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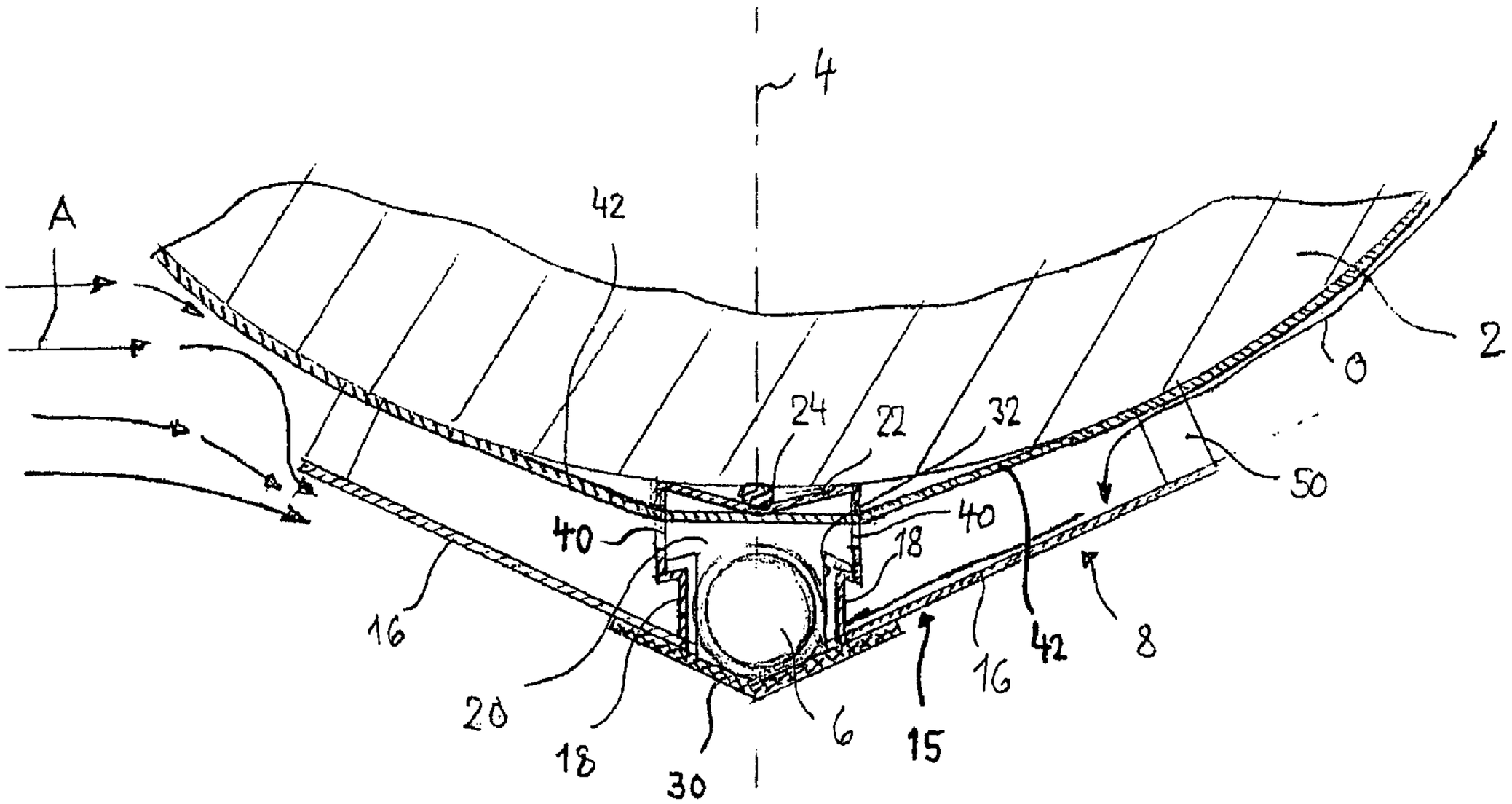
(54) Titre : CONFIGURATION PERMETTANT LA SURVEILLANCE D'UNE CONDUITE POUR LES PIPELINES SERVANT AU TRANSPORT DES LIQUIDES

(54) Title: LEAK MONITORING CONFIGURATION FOR LIQUID TRANSPORT PIPELINES



(57) Abrégé/Abstract:
The invention relates to a line assembly for transporting a liquid (0), in particular crude oil. Said line assembly comprises an over-ground pipeline (2) below which a sensor line (6) is arranged in order to detect a leak, said sensor line extending along the pipeline (2) in the longitudinal direction thereof. According to the invention, said sensor line (6) is arranged in a collecting container (8), in the deepest point thereof, that also extends along said pipeline and is fixed to the pipeline (2), and the lateral edges (10) of said collecting container extending in the longitudinal direction are at a distance to the outer surface (12) of the pipeline (2). Means for reducing an air flow (A) passing transversally to the longitudinal direction of the pipeline, between the collecting container (8) and the outer surface (12) of the pipeline (2), are arranged inside the collecting container (8).

Abstract

The invention relates to a line assembly for transporting a liquid (0), in particular crude oil. Said line assembly comprises an over-ground pipeline (2) below which a sensor line (6) is arranged in order to detect a leak, said sensor line extending along the pipeline (2) in the longitudinal direction thereof. According to the invention, said sensor line (6) is arranged in a collecting container (8), in the deepest point thereof, that also extends along said pipeline and is fixed to the pipeline (2), and the lateral edges (10) of said collecting container extending in the longitudinal direction are at a distance to the outer surface (12) of the pipeline (2). Means for reducing an air flow (A) passing transversally to the longitudinal direction of the pipeline, between the collecting container (8) and the outer surface (12) of the pipeline (2), are arranged inside the collecting container (8).

30146-33

Description

LEAK MONITORING CONFIGURATION FOR LIQUID TRANSPORT PIPELINES

The invention relates to a line assembly for transporting a liquid, in which the liquid, in particular crude oil, is transported in an above-ground pipeline.

In above-ground, e.g. crude-oil conveying pipelines, the occurrence of a leak can lead to serious environmental damage.

In order to be able to detect even small leaks as early as possible and also determine their location, therefore, it is known, e.g. from DE 43 34 550 A1, to place a sensor device under a pipeline of this type - in the 6 o'clock position - with which it is possible to detect product liquid escaping from the pipeline and to simultaneously measure the location of the leak. In this known device, an angle section is placed under the pipeline, said angle section serving as a collecting channel for the liquid escaping from the pipeline in the case of a leak, and in which the sensor device, an electric sensor cable in the known device, is placed.

A sensor device or sensor line suitable for use in such pipelines is known, for example, from EP 0 175 219 B1 and consists of a carrier pipe which is provided with a permeable layer on its outer surface through which a substance escaping from a leak in the pipeline into the environment of the sensor line and which is to be detected is able to diffuse. The carrier pipe is impermeable to this substance. Its wall is provided with openings, so that the substance passing through the permeable layer can reach inside the sensor line through these openings. A sensor line of this type is also called a collecting line. The location at which the substance has penetrated into the sensor line is then detected with a method

known from DE 24 31 907 C3. This location corresponds to the point at which the substance escaped from the monitored pipeline. In this known method, by means of a pump attached to the sensor line, the substance which has penetrated into the sensor line is conveyed together with a carrier gas found in the sensor line to a test data recorder also attached to the sensor line and with which the substance found in the carrier gas can be detected. In known flow velocities, the location at which the substance penetrates into the sensor line can be determined from the time interval between switching the pump on and the arrival of the substance at the data recorder and, consequently, the location of the leak on the pipeline.

To detect and locate leaks in pipelines, alternatively or in addition to the aforementioned permeable sensor line (collecting line) conveying a carrier gas, it is known e.g. from DE 195 35 399 A1 or DE 101 16 496 A1 to use an optical waveguide as sensor line, the transmission properties of which can be locally altered, either directly by the substance escaping from the pipeline or by a thermal effect generated when the substance escapes into the environment.

However, when monitoring leaks on above-ground pipelines, in particular in environments in which strong winds often occur, it has been found to be a problem that the liquid escaping from the pipeline and flowing downward along its outer periphery, especially if these are small amounts, can not be detected with sufficient certainty with a sensor line located underneath the pipeline.

Therefore, some embodiments of the invention may provide a line assembly for transporting a liquid, in particular crude oil, with an above-ground pipeline and a sensor line placed below it, in which the detection of a leak at a distance from the sensor line,

even in small leakage amounts, is improved.

According to an aspect of the invention, there is provided a line assembly for transporting a liquid, including crude oil, the line assembly comprising: an above-ground pipeline, having an outer surface and a longitudinal direction; a collecting container below the pipeline, extending along the pipeline and fixed to the pipeline, lateral edges of the collecting container extending in the longitudinal direction and at a distance from the outer surface of the pipeline; and a sensor line arranged for detecting a leak, said sensor line extending along the pipeline in the longitudinal direction, in a deepest part of the collecting container; wherein means for reducing an air flow passing transversely to the longitudinal direction of the pipeline, is arranged inside the collecting container between the collecting container and the outer surface of the pipeline.

According to these features, to detect a leak, a sensor line is arranged below the pipeline, said sensor line extending along the pipeline in its longitudinal direction thereof and is located in a collecting container, in the deepest point thereof, that also extends along said pipeline and is fixed to the pipeline, and the lateral edges of said container extending in longitudinal direction at a distance from the outer surface of the pipeline.

The invention is based on the realization that the problems when detecting small leakage amounts escaping from the pipeline outside of the 6 o'clock position can primarily be attributed to the fact that the liquid flowing downward along the outer surface of the pipeline drips off the pipeline before it reaches the sensor line located below the pipeline in a 6 o'clock position and wets it.

By using a collecting container in which the sensor line is arranged and which extends along the pipeline, the lateral edges thereof extending in longitudinal direction at a distance from the outer wall of the pipeline, the liquid coming off from

the outer surface of the pipeline drips into the collecting container and flows off into it toward the deepest point at which the sensor line is located.

The dimensions of the collecting container diagonally to the longitudinal direction of the pipeline are thereby essentially determined by the physical properties of the outer surface of the pipeline and the liquid to be detected, i.e. its flow and adhesive properties, which determine the separation position of the liquid running downward on the surface of the pipeline.

The distance of the lateral edges of the collecting container from the outer surface of the pipeline must also be adapted to the physical properties of pipeline and liquid to ensure that the liquid flowing along the outer surface of the pipeline flows into the space formed between pipeline and collecting container and does not drip off the edge.

It is thus obtained with the features according to the invention that the liquid escaping from the pipeline during a leak outside of the 6 o'clock position also comes into contact with the sensor line when there are small leak flows and, consequently, can be reliably detected.

Since, moreover, means are provided for reducing an air flow extending between the collecting container and the outer surface of the pipeline diagonally to its longitudinal direction, it is possible to detect leaks which occur on the side of the pipeline facing away from the wind (lee side) during a strong wind, as a clearly reduced air flow can occur along the underside of the pipeline. That is, a pronounced air flow within the collecting container diagonally to the longitudinal direction of the pipe would lead thereto that, during strong crosswinds on the lee side, the separation point or the separation edge can be driven into a zone which is outside of the collecting container due to the air flowing out of the collecting container between the leeward edge and the pipeline. Means of this type include all practical measures which reduce the flow resistance for a cross flow occurring within the collecting container, for example deflector vanes extending into the interior of the collecting container, spaced in longitudinal direction and staggered vis-à-vis one another in transverse direction. In other words: flow obstacles arranged inside the collecting container which are designed and arranged in such a manner that they do not hinder transport of the

liquid escaping during the leak into the deepest point of the collecting container.

In an advantageous embodiment of the invention, a channel extending in longitudinal direction is provided in the collecting container for accommodating the sensor line. This enables a defined positioning of the sensor line inside the collecting container.

In particular, the channel has essentially vertically extending side walls which are provided with openings and divide the collecting container into two zones arranged symmetrically to the vertical mid plane of the pipeline, which convey the liquid escaping from the pipeline during a leak to the channel, so that it reaches through the openings to the sensor line. Due to these side walls, a high flow resistance is generated transversely to the longitudinal direction which significantly reduces the extent of a cross flow in the space between collecting container and pipeline.

An especially high flow resistance is obtained when the channel adjoins the pipeline. For this purpose, in an especially preferred embodiment of the invention, a sealing element extending in longitudinal direction of the pipeline is inserted between a base of the channel and the outer surface of the pipeline.

When the collecting container is fastened to the pipeline with a clamping band surrounding said pipeline which is preferably led through recesses in the side wall of the channel, a simple and secure additional mounting of the collecting container on an already existing pipeline is made possible.

In an especially advantageous embodiment of the invention, the channel is formed by a U-shaped form in the collecting container which is open at the bottom and sealed with a base part on its

underside which is fixed to the collecting container with a locking connection. By means of this measure, in a first step, it is possible to mount the collecting container, which has not as yet been sealed with the base part, on the pipeline before the sensor line has been placed into the channel if the clamping band is led through the collecting container at a distance from the lower opening in the collecting container which is larger than the diameter of the sensor line. After the collecting container has been mounted, the sensor line can then be placed into the channel from the bottom which is then sealed by simply pressing against the base part and snapping it into position, so that the sensor line is then lodged in the channel in a defined manner.

In accordance with an aspect of the invention, there is provided a line assembly for transporting a liquid, including crude oil, with an above-ground pipeline below which a sensor line is arranged for detecting a leak, said sensor line extending along the pipeline in longitudinal direction thereof and in a collecting container, in the deepest point thereof, that also extends along said pipeline and is fixed to the pipeline, and lateral edges of said collecting container extending in a longitudinal direction are at a distance to outer surface of the pipeline, wherein means for reducing an air flow passing transversely to the longitudinal direction of the pipeline, between the collecting container and the outer surface of the pipeline, are arranged inside the collecting container.

To further illustrate the invention, reference is made to the example of an embodiment of the drawings, showing:

Fig. 1 a line assembly according to the invention in a schematic diagrammatic sketch,

Fig. 2 the line assembly according to the invention in the final assembled state in which the collecting container is fixed to the pipeline,

Fig. 3 the collecting container before it is mounted on the pipeline.

According to Fig. 1, the line assembly for transporting a liquid 0 comprises a pipeline 2, on the bottom of which a sensor line 6 is arranged in a 6 o'clock position, i.e. in the mid plane 4 which is vertical and parallel to the longitudinal direction of the pipeline 2, i.e. extending at a right angle to the drawing plane. The sensor line 6 is arranged inside a collecting container 8 which is almost V-shaped in cross section and arranged on the pipeline 2 and is there found at its deepest point. Between the lateral edges or periphery 10 of the collecting container 8 extending in

longitudinal direction of the pipeline 2 and the outer surface 12 of the pipeline, there is a gap 14 through which liquid 0, crude oil in the example, escaping during a leak and flowing along the outer surface 12 can flow into the collecting container 8.

A situation is now shown in the figure in which the liquid 0 escaping during a leak reaches the outer surface 12 of the pipeline 2 at a leakage point L that is located in an upper area of the pipeline 2 within the 6 o'clock position. Proceeding from this leakage point L, the liquid 0 now flows downward on the outer surface 12 due to the force of gravity, whereby the force of gravity exerted upon the liquid is directed away from the outer surface once it has reached the 3 o'clock position. Depending on the viscosity and adhesive properties of the liquid 0, it flows along the outer surface 12 up to a drip point D until the adhesive forces are no longer sufficient to keep the liquid 0 on the outer surface 12. At this point, the liquid 0 drips from the outer surface 12 and reaches, as shown in the figure, into the collecting container 8 in which it runs down into the deepest point in the 6 o'clock position and wets the sensor line 6.

The cross-sectional dimensions of the collecting container 8, i.e. the angular area α up to which the collecting container 8 extends with its edge 10, depends on the physical properties of the liquid 0 and the outer surface 12 of the pipeline 2, and is measured in such a way that it is ensured that the drip point D is within this angular area α.

It can be seen in Figs. 2 and 3 that the collecting container 8 is constructed from an almost V-shaped section 15 which has two legs 16 oriented diagonally to one another which extend in a mirror-symmetrical manner opposite one another, each proceeding from a side wall 18 directed almost vertically in the final assembled

state of a channel 20 formed between them and almost U-shaped in cross section. The legs 16 are inclined to the side walls 18 and with them each comprise an acute angle, so that the U-shaped channel 20 is situated within the V-shaped section 15 formed by the legs 16.

The base 22 of the U-shaped channel 20 is provided with a form projecting into it in which, in the final assembled state, an elastic sealing element 24 is placed with which the base 22 of the channel 20 fits tightly against the outer surface 12 of the pipeline 2 (Fig. 2).

According to Figs. 2 and 3, the channel 20 divides the collecting container 8 into two zones arranged symmetrically to the vertical mid plane 4 which convey the liquid 0 escaping from the pipeline 2 during a leak to the sensor line 6. For this purpose, the side walls 18 of the channel 20 are provided with openings 26 through which a liquid 0 flowing downward along the inner side of the legs 16 penetrates into the channel 20.

In the final assembled state (Fig. 2), the channel 20 is sealed at its bottom with a base part 30, also V-shaped, so that the liquid 0 entering it through the openings 26 cannot escape downward.

The strip-like base part 30 shown in Fig. 3 in a state prior to the final assembly is provided with spring-locking elements 32 arranged symmetrically to the mid plane 4 which, with their latches 34, each grip behind a shoulder or a projection 36 formed in the side walls 18 and securely fix the base part 30 to the collecting container and seal the channel 20 on its bottom. The locking elements 32 are flaps formed out of the base part 30 which make a locking or spring connection with the channel 20. Instead of a projection 36 extending in longitudinal direction of the side walls 18,

projections spaced from one another or openings spaced from one another, which are arranged at the same distance as the locking elements 32, can also be provided in the side walls 18.

The side walls 18 of the channel 20 are each provided with a recess 40 at given distances through which a clamping band 42 is passed that grips under the base 22 and surrounds the pipeline 2, so that the collecting container 8 is fixed to it. To enable an easier insertion of the clamping band 42 into the recess 40, the base 22 is interrupted in the area of this recess 40, so that the clamping band 42 can be led under a projection 46 bent in the shape of an L and protruding over the lateral recess 40.

A plurality of flaps 50 are formed from the legs 16, said flaps standing at a right angle on the legs 16, pointing into the profiled section 15, and used as spacers to the outer surface 12 of the pipeline 2.

The collecting container 8 is mounted in such a way that the sealing element 24, e.g. a sealing compound or an elastic sealing cord, is first inserted into the cavity formed by the shaping of the base 22. The profiled section 15 is then attached to the pipeline 2 in a 6 o'clock position, the clamping band 42 introduced into the recess 40 and the profiled section 15 fixed to the pipeline 2. In this stage of assembly, the channel 20 is open on its bottom. The sensor line 6, which is preferably a sensor line as is known, for example, from the above cited EP 0 175 219, is then inserted from the bottom into this channel 20. After the sensor line 6 has been inserted, the channel 20 is sealed with the base part 30.

The side walls 18 of the channel 20, the sealing element 24 essentially only used to offset unevennesses in the outer surface

12 of the pipeline 2, and the sensor line placed inside the channel 20 result in that an air flow A laterally striking the pipeline 2 is not conveyed through the collecting container 8 but past its bottom, as shown on the left in Fig. 2. The striking of a cross flow of this type inside the collecting container 8 is significantly reduced, since the at most small openings 26 arranged at the deepest point of the collecting container 8 and the recesses 40 made only at greater distances from one another do not enable a pronounced cross flow. Moreover, a cross flow of this type is, in addition, hindered by the sensor line 6 situated in the channel 20. In this way, it is prevented that the drip point D travels to the outside on the leeward side, so that the liquid 0 flowing down on the leeward side of the outer surface 12 drips down into the collecting container 8, even with strong cross winds.

List of Reference Symbols

2	Pipeline
4	Mid plane
6	Sensor line
8	Collecting container
10	Edge
12	Outer surface
14	Gap
15	Profiled section
16	Leg
18	Side wall
20	Channel
22	Base
24	Sealing element
26	Opening
30	Base part
32	Locking element
34	Latch
36	Shoulder
40	Recess
42	Clamping band
46	Projection
50	Flap
0	Liquid
L	Leakage point
D	Drip point
α	Angular area

30146-33

CLAIMS:

1. A line assembly for transporting a liquid, including crude oil, the line assembly comprising:

an above-ground pipeline, having an outer surface and a longitudinal direction;

a collecting container below the pipeline, extending along the pipeline and fixed to the pipeline, lateral edges of the collecting container extending in the longitudinal direction and at a distance from the outer surface of the pipeline; and

a sensor line arranged for detecting a leak, said sensor line extending along the pipeline in the longitudinal direction, in a deepest part of the collecting container;

wherein means for reducing an air flow passing transversely to the longitudinal direction of the pipeline, is arranged inside the collecting container between the collecting container and the outer surface of the pipeline.

2. The line assembly according to claim 1, wherein a channel, extending in the longitudinal direction, for accommodating the sensor line is arranged in the collecting container.

3. The line assembly according to claim 2, wherein the channel has generally vertically extending side walls which are provided with openings and divide the collecting container into two zones arranged symmetrically to a vertical mid plane of the pipeline, said zones conveying the liquid to the channel when a leak escapes from the pipeline.

4. The line assembly according to claim 2 or 3, wherein the channel adjoins the pipeline.

5. The line assembly according to claim 4, wherein a sealing element, extending in the longitudinal direction, is placed between a base of the channel and the outer surface of the pipeline.

6. The line assembly according to any one of claims 1-5, wherein the collecting container is fastened to the pipeline with a clamping band surrounding said pipeline.

7. The line assembly according to claim 6, wherein the side walls of the channel are each provided with a recess through which the clamping band is passed.

8. The line assembly according to any one of the claims 2 to 7, wherein the channel is formed by a U-shaped molding in the collecting container which is sealed at a bottom of the channel with a base part that is fixed to the collecting container with a locking connection.

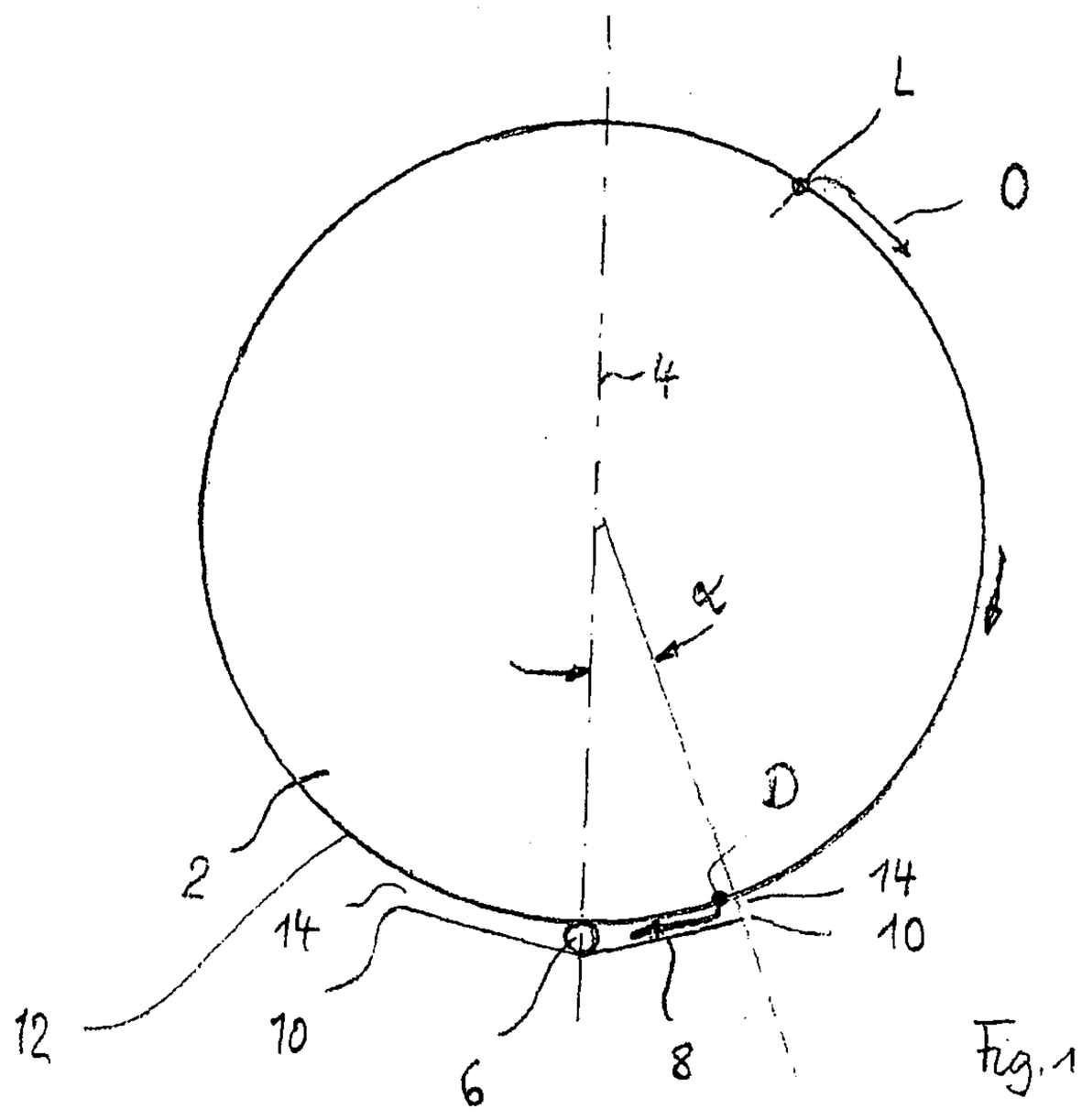


Fig. 1

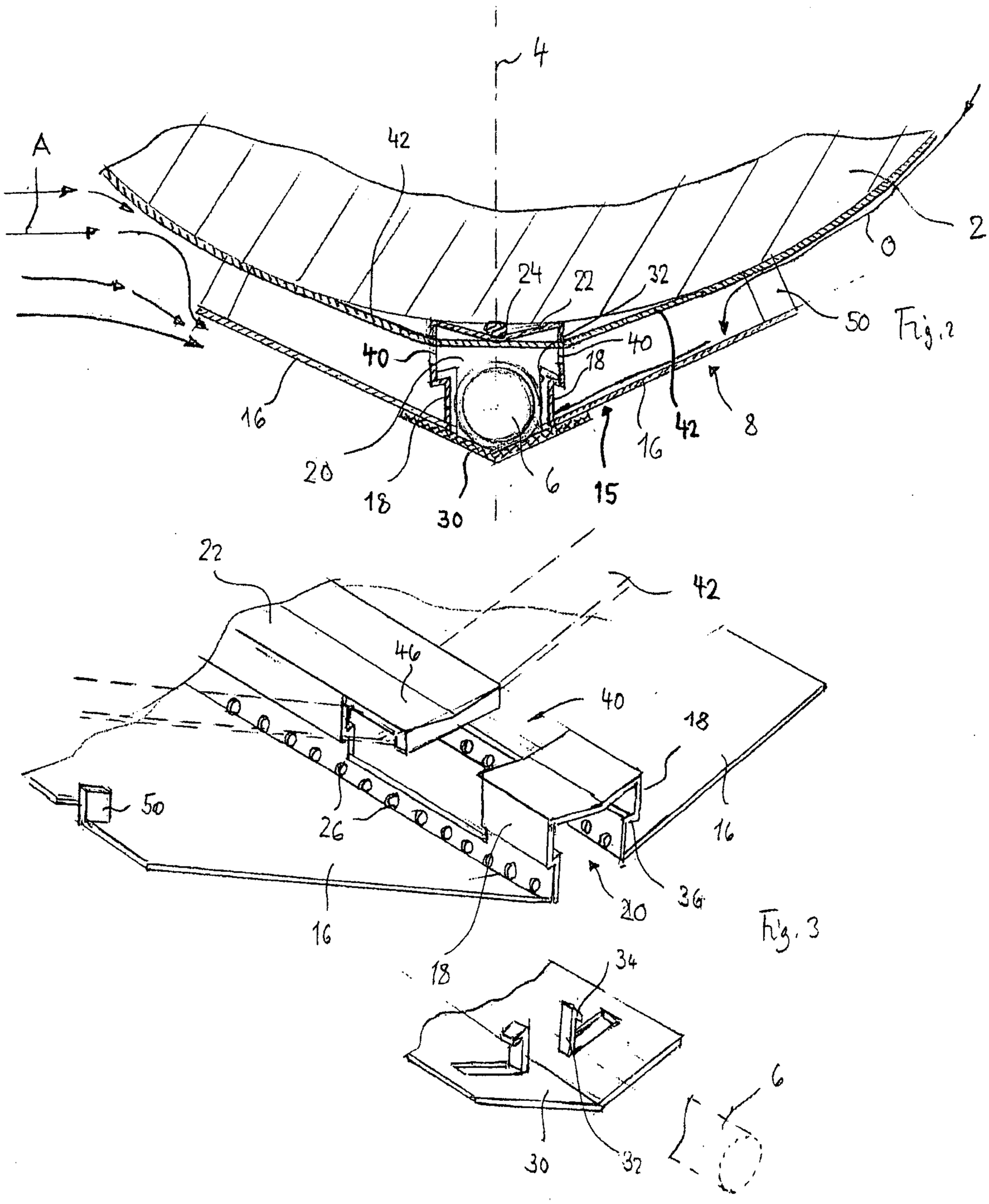

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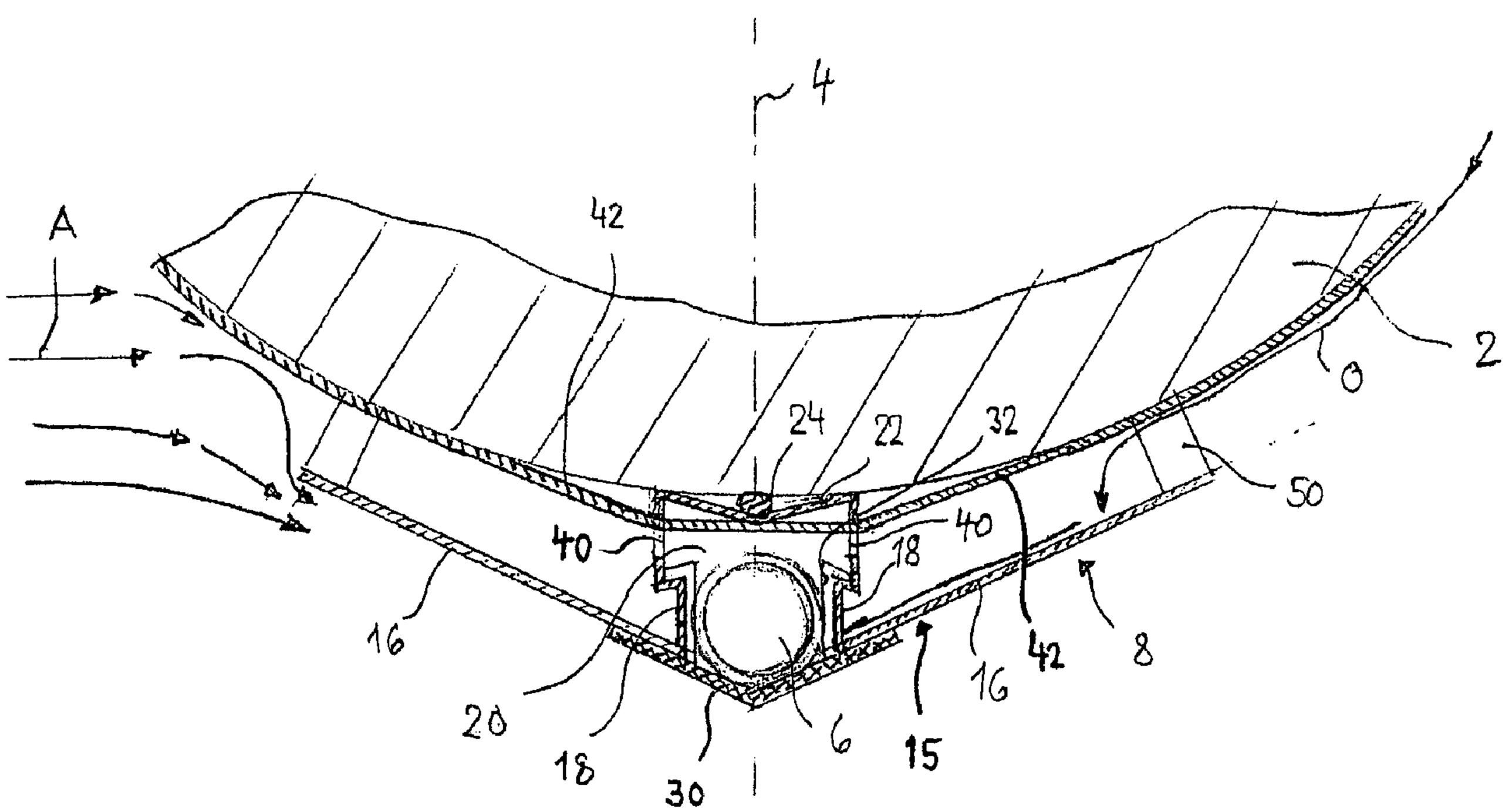
Fig. 2

Fig. 3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