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(54) **EXHAUST SYSTEM AND A METHOD OF PRODUCING THE SAME**

ABGASANLAGE UND HERSTELLUNGSVERFAHREN DAFÜR

SYSTEME D'ECHAPPEMENT ET PROCEDE DE PRODUCTION DE CE SYSTEME

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US-A- 4 356 886
WO-A-99/40297
US-A- 4 352 408

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Description

[0001] The present invention relates to an exhaust system to be used in combination with a combustion engine comprising an exhaust pipe and a silencer which system consists of an outer casing (2) of a mainly uniform cross-section and an internal construction comprising a number of chambers (4) and passages (6), acting as noise reduction for the combustion engine.

[0002] Such an exhaust system has been described in WO-A-99-40297.

[0003] Automotives of the types, which are powered by combustion engines, are equipped with an exhaust system in order to lower the noise emitted from the engine. The known exhaust system consists of one or more large pots or chambers acting as silencers, which are interconnected by pipes. They are normally placed underneath the automotive, where they take up a considerable amount of space. In modem design, where the use of space is optimised in order to maximise the exploitation of the available space, a less space consuming solution is heavily sought. Also, the size and shape of the known exhaust systems have a negative influence on the aerodynamic properties of the automotive. This is another important aspect, since the aerodynamic properties must be optimised in order to minimise fuel consumption, and thereby also pollution. A further negative aspect of the known exhaust systems is, that the weight is generally high due to the use of steel in the design. Steel has very poor resistance against corrosion at high temperatures, which leads to increased wall thickness of the pots and pipes, in order to prolong the life span (until corrosion has penetrated the wall thickness). The increased wall thickness leads to increased weight, which also leads to increased fuel consumption. To slow down corrosion, an aluminium coating is often applied to steel exhaust systems, which do at least partly work, but makes it difficult to recycle the used exhaust systems, because of the mixing of the basic materials. Also, exhaust systems made from stainless steel have been proposed, but these are expensive due to the high price of the material, and difficult to produce as stainless steel is harder to machine and to braze than standard steel. The system described in WO-A-9940297 is made of aluminium and avoids some of the problems mentioned above.

[0004] One objective of the present invention is to provide an exhaust system with improved less aerodynamic properties. Another objective is to provide an exhaust system, which is less space consuming. A further objective is to provide an exhaust system with reduced weight. A further objective is to provide an exhaust system with improved life span.

[0005] According to the invention these objects are obtained in that it is formed as one single extruded multiple-port tube-element provided with internal walls which walls after extrusion have been partly removed, partly perforated and/or partly deformed, in order to form the chambers and passages.

[0006] An exhaust system with outer casing of mainly uniform cross-section does not have the shifts in dimensions and numerous sharp edges as the known types of systems, whereby the aerodynamical properties are greatly enhanced. The outer casing of mainly uniform cross-section and the internal system comprising a number of chambers and passages allow a design of the exhaust system, which consumes less space and with reduced weight. The exhaust system may be made from a light metal such as aluminium, whereby the life span may be increased to any chosen time, and at the same time reducing the overall weight.

[0007] The invention further relates to a method for producing an exhaust system as described above.

[0008] The method of producing the exhaust system comprises the extruding at least an outer casing, and providing a system of internal walls so as to form chambers and passages acting as noise reduction for the combustion engine, which is characterised in that a single multiple port tube is extruded, in that the internal walls are partly removed, partly perforated and/or partly deformed in order to form the chambers and the passages. It is hereby obtained, that the exhaust system may be produced at a low cost, since an even complex design of the cross-section of the casing is possible with insignificant effect on the cost. This is due to the use of the extrusion process to produce it.

[0009] In the following the invention is described with reference to the drawings, which display examples of embodiments of the invention.

Fig. 1 shows an embodiment of a cross-section of a profile for an exhaust system

Fig. 2 shows another embodiment of a cross-section of a profile for an exhaust system

Fig. 3 shows a further embodiment of a cross-section of a profile for an exhaust system

Fig. 4 shows another embodiment of a cross-section of a profile for an exhaust system

Fig. 5 shows section A-A of the profile according to Fig. 4.

Fig. 6 shows an end view of an exhaust system

Fig. 7 shows section B-B according to Fig. 6.

Fig. 8 shows section B-B according to Fig. 6, with arrows indicating the flow of gas through the exhaust system

Fig. 9 shows a cross-section of another profile for an exhaust system

Fig. 10 shows a schematic view of an exhaust system

using the profile according to Fig. 9

Fig. 11 shows a finished exhaust system as it can be fitted to a car.

[0010] Fig. 1 displays an outer casing 2 comprising a first profile with another profile placed inside, which other profile comprises a number of walls 3. The outer casing 2 is shaped to have good aerodynamic properties. The walls 3 of the inner profile are suitable for constituting internal divisions inside an exhaust system after further processing.

[0011] Fig. 2, 3 and 4 display different designs of an outer casing 2, which is extruded as one piece including internal walls 3.

[0012] Fig. 5 displays section A-A of Fig.4 with an outer casing 2 and internal walls 3.

[0013] Fig. 6 displays an exhaust system comprising the profile of Fig. 4 and 5. The exhaust system comprises an outer casing 2 with internal walls 3. At one side the wall 3' is plastically deformed and passages 6 have been machined, e.g. punched, drilled etc. At the other side, the casing 2' and internal wall 3" are plastically deformed to form an inlet 14. Also passages 6 have been formed as well as chambers 4, which are more clear in Fig.7.

[0014] Fig. 7 essentially displays section B-B of Fig. 6. However, blockings or baffles 12 have been added to close the ends and to further separate the chambers 4. The outer casing 2 and the walls 3 have been deformed at the ends to form an inlet 14 and an outlet 16. Further chambers 4 have been formed, e.g. by using mandrels. In suitable places, passages 6 have been formed to allow flow of gas between the chambers 4. The passages 6 may be of any size, shape and form. The sizes, shapes and forms of the chambers 4 as well as the passages 6 are design parameters, which are calculated using known technical formulas corresponding to the flow of gas, speed, desired noise reduction etc., which is knowledge of the skilled person.

[0015] Fig. 8 is in essence identical to Fig. 7. Only arrows indicating the flow of gas through the inlet 14 via a chamber 4 through passages 6 into the next chamber 4 etc. have been added.

[0016] According to the invention, the design of the exhaust system can assume a variety of shapes, sizes and forms depending on the kind of automotive, its use, the kind of engine etc.

[0017] If convenient, the inlets 14 and outlet 16 may be equipped with pipes for easy connection to other components. Especially the outlet 16 may be equipped with a piece of pipe designed to accommodate a specific sound of the engine. The inlet 14 may be connected directly to a combustion chamber, to a manifold or e.g. to a catalytic unit and/or a small particle filter.

[0018] Fig. 9 shows another tube 20 to be used as basic profile for an exhaust system according to the invention. The exact cross-section of this profile is not critical, as long as it is adapted to be mounted to the underside of a car. In view thereof it has a flat part 21 and curved parts 22, 23. At the junctions between the curved parts 22, 23 a semicircular part 24 has been provided, extending over substantially more than 180° C, so that a tube with circular cross-section and suitable diameter can be fixed into this part 24.

[0019] In order to make an exhaust system as shown in Fig. 10, baffles 25 having a cross-section corresponding to the cross-section of the tube 20 of fig. 9, except for the circular part 24 which is left open, are inserted through one end and positioned at defined distances from that end. This can be done in a way corresponding to the way in which baffles are positioned in manifolds such as disclosed e.g. in EP-A-0 891 528 or EP-A-0 214 670. In this way the tube 20 is divided into a number of spaces divided by the baffles and interconnected through the semicircular parts 24. These volumes of these spaces can be adapted to the requirements of the exhaust system to act as a silencer.

[0020] An improvement can be made by inserting circular tube ends 26 into the semicircular parts 24 and position these tube ends 26 in such a way that either one end is in the same plane as a baffle or each of the tube ends extend into one of two neighbouring spaces divided by a baffle 25. In this way the silencing can be optimized.

[0021] Baffles 25 and tube ends 26 can be fixed inside the tube 20 by welding process commonly used in the art.

[0022] In Fig. 11 there is shown the final shape of an exhaust system as can be made according to the invention, and which can be applied directly to the bottom part of a car. Because of the larger cross-section of the tube the exhaust line has sufficient strength and at the same time sufficient volume for noise reduction. In view of this latter requirement bending of the extruded profile is important to have sufficient length and thereby sufficient volume for noise reduction and to fit to the bottom of a car. This bending may also be important in view of other structural elements fitted to the bottom of the car, such as driving axie etc.

[0023] The silencer may be made using steel/steel alloys, but is preferably made using light metal alloys, such as titanium, aluminium, magnesium. It may also comprise components made from ceramic materials. Plastics, with or without reinforcements may also be used in part or as a whole. Optionally with an internal shield for improved heat resistance.

Claims

1. Exhaust system to be used in combination with a combustion engine comprising an exhaust pipe and a silencer which system consists of an outer casing (2) of a mainly uniform cross-section and an internal construction comprising a number of chambers (4) and passages (6), acting as noise reduction for the combustion engine **characterized in that** it is formed as one single multiple port extruded tube-el-

ement provided with internal walls which walls after extrusion have been partly removed, partly perforated and/or partly deformed, in order to form the chambers and passages.

2. Exhaust system according to claim 1, **characterized in that** at least one baffle has been installed in the outer casing in order to form the chambers.

3. Exhaust system according to anyone of the claims 1-2, **characterized in that** the tube-element has been provided with at least one baffle forming two neighbouring chambers and tube-like hollow elements are forming the passage between the neighbouring chambers, said tube-like element protruding at least into one of said chambers.

4. Exhaust system according to anyone of the preceding claims, **characterized in that** it consists substantially of aluminium or an aluminium alloy,

5. A method of producing an exhaust system according to anyone of the preceding claims 1-4, which method comprises the extruding of at least an outer casing and providing a system of internal walls so as to form chambers and passages acting as noise reduction for the combustion engine, **characterized in that** a single multiple port tube is extruded, that the internal walls are partly removed, partly perforated and/or partly deformed in order to form the chambers and passages.

6. A method according to claim 5 **characterized in that** at least one baffle is installed in the multiple port tube.

7. A method according to anyone of the claims 5-6, **characterized in that** the outer casing is shaped to fit to the undercarriage of the car.

Patentansprüche

1. Abgassystem zur Nutzung in Kombination mit einem Verbrennungsmotor, das ein Abgasrohr und einen Schalldämpfer umfasst, wobei das System ein äußeres Gehäuse (2) mit einem nahezu einheitlichen Querprofil und einen Innenaufbau mit mehreren Kammern (4) und Leitungen (6) zur Geräuschreduzierung des Verbrennungsmotors umfasst, **gekennzeichnet dadurch, dass** es als einzelnes stranggepresstes Mehrfach-Anschluss-Röhrenelement ausgebildet ist, welches mit Innenwänden versehen ist, die nach dem Strangpressen zur Bildung der Kammern und Leitungen teilweise entfernt, teilweise perforiert und/oder teilweise verformt worden sind.

2. Abgassystem nach Anspruch 1, **gekennzeichnet dadurch, dass** wenigstens eine Schallwand zur Bildung der Kammern im äußeren Gehäuse angeordnet ist.

3. Abgassystem nach einem der Ansprüche 1 und 2, **gekennzeichnet dadurch, dass** das Röhrenelement wenigstens eine Schallwand aufweist, die zwei benachbarte Kammern bildet, und röhrenartige Elemente, welche die Leitung zwischen den benachbarten Kammern bilden, wobei das röhrenartige Element wenigstens in eine der Kammern hineinragt.

4. Abgassystem nach einem der vorangehenden Ansprüche, **gekennzeichnet dadurch, dass** es im Wesentlichen aus Aluminium oder einer Aluminium-Legierung besteht.

5. Verfahren zur Herstellung eines Abgassystems nach einem der vorangehenden Ansprüche 1 bis 4, wobei das Verfahren das Strangpressen von wenigstens einem äußeren Gehäuse und das Ausbilden eines Systems von Innenwänden für die Bildung von Kammern und Leitungen zur Geräuschreduzierung des Verbrennungsmotors umfasst, **dadurch gekennzeichnet, dass** eine einzelne Mehrfachanschlussleitung stranggepresst wird und dass die Innenwände zur Bildung der Kammern und Leitungen teilweise entfernt, teilweise perforiert und/oder teilweise verformt werden.

6. Verfahren nach Anspruch 5, **gekennzeichnet dadurch, dass** wenigstens eine Schallwand in der Mehrfachanschlussleitung angeordnet wird.

7. Verfahren nach einem der Ansprüche 5 bis 6, **gekennzeichnet dadurch, dass** das äußere Gehäuse so geformt ist, dass es an das Fahrwerk des Autos gefügt werden kann.

Revendications

1. Système d'échappement à utiliser avec un moteur à combustion comportant un tuyau d'échappement et un silencieux dont le système se compose d'un boîtier externe (2) d'une section transversale uniforme principalement et d'une construction interne comprenant un nombre de chambres (4) et de passages (6), agissant comme réducteur de bruit pour le moteur à combustion, **caractérisé en ce qu'**il est formé d'un élément tubulaire extrudé en une seule pièce avec ouvertures multiples pourvu de parois internes, lesdites parois après extrusion ont été partiellement supprimées, partiellement perforées et/ou partiellement déformées, afin de former les chambres et les passages.

2. Système d'échappement conformément à la revendication 1, **caractérisé en ce qu'**au moins un dé-

flecteur a été installé dans le boîtier externe afin de former les chambres.

3. Système d'échappement conformément à chacune des revendications 1-2, **caractérisé en ce que** l'élément tubulaire a été muni d'au moins un déflecteur formant deux chambres voisines et d'éléments évidés de forme tubulaire forment le passage entre les chambres voisines, ledit élément de forme tubulaire dépassant au moins dans l'une desdites chambres.

4. Système d'échappement conformément à chacune des revendications précédentes, **caractérisé en ce qu'**il est en grande partie composé d'aluminium ou d'un alliage d'aluminium.

5. Une méthode de production d'un système d'échappement conformément à chacune des revendications précédentes 1-4, dont la méthode comprend le filage d'au moins un boîtier externe et fournit un système de parois internes de telle sorte que se forment des chambres et des passages agissant comme réducteurs de bruit pour le moteur à combustion, **caractérisé en ce qu'**un tube en une seule pièce avec ouvertures multiples est extrudé, que les parois internes ont été partiellement supprimées, partiellement perforées et/ou partiellement déformées, afin de former les chambres et les passages.

6. Une méthode conformément à la revendication 5 **caractérisée en ce qu'**au moins un déflecteur est installé dans un tube en une seule pièce avec ouvertures multiples.

7. Une méthode conformément à chacune de revendications 5-6, **caractérisée en ce que** le boîtier externe est conçu pour s'adapter au châssis de la voiture.

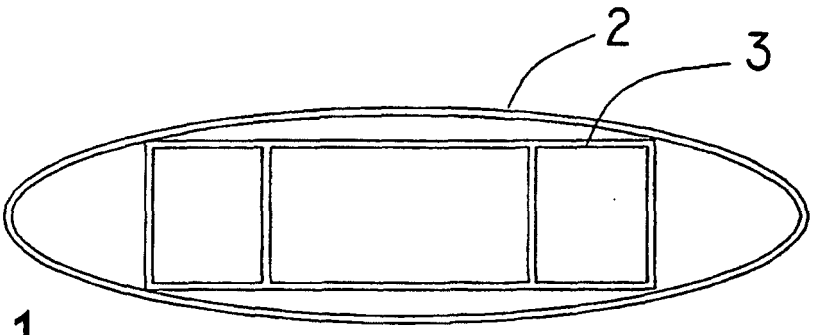


Fig. 1

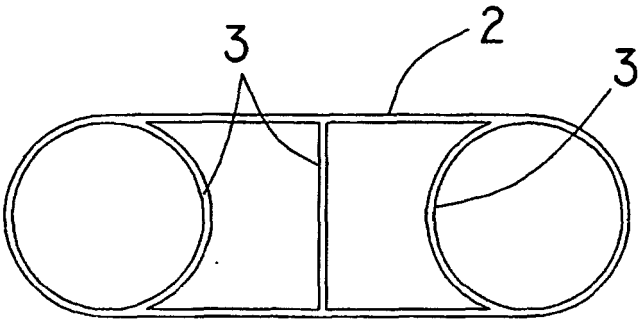


Fig. 2

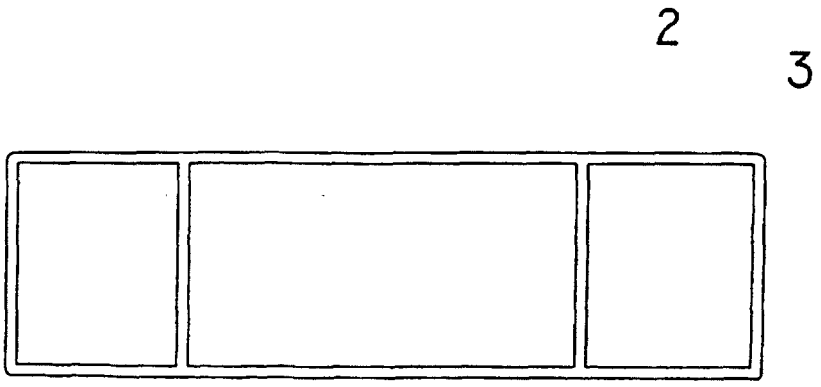


Fig. 3

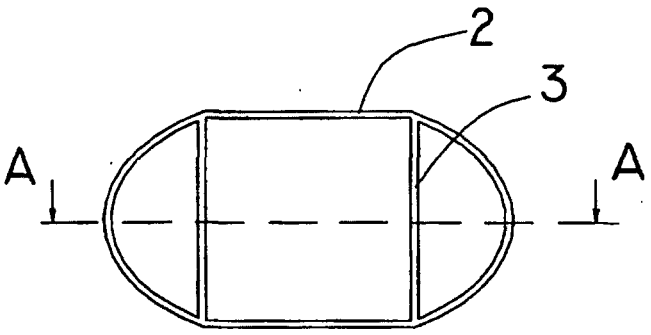


Fig. 4

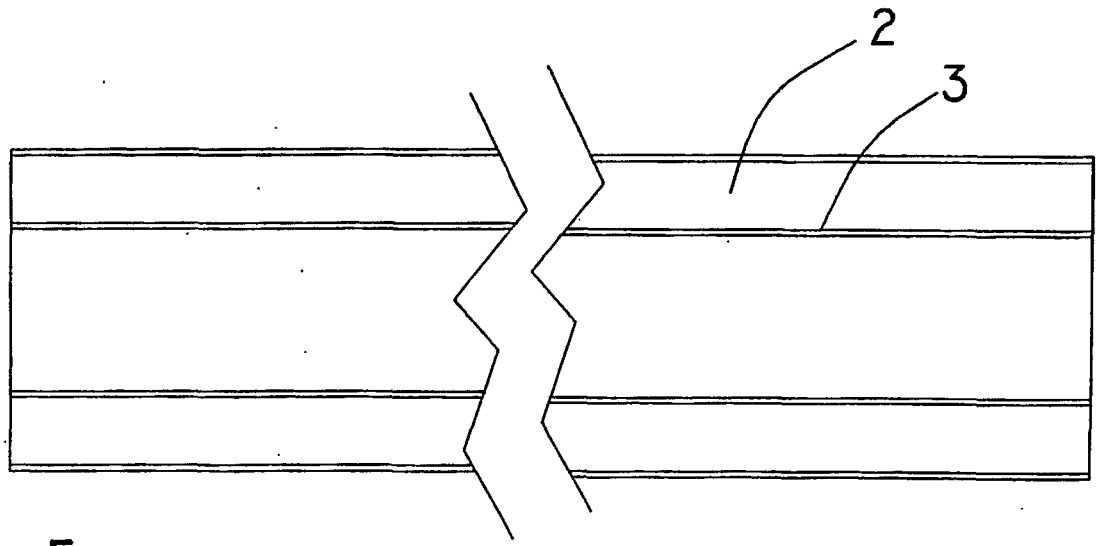


Fig. 5

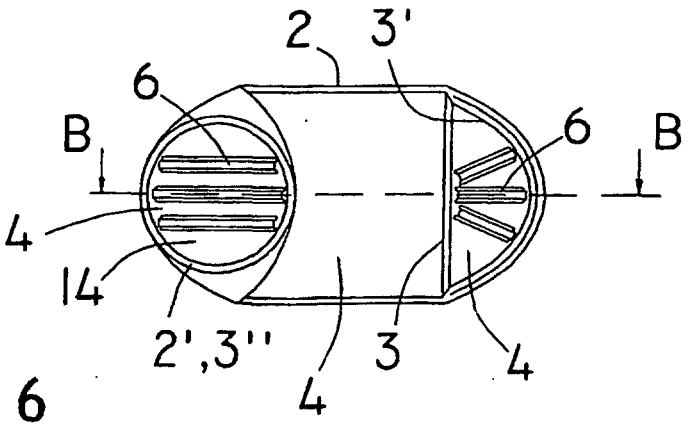


Fig. 6

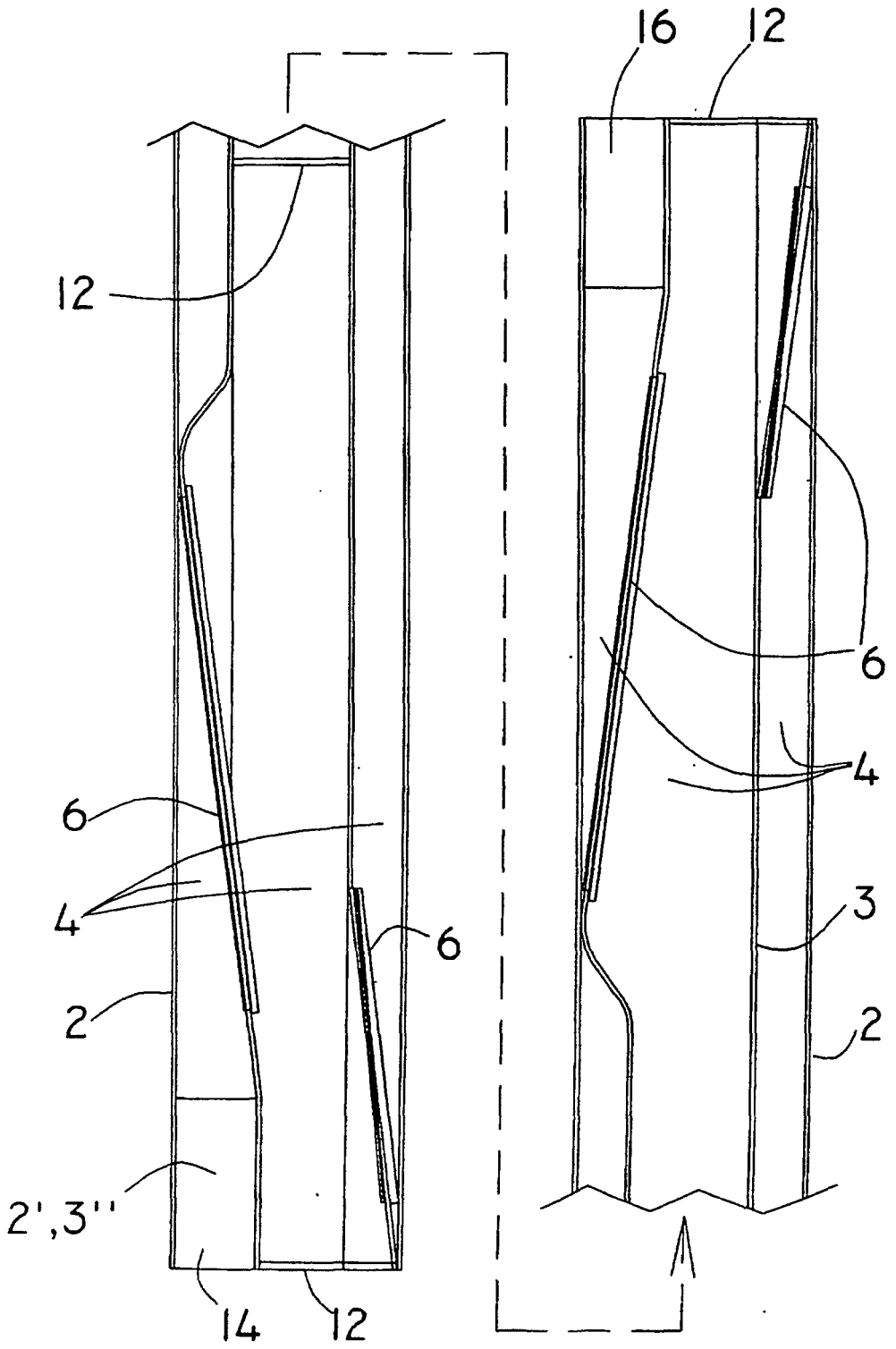


Fig. 7

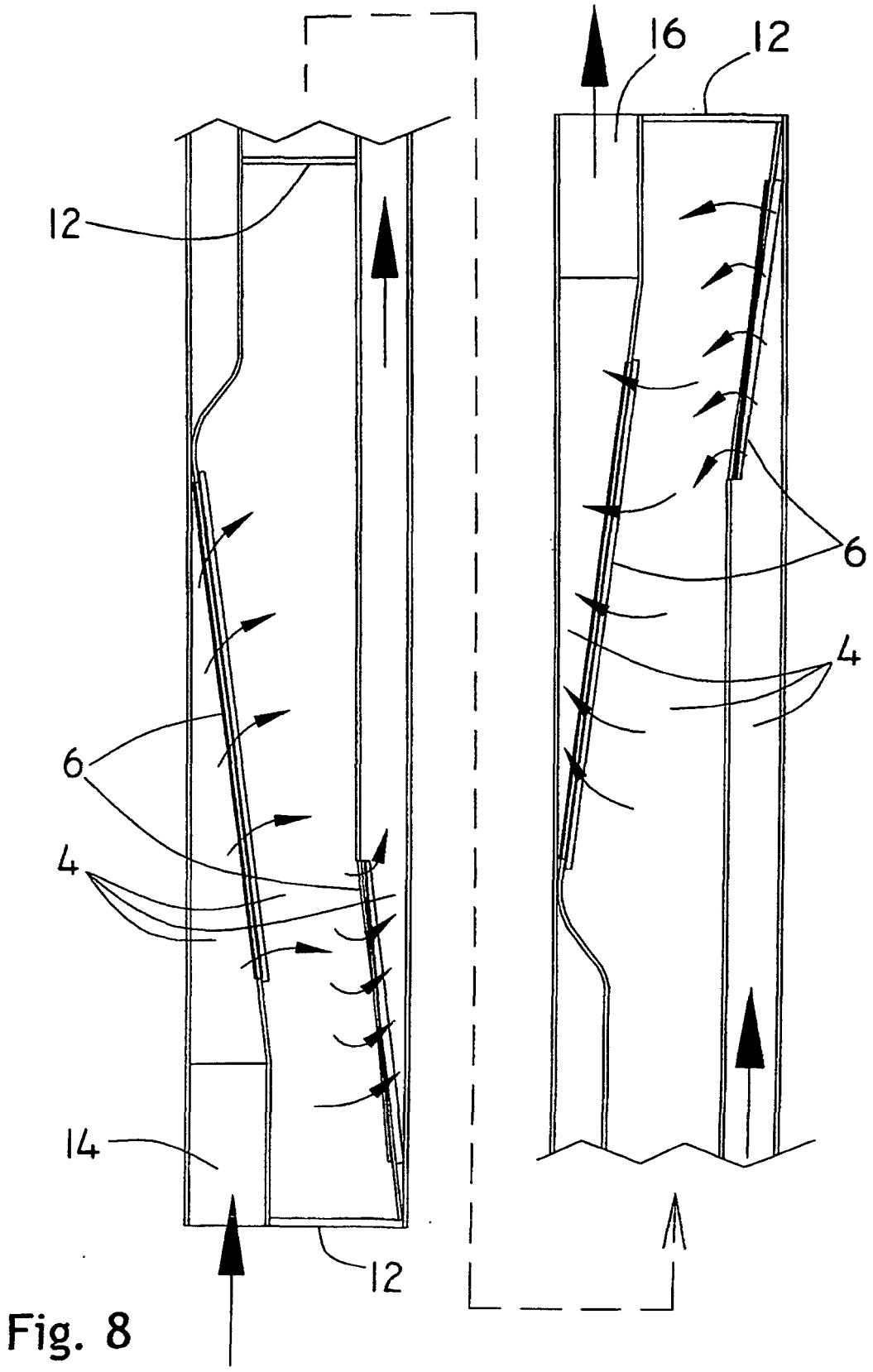


Fig. 8

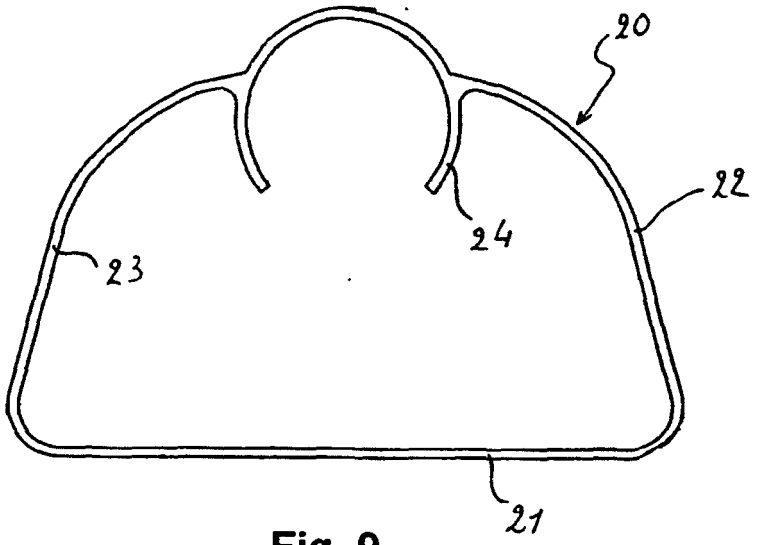


Fig. 9

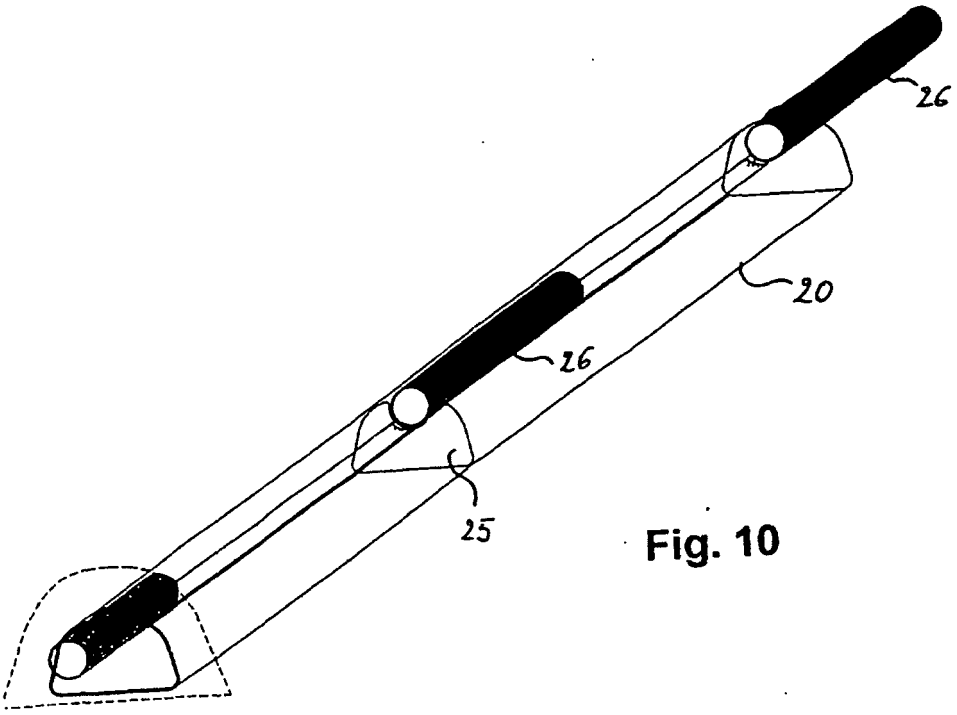


Fig. 10

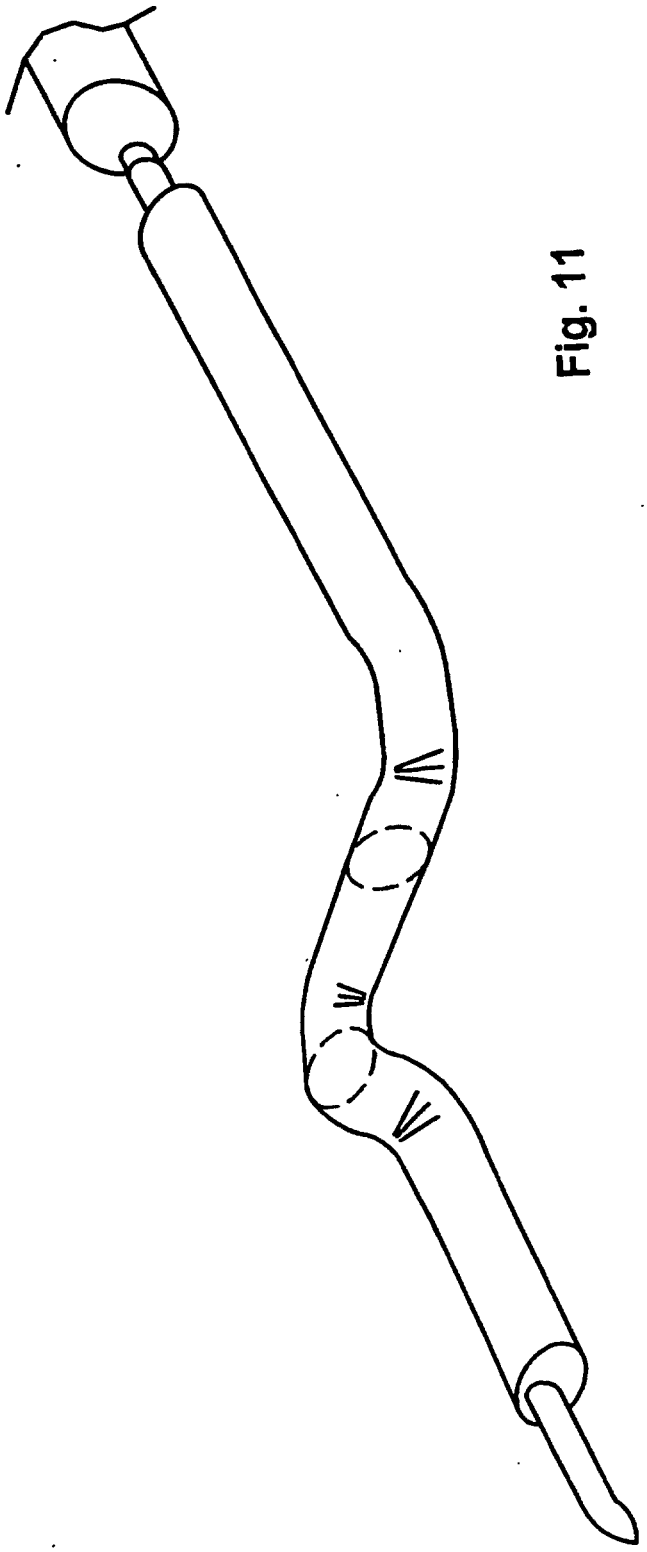


Fig. 11