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CA 2424497 C 2007/08/14

(11)(21) **2 424 497**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(22) Date de dépôt/Filing Date: 2003/04/04

(41) Mise à la disp. pub./Open to Public Insp.: 2003/10/09

(45) Date de délivrance/Issue Date: 2007/08/14

(30) Priorité/Priority: 2002/04/09 (DE102 15 551.8)

(51) Cl.Int./Int.Cl. *B64D 33/02* (2006.01),
F02C 7/04 (2006.01), *F02C 7/052* (2006.01)

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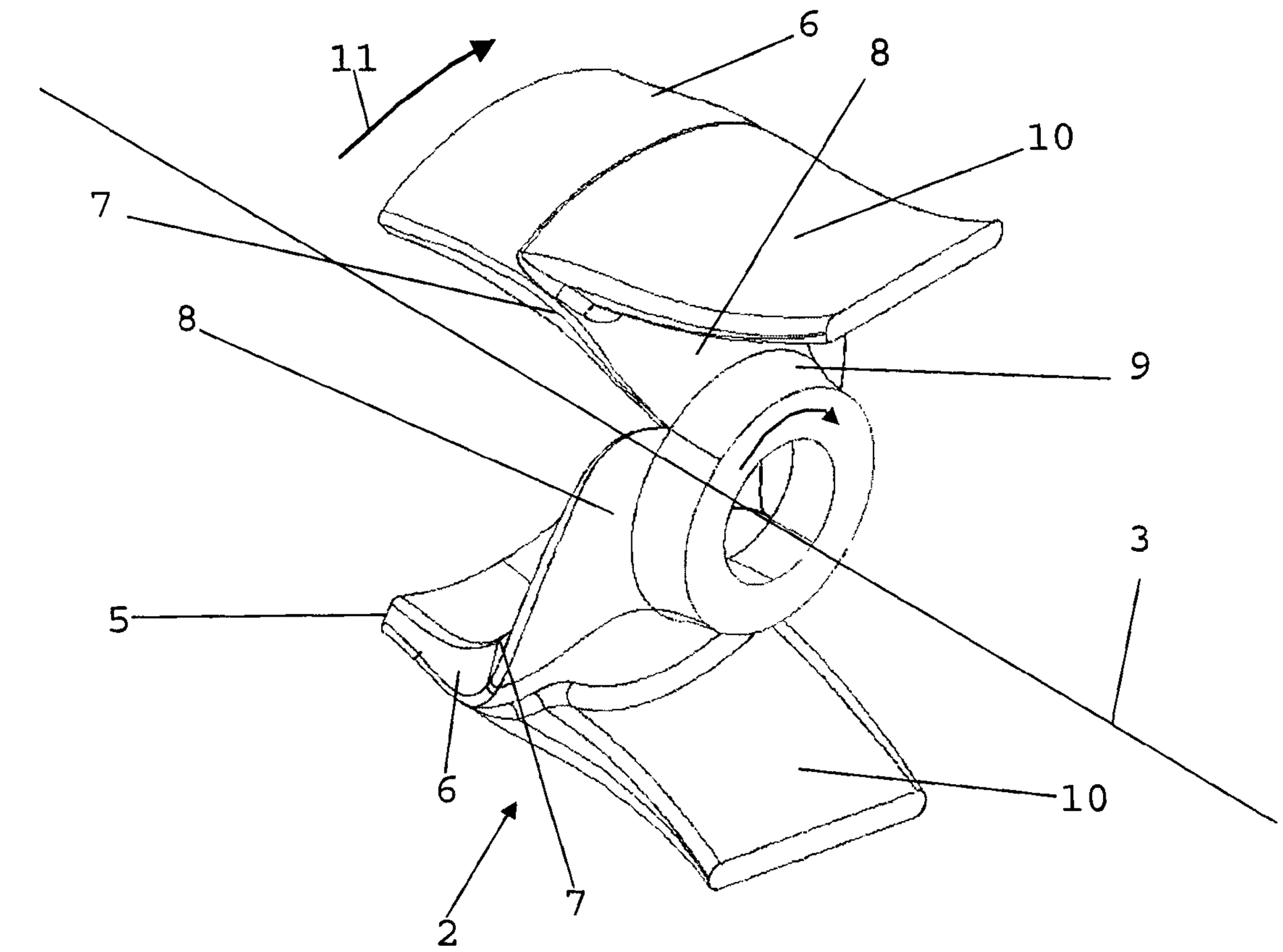
(54) Titre : MOTEUR TURBOPROPULSEUR
(54) Title: TURBOPROP AIRCRAFT ENGINE



(57) Abrégé/Abstract:
The invention relates to a turboprop aircraft engine with at least one outer air intake 1 and with at least one downstream inner duct system 2 for the delivery of air to a compressor, characterized in that the inner duct system 2 spirals around the center axis of the engine.

Abstract of the invention

The invention relates to a turboprop aircraft engine with at least one outer air intake 1 and with at least one downstream inner duct system 2 for the delivery of air to a compressor, characterized in that the inner duct system 2 spirals around the center axis of the engine.

Specification

This invention relates to a turboprop aircraft engine with an outer air intake and a downstream inner duct system for the delivery of air to a compressor.

The air required by the turboprop aircraft engine is initially routed through at least one outer air intake and subsequently delivered to the compressor via an associated inner duct system.

Such air inlets may consist of only one outer air intake and only one associated duct system or comprise several such air intakes and duct systems. The state of the art shows these air guiding systems as chin intakes or scoop intakes. These can be multi-fluted or branched (e.g. the bifurcated inlet).

Known designs are shown in the US Specifications 5,725,180 and 4,617,028, for example.

The known designs are geared to delivering the air to the entry of the compressor with maximal uniformity and with minimal swirl. Accordingly, the total pressure loss between the intake lip and the compressor entry should be as low as possible. The efficiency and stability of the compressor are influenced by the total pressure loss, the uniformity of the air supply and the swirl of the airflow.

In the state of the art, the walls of the air guiding system are designed in view of the above situation. The

entire system of both the outer air intake and the subsequent inner duct system are designed such that the air is

guided in parallel with the center axis of the engine (machine axis). The entry stator of the compressor then deflects the airflow in a direction suitable for the compressor by imparting an appropriate circumferential component to the airflow in the direction of rotation of the compressor.

The state of the art is disadvantageous in that the airflow in front of the outer air intake is deflected by the rotating propeller and is given a swirl. This swirl is eliminated in the state of the art by the design of the outer air intake and the subsequent inner duct system. Depending on the direction of rotation of the compressor and the propeller, this may result in undesired effects which decrease efficiency.

It is further disadvantageous that the interaction of the swirly flow in the axially orientated duct walls of the duct system known from he state of the art promotes the formation of recirculation zones and longitudinal swirls in the flow within the duct system. This will again decrease efficiency, impair the uniformity parameters of the flow at the compressor entry and worsen the total pressure loss.

In a broad aspect, the present invention provides a development of a turboprop aircraft engine of the type specified at the beginning in such a manner that the air is delivered to the compressor without loss and the stability of operation of the compressor is supported.

It is a particular object of the present invention to provide solution to the above problem, with further objects and advantages of the present invention becoming apparent from the sub-claims.

The present invention accordingly provides for at least one inner duct system spiraling around the center axis of the engine.

The design according to the present invention is characterized by a variety of merits.

The specific form of the duct system advantageously influences the flow of air from the outer air intake to the compressor.

Compared with the designs known from the state of the art, the present invention reduces the pressure loss in the duct system and makes the flow less uneven. Thus, the performance of the entire air intake system will be enhanced. The flow will generally be guided in an improved manner, resulting in a reduction of local effects, for example local deflections and swirling. This in turn will minimize the interaction between the air-flow and the fixed walls of the air intake and the inner duct systems as well as the formation of secondary flows (swirls, separation etc.).

Generally, the present invention provides for an in-crease of efficiency of the intake or a minimization of losses. Thus, the specific fuel consumption

of the engine will be improved and the quality of the inflow to the compressor enhanced.

Further, the present invention is highly advantageous if the directions of rotation of the propeller and of the compressor are identical. In this case, the specific form of the design will support the direction of propeller rotation of the airflow. The swirl of the inflowing air will be conserved and optimized accordingly, resulting in an improved inflow to the compressor, in particular its entry area.

The present invention, therefore, provides the opportunity to design the swirl of the airflow from the outer air intake to the compressor in a suitable manner and to optimize it by the form of the duct system, with the swirl being either decreased or increased. With the inflow to the compressor being improved, it is also possible to dispense with the entry stator of the compressor. Thus, design of the entire engine can be simplified, resulting in a considerable saving of weight. In addition, total efficiency will be further enhanced as a result of the absence of any pressure loss at the entry rotor.

Obviously, the principal idea underlying the present invention is to design the air inlet system in such a manner that the swirl imparted by the propeller is conserved to a large extent. In accordance with the present invention, the inner duct system and, in a preferred development, the outer air intake are oriented in the direction of the swirly flow. The specific form

of the air guiding system according to the present invention (twist angle in dependence of the axial position relative to the center axis of the engine) can, therefore, be optimized according to the angular momentum conservation law of aerodynamics. Thus, a form of the inner duct system as well as of the outer air intake will be obtained which spirals, or corkscrews, around the center axis of the engine. Hence, the design of the respective air ducts and guides follows the form of swirl of the airflow, resulting in a "twisted duct".

This invention is more fully described in the light of the accompanying drawing showing a preferred embodiment. On the drawing:

Fig. 1 is a perspective schematic view of the air guiding system according to the present invention with outer air intake and inner duct system,

Fig. 2 is a top view of the embodiment shown in Fig. 1,

Fig. 3 is a front view of the arrangement shown in Figs 1 and 2,

Fig. 4 is a rear view of the embodiment shown in Figs 1 to 3, and

Fig. 5 is a schematic side sectional view of the air guiding system.

Fig. 5 shows an outer air intake 1 which is followed by an inner duct system. Figs 1 to 4 start only with the representation of the throat 5 and detail the inner duct system 2. The center axis of the engine is indicated by the reference numeral 3.

In particular, the air intake comprises a throat 5, which transits into a diffusor 6. Downstream of the diffusor 6, a deflection 7 and a confusor 8 are arranged in this sequence, the latter issuing into an annulus 9. Downstream of the annulus 9 is a compressor, which is not illustrated herein.

Furthermore, a particle separator 10 is provided (device for the removal of particles introduced by the airflow) which is arranged in an extension of the diffusor section (diffusor 6).

Since the general design of both the outer air intake and the inner duct system is known from the state of the art, a detailed description of the airflow ducting and guiding arrangement has been dispensed with herein.

The present invention provides for the spiral or corkscrew form as already described. Figs 1, 3 and 4 show the swirl direction 11 in which the entire arrangement is twisted around the center axis 3, with the components being illustrated in schematic representation.

What is claimed is:

1. Turboprop aircraft engine with at least one outer air intake and with at least one downstream inner duct system for the delivery of air to a compressor, characterized in that the inner duct system spirals around a center axis of the engine.

2. Turboprop aircraft engine in accordance with Claim 1, characterized in that a twist angle of a spiral arrangement of said inner duct system is determined in dependence of a swirl of an airflow imparted by a propeller of the aircraft.

3. The turboprop aircraft engine in accordance with Claim 2, characterized in that the twist angle is destined for the conservation of the swirl of the air-flow imparted by the propeller.

4. The turboprop aircraft engine in accordance with any one of claims 2 and 3, characterized in that the twist angle is orientated in a direction of the swirl of air flowing into said outer air intake.

5. The turboprop aircraft engine in accordance with any one of claims 1 to 4, characterized in that the compressor has no entry rotor.

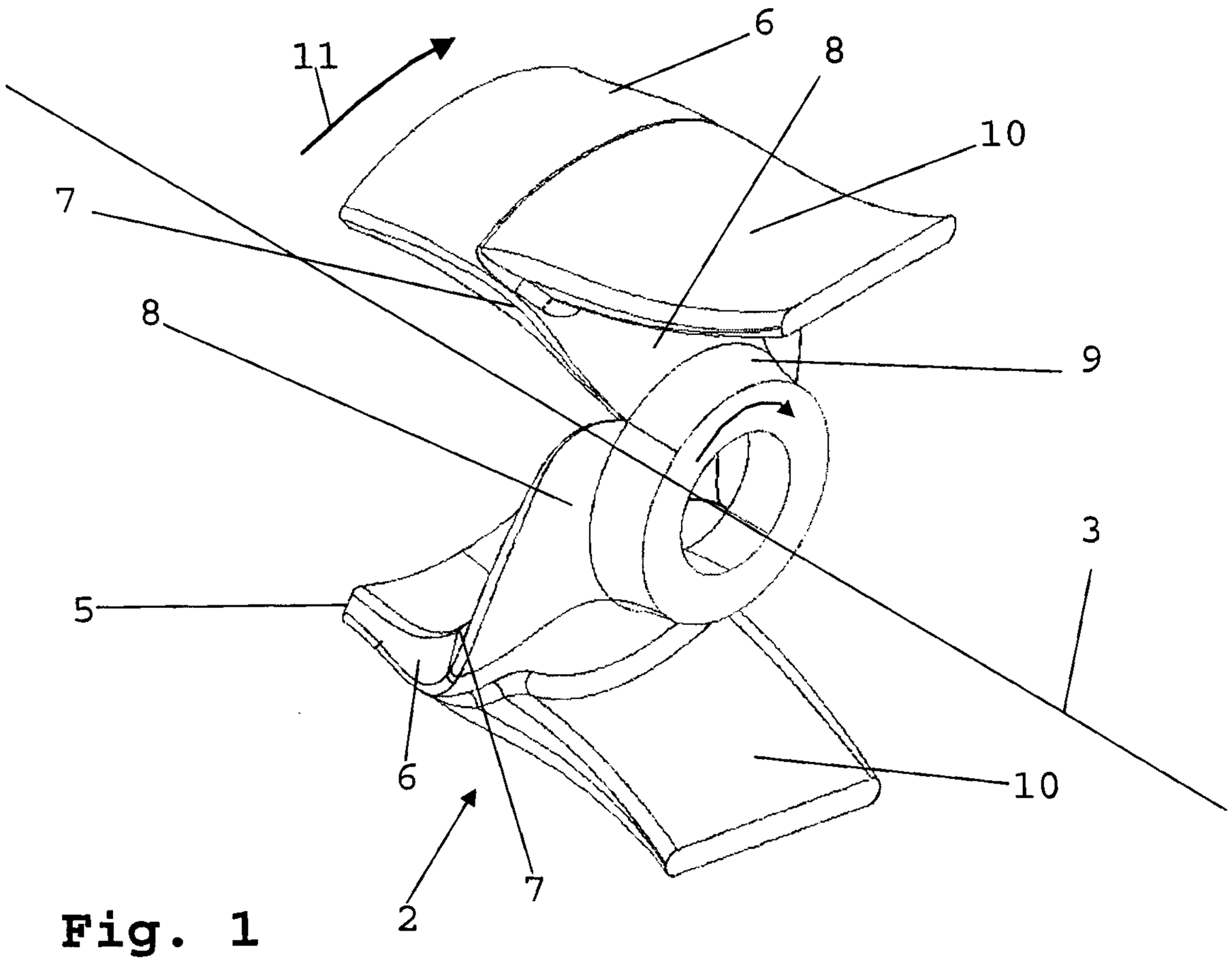


Fig. 1

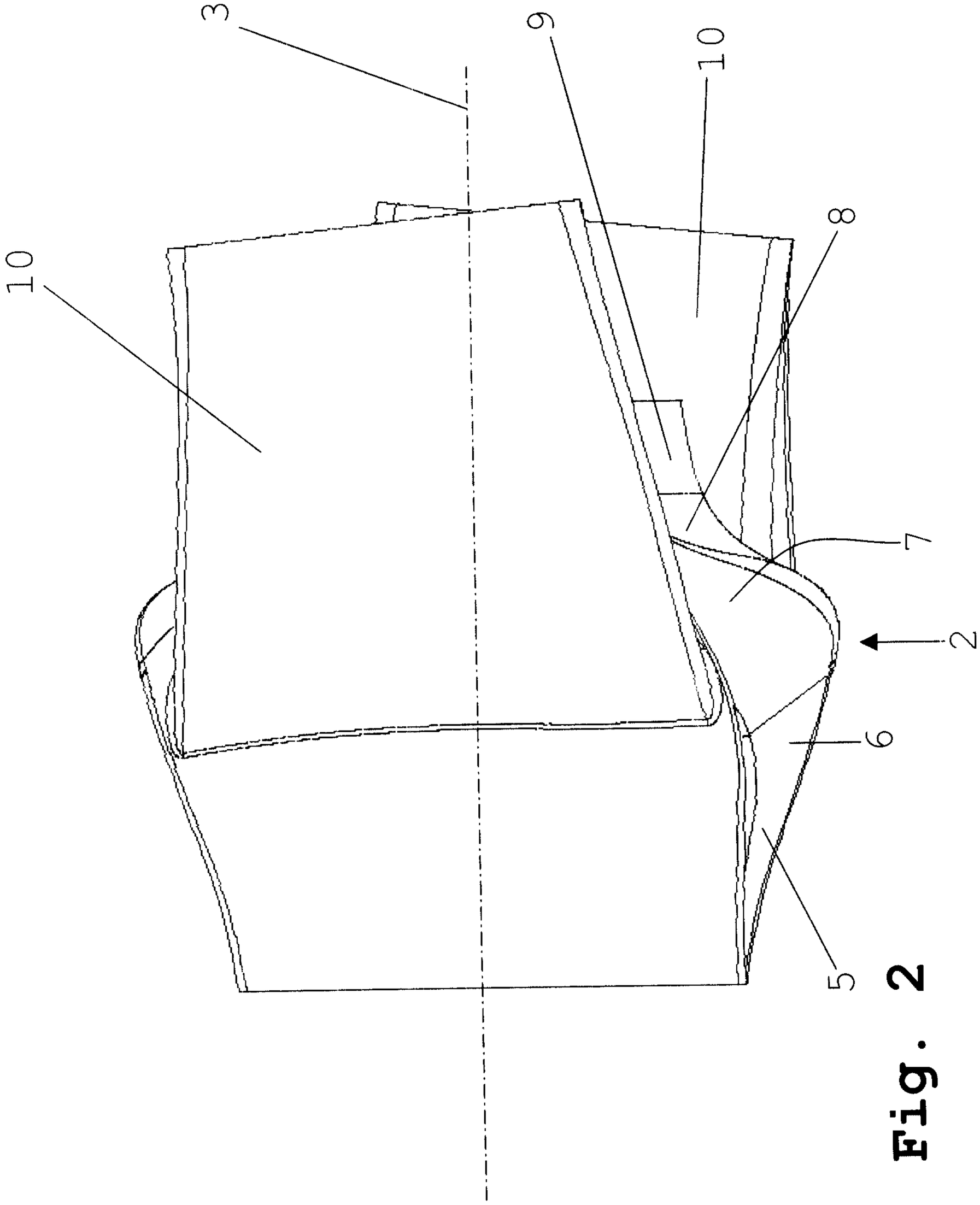


Fig. 2

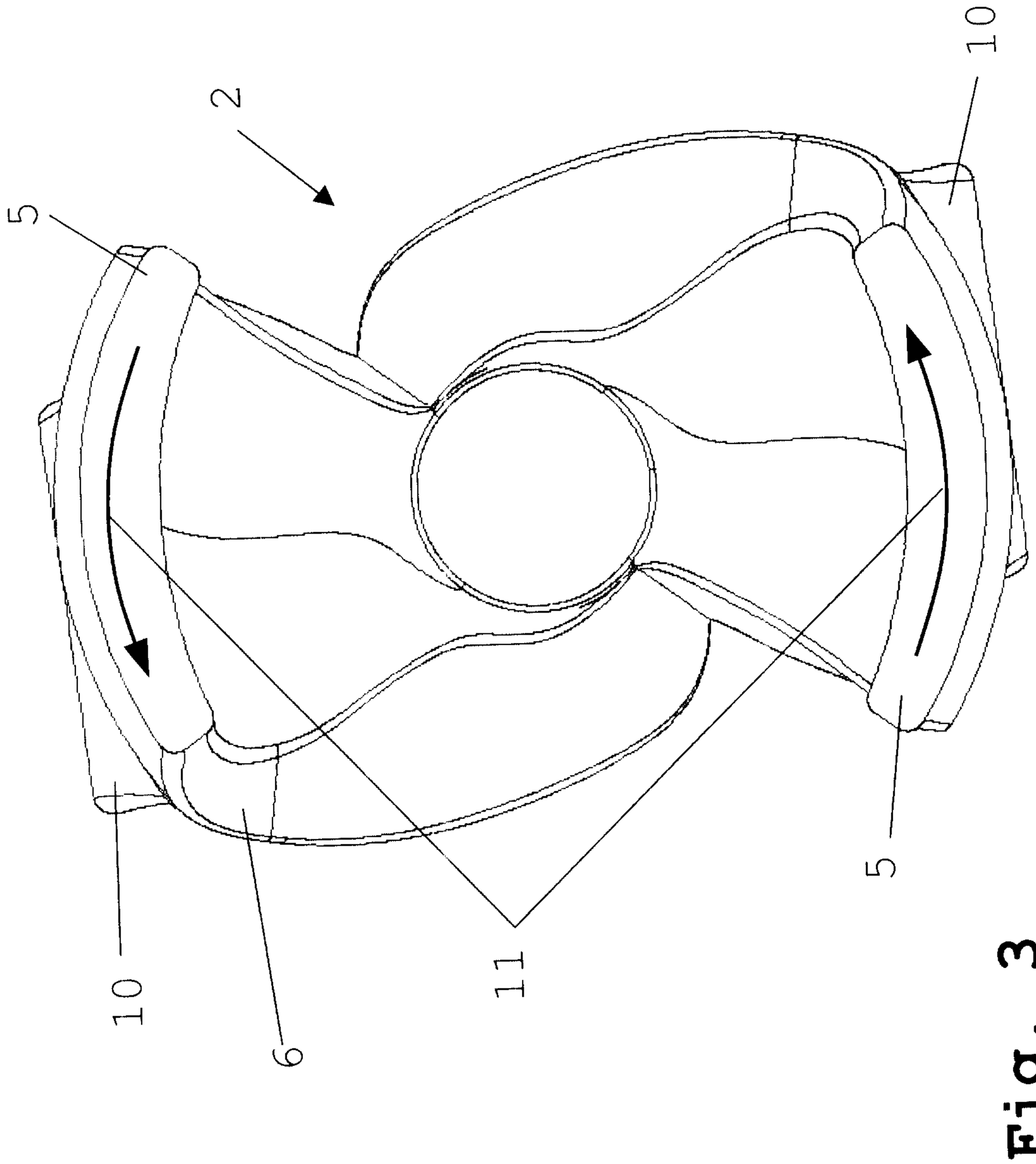


Fig. 3

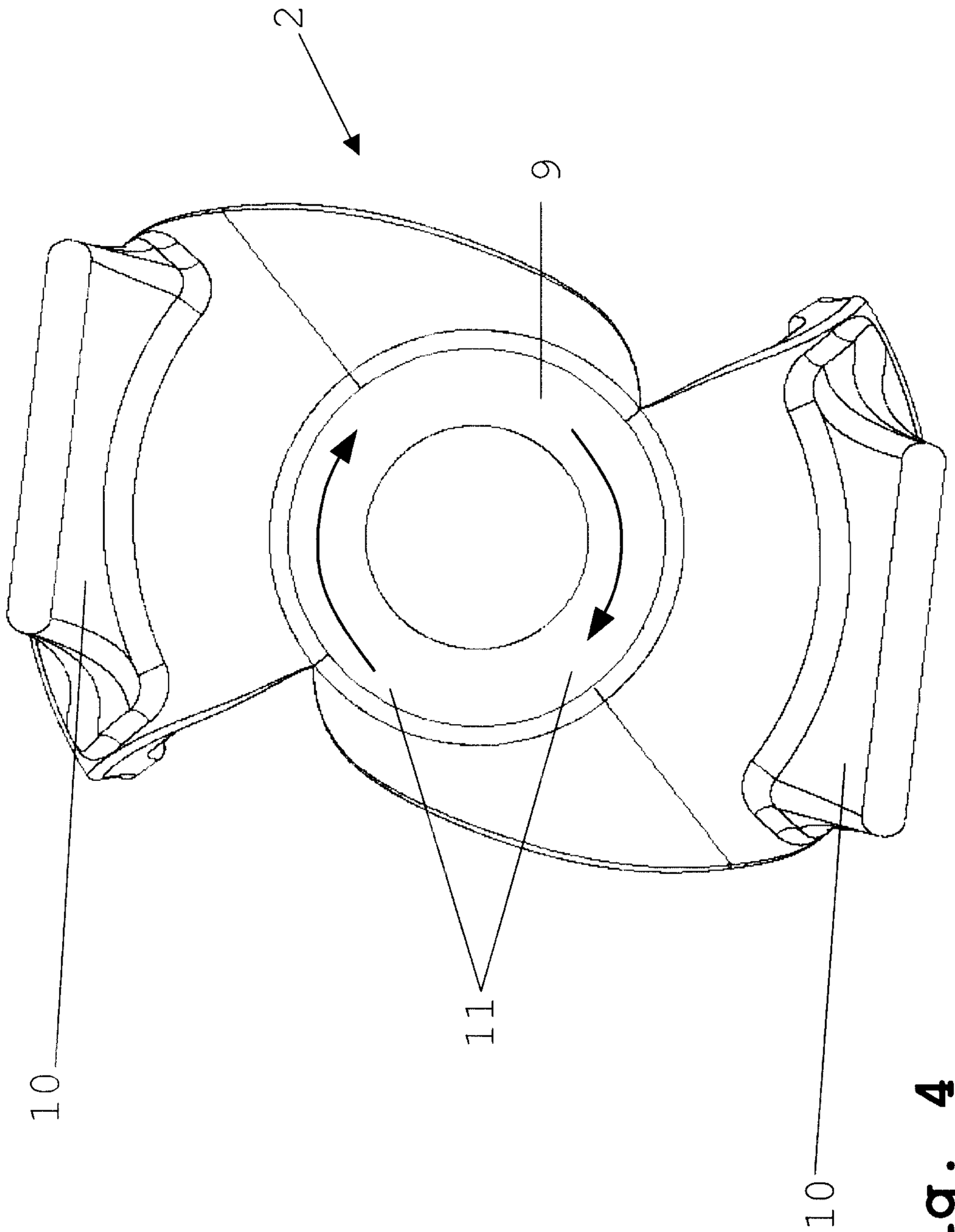


Fig. 4

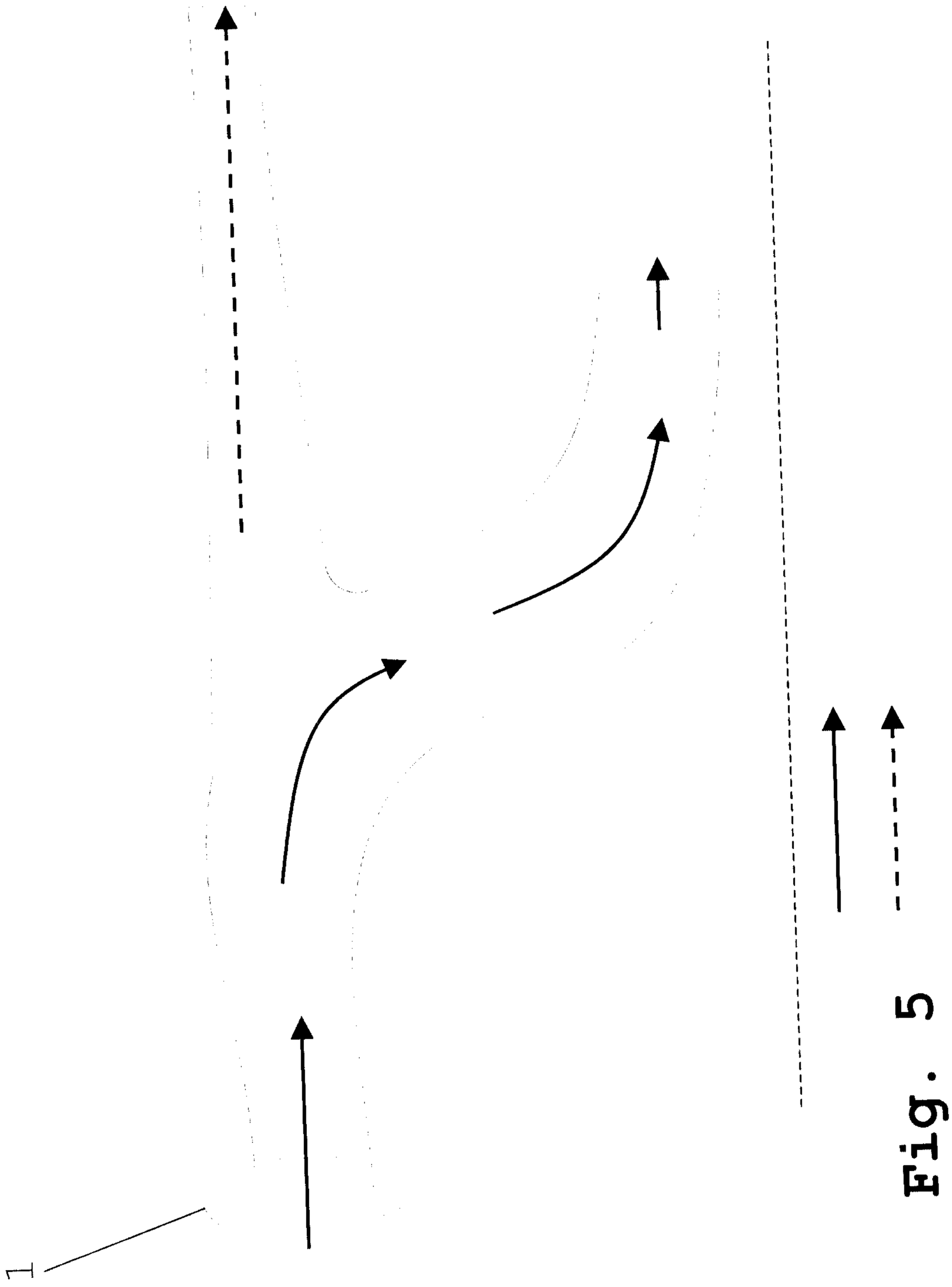
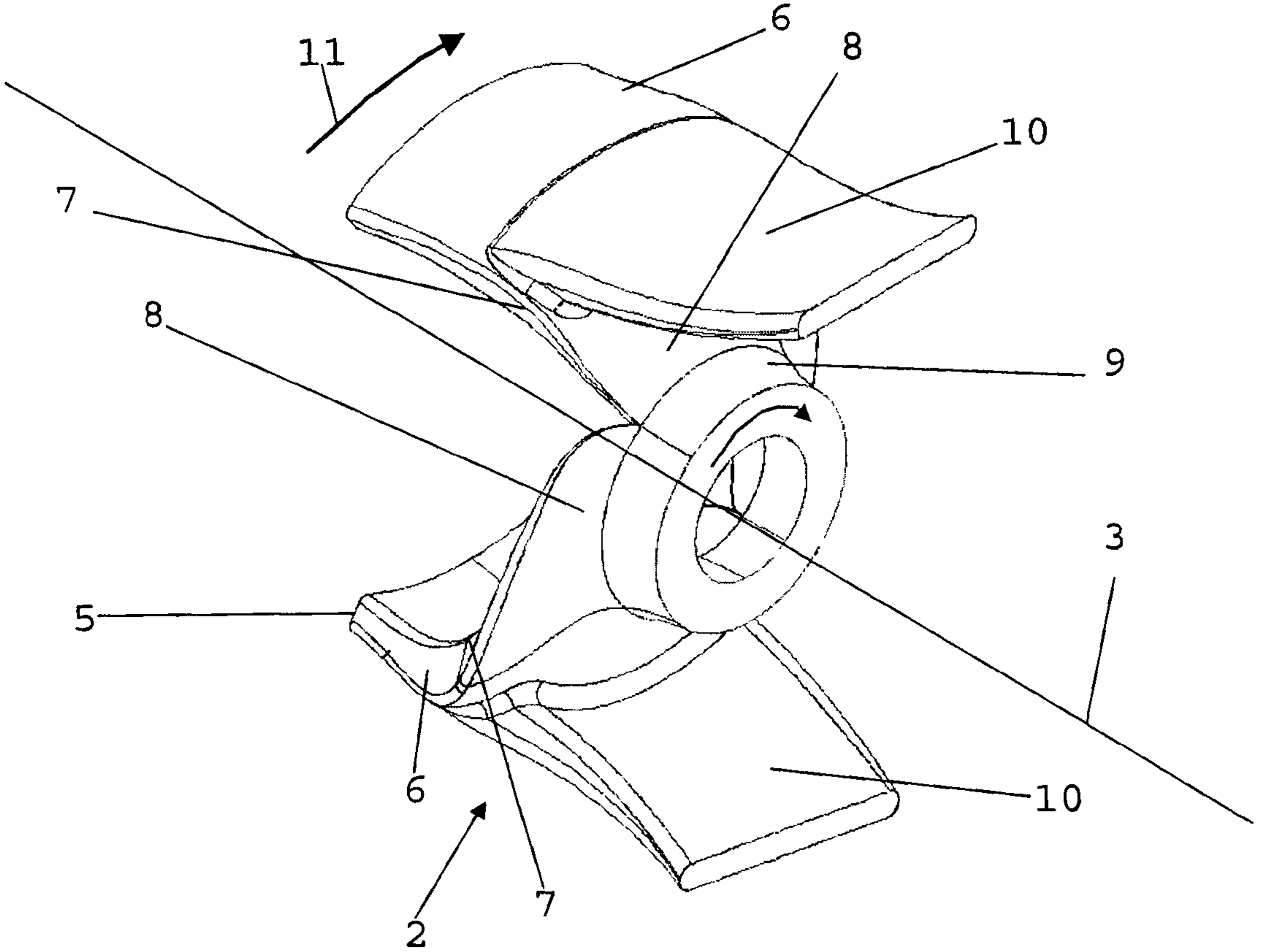


Fig.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