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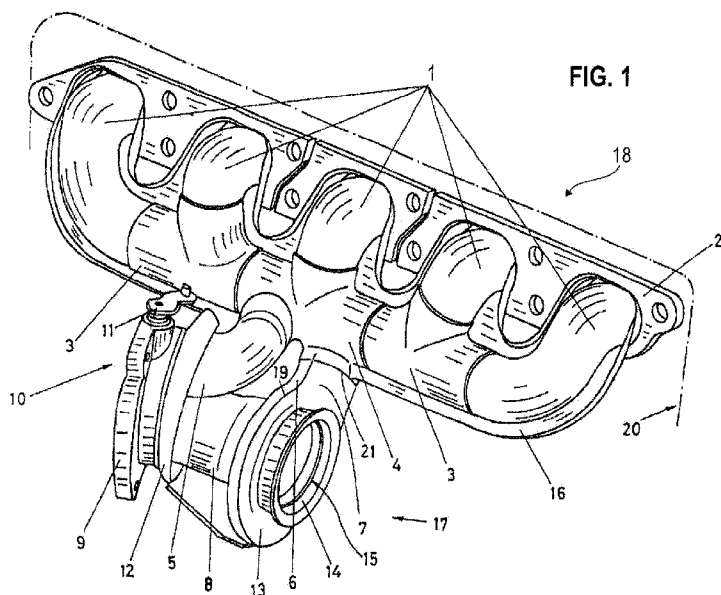
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[Continued on next page]

(54) Title: EXHAUST MANIFOLD OF AN INTERNAL COMBUSTION ENGINE



(57) Abstract: The invention relates to an exhaust manifold (18) of an internal combustion engine (20), with a number of exhaust pipe bends (1) corresponding to the number of cylinders of the internal combustion engine (20), said exhaust pipe bends being brought together at one end into an input flange (2) which can be fastened to the internal combustion engine (20), and being brought together at the other end; with a supply gas duct (21) which is connected at one end to a collector component (4) and at the other end to a rotor space (15) of a turbine housing (17) of a turbine of an exhaust-gas turbocharger; and with at least one compensator (19) for compensating for thermal stresses in at least one exhaust pipe bend (1) and the supply gas duct (21), wherein the at least one compensator (19) is designed as a component which is integrated in at least one exhaust pipe component (1).



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EXHAUST MANIFOLD OF AN INTERNAL COMBUSTION ENGINE

DESCRIPTION

The invention relates to an exhaust manifold of an internal
5 combustion engine according to the precharacterizing clause of claim 1.

An exhaust manifold of this type is known from EP 1 426 557 A1.

A technical problem occurring in the case of exhaust manifolds of
this type is thermal expansion which occurs both between the exhaust pipe
bends themselves, but also between said pipe bends and a supply gas
10 duct of the turbine housing of an exhaust-gas turbocharger connected to
the exhaust manifold. This thermal expansion has to be compensated for in
order to avoid damage. If the exhaust manifold is designed as a double-
walled, air-gap-insulated (AGI) manifold, use is made as compensators
therefor of internal sliding fits which are not, however, gastight, since the
15 pipe components forming the sliding fits are merely plugged one inside
another, but are not welded in a gastight manner to one another. However,
the leakages which occur as a result at the inner pipes of the AGI manifold
smooth the exhaust pressure pulsations which are needed in the case of
twin scroll applications for better utilization of power and therefore for
20 increasing performance. Sliding fits at the connecting points result in the
volume surrounding the pipe components and being formed by the outer,
gastight casing being filled and emptied by the exhaust pressure
pulsations.

The composition of the exhaust mixture in said outer volume
25 changes, for example, with the degree of flushing of the cylinders with fresh
air.

It is therefore the object of the present invention to provide an
exhaust manifold of an internal combustion engine of the type specified in
the preamble of claim 1, making it possible, in particular if the manifold is
30 designed as a single-walled sheet-metal manifold, to provide a structurally
flexible, gastight configuration which can be produced cost effectively.

This object is achieved by the features of claim 1.

- 2 -

The following features in particular are included in the particular advantages of the solution according to the invention:

- gastight pipe connection;
- exhaust composition is not changed by mixing an additional
5 volume with gas. Better conditions for cylinder flushing as a result of increased valve overlapping;
- no efficiency losses as a result of internal leakage in the case of turbochargers with twin scroll applications;
- cost-neutral possibility of production in comparison to known
10 sliding fit embodiments;
- no construction space losses for the outer shell which is required in the case of standard AGI manifolds, and therefore the solution according to the invention is virtually identical in terms of fit to single-wall manifolds;
- 15 - cost saving on account of omitting the outer shell;
- unrestricted use of the advantages of sheet-metal manifold embodiments in comparison to cast manifolds, such as, for example, short heating time of the catalytic converter and corresponding emission and power advantages.

20 Since it is customary in the case of sheet-metal manifolds according to current standards frequently to use pipes formed by internal high pressure (IHP pipes), it is advantageously possible, by means of the integrated design of the compensator, to form the latter neutrally in terms of costs during the forming by internal high pressure.

25 The dependent claims contain advantageous developments of the invention.

In this connection, in particular the provision of a supporting sleeve should be mentioned, said supporting sleeve being placed loosely into the region of the compensator before the welding of the pipe components and
30 preventing sagging transversely with respect to the axial direction of compensation by absorbing the bending forces which occur.

- 3 -

In a particularly preferred embodiment, it is possible to fix the supporting sleeve on one side, for which purpose, for example, welding is possible.

Furthermore, a turbine housing according to the invention, which
5 constitutes a subject which can be treated independently, is defined in claims 15 and 16.

Further details, advantages and features of the present invention emerge from the description below of exemplary embodiments with reference to the drawing, in which:

10 Figure 1 shows a perspective illustration of the essential parts of an AGI exhaust manifold with a turbine housing of an exhaust-gas turbocharger (prior art);

Figure 2 shows a perspective illustration of an exhaust manifold according to the invention;

15 Figure 3 shows a sectional illustration through a pipe connection between the exhaust manifold and a connecting pipe to the turbine housing in order to clearly show the compensator according to the invention which is integrated into the pipe connection;

Figure 4 shows a sectional illustration through a pipe
20 connection between two exhaust pipe bends with the use of a second material layer.

Figure 1 shows a perspective view of an exhaust manifold 18 which is flange-mounted on an internal combustion engine 20 (indicated by a chain-dotted line) and is connected to a turbine housing 17 of an exhaust-
25 gas turbocharger (not illustrated in its entirety). The illustration of said parts suffices for the explanations below of the principles of the present invention, wherein it should be emphasized that the exhaust-gas turbocharger of course has all of the other customary design features, but which are not reproduced in figure 1 so as to simplify the illustration.

30 According to the embodiment illustrated in figure 1, the internal combustion engine 20 has five exhaust pipe bends 1 which lead to associated T exhaust pipes 3 and are connected thereto, and open into a

- 4 -

collector component 4 which is likewise designed as a T exhaust pipe, as revealed in detail in the graphical illustration of figure 1.

As explained, figure 1 merely shows an exemplary embodiment of an exhaust manifold, and therefore it is self-evident to a person skilled in the art that other types of exhaust manifold, in particular matched to the
5 the particular internal combustion engine, are also possible.

The exhaust manifold 18 illustrated in figure 1 corresponds to that of EP 1 426 557 A1 belonging to the applicant of the present application, and therefore the content of EP 1 426 557 A1 is hereby incorporated in its
10 entirety, by reference to this application, in the content of disclosure of the present application, since a compensator according to the invention, to be described below, can also be used in the case of this exhaust manifold.

Figure 1 shows in particular that the exhaust manifold 18 is connected to the collector component 4 via a supply gas duct 21. The
15 supply gas duct 21 is connected in terms of flow to a rotor space 15 of the turbine housing 7, with the rotor space 15 accommodating the turbine rotor (not illustrated specifically in figure 1).

Figure 2 shows the single-walled exhaust manifold according to the invention with pipe bends 1 together with compensators 19' and the turbine
20 housing 17.

The use of the at least one compensator 19' in at least one pipe bend 1 is provided in this case. After all of the pipe bends 1 have been brought together, the arrangement of an additional compensator 19' in a connecting conduit 27 to the turbine housing 17 is possible, but not
25 necessary.

In order to compensate for the thermal expansions, the exhaust manifold according to the invention has a compensator 19' which is illustrated in detail in the sectional illustration of figure 3.

For this purpose, figure 3 shows a pipe portion 4' of the pipe component 4 together with the compensator 19' which is designed as an
30 integral component of said pipe component 4'.

As the sectional illustration of figure 3 shows, the compensator 19' is designed as a compensator bellows 22 which, in the case of the example,

- 5 -

comprises four bellows parts 22a-22d. It goes without saying that the number of bellows parts can be varied depending on the application in order to be able to correspondingly compensate for thermal expansions which differ under some circumstances from case to case. As emerges
5 from figure 3, the compensator 19' is an axial compensator which, in the case of the example, compensates for distortions between the pipe portion 4' and the supply gas duct 21. It should be mentioned that, in terms of principle, such a compensator 19' can likewise be used between the other pipe connection portions of the exhaust manifold 18.

10 The particular advantage of the integrated design of the compensator 19' is that it is now possible, according to the embodiment illustrated in figure 3, to weld the pipe portion 4' and the supply gas duct 21 to each other in a gastight manner, for which purpose a welded pipe joint 25 is provided.

15 In order, furthermore, to prevent sagging transversely with respect to the axial extent of the arrangement illustrated in figure 3, said particularly preferred embodiment furthermore has a supporting sleeve 23 which, as shown in figure 3, is arranged within the pipe connection in the region of the compensator 19'. Said supporting sleeve can be placed loosely into the
20 arrangement during the course of the assembly and, if the need arises, can be fixed, for example at the welding point 24, to the pipe portion 4', with an inner sliding fit being produced at the point marked by the reference number 26.

Although, in the case of the particularly preferred embodiment
25 illustrated in figure 3, a compensator bellows is illustrated as the compensator structure, other compensator structures are in principle also conceivable if they permit a gastight connection between the pipe components which are connected to one another.

Although, according to the particularly preferred embodiment of
30 figure 3, the compensator 19' is an integral component of the pipe portion 4', it is also conceivable in principle to design the compensator 19' as an integral component of the supply gas duct 21.

- 6 -

It is also possible in principle to design the compensator 19' as a separate component which is an integral part of an intermediate pipe component which is then connected in a gastight manner at one of its ends to the exhaust manifold 18, such as, for example, the pipe portion 4', and at
5 the other end to the supply gas duct 21 of the turbine housing 17.

Figure 4 shows, in the form of a sectional image, the use of a plurality of material layers in the region of the compensator 19'. During the formation of the expansion bellows geometry in the high pressure forming operation, further material layers (such as, for example, a second material
10 layer 28), which were placed loosely onto the inner pipe, are connected fixedly to one another by the forming operation and can therefore absorb increased forces.

In addition to the above written disclosure of the invention, reference is hereby explicitly made to the graphical illustration thereof in the figures.
15

- 7 -

List of reference numbers

	1	Exhaust pipe bend
	2	Input flange
5	3	T exhaust pipe
	4	Collector component
	4'	Pipe portion
	5	Bypass duct
	6	Left spiral half
10	7	Right spiral half
	8	Outlet duct
	9	Outlet flange
	10	Throttle plate
	11	Throttle lever
15	12	Outlet sheet
	13	Terminating sheet
	14	Bearing housing flange
	15	Rotor space
	16	Lower cover
20	17	Turbine housing
	18	Exhaust manifold
	19	Welded seam between 6 and 7
	19'	Compensator
	20	Internal combustion engine
25	21	Supply gas duct
	22	Compensator bellows
	22a-22d	Expansion bellows portions
	23	Supporting sleeve
	24	Welding point
30	25	Pipe weld
	26	Inner sliding fit
	27	Connecting conduit
	28	Second material layer

CLAIMS

1. An exhaust manifold (18) of an internal combustion engine (20),
5 - with a number of exhaust pipe bends (1) corresponding to the number of cylinders of the internal combustion engine (20), said exhaust pipe bends opening at one end into an input flange (2) which can be fastened to the internal combustion engine (20), and being brought together at the other end;
- 10 - with a supply gas duct (21) which is connected at one end to a collector component (4) and at the other end to a rotor space (15) of a turbine housing (17) of a turbine of an exhaust-gas turbocharger; and
- with at least one compensator (19') for compensating for thermal stresses between the at least one exhaust pipe bend (1) and the
15 supply gas duct (21), characterized
- in that the at least one compensator (19') is designed as a component which is integrated in at least one exhaust pipe bend (1).
2. The exhaust manifold as claimed in claim 1, characterized in
20 that the compensator (19') is designed as a compensator bellows (22).
3. The exhaust manifold as claimed in claim 1 or 2, characterized in that the supply gas duct (21) and the collector component (4) are welded to each other.
25
4. The exhaust manifold as claimed in claim 1, characterized in that at least the exhaust pipe bends (1) together with the compensator (19') are designed as pipes formed by internal high pressure.
- 30 5. The exhaust manifold as claimed in claim 1, characterized in that the compensator (19') is provided with a supporting sleeve (23).

- 9 -

6. The exhaust manifold as claimed in claim 5, characterized in that the supporting sleeve (23) is arranged within the compensator (19').

7. The exhaust manifold as claimed in claim 6, characterized in that the supporting sleeve (23) is placed loosely within the compensator (19').

8. The exhaust manifold as claimed in claim 5, characterized in that the supporting sleeve (23) is fixed at one of its ends to an exhaust pipe bend (1).

9. The exhaust manifold as claimed in claim 1, characterized in that the compensator (19') is provided with at least two sheet-metal layers.

10. The exhaust manifold as claimed in claim 7, characterized in that the supporting sleeve (23) is welded at one of its ends to the collector component (4).

11. The exhaust manifold as claimed in claim 1, characterized in that the exhaust pipe bends (1) are surrounded by a heat protection sheet.

12. The exhaust manifold as claimed in claim 1, characterized in that the exhaust pipe bends (1) are surrounded in a non-gastight manner by the heat protection sheet.

13. The exhaust manifold as claimed in claim 1, characterized in that a twin scroll turbine housing is used.

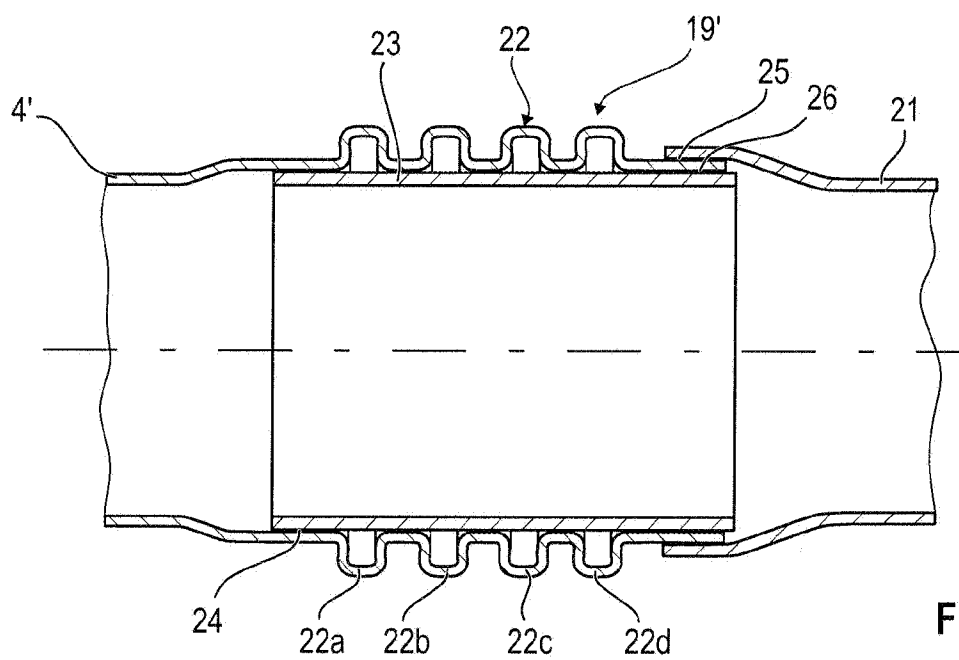
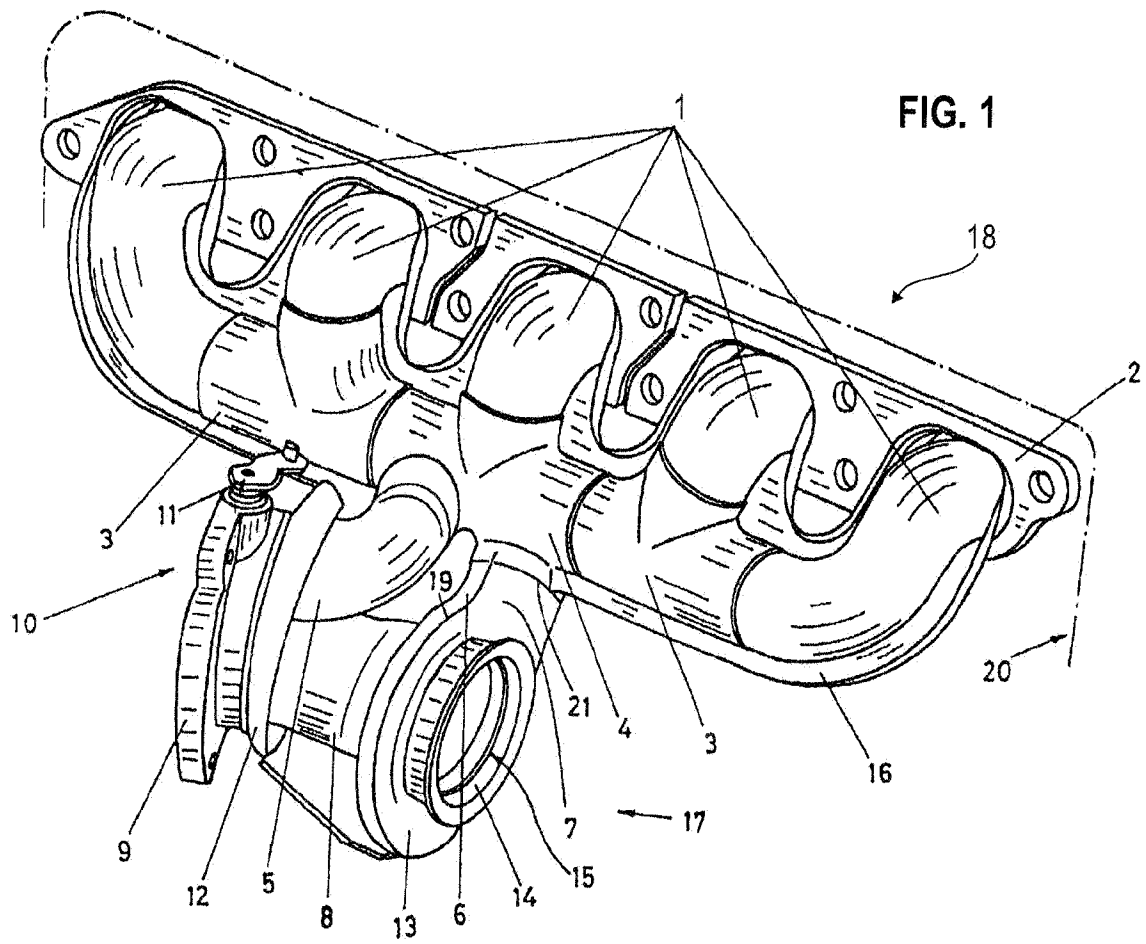
14. The exhaust manifold as claimed in claim 1, characterized in that a single-flow turbine housing is used.

15. A turbine housing (17) of an exhaust-gas turbocharger, which is provided with an exhaust manifold (18) as claimed in claim 1.

- 10 -

16. A turbine housing (17) of an exhaust-gas turbocharger,
- with a supply gas duct (21) which is connected in terms of
flow to a rotor space (15) of a turbine rotor, characterized
5 - by a compensator (19') as claimed in at least one of the
characterizing features of claims 1 to 14.

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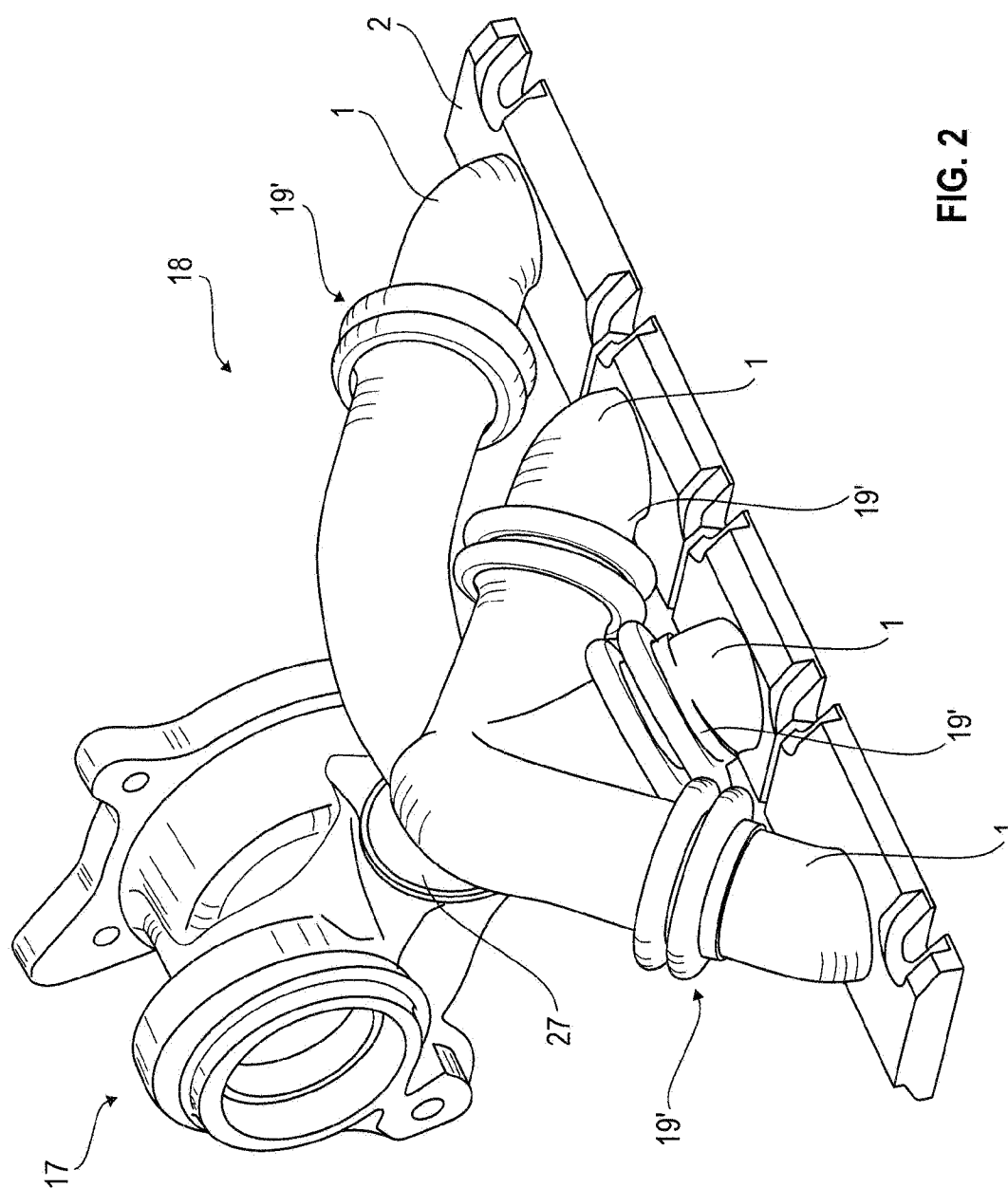


FIG. 2

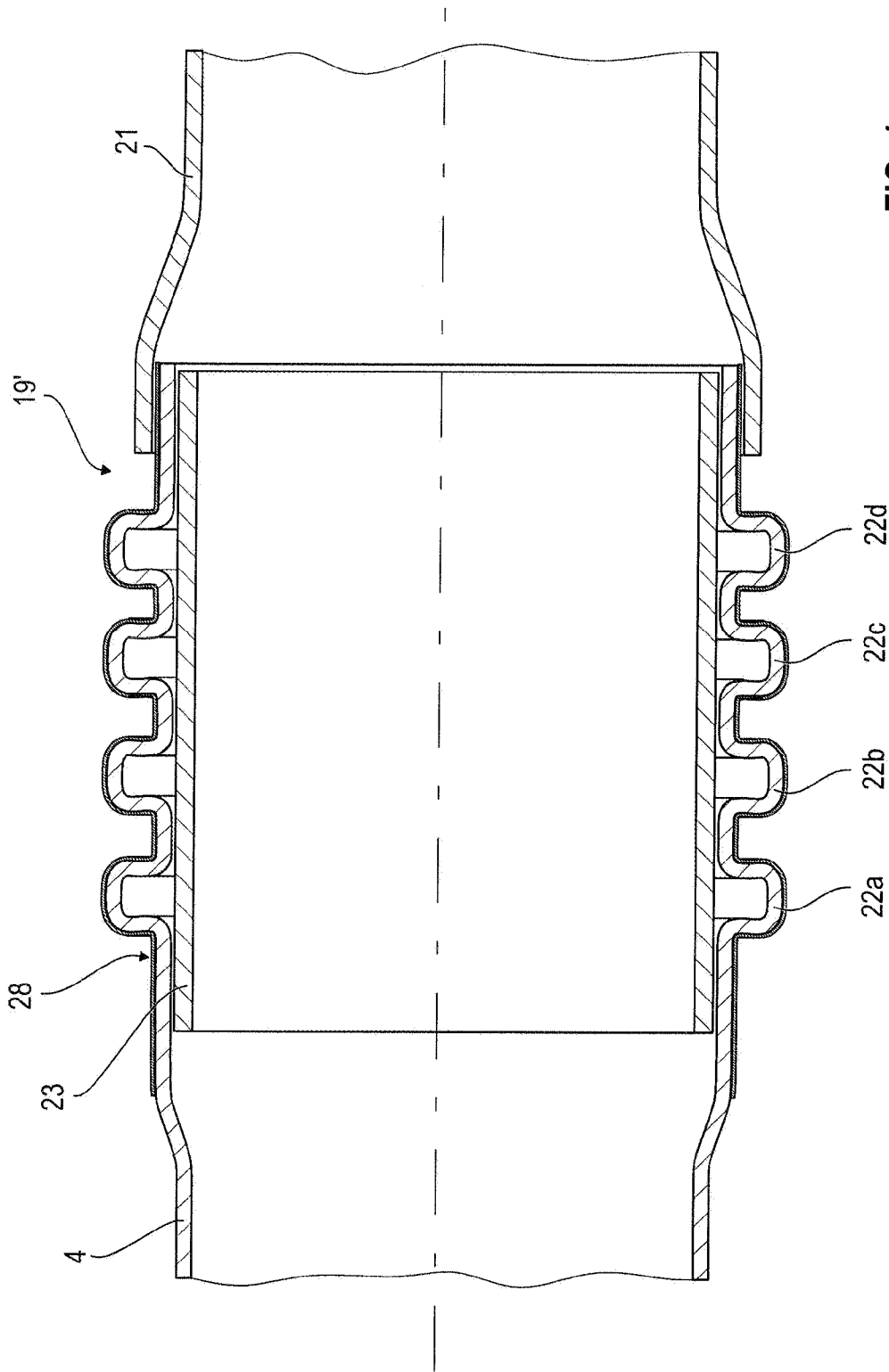


FIG. 4