18) i pladen (1).

6. Gennemføring (10) ifølge ethvert af kravene 3 til 5, hvor pladen (1) har et plant og trekantet tværsnit.

7. Gennemføring (10) ifølge ethvert af de foregående krav, hvor føringsdelen (3) og dækpladen (4) danner et rum (30), hvorigennem kablet kan passere.

8. Gennemføring (10) ifølge krav 7, hvor rummet (30) er således udformet, at det kan lede kablet i en nogenlunde cirkulær bane til og fra åbningen i skibsskroget.

9. Fartøj, som omfatter:

a. et skibsskrog, som har en åbning; og
b. en antiballistisk gennemføring til et kabel, og som omfatter en gennemføring ifølge ethvert af kravene 1 til 8; hvor en føringsdel (3) omgiver i det mindste en del af åbningen i skibsskroget.

10. Fartøj ifølge krav 9, som omfatter en gennemføring ifølge krav 2, hvor dækpladen (4) er tilsluttet oven på føringsdelen (3), og hvor pladen (1) er tilsluttet til skibsskroget, og åbningen (18) i pladen (1) ligger på linje med åbningen i skibsskroget.

11. Fartøj ifølge krav 9 eller 10, hvor føringsdelen (3) omfatter en første del (22), som ligger på linje med åbningen i skibsskroget.

12. Fartøj ifølge ethvert af kravene 9 til 11, og som yderligere omfatter et kabel, hvilket kabel er ført ved hjælp af føringsdelen (3) til eller fra åbningen i skibsskroget efter en ikke-lineær bane langs en ydre flade på skibsskroget, så at kablet kan forlade gennemføringen i hovedsagen parallelt med den ydre overflade af skibsskroget.

# DRAWINGS

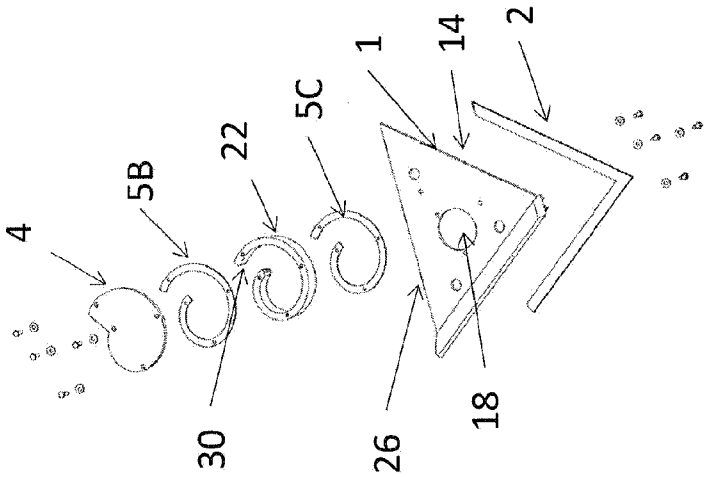



FIG. 1A

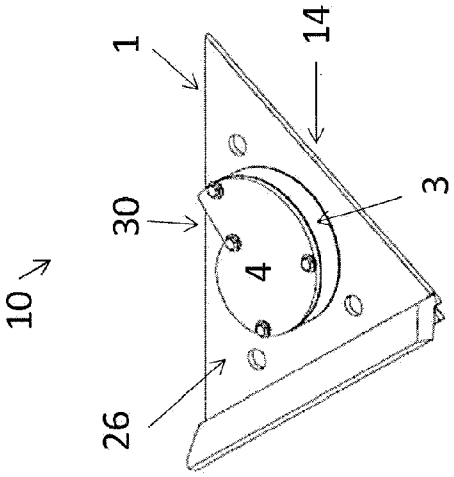



FIG. 1B

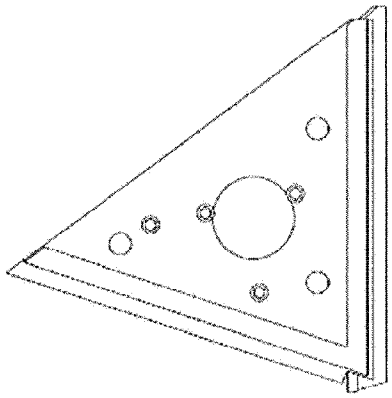


FIG. 1C

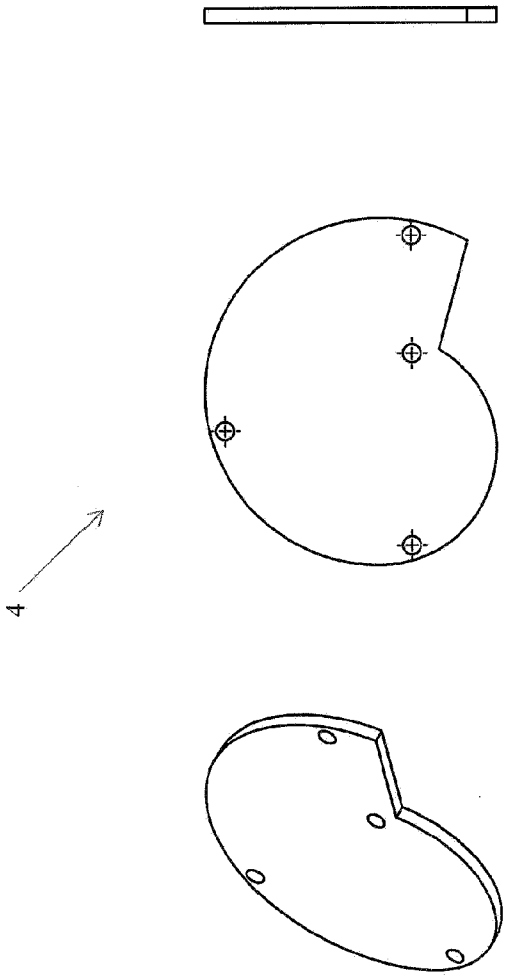



FIG. 2

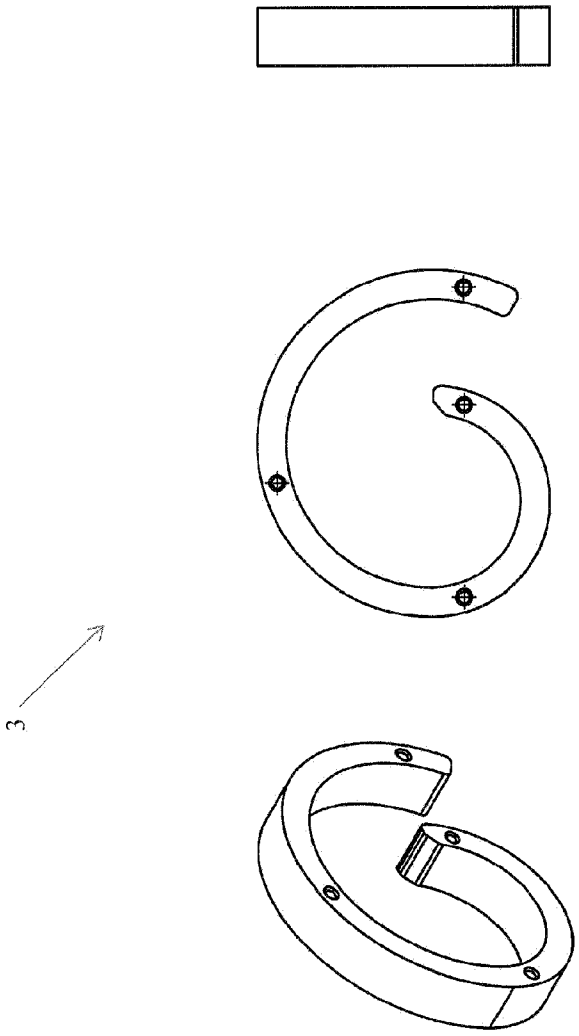



FIG. 3