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(54) **OBSTACLE DEFLECTOR FOR A RAIL VEHICLE**

HINDERNISABLENKER FÜR EIN SCHIENENFAHRZEUG

DÉFLECTEUR D'OBSTACLES POUR VÉHICULE FERROVIAIRE

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## Description

**[0001]** The present invention relates to a vehicle with an obstacle deflector

**[0002]** An obstacle deflector for a rail vehicle, also known as snowplough or pilot, is a device which is usually placed at the front end of a carbodyshell of a rail vehicle, such as a train, and is arranged to deflect possible obstacles present on the railway track that might otherwise derail the train when the latter is travelling along the track. Obstacles should be deflected as early as possible because otherwise they might damage the train, thus resulting in unnecessary maintenance costs.

**[0003]** Figure 1 shows a schematic lateral view of a train 1 having an obstacle deflector 2 which is fixed to the front end of its carbodyshell 4 and is capable of performing the primary task of removing obstacles from the railway track, thus protecting the train 1 from derailment. However, this obstacle deflector 2 is not capable of protecting the carbodyshell 4 from damages, because it happens quite frequently that obstacles firstly hit the cover panel of the carbodyshell 4 and only later they are pushed away by the obstacle deflector 2.

**[0004]** In fact, an obstacle deflector designed according to the EN 15227 standard has usually to be installed in longitudinal direction behind or in a back position below the energy absorber elements, also known as energy dissipation devices, which are fixed, in known manner, to the front end of the carbodyshell 4 and are arranged to absorb the impact energy in case of impacts with obstacles which may be present on the path of the train 1.

**[0005]** In order to guarantee the proper functioning of these energy absorber elements, the obstacle deflector 2 is usually placed behind them because otherwise, due to the fact that it is a fixed element, in case of crash events it would restrain the energy absorber elements, not allowing their proper functioning.

**[0006]** As a result, the front end of the carbodyshell of the train 1, with its grp (glass reinforced plastic) structure and equipment, remains unprotected.

**[0007]** Document DE 10 2015 205283 discloses a portion of a load-bearing structure of a rail vehicle, e.g. of a car body, wherein at the frontal end of a front assembly there is a front cover which extends along a curved contour, in a lower end region of the front cover 14, and the lower end portion 11 forms a deflector.

**[0008]** It is therefore an object of the present invention to provide a vehicle with an obstacle deflector which is capable of both removing obstacles from the railway track and protecting the carbodyshell of the train from impacts with these obstacles, thus overcoming the limitations of the prior art solutions.

**[0009]** This and other objects are fully achieved by virtue of a vehicle with an obstacle deflector having the characteristics defined in independent claim 1.

**[0010]** Preferred embodiments of the invention are specified in the dependent claims, whose subject-matter is to be understood as forming an integral part of the

present description.

**[0011]** Further characteristics and advantages of the present invention will become apparent from the following description, provided merely by way of a non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 shows a schematic lateral view of a train having an obstacle deflector according to the prior art;
- Figure 2 shows a schematic lateral view of a train having an obstacle deflector according to the present invention;
- Figure 3 shows a lateral view of the train of figure 2 with its obstacle deflector;
- Figure 4 shows a perspective view of an obstacle deflector according to the present invention;
- Figure 5 shows a perspective view of the obstacle deflector of figure 4 in an extended position, when seen in a direction different from the one of figure 4;
- Figure 6 shows a perspective view of the obstacle deflector of figure 5 in a retracted position, when seen in the same direction as in figure 4;
- Figure 7 shows a perspective view of an alternative embodiment of the obstacle deflector according to the present invention;
- Figure 8 shows a perspective view of the obstacle deflector of figure 7 in an extended position, when seen in a direction different from the one of figure 7; and
- Figure 9 shows a perspective view of the obstacle deflector of figure 8 in a retracted position, when seen in the same direction as in figure 7.

**[0012]** Briefly, the vehicle with the obstacle deflector of the present invention is capable of both removing obstacles present on a railway track and protecting the carbodyshell of a train without requiring modifications to the energy absorber elements usually present on the front end of a carbodyshell of a train.

**[0013]** The obstacle deflector of the present invention, thanks to the fact that of being movable, can be placed in front of the energy absorbers because during a crash scenario it is arranged to slide back without affecting the operation of the energy absorbers.

**[0014]** The obstacle deflector according to the present invention has the same functionalities as any other fixed mounted deflector of the prior art according to the EN 15227 standard.

**[0015]** Figure 2 shows a schematic lateral view of a train 10 having an obstacle deflector 12 fixed to the front end of its carbodyshell 14 in a forward position with respect to the prior art, so that obstacles first collide with the obstacle deflector 12 and then are moved away from the railway track.

**[0016]** The obstacle deflector 12 is mounted in an extended position so as to project forward beyond energy absorber elements of the train 10: when an obstacle ap-

proaches the train 10, it firstly impacts the obstacle deflector 12.

**[0017]** If the level of the impact force between the obstacle and the obstacle deflector 12 itself is below a predetermined threshold, the obstacle deflector 12 pushes the obstacle away from the railway track, otherwise, it moves to a retracted position wherein it does no more project beyond the energy absorber elements.

**[0018]** Figure 3 shows a lateral view of the train 10 with its obstacle deflector 12 placed under energy absorber elements 22, and another opposed train 10' with its obstacle deflector 12' placed under its energy absorber elements 22'.

**[0019]** In case of crash between the two trains 10 and 10', the respective obstacle deflectors 12 and 12' move from the extended position shown in figure 3, wherein they project beyond the corresponding energy absorber elements 22 an 22', to the retracted position, wherein they do not project beyond the corresponding energy absorber elements 22 an 22', as disclosed herein below in detail.

**[0020]** In order to withstand accidents with obstacles having an impact force level below a threshold, for example equal to 300kN, as indicated in the scenarios disclosed in the EN 15227 standard, the obstacle deflector 12 is positioned, as above indicated, so as to project beyond the energy absorber elements 22, while having at the same time the stability and stiffness required by EN 15227 standard. The obstacle deflector 12 is however able to move backwards to the retracted position if the impact force level exceeds said threshold.

**[0021]** With reference to figure 4 the obstacle deflector 12 of the present invention includes a support member 18 having a buckling-free system, for example a sledge 16 (e.g. a Coradia LINT, a light regional train of Alstom TD), and a shield element 20 fixed to a front end 16a of the sledge 16. The sledge 16 is carried by the support member 18 so as to be slideably movable with respect to the support member 18 between a first position represented on figures 4 and 5, the above-cited extended position, and a second position represented on figure 6, the above-cited retracted position. The sledge 16 and the shield 20 together form a sub-assembly 17, movable with respect to support member 18.

**[0022]** The support member 18 is arranged to be fixed at a proximal end 18a to a front end of the carbodyshell 14 of the train 10.

**[0023]** The sledge 16 is arranged to slide between the extended position, wherein the shield element 20 is spaced from a distal end 18b of the support member 18 and is arranged to push away obstacles placed in front of the train 10, and the retracted position, wherein the shield element 20 is in contact with such distal end 18b of the support member 18.

**[0024]** In case of a crash force exceeding the threshold, the sub-assembly 17, and thus the sledge 16, can slide into the lower area of the grp part of the carbodyshell 14, thus moving from the extended position to the retract-

ed position.

**[0025]** In order to allow this sliding movement of the sub-assembly 17, the sledge 16 and the support member 18 are connected by tearing elements 21, such as breakable screws, one of which is represented in an exploded position on figure 5. This allows sledge 16 to slide with respect to support member 18, from the extended position of figures 4 and 5, to the retracted position of figure 6, when the tearing elements 21 are broken due to an impact force of an obstacle on the shield element 20 exceeding the threshold of the impact force.

**[0026]** Two energy absorber elements 22, placed side by side above the obstacle deflector 12, are arranged to be fixed at a proximal end 22a to the carbodyshell 14 of the train 10 without being in contact with the obstacle deflector 12, and the shield element 20 is mounted so that, in the extended position, it project forwards beyond distal ends 22b of the energy absorber elements 22. In the retracted position, the shield element 20 does not project anymore beyond the distal end 22b of the energy absorber elements 22, so that it does not interfere with an obstacle if this obstacle interacts with the energy absorber elements 22.

**[0027]** Energy absorber elements 22 are distributed on either sides of a central longitudinal axis X14 of carbodyshell 14. For the sake of simplicity energy absorber elements 22 are not represented on figures 5 and 6.

**[0028]** Figure 5 is a further perspective view of the obstacle deflector 12 of figure 4 with its sub-assembly 17 in the extended position; while figure 6 is a perspective view of the obstacle deflector 12 of figure 4 with its sub-assembly 17 in the retracted position.

**[0029]** Figure 7 is a perspective view of an alternative embodiment of the obstacle deflector 12 of the present invention which includes two lateral rods 24 and a supporting member or box 26 arranged to host said rods 24. Two energy absorber elements 22 are distributed on either sides of a central longitudinal axis X14 or carbodyshell 14. For the sake of simplicity energy absorber elements 22 are not represented on figures 8 and 9.

**[0030]** The shield element 20 and the rods 24 together form a sub-assembly 17, movable with respect to support member 18. Preferably, tearing elements 21 are screws or bolts.

**[0031]** The shield element 20 is fixed to a front end 24a of the rods 24.

**[0032]** The rods 24 are arranged to slide between the extended position, wherein the shield element 20 is spaced from a distal end 26b of the supporting member 26 and is arranged to push away obstacles placed in front of the train 10, and the retracted position, wherein the shield element 20 is in contact with such distal end 26b of the supporting member 26.

**[0033]** Figure 8 is a further perspective view of the obstacle deflector 12 of figure 7 with its sub-assembly 17 in the extended position, while figure 9 is a perspective view of the obstacle deflector 12 of figure 7 with its sub-assembly 17 in the retracted position.

**[0034]** Advantageously, in one embodiment and/or the other, the obstacle deflector 12 comprises also an anti-climber known per se, in order to avoid to slide vertically when compressed to the retracted position and to remain in a horizontal position.

**[0035]** In all embodiments, when the impact force level exceeds the above cited threshold, the tearing elements 21 break and the sub-assembly 17 moves from the extended position to the retracted position.

**[0036]** The tearing elements 21 such as the above cited bolts or screws are common elements which shall break in a controlled manner. In particular, the tearing elements 21 have to break at the predefined impact force level threshold.

**[0037]** Preferably, the threshold of the impact force is higher than the level of forces occurring during one impact against a big obstacle, and therefore higher than the requirements provided by the fourth scenario of the EN15227 standard.

**[0038]** The obstacle deflector 12 can remain in its retracted position without losing its functionality while, in an alternative embodiment, it is locked in the retracted position so as not to slide, but after a crash this should not be a real problem anymore.

**[0039]** Clearly, the principle of the invention remaining the same, the embodiments and the details of production can be varied considerably from what has been described and illustrated purely by way of non-limiting example, without departing from the scope of protection of the present invention as defined by the attached claims.

## Claims

1. Vehicle (10) with an obstacle deflector (12), the vehicle having a carbodyshell (14) with a front end, the obstacle deflector (12) comprising:
  - a support member (18, 26) arranged to be fixed at a proximate end (18a) to the a front end of the carbodyshell (14);
  - a moving element (16, 24) supported by said support member (18, 26) so as to be slideably movable with respect to the support member (18, 26);
  - a shield element (20) fixed to a front end (16a, 24a) the moving element (16, 24); wherein the moving element (16, 24) is arranged to move between:
    - an extended position, wherein the shield element (20) is spaced from a distal end (18b, 26b) of the support member (18, 26) and is arranged to push away an obstacle placed in front of the rail vehicle (10); and
    - a retracted position, wherein the shield element (20) is in contact with the distal end (18b, 26b) of the support member (18) and is arranged not to push away said obstacle,

wherein when the moving element (16, 24) is in the retracted position, the shield element (20) is moved backwards with respect to the position it has when the moving element (16, 24) is in the extended position;

wherein in the extended position, the shield element (20) is arranged to project forward beyond a distal end (22b) of energy absorber elements (22) fixed to the front end of the carbodyshell (14); and in the retracted position, the shield element (20) is arranged not to project beyond the distal end (22b) of the energy absorber elements (22).

2. The vehicle of claim 1, wherein the movement between the extended position and the retracted position is only a backward translational movement.
3. The vehicle of claim 1 or 2, wherein the moving element (16, 24) is arranged to move from the extended position to the retracted position when the force of an impact between an obstacle and the shield element (20) exceeds a predetermined threshold.
4. The vehicle of claim 1, wherein one of said energy absorber elements (22) is placed on the moving element (16, 24) between two portions (19) of the support member (18).
5. The vehicle of any of the preceding claims, wherein the moving element is a sledge (16).
6. The vehicle of any of the preceding claims, wherein the moving element is formed by two lateral rods (24).
7. The vehicle of claim 6, wherein the support member (26) is a supporting box (26) arranged to host said lateral rods (24).
8. The vehicle of any of the preceding claims, wherein the moving element (16, 24) and the shield element (20) together form a sub-assembly (17) movable with respect to the support member (18, 26).

## Patentansprüche

1. Fahrzeug (10) mit einem Hindernisablenker (12), wobei das Fahrzeug eine Wagenkörperhülle (14) mit einem vorderen Ende hat, wobei der Hindernisablenker (12) aufweist:
  - ein Haltelement (18, 26), welches angeordnet ist, um an einem proximalen Ende (18a) am vorderen Ende der Wagenkörperhülle (14) befestigt zu sein,
  - ein Bewegungselement (16, 24), welches mittels des besagten Haltelements (18, 26) gehalten

ten wird, um mit Bezug auf das Halteelement (18, 26) verschiebbar bewegbar zu sein,  
 - ein Schildelement (20), welches an einem vorderen Ende (16a, 24a) des Bewegungselements (16, 24) befestigt ist, wobei das Bewegungselement (16, 24) angeordnet ist, um sich zu bewegen zwischen:  
 - einer Ausgefahren-Position, wobei das Schildelement (20) im Abstand von einem distalen Ende (18b, 26b) des Halteelements (18, 26) angeordnet ist und angeordnet ist, um ein Hindernis, welches vor dem Schienenfahrzeug (10) angeordnet ist, wegzudrücken, und  
 - eine Eingefahren-Position, wobei das Schildelement (20) in Kontakt mit dem distalen Ende (18b, 26b) des Halteelements (18) ist und angeordnet ist, um das besagte Hindernis nicht wegzudrücken,

wobei, wenn das Bewegungselement (16, 24) in der Eingefahren-Position ist, das Schildelement (20) zurückbewegt ist mit Bezug auf die Position, welche es hat, wenn das Bewegungselement (16, 24) in der Ausgefahren-Position ist,  
 wobei in der Ausgefahren-Position das Schildelement (20) angeordnet ist, um nach vorne über ein distales Ende (22b) von Energieabsorberelementen (22) hinaus vorzustehen, welche am vorderen Ende der Wagenkörperhülle (14) befestigt sind, und in der Eingefahren-Position das Schildelement (20) angeordnet ist, um nicht über das distale Ende (22b) der Energieabsorberelemente (22) hinaus vorzustehen.

2. Das Fahrzeug gemäß Anspruch 1, wobei die Bewegung zwischen der Ausgefahren-Position und der Eingefahren-Position nur eine Rückwärtstranslationsbewegung ist.
3. Das Fahrzeug gemäß Anspruch 1 oder 2, wobei das Bewegungselement (16, 24) angeordnet ist, um sich von der Ausgefahren-Position in die Eingefahren-Position zu bewegen, wenn die Kraft eines Aufpralls zwischen einem Hindernis und dem Schildelement (20) einen vorbestimmten Schwellwert übersteigt.
4. Das Fahrzeug gemäß Anspruch 1, wobei eines der besagten Energieabsorberelemente (22) an dem Bewegungselement (16, 24) zwischen zwei Abschnitten (19) des Halteelements (18) angeordnet ist.
5. Das Fahrzeug gemäß irgendeinem der vorherigen Ansprüche, wobei das Bewegungselement ein Schlitten (16) ist.
6. Das Fahrzeug gemäß irgendeinem der vorherigen Ansprüche, wobei das Bewegungselement mittels zwei lateraler Stäbe (24) gebildet ist.

7. Das Fahrzeug gemäß Anspruch 6, wobei das Halteelement (26) eine Haltebox (26) ist, welche angeordnet ist, um die besagten lateralen Stäbe (24) unterzubringen.

8. Das Fahrzeug gemäß irgendeinem der vorherigen Ansprüche, wobei das Bewegungselement (16, 24) und das Schildelement (20) zusammen eine Sub-Anordnung (17) bilden, welche mit Bezug auf das Halteelement (18, 26) bewegbar ist.

## Revendications

1. Véhicule (10) avec un déflecteur d'obstacle (12), le véhicule ayant une carrosserie (14) avec une extrémité avant, le déflecteur d'obstacle (12) comprenant :

un élément de support (18, 26) agencé pour être fixé au niveau d'une extrémité proximale (18a) à l'extrémité avant de la carrosserie(14) ;  
 un élément mobile (16, 24) supporté par ledit élément de support (18, 26) afin d'être mobile, de manière coulissante, par rapport à l'élément de support (18, 26) ;  
 un élément de protection (20) fixé sur une extrémité avant (16a, 24a), de l'élément mobile (16, 24) ;  
 dans lequel l'élément mobile (16, 24) est agencé pour se déplacer entre :

une position étendue, dans laquelle l'élément de protection (20) est espacé d'une extrémité distale (18b, 26b) de l'élément de support (18, 26) et est agencé pour éloigner un obstacle placé en face du véhicule ferroviaire (10) ; et  
 une position rétractée dans laquelle l'élément de protection (20) est en contact avec l'extrémité distale (18b, 26b) de l'élément de support (18) et est agencé pour ne pas éloigner ledit obstacle,  
 dans lequel, lorsque l'élément mobile (16, 24) est dans la position rétractée, l'élément de protection (20) est déplacé vers l'arrière par rapport à la position qu'il a lorsque l'élément mobile (16, 24) est dans la position étendue ;  
 dans lequel, dans la position étendue, l'élément de protection (20) est agencé pour faire saillie vers l'avant au-delà d'une extrémité distale (22b) des éléments d'amortisseur (22) fixés sur l'extrémité avant de la carrosserie (14) ; et  
 dans la position rétractée, l'élément de protection (20) est agencé pour ne pas faire saillie au-delà de l'extrémité distale (22b)

des éléments d'amortisseur (22).

2. Véhicule selon la revendication 1, dans lequel le mouvement entre la position étendue et la position rétractée est uniquement un mouvement de translation vers l'arrière. 5
3. Véhicule selon la revendication 1 ou 2, dans lequel l'élément mobile (16, 24) est agencé pour se déplacer de la position étendue à la position rétractée lorsque la force d'un impact entre un obstacle et l'élément de protection (20) dépasse un seuil prédéterminé. 10
4. Véhicule selon la revendication 1, dans lequel l'un desdits éléments d'amortisseur (22) est placé sur l'élément mobile (16, 24) entre deux parties (19) de l'élément de support (18). 15
5. Véhicule selon l'une quelconque des revendications précédentes, dans lequel l'élément mobile est un traîneau (16). 20
6. Véhicule selon l'une quelconque des revendications précédentes, dans lequel l'élément mobile est formé par deux tiges latérales (24). 25
7. Véhicule selon la revendication 6, dans lequel l'élément de support (26) est une boîte de support (26) agencée pour accueillir lesdites tiges latérales (24). 30
8. Véhicule selon l'une quelconque des revendications précédentes, dans lequel l'élément mobile (16, 24) et l'élément de protection (20) forment ensemble un sous-ensemble (17) mobile par rapport à l'élément de support (18, 26). 35

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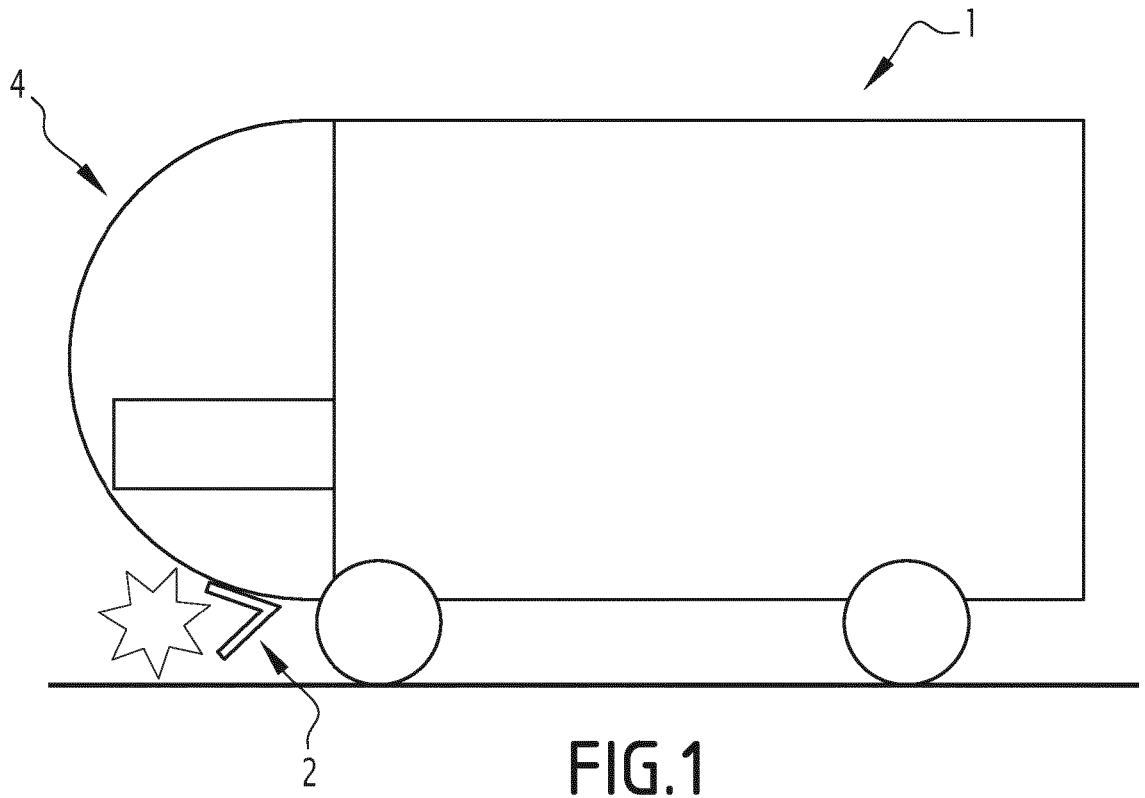


FIG. 1

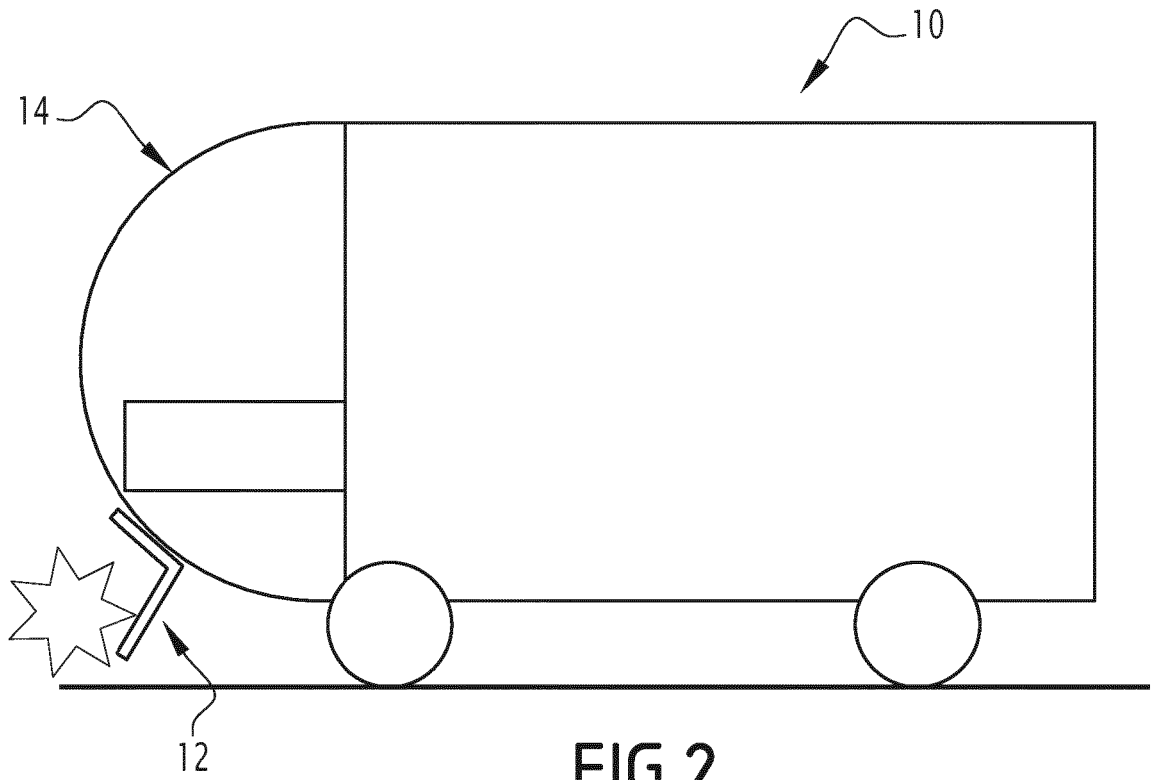
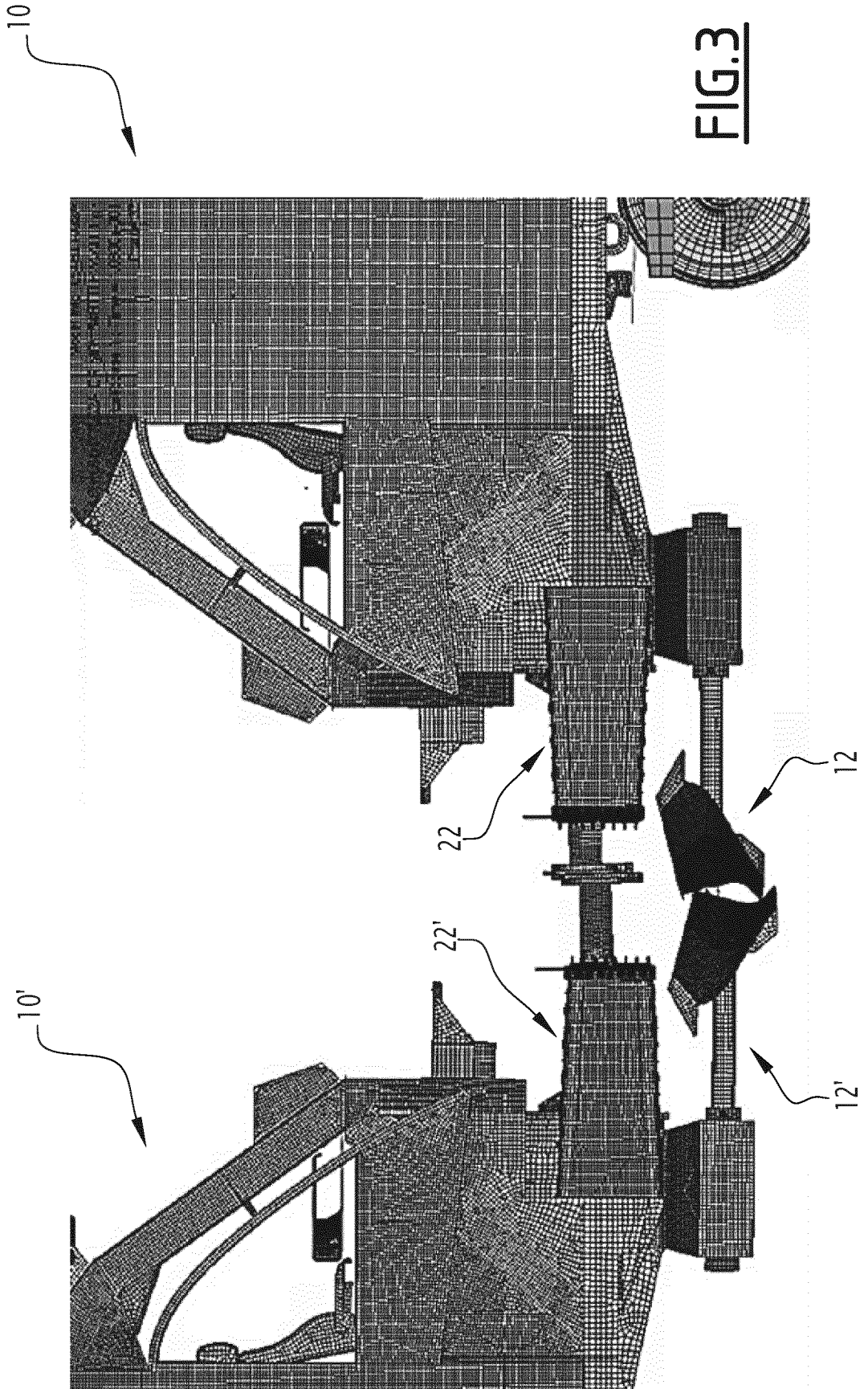
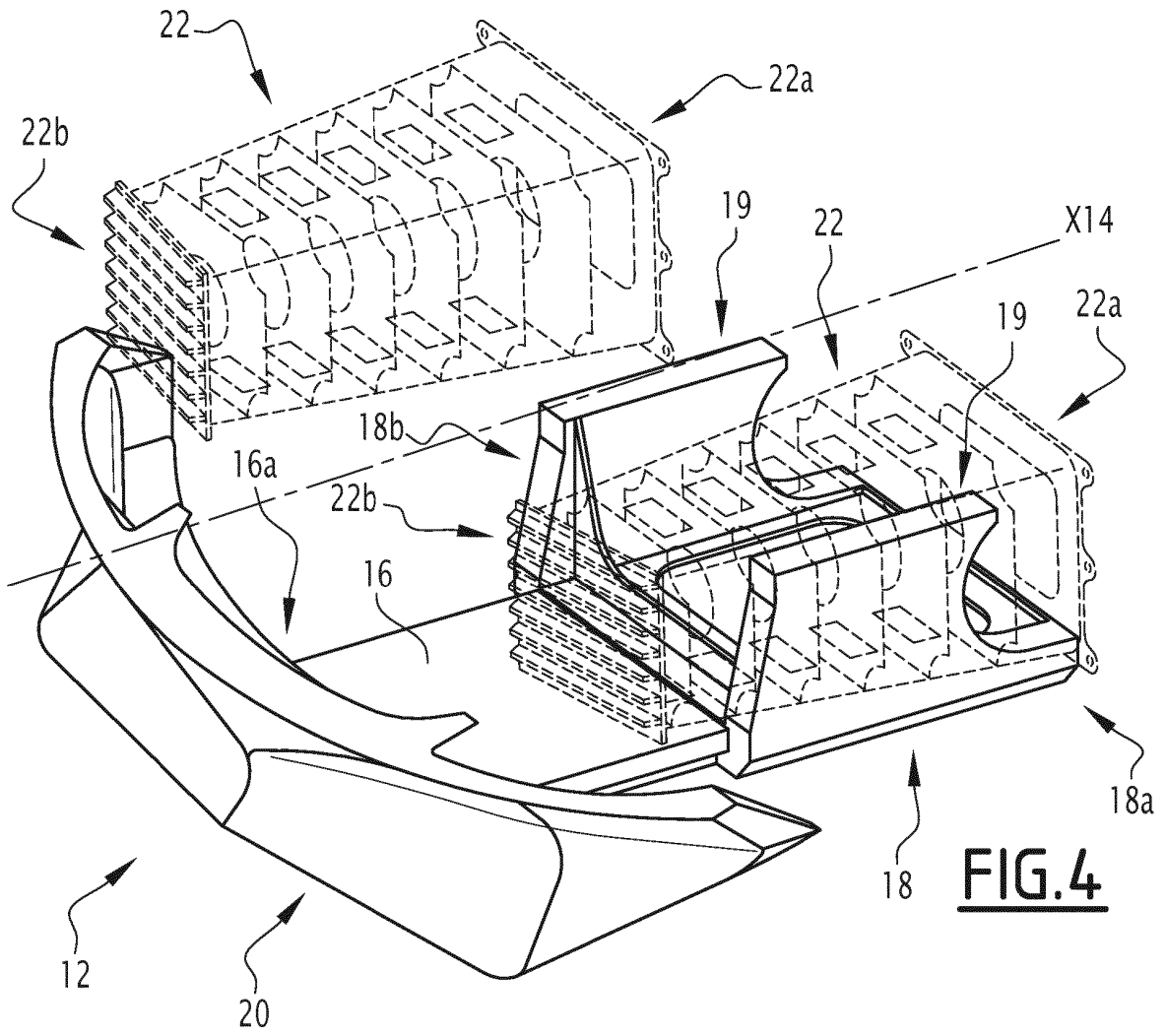
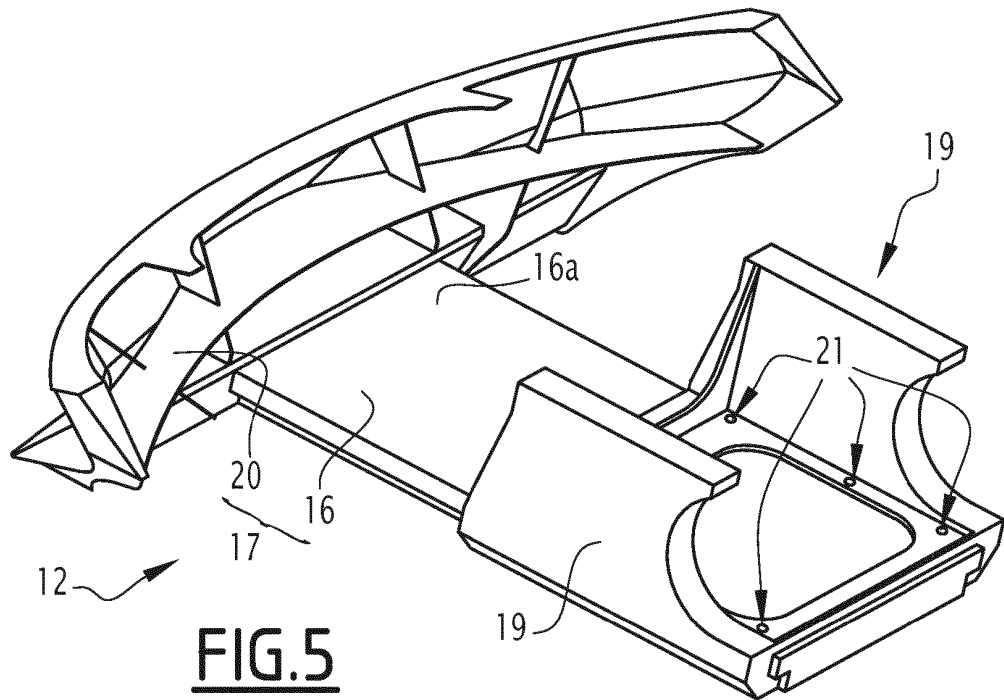


FIG. 2

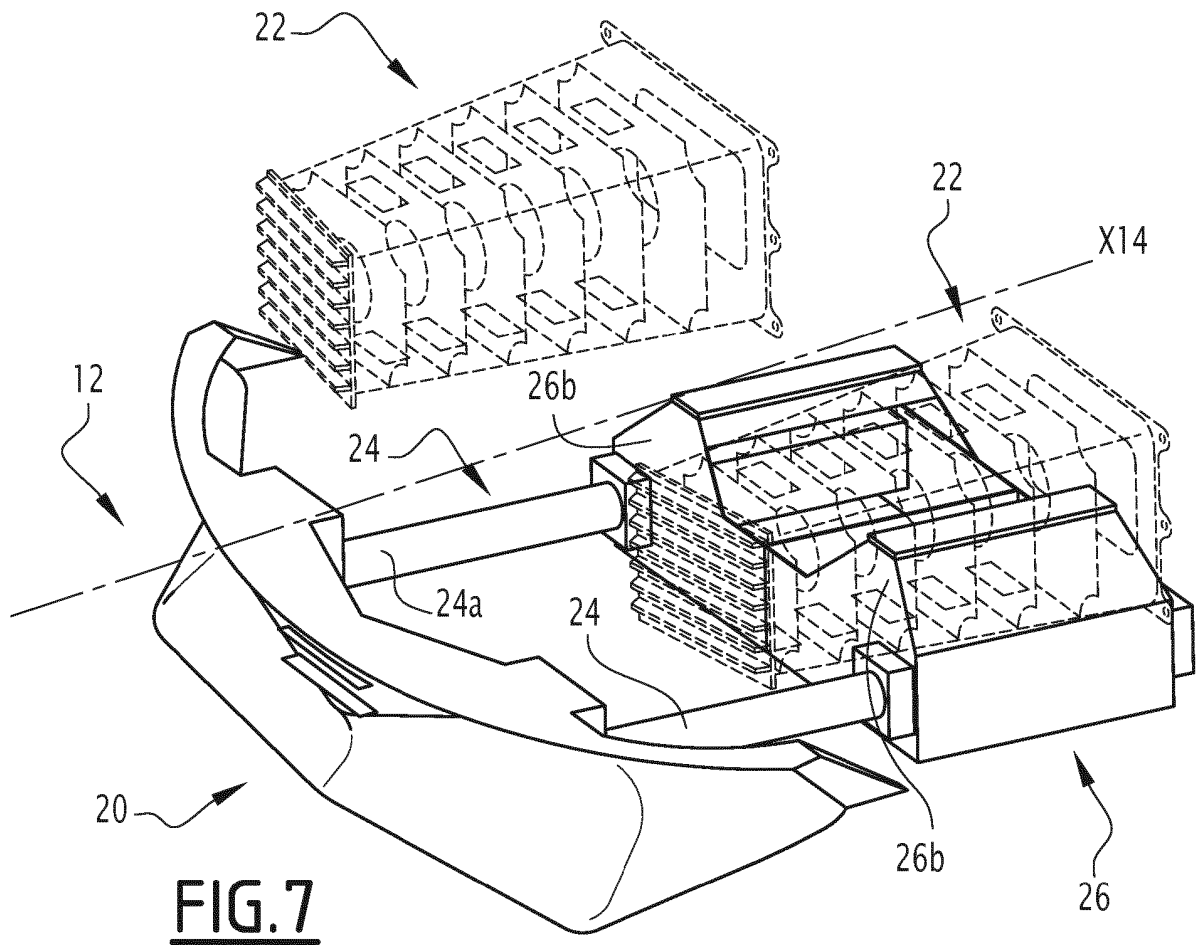
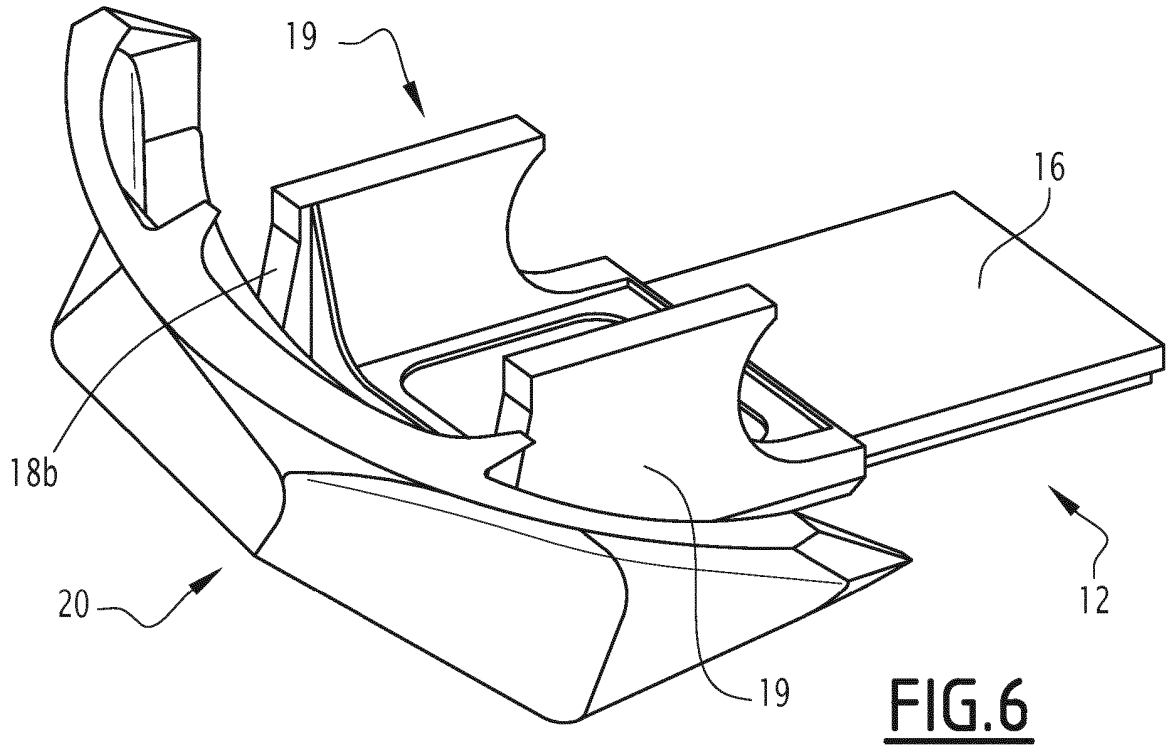


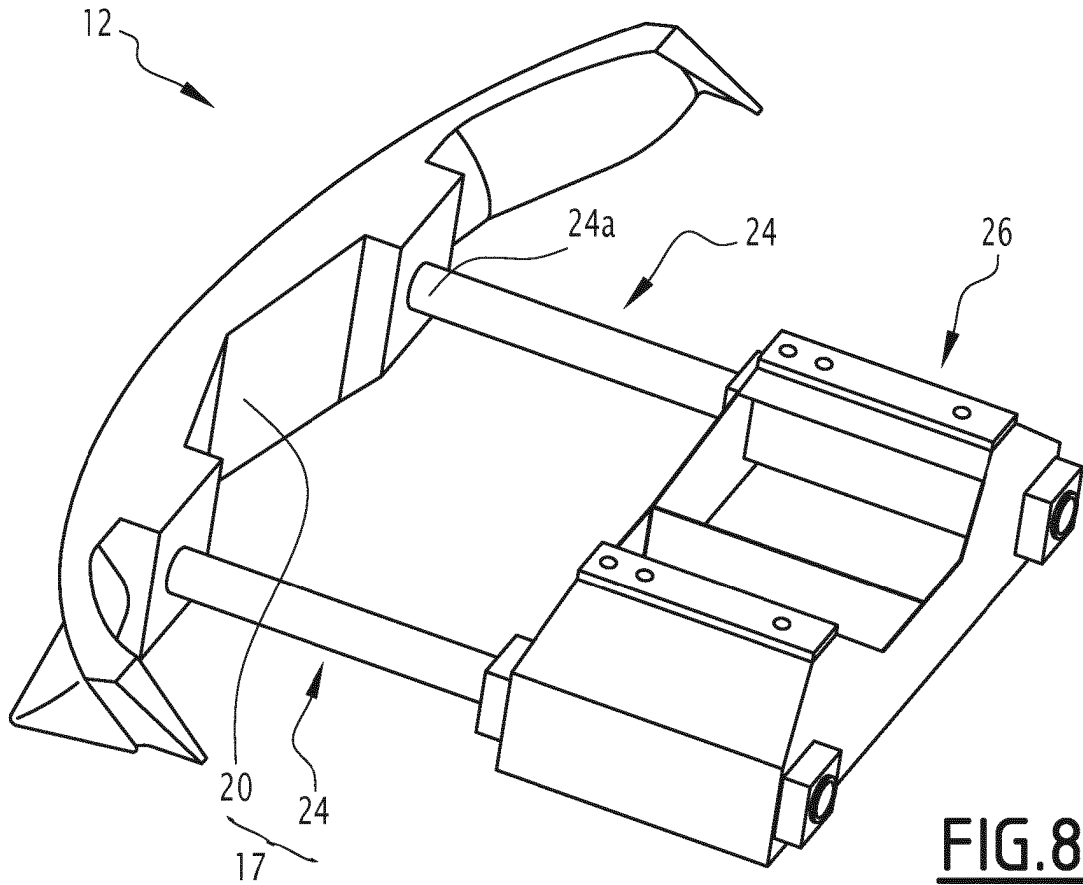


**FIG. 4**

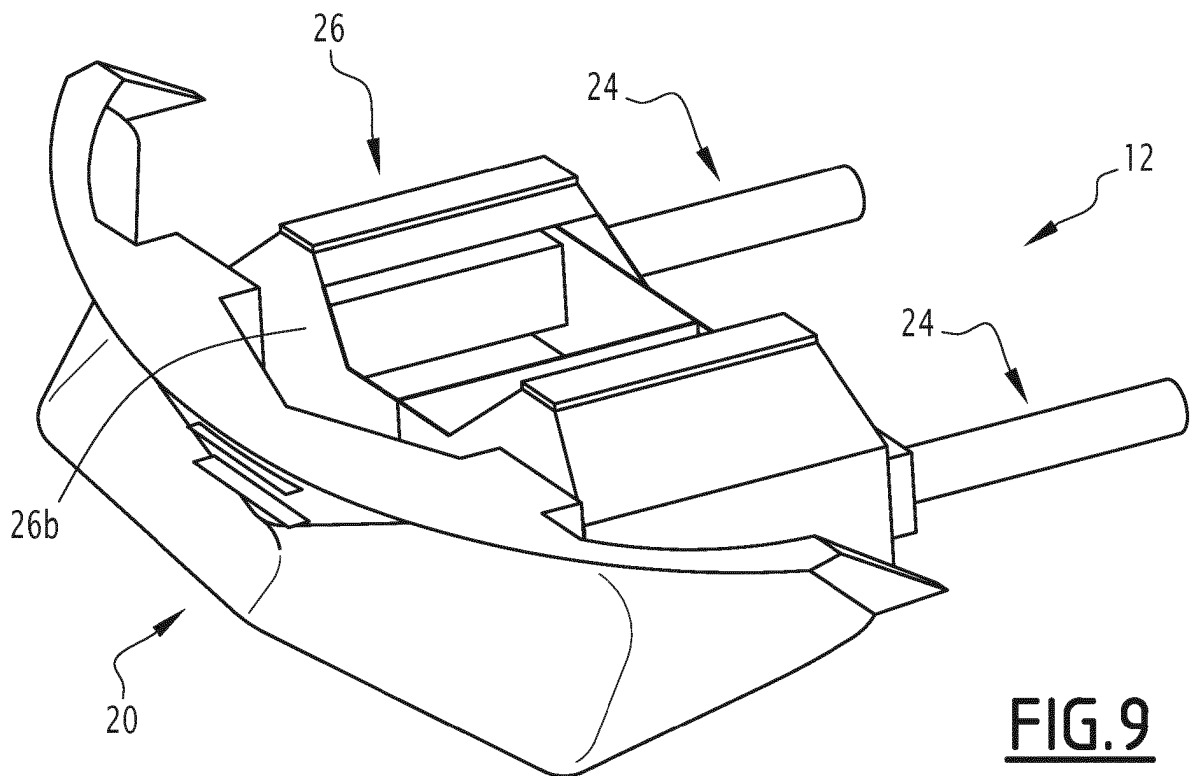


**FIG. 5**





**FIG. 8**



**FIG. 9**

**REFERENCES CITED IN THE DESCRIPTION**

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