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(71) Applicant: **BORGWARNER INC.** [US/US]; Patent Department, 3850 Hamlin Road, Auburn Hills, Michigan 48326 (US).

(72) Inventors: **KREWINKEL, Robert**; Jeneverbes 20, NL-6467 Kerkrade (NL). **SCHERRER, Frank**; Ludwig-Richter-Str. 10, 67227 Frankenthal (DE).

(74) Agents: **PENDORF, Stephan, A.** et al.; Patent Central LLC, 1401 Hollywood Blvd., Hollywood, FL 33020 (US).

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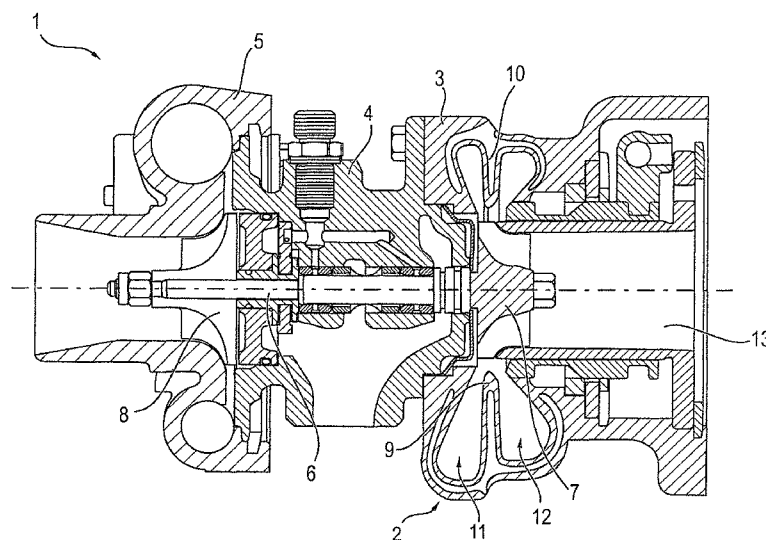


FIG. 1

(57) Abstract: The invention relates to an exhaust-gas turbocharger (1) with 2-channel turbine inflow, comprising a housing (2), a shaft (6) mounted in the housing (2), a compressor wheel (8) arranged on the shaft (6) and a turbine wheel (7) arranged on the shaft (6), a first and a second inflow duct (11, 12) formed in the housing (2), wherein both inflow ducts (11, 12) open in the direction of the turbine wheel (7), and a partition (9) which separates the two inflow ducts (11, 12) from one another, characterized by at least one water-cooling duct (10) in the interior of the partition (9).

## EXHAUST-GAS TURBOCHARGER

## DESCRIPTION

5           The invention relates to an exhaust-gas turbocharger according to the preamble of claim 1.

          Known from the prior art are exhaust-gas turbochargers in which a 2-channel exhaust-gas supply arrangement is formed in the turbine housing. This is also referred to as a 2-channel turbine inflow or a twin-scroll design. The 2-channel inflow has a  
10   thin-walled partition for dividing the gas-conducting spiral into the two inflow ducts. Hot exhaust gas flows around said partition at both sides, and said partition projects radially into the immediate vicinity of the turbine wheel inlet in order to attain the best possible separation effect. Very fast heating of the partition thus occurs, such that  
15   Said effect results, in part, in extreme stresses in the partition, which in turn can lead to distortion and cracks as a result of the cyclic loading.

          It is an object of the present invention to provide an exhaust-gas turbocharger which, while being inexpensive to produce and operable with low maintenance, permits an operationally reliable 2-channel turbine inflow.

20           The object is achieved by the features of claim 1. The dependent claims relate to advantageous developments of the invention.

          It is provided according to the invention that a water-cooling arrangement is integrated into the interior of the partition. The water-cooling arrangement in the partition which is surrounded at both sides by hot gas leads to a slowed expansion and  
25   a reduction of the overall expansion in the partition. As a result of the reduction of the material temperature in the turbine housing, it is possible to use an inexpensive material (for example GJV or aluminum). In this way, it is possible to attain a significant cost reduction in relation to conventional steel housings.

          The two inflow ducts extend in the housing from an exhaust-gas inlet to the  
30   mouth thereof at the turbine wheel. The two inflow ducts are separated by the partition over this entire length. It is preferably provided that the cooling duct is formed in the interior of the partition also over this entire length in order to effectively prevent excessive heating of the partition.

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In certain types of exhaust-gas turbochargers, wastegate ducts branch off from the inflow ducts. Said wastegate ducts lead, bypassing the turbine wheel, directly into an exhaust-gas outlet of the turbocharger. It is preferable for a separate wastegate duct to be provided for each of the two inflow ducts. Said two wastegate ducts must also be separated from one another. It is therefore preferable for the partition to extend in  
5 between said two wastegate ducts. To achieve effective cooling here, the water-cooling duct is also provided in the interior of the partition between the two wastegate ducts.

The two inflow ducts and the partition must be dimensioned and positioned such that the water-cooling duct can be formed in the interior of the partition. For  
10 thermodynamic reasons, it is preferably provided that the partition and therefore also the water-cooling duct, as viewed in cross section, taper in the direction of the shaft. Said cross section is defined in a plane which runs parallel through the shaft. In particular, for the definition of the tapering, the width of the partition is measured. Said width is measured along a line parallel to the shaft. Here, the width is measured only  
15 where said line intersects both the first and also the second inflow duct. It is specifically at these points that the partition can be clearly identified and distinguished from the other housing components. It is preferable for the width of the partition to decrease from the outside to the inside by at least 20%, preferably at least 30%. As a result of the tapering defined in this way, adequate installation space for the water-  
20 cooling duct is provided.

Further details, advantages and features of the present invention become apparent from the following description of the exemplary embodiment with reference to the drawing, in which:

figure 1 shows an exhaust-gas turbocharger according to the invention as per an  
25 exemplary embodiment,

figure 2 shows a detail from figure 1,

figure 3 shows a water core of the water-cooling arrangement of the exhaust-gas turbocharger according to the invention as per the exemplary embodiment,

figure 4 shows a gas flow core of the exhaust-gas turbocharger according to the  
30 invention as per the exemplary embodiment, and

figure 5 is an enlarged illustration of figure 2.

An exemplary embodiment of the exhaust-gas turbocharger 1 will be described in detail below on the basis of figures 1 to 5.

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Figure 1 shows, in a simplified schematic illustration, a section through the entire exhaust-gas turbocharger 1. The exhaust-gas turbocharger 1 comprises a housing 2. Said housing 2 is assembled from a turbine housing 3, a bearing housing 4 and a compressor housing 5. A shaft 6 is mounted in the housing 2. A turbine wheel 7 and a compressor wheel 8 are seated in a rotationally conjoint manner on the shaft 6. The turbine wheel 7 is impinged on by flow of exhaust gas and thus sets the shaft 6 and the compressor wheel 8 in rotation. Charge air for an internal combustion engine is compressed by means of the compressor wheel 8.

A first inflow duct 11 and a second inflow duct 12 are formed in the housing 2, in particular in the turbine housing 3. Said two inflow ducts 11, 12 constitute a 2-channel turbine inflow. The two inflow ducts 11, 12 are separated from one another by a partition 9. The partition 9 is an integral constituent part of the housing 2, in particular of the turbine housing 3. A water-cooling duct 10 is formed in the interior of the partition 9. Said water-cooling duct 10 of the partition 9 is fluidically connected to further water-cooling ducts for the housing 2.

The exhaust gas flows via the two inflow ducts 11, 12 to the turbine wheel 7 and exits the exhaust-gas turbocharger 1 via an exhaust-gas outlet 13.

Figure 2 shows a detail of the exhaust-gas turbocharger 1. The illustration shows a section through the turbine housing 3. For the sake of clarity, the shaft 6 and the turbine wheel 7 are not shown.

Figure 2 shows that a first wastegate duct 14 branches off from the first inflow duct 11. A second wastegate duct 15 likewise branches off from the second inflow duct 12. The two wastegate ducts 14, 15 constitute a direct connection, bypassing the turbine wheel 7, between the inflow ducts 11, 12 and the exhaust-gas outlet 13. The partition 9 and the water-cooling duct 10 formed in the interior of the partition 9 extend between the two wastegate ducts 14, 15.

The water supply to the water-cooling duct 10 takes place via a central water inflow duct 16. The discharge of the water takes place via a central water outflow duct 17. The central water inflow duct 16 and the central water outflow duct 17 are utilized for the water supply to the entire housing 2, in particular to the entire turbine housing 3. Secondary ducts 18 therefore branch off from the central water inflow duct 16 and central water outflow duct 17.

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Figure 3 shows the so-called "water core" for the exhaust-gas turbocharger 1. The geometry illustrated in figure 3 is, in the finished exhaust-gas turbocharger 1, a water-filled cavity. The "water core" illustrated in figure 3 may thus be regarded as part of a casting mold for the housing 2. Figure 3 shows the central water inflow duct 16 at the bottom and the central water outflow duct 17 at the top. It is particularly preferable for the water to be supplied from below and discharged at the top, such that any bubbles and air inclusions can exit the water-cooling arrangement. From the central water outflow duct 17 there branches off at least one secondary duct 18 which leads directly into the water-cooling duct 10 in the partition 9. A continuous and low-loss flow through all of the water-cooling ducts is thereby ensured.

The central water inflow duct 16 and the central water outflow duct 17 can be distinguished from the secondary ducts 18 in that the secondary ducts 18 have a smaller diameter than the central water inflow duct 16 and the central water outflow duct 17.

Figure 4 shows a so-called "gas flow core". The geometry illustrated in figure 4 is, in the finished exhaust-gas turbocharger 1, a cavity in which the exhaust gas flows. It can be seen how the two inflow ducts 11, 12 run parallel and approach the turbine wheel 7 in spiral form. The partition 9 with its water-cooling arrangement 10 is formed over the entire length of the two inflow ducts 11, 12.

Figure 5 is an enlarged view from figure 2. In figure 5, the position of the shaft 6 is indicated. The width of the partition 9 is measured parallel to the shaft 6. Reference sign 19 denotes a first width of the partition 9. Reference sign 20 denotes a second width of the partition 9. The partition 9 is defined at least between said two widths 19, 20. The two widths 19, 20 are measured on lines, wherein said lines are arranged parallel to the shaft 6 and intersect both the first inflow duct 11 and also the second inflow duct 12. The second width 20 is at least 20% shorter than the first width 19. In this way, adequate tapering of the partition 9, or an adequate spacing of the two inflow ducts 11, 12 in the region of the first width 19, is provided in order to allow the water-cooling arrangement 10 to be positioned in the interior of the partition 9.

In addition to the above written description of the invention, reference is hereby explicitly made to the diagrammatic illustration of the invention in figures 1 to 5 for additional disclosure thereof.

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## LIST OF REFERENCE SIGNS

	1	Exhaust-gas turbocharger
	2	Housing
5	3	Turbine housing
	4	Bearing housing
	5	Compressor housing
	6	Shaft
	7	Turbine wheel
10	8	Compressor wheel
	9	Partition
	10	Water-cooling duct in the interior of the partition
	11	First inflow duct
	12	Second inflow duct
15	13	Exhaust-gas outlet
	14	First wastegate duct
	15	Second wastegate duct
	16	Central water inflow duct
	17	Central water outflow duct
20	18	Secondary ducts
	19	First width
	20	Second width

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## CLAIMS

1. An exhaust-gas turbocharger (1) with 2-channel turbine inflow, comprising

- 5           - a housing (2),  
          - a shaft (6) mounted in the housing (2),  
          - a compressor wheel (8) arranged on the shaft (6) and a turbine wheel (7) arranged on the shaft (6),

- a first and a second inflow duct (11, 12) formed in the housing (2),  
10 wherein both inflow ducts (11, 12) open in the direction of the turbine wheel (7), and  
          - a partition (9) which separates the two inflow ducts (11, 12) from one another,

characterized by

- at least one water-cooling duct (10) in the interior of the partition (9).  
15

2. The exhaust-gas turbocharger as claimed in claim 1, wherein the partition (9) is an integral constituent part of the housing (2).

3. The exhaust-gas turbocharger as claimed in one of the preceding claims,  
20 wherein the two inflow ducts (11, 12) begin at an exhaust-gas inlet on the housing (2) and approach the turbine wheel (7) in spiral form, wherein the partition (9) is formed over the entire length of the two inflow ducts (11, 12).

4. The exhaust-gas turbocharger as claimed in claim 3, wherein the water-cooling duct (10) is formed in the interior of the partition (9) over the entire length of the partition (9).  
25

5. The exhaust-gas turbocharger as claimed in one of the preceding claims, characterized by a first wastegate duct (14), which branches off from the first inflow duct (11), and a second wastegate duct (15), which branches off from the second inflow duct (12), wherein the partition (9) is continued between the two wastegate ducts (14, 15).  
30

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6. The exhaust-gas turbocharger as claimed in claim 5, wherein the water-cooling duct (10) is formed between the two wastegate ducts (14, 15) in the interior of the partition (9).

5 7. The exhaust-gas turbocharger as claimed in one of the preceding claims, wherein, in a cross section defined parallel through the shaft (6), the partition (9) and the water-cooling duct (10) taper in the direction of the shaft (6).

10 8. The exhaust-gas turbocharger as claimed in claim 7, wherein, in the cross section, the width (19, 20) of the partition (9), defined parallel to the shaft (6), decreases by at least 20%, preferably at least 30%.

15 9. The exhaust-gas turbocharger as claimed in one of the preceding claims, wherein the water-cooling duct (10) of the partition (9) is fluidically connected to further water-cooling ducts in the housing (2).

20 10. The exhaust-gas turbocharger as claimed in claim 9, characterized by a central water outlet duct (17) on the housing (2) and a plurality of secondary ducts (18) which issue into the central water outlet duct (17), wherein one of the secondary ducts (18) directly connects the water-cooling duct (10) in the interior of the partition (9) to the central water outlet duct (17).



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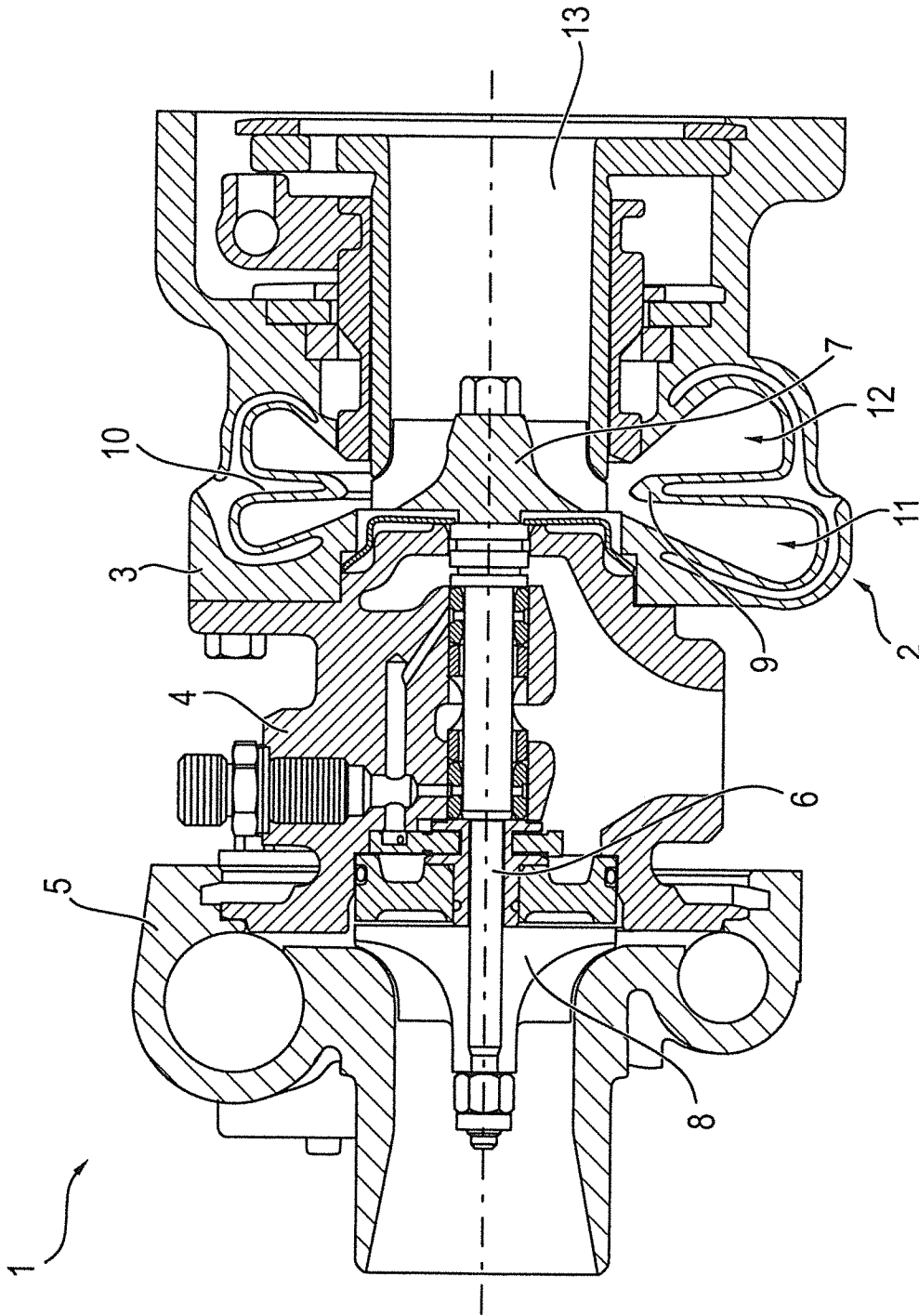


FIG. 1

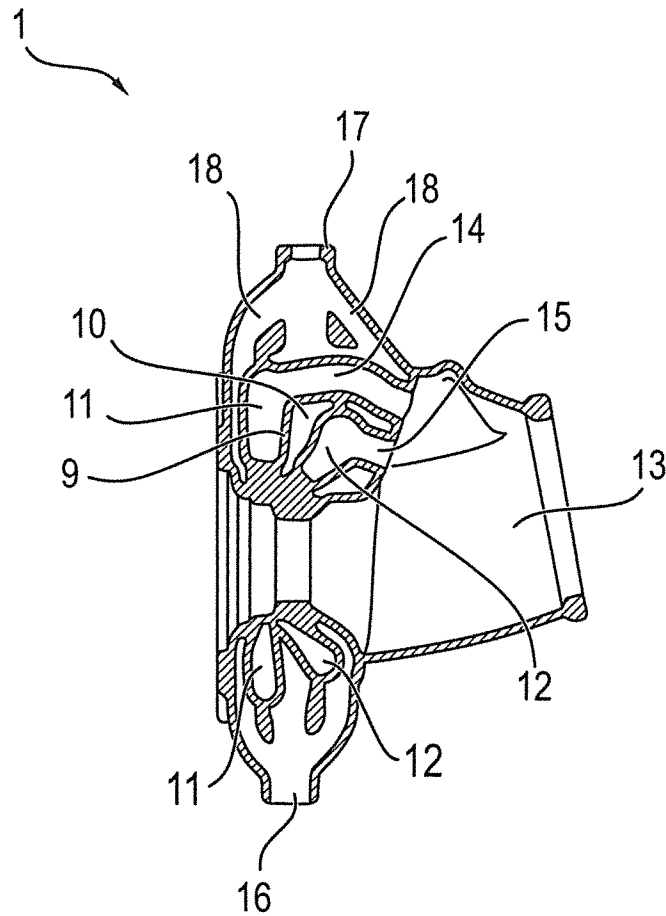
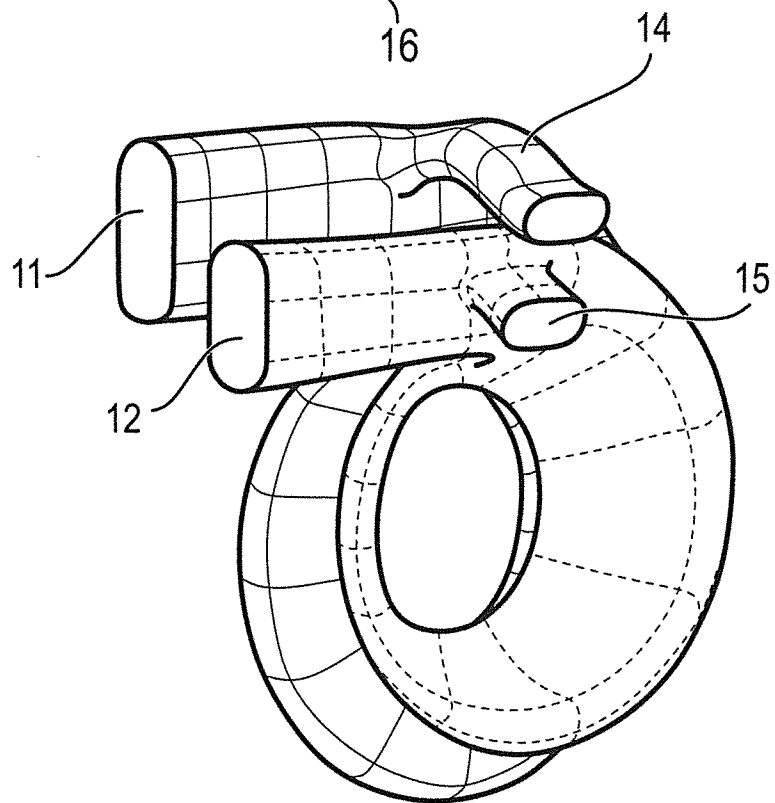
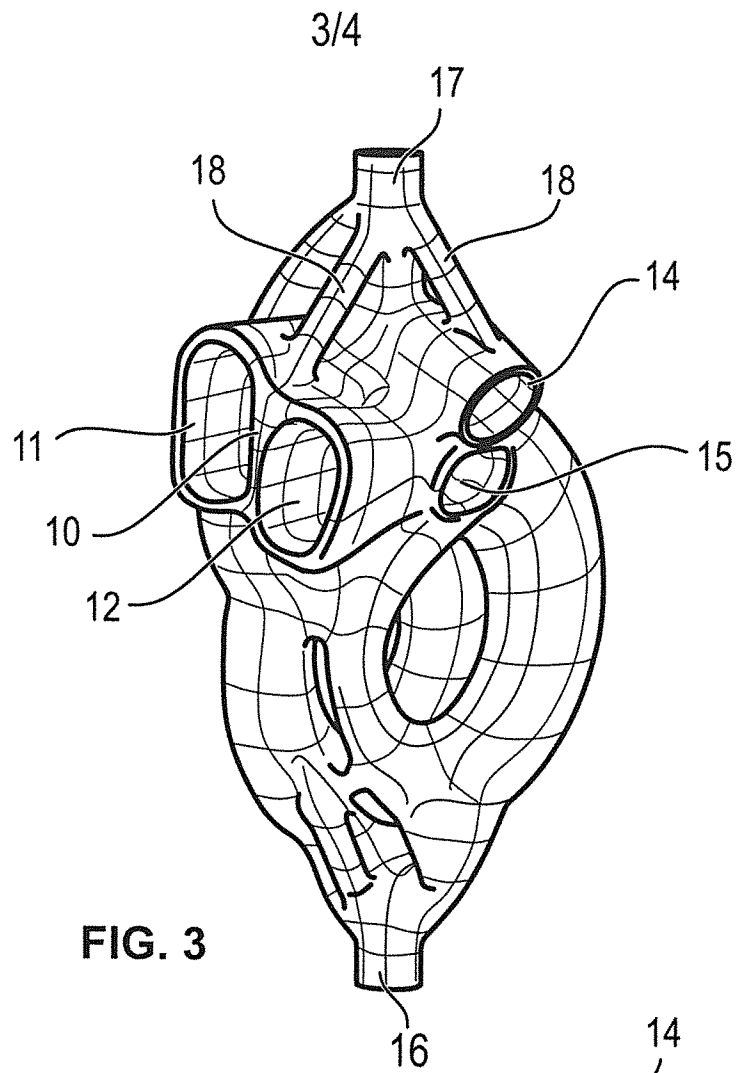


FIG. 2



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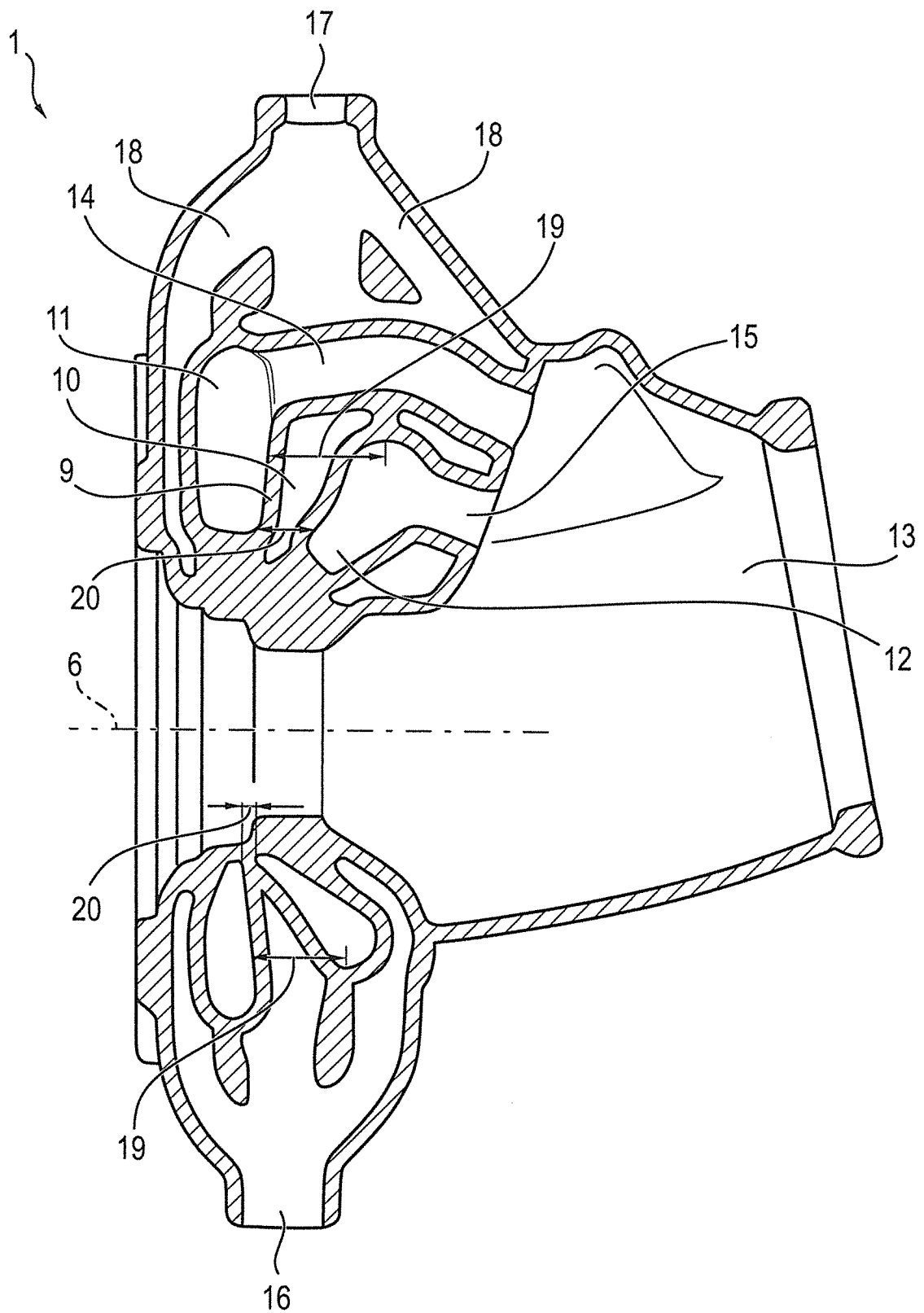


FIG. 5