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# (54) AIR CHAMBER WITH ADJUSTABLE ELEMENT FOR REGULATION AND/OR DIRECTIONING OF THE FLOW

(57) An air chamber includes at least one wing (4) which is tiltably placed inside the body (1) on the base wall (5) in such a way that the wing (4) can rotate from one extreme position to the other extreme position, whereby two opposite edges of the wings (4) are designed for adjacent contact with the lateral wall (6) of the body, or one edge of the wing (4) and one line on the surface of the wing (4) are designed for adjacent contact with the neighboring wing (4). The air chamber has preferably two wings (4) or at least six wings (4). In case of realization with two wings (4), it is preferable if the wings (4) have rotation mechanically and/or electromechanically coupled for mutual regular contrary movement of the outflow sides (43). It is also preferable if the wing (4) has a curvature (7) which produces fold on the outflow side (43), preferably the curvature (7) runs all the way to the base side (41), whereby it conically or pyramidically tightens towards the base side (41).

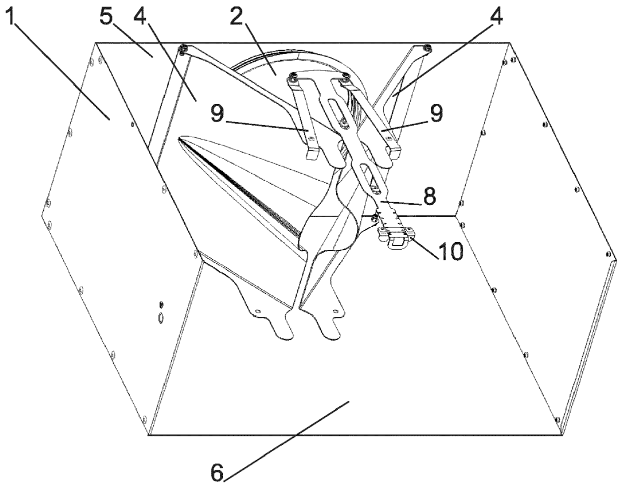

Fig. 4



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# Description

## Field of technology

**[0001]** The invention concerns a plenum chamber (plenumbox), that is, an air chamber which includes an adjustable element designed for regulation of the flow and/or directioning of the flow in its body. The new air chamber usually follows upon the end of the air duct, it leads the air to the diffuser or to the distributor, and it stabilizes flow ratios, muffles the noise, and allows for measurement of the flow of the air, and it can also be a basis for direct placement of an outlet.

## Prior state of the art

**[0002]** An air chamber has a body which is commonly produced from a steel sheet, where the body has on the bottom or top wall the input opening for connection of an air duct. The body of the air chamber is usually rectangular, eventually trapezoid, and inside it the air chamber can be equipped by a regulation element for setting the desired air flow between the end of the input air duct and output from the air chamber. Throttles are used for regulation, whereby the throttle plate or multiple throttle plates are tilted in the channel and they gradually open or close the flow cross-section of the channel.

**[0003]** Publications SK 500852020U (UV 9190), US2011263194A1 disclose plenum chamber with a perforated pipe inside the body of the air chamber, where the perforated chamber serves the purpose of regulating the flow. Such solutions are suitable, for example, for industrial operations where the low noise emission is not required.

**[0004]** Various solutions of the outlet with regulation of the directioning and flow of the air are known, such as JP2009222270A, US6099406A, US6264551B1, WO2020091603A1, EP3117155A1, US2015107802A1, which, however, are not very flexible and they are relatively difficult to produce and install.

**[0005]** The problems with noise production and pressure loss are partially addressed by an invention according to EP1469258A1, which discloses use of two curved plates in a rectangular flow channel. This solution is, however, conceived into confined spaces, for example, air distribution in a car, and the suggested plates configuration is not suitable for the air conditioning in buildings. The pair of plates can be used even in solution according to WO2005063516A1, but this solution is only suitable for car air conditioning and heating.

**[0006]** A realization of a body of air chamber such as pursuant to EP3410028A1, with elements for easy assembly and installation of the body are known, or there is, for example, publication WO2012066184A1 with muffling elements for decreasing the noise. Known realizations offer only partial solutions to the problems and their aggregation leads to increased size and complexity of the air chamber.

**[0007]** Publication DE29505070U1 discloses simple placement of the valve's plate by means of two strips of sheet in the axis of rotation, which deform and hold the plate in the set position. Similarly, the file DE4400072 A1 uses deformation of the connecting strip to hold the set position of the throttling and directioning lamellas.

**[0008]** A new solution is desired and not known; a solution of the air chamber with adjustable element, which generates pressure loss with low noise emission. New solution's construction should be reliable and the maintenance should be simple.

## Essence of the invention

**[0009]** Abovementioned deficiencies are significantly remedied by an air chamber with an adjustable element for regulation and/or directioning of the flow, which includes a body with input opening and with at least one output opening, where the input opening is placed on a base wall of the body and it is designed for connection to the air duct, whereby inside the body there is an adjustable regulation element for the regulation of the flow of the air flowing between the input opening and at least one output opening, according to this invention, whose essence lies in the fact, that the regulation element includes at least one wing which is tiltably placed inside the body on the base wall in such a way that the wing can rotate from one extreme position to another extreme position, whereby the two opposite edges of the wing or a single edge of the wing and one line on the surface of the wing are designed for adjacent contact with the neighboring wing, or with the lateral wall of the body, and the wing is placed against the input opening in such a position that the air flowing from the input opening to the body was directed onto the inner surface of the wing.

**[0010]** The wing has a base side by the axis of rotation, it has two lateral sides and an outflow side which is opposite the base side. In case of use of one or two wings the lateral sides of the wing are designed for adjacent contact with the lateral sides of the body. The tiltable placement of the wing has an axis of rotation which is at the input opening, whereby the axis of rotation does not interfere in the input opening and it is parallel with the tangent to the circumference of the input opening. In case of use of one or two wings, the axis of rotation is perpendicular onto the lateral side of the body, which the lateral sides of the wing use for sealing. The axis of rotation of the wing does not interfere into the input opening, and nor does the edge of the wing in the axis of rotation (the base side of the wing). The air flowing from the input opening does not bounce upon the edge of the base side of the wing nor on the element ensuring rotational placement of the wing.

**[0011]** The axis of rotation is by the edge of the wing, by means of which the wing differs from the common throttle plate placed directly in the channel, where the throttle has an axis of placement in the vicinity of the center of the plate or in the vicinity of the central zone of the plate, respectively. The plates of the throttle in the circular or rectangular pipe known in the prior art have tiltable placement of the plate in the central plane of the respective channel, and in the closed state they basically perpendicularly block the cross-section of the channel. With partial opening the throttle causes turbulence and this, inter alia, increases noise.

**[0012]** The proposed invention uses a wing which is not placed in the flow channel. The axis of rotation of the wing according to this invention is perpendicular onto the axis of the input opening and it is usually parallel with the plane of the base wall of the body. Neither the axis of rotation of the wing, nor the respective edge of the wing (the base side of the wing) interfere in the cross-section of the input opening, but they are only present inside the chamber's body (by the sides of the input opening), whereby the chamber's body's inner dimensions are larger than the cross-section of the input opening. In this body, the wing can tiltably rotate from one extreme position to the other extreme position. Usually, the wing's groundplan will have length that is 1,5 times, preferably 2 times width of the wing, whereby the axis of rotation is by the edge of the shorter side, therefore the length of the wing runs in parallel with the direction of the flow of the air. The width of the wing is the dimension of the wing that is parallel with the axis of rotation. The relative length of the wing is larger compared to prior art, which achieves a longer course on which the pressure loss during flowing around takes place, and thereby there is less noise produced. The wings can be formed by straight planes, or the wings are straight at least in the direction of length, that is, perpendicular onto the axis of rotation, and the eventual rounding is led in the plane that is parallel with the axis of rotation. The longitudinal profile of the wing is usually straight.

**[0013]** The tiltable rotation of at least one wing inside the chamber's body leads to change of the flow cross-section in such a way that it can be likened to gradual change in the dimensions of the pipe, where the outflow edge of the wing or multiple wings define by its position the end shape and cross-section of the flowing air at the output of the regulation element. The flowing is formed gradually by the surface of the wing which generates pressure loss with low noise emission. These are also the main advantages of the air chamber according to this invention. Even at closed position the wing or multiple wings are not in position where they directly cover the input opening, where the wing is perpendicular onto the axis of the input opening. On contrary, the angle between the wing in the completely open position and the wing in the completely closed position is less than 60°, preferably less than 45°. The shorter the length of the wing and the higher the number of wings, the smaller the angle that is required for transition from the extreme closed/open positions and back.

**[0014]** The regulation element is functional even with use of a single wing which is placed in such a way that the opposite lateral edges of the wing align from the inside to two lateral walls of the body and the output side of the wing is moving towards the third wall of the body (which connects the two lateral walls), but an arrangement with two wings is preferable, where both wings are tiltably placed on a base wall with an input opening. The pair of wings creates a symmetry pursuant to the axis of the input opening, where the axes of rotation of both wings are perpendicular. Preferably, the rotation of the wings can be mechanically or electrically coupled for mutually parallel contrary movement of the output sides of the wings. Each wing has lateral walls adjacently placed by the lateral sides of the body; in these contact lines the wing can also be equipped by a sealing. During the setting of the flow from one extreme position to the other extreme position the wing preferably moves in such a way that in the extreme position which corresponds to the full opening of the regulation element the projection of the outflow side of the wing does not interfere inside the input opening. The wings in fully open position are approximately parallel with the axis of the opening position, or their position differs from the parallel by less than 15°. The air flowing from the input opening inside the body with wings fully open is basically not hampered by wings in its flow. In the second extreme position which corresponds to closing or total closing of the regulation element, the projection of the outflow side of the wing is inside the shape of the input opening. In a preferable symmetrical arrangement of two wings, the projection of both outflow sides of the wings is symmetrical to the axis of the input opening.

**[0015]** The "projection" in this text denotes display in the plane of the base wall, for example, display or depiction of the geometric shape of the outflow side in the plane of the base wall on which the input opening is present. Pursuant to the angular position of the wing, this projection can be present in various position against the position and shape of the input opening, which defines the degree of regulation of the air flow. In an arrangement with two or multiple wings, the projection of the outflow sides of all wings defines the shape of the outflow opening in relation to the position and size of the input opening. The term "outflow opening" denotes an opening produced by outflow wings by their connection in the closed position. The term "output opening" denotes a single opening or multiple openings or a group of openings in the chamber's body.

**[0016]** For example, in the arrangement with six or eight wings, the outflow opening is defined by the edges of the outflow sides with six or eight wings. The projection of the outflow opening to the plane of the base wall in various regulation positions defines the ration of tightening of the cross-section against the input opening.

**[0017]** These basic features allow to create various versions of air chamber with variously shaped bodies with various number of wings. The prevailing shape of the body in technologically preferable simple arrangement will be cuboid or cube, where four lateral walls follow upon the base wall with input opening and the body is closed by an output wall which is opposite and preferably parallel with the base wall. On the output well of the body there is at least one output opening or group of openings in the form of the distributor (switch) into various branches of the air distribution system. On the output wall there can be an outlet or multiple outlets, preferably with setting the direction of the air on the output.

**[0018]** In another arrangement the body of the air chamber can have shape with two trapezoid lateral walls which are mutually parallel and two wings align with them from the inner side. In case of arrangement with more than two wings adjacent to each other, there is no need for production of tight contact with lateral walls of the body; there is greater freedom in shaping the body of the air chamber, which can have a shape of the cylinder, where the base wall is flat for parallel placement of the holders of multiple wings, and the cylindrical sheath with sufficient gap surrounds the wings in their extreme open position.

**[0019]** The invention can be used for various air flows, that is, for variously large input openings. In larger flow cross-sections in is not necessary if the lower regulation gear was in form of complete closing of the air flow in the air chamber. In such case it is preferable if the edge of the outflow side of the wing is not straight, but shaped, curved (dented) in such a way that in the closed position the fold on the outflow side does not align to the opposite wall or to the opposite outflow edge of the second wing. The curvature in the projection has a plane of the base well preferably in shape of a part of the circle, for example semicircle in a set with two wings. The curvature can run all the way to base side of the wing, whereby it gradually conically narrows. Such shaped two wings in the extreme position gradually form a tightening profile of flow ended by two edges of the outflow sides of the wings. The curvature is oriented in such a way that the fold in the closed position of the wing produces a channel for the air flow; the closed position is thus not a position with zero flow, but it is a position with minimal flow. The disclosed curvature is manifested by partially circular or semicircular fold on the outflow side of the wing, whereby preferably the curvature runs conically from the zero deformation at the base side of the wing all the way to the fold on the outflow edge of the wing. It is also possible that the curvature will be shaped as a pyramid, whereby three folding lines create a simple geometry of the fold. Such curvature also preferably runs from zero at the base side of the wing to the resulting triangular fold on the output side of the wing. The curvature is shaped by a flow through three lines and it is simple to produce, it does not require stretching the material during pressing in a mold, and can be produced form a simple developed shape. When using two wings with such curvatures, an opening with four-side cross-section is produced in a closed position.

**[0020]** It is also possible to produce a curvature by use of more than three fold lines. In order to start developing the curvature at the base side it holds that one should start before the point to which the air flow running by the circumference from the input opening hits; this point does not necessarily need to be at the very edge of the base side. The more is the axis of rotation of the wing distanced from the tangent to the input point, the more can the zero point of curvature be further from the base side of the wing.

**[0021]** A simple mechanism can be used for simultaneous contrary movement of the two wings, whereby the mechanism includes a slider and two draw rods. The slider is placed on the lateral wall of the body in the central plane between two wings. One end of the slider serves as a handle and is present in the vicinity of the output wall of the body. The second end of the slider is in the base wall and this end of the slider is connected to two draw rods through pins. The connecting draw rods are on the other end connected to the wings. Moving the slider simultaneously moves the draw rods and thereby both wings move contrary to each other or from each other. In order to stop (arrestation) of the set position, a stop (arresting or arrestation stop) can be used, or pair of stops, which fall into the grooves in the slider. The slider can be placed from the outer side of the body of the air chamber, eventually together with the connecting draw rods, where the draw rods are connected with the wings through the pins which run through shaped openings on the lateral side of the body. In such arrangement the regulation from the outer side of the body is possible. In another arrangement the slider and draw rods will be placed on the inner side of the lateral wall of the body and the control could be approached after the opening of the output wall of the body. Such solution is constructionally simple and easy to operate, since the change of the regulation happens only occasionally, for example during the switch of regime from cooling to heating and vice versa.

**[0022]** The movement of the wings into the regulation position of choice can be realized electromechanically, too, by means of commonly available servomotors with control.

**[0023]** In another preferably arrangement the regulation element has at least six or at least eight wings which form a spatial shade together. The axes of rotation of the wings are uniformly distributed on the base wall of the body at the inner circumference of the input opening. The axes of rotation of all wings are parallel with base wall, but the wings have sloped shape since the lateral walls of the wings are mutually parallel, but they are not perpendicular onto the axis of rotation. The deviation of the lateral sides of the wing from the perpendicular line onto the axis of rotation is at least 8°, preferably at least 15°, but less than 40°. The wings are folded into the shape of the part of the cylindrical surface, whereby the orientation of the folding corresponds to the arc of the input opening. In the extreme open position, the outflow sides of the wings produce at least approximately circular shape of the outflow opening, whereby the diameter of the outflow opening is at least 90°of the diameter of the input opening. This diameter is also basically defined by the curvature of the wings, where it basically holds that the diameter of the curvature of the edge of the outflow side of the wall corresponds to the radius of the outflow opening of the regulation element in its extreme open position. Subsequently, when closing the wing, thanks to the askew course of the lateral sides these move outside the central zone, whereby the outflow opening is diminishing and it is formed by a hexagon or an octagon whose individual sides are curved with the radius of the folding of the wing. The spatial shade is sealed by the contact of the first edge of one lateral wall of the wing with the inner surface of the neighboring wing. This linear touch is repeated with each subsequent pair of the wings all around the circumference of the spatial shade. The lateral wall of the wing which is opposite to the touching edge protrudes out of the conical body of the spatial shade. The contact between the shades can also serve to transfer the regulation element when restructuring the sizes of the outflow opening, where it suffices to set the position of a single wing and the others are subsequently carried by a pressure to the edge of the neighboring wing. In order to decrease the gap between the setting wing and the last wing in the course of transfer, one can use a circumferential spring which withdraws all wings from the outer side to the closed position. The spatial shade with six or multiple wings is a regulation element which directions the flow similarly as when the air flows into the conical tightening in the transition between the pipes with different diameters. The spatial shade allows to change the peak angle of the cone even all to the shape of the cylindrical surface in the extreme open position.

**[0024]** The output wall of the body of the air chamber can be equipped by two openings by which the air flows into the distribution branches or the output wall can be perforated or it can be equipped by an outlet or multiple outlets. It is preferable if the output wall is on the inner side, opposite to the regulation element, equipped by a muffling material which directions and/or slows down the air flow and, at the same time, muffles noise. The muffling material can be a perforated foam, for example, from PET material or a perforated sheet, or any similar material.

**[0025]** In order to simplify the installation, a body of the air chamber can have connecting hinges and/or connecting elements. In one realization, the body has short strips from the sheet protruding at the edges from the lateral walls of the body. After the insertion of the body into the opening in the wall or in the ceiling, the strips bend outwards. The bending of the strips is simplified by perforation in the line of fold.

**[0026]** When using two or multiple wings, an arrangement is also possible where the wings are not controlled symmetrically during their regulation movement, which allows to achieve not only regulation of the size of the outflow opening but also its directioning, where the axis of the outflow opening is outside the axis of the input opening. In such arrangement, the regulation element can also serve to direction the flow to the desired place on the output wall.

**[0027]** From construction point of view, it is preferably if the wings and the walls of the body are formed by a steel sheet in anti-rust form, for example from stainless steel or galvanized sheet. The sheet is suitable for producing curvature of the wings. In case of mass production, the wings can be produced as plastic moldings, preferably mainly in case of a multi-wing arrangement with spatial shade.

**[0028]** The air chamber according to this technical solution stabilizes the flow ratios, generates repeatedly predictable pressure loss, muffles the noise, and its construction is reliable. The advantage is also the possibility to place the measurement cross inside the input opening, whereby at this place, and just behind it, there is no turbulent eddying, which would spoil the accuracy of the measurement. Pipes are led from the measurement cross for the measurement of the setting of the flow, the ends of the pipes are led outside the body to a place approachable during installation and maintenance.

## Description of drawings

**[0029]** The invention is further disclosed by drawings 1 to 15. The depicted shape of the air chamber, the orientation of the input opening, as well as dimension ratios of individual elements of the air chamber and the shape of the wings are all for illustration purposes only and cannot be interpreted as limiting the scope of protection.

Figures 1 and 2 are schematic views of the body of the air chamber with two wings, whereby on figure 1 there is a state of the closed extreme position of the wings and on figure 2 there is a state of the open extreme position of the wings. The arrows denote air.

Figure 3 is a view of the spatial relationship between two wings and the input opening without the lateral walls of the body being depicted, whereby the wings are basically in the extreme closed position.

Figure 4 is a view from the figure 3 with a setting mechanism added and with the body of the air chamber without one lateral wall, which is removed for the purposes of clarity, even though in the example it is produced as a whole with the base wall.

Figure 5 is a view of the inside of the air chamber with wings with curvature. The muffling material is placed against the input opening.

Figure 6 is a groundplan of pair of wings seen from the direction of input opening.

Figure 7 us a lateral view depicting the alignment of the wings to the lateral walls.

Figures 8 and 9 depict a wing with curvature which is formed by a fold of the sheet in three lines. Figure 8 is a spatial view of the wing and figure 9 is a groundplan of the unfolded shape of the wing before the folding of the edges and curvature.

Figure 10 is a spatial view where only one wall of the body is visible. The outflow opening of the wings is directed from the input opening to the muffling material. In figure 10, one can clearly see the gap from base sides of the wings from the edge of the input opening. The wall of the body with the output opening and the muffling material is depicted separately on figure 11, seen from the outside.

Figures 12 and 13 depicted the spatial shade with eight wings where the figure 12 depicts an open position and figure 13 the closed position. Only a base wall is depicted from the chamber's body, or only its part at the input opening, respectively; the other walls of the chamber can be variously shaped. In the right part of figures 12 and 13 an outflow opening formed by outflow sides of the wings in the position against the input opening is depicted in the simplified way.

Figures 14 and 15 are graphs which depicted the measured dependencies of the pressure loss in various volume flow and various position of the wings. Graph according to figure 14 is for the direction of the input neck DN 100 and for the body with dimension 300 × 150 mm. Graph according to figure 15 is for the direction of the input neck DN 250 and for the body with dimension 550 × 300 mm. The curves are ordered from an open position in the lower part until the closed part in the upper part of the graphs. The pressure loss is in Pa, the volume flow is in $m^3/h$. The numbers stated by individual points of the curves are the measured noise in dB.

## Examples of realization

### Example 1

**[0030]** In this example according to figures 1 to 7 and 10, 11, 14, 15, the air chamber (plenum box) has an outer body 1 produced from galvanized steel sheet. The body 1 has an outer shape of the cuboid and it is construed from base wall 5 from which two opposite lateral walls 6 run through the fold. Two other lateral walls 6 are connected to the folded edges of the lateral walls 6 and folded edges of the base wall 5 by rivets. This set produces an open steel sheet box. A circular input opening 2 with attached flanging is on the base wall 5; the purpose of flanging is the connection to the air distribution. The connection of flange with the pipe can be equipped by sealing. The input opening 2 in this case is placed basically in the center of the base wall 5; the diameter of the input opening is less than half the length of the longer side of the base wall 5.

**[0031]** Inside the body 1 there are two wings 4 rotationally placed; the axis of rotation of the wings 4 is perpendicular onto the lateral walls 6 which run out of the base wall 5. The axis of rotation of the wings 4 is led symmetrically on the sides of the input opening 2 in such a way that the pins of tiltable placement run from the body 1 to the lateral folds of the wings 4 in the vicinity of the edge of the base wall 5. The wing 4 in this example can have a simple flat shape with base side 41, two parallel sides 42 and straight outflow side 43. The base side 41 of the wing 4 is just by the base wall 5. Between the edge of the base side 41 and the base wall 5 there is a gap which allows for free rotation of the wings 4 in the pins. The lateral sides 42 of the wing 4 have folded edges which strengthen the wing 4 and also form the zone for adjacent placement to the inner surfaces of the lateral sides 6. A sealing is stuck on these folds; the sealing fills the gap between the lateral side 42 of the wing 4 and the lateral side 6 of the body 1.

**[0032]** In this example, the outflow side 43 of the wing 4 has straight direct shape which defines the flow cross-section with a rectangular shape. Both wings 4 are controlled simultaneously by means of a slider 8 which is slidably placed on one lateral wall 6 symmetrically in the center between the wings 4. The slider 8 has two grooves which form a slidable guiding in cooperation with two pegs and gibs. On one side the sheet of the slider 8 is folded and forms and ending to be grasped by fingers. On this end, the slider 8 has a series of notches into which the pair of contrary placed stops 10 for arresting the slider 8 in the set position falls. The opposite end of the slider 8 has a short crossbar with openings for connection with the connecting draw rods 9. The connecting draw rods 9 are connected with the crossbar of the slider 8 by the pins on one side, and on the other side they are connected with folds by the lateral side 42 of the wings 4. On the inner side of the lateral walls 6, in the vicinity of the end of the slider 8, the scale and numbers of the regulation gears are engraved. The number of numbers - in this example from 1 to 6 - corresponds to the number of pairs of notches for the arresting of the slider's 8 position. The pitches between notches between regulation gears are irregular so that the desired kinematics for the movement of the wings with the desired difference in the set air flow is achieved.

**[0033]** Output opening 3 in this example has a perforated plate with a series of openings which are regularly distributed outside the zone where the outflow of air is directed from the input opening 2 with wings 4 open. This zone in the shape of a circle has an overhang into which the muffling material 11, kept by springs for the purpose of simple replacement during maintenance, is placed. The muffling material 11 decreases the noise emission and also directions the air. The perforated plate is placed inside the body 1. A plate with series of outlets is subsequently placed onto the body installed in the opening in the wall or the ceiling, whereby the plate covers the body 1 together with edges and connecting strips in such a way that it forms the final aesthetic adjustment of the air chamber.

**[0034]** In this example, blind rivets are used to connect the walls 5, 6 and the body 1. The rivets can also function as pins and pegs of rotation and slide placements. Such simplification speeds up the production of the air chamber, whereby some joints, such as connection of the draw rod 9 with the wing 4, can be demountable so that the cleaning and maintenance of the air chamber is simplified.

**[0035]** A measurement cross with pipes led outside to a place approachable during installation and maintenance of the air distribution system can be placed inside the input opening 2. When setting the air flow, the slider 8 changes the air flow.

Example 2

**[0036]** In this example (fig. 3 to 7, 10, 11, 14 a 15) both wings 4 have formed curvature 7 which conically runs from the outflow side 43 towards the center of the base side 41. The curvature 7 according to figure 6 produces an approximately semicircular shape on the outflow side 43, which as a fold runs through curved transitions into the straight edges of the outflow side 43. In the direction of base side 41, the curvature 7 becomes gradually flatter and ceases before the edge of the base side 41. This shape of the wings 4 ensures that even at complete closing of the wings 4, when these touch each other, or almost touch each other by the edges of the outflow sides 43, the free outflow opening is still ensured and the size of this opening is set by the size of two curvatures 7 by the edges of the outflow sides 43. Such arrangement uses an effect of a Venturi tube with adjustable cross-section.

**[0037]** The body 1 can have a similar shape and construction as in example 1, where the lateral sides 42 of the wings 4 touch the lateral walls 6 of the body 1.

Example 3

**[0038]** In this example both wings 4 according to figures 8 and 9 have formed curvature 7 by means of three folds through the lines forming two triangles with identical peak. Such curvature 7 is formed simply without pressing in the mold, whereby the developed shape according to figure 9 is used. The curvature 7 begins at the base side 41 and gradually pyramidically grows all the way into the triangular fold in the outflow side 43. In the closed position of the wings 4, both curvatures 7 form an outflow opening with four straight lines together. This shape of the wings ensures that even at complete closing of the wings 4, when these touch each other, or almost touch each other by the edges of the outflow sides 43, the free outflow opening is still ensured. Compared to example 2, the wing 4 is easier to produce and the production does not require press tools.

**[0039]** The body 1 can have a similar shape and construction as in example 1 or 2, where the lateral sides 42 of the wings 4 touch the lateral walls 6 of the body 1.

Example 4

**[0040]** In this example according to figures 12 and 13 the regulation element is produced as a spatial shade with adjustable configuration. It consists of eight wings 4 which are tiltably placed in holders on the base wall 5. All wings 4 and their holders are the same and, in this example, they are produced from galvanized steel sheet. The axes of the rotation of the wings 4 are parallel with the tangents to the input opening 2, whereby the axes are placed angularly regularly against the axis of the input opening 2. In case of each wing 4 it holds that one edge of the wing 4 and one line on the inner surface of the wing 4 is adjusted for adjacent contact with the neighboring wing 4. With the change of rotation of the wing 4 the position of the contact line in which the neighboring wing 4 touches the respective wing 4 on its inner side changes.

**[0041]** The length of the wing 4 is more than three times the width of the wing 4. The wing has two askew-led lateral sides 43 and the edge of the outflow side 43 is rounded with a radius that corresponds to the radius of the outflow opening in the completely closed extreme position. The lateral sides 42 deviate from the perpendicular line led onto the axis of rotation of a respective wing 4, which achieves a state when the edge of the outflow side 43 during rotation moves not only towards the axis of the input opening 2 or from the axis of the input opening 2, but at the same time the projection of the outflow side 43 to the plane of the base wall 5 moves in the direction of a tangent of the outflow opening. The base side 43 of the wing 4 is placed behind the outer circumference of the input opening 2 and in all positions of the wing 4 the air flowing from the input opening 2 does not hit the edge of the base side 43.

**[0042]** During closing or opening the spatial shade the position of the line in which the neighboring wings 4 touch each other changes. The spatial shade does not allow for complete closure of the outflow opening, but there is no need for that in actual operation. The advantage of the spatial shade is the generation of the pressure loss and quiet operation. The body 1 can have any outer shape which will not interfere with the movement of the wings 4 inside.

**[0043]** The regulation of the shade according to this example changes the flow geometry from an approximately cylindrical shape to approximately conical shape and vice versa. Such gradual limitation of flow is hydraulically preferable and it does not produce noise. The shade can be design part of the bad, visible for the users.

**Industrial applicability**

**[0044]** Industrial applicability is obvious. According to this invention it is possible to industrially and repeatedly produce and use air chamber, plenum chamber (plenumbox), for connection into the air distribution systems.

**List of symbols**

**[0045]**

1 - body

2 - input opening

3 - output opening

4 - wing

41 - base side of the wing

42 - lateral side of the wing

43 - outflow side of the wing

5 - base wall

6 - lateral wall

7 - curvature

8 - slider

9 - connecting draw rod

10 - stop

11 - muffling material

$p_s$ - pressure loss

$q_v$ - volume flow

DN - dimension of input neck

## Claims

1. An air chamber with an adjustable element for a regulation and/or directioning of a flow, which includes a body (1) with an input opening (2) and at least one output opening (3), where the input opening (2) is placed in a base wall (5) of the body (1) and is designed for connection to an air distribution, whereby inside the body (1) there is the adjustable regulation element for the regulation of the flow of an air flowing between the input opening (2) and the output opening (3), and where the regulation element includes at least one wing (4),
**is characterized by the fact,** that

the wing (4) is tiltably placed inside the body (1) on the base wall (5) in such a way that the wing (4) can rotate from one extreme position to other extreme position and back;
the tiltable placement of the wing (4) has an axis of rotation which is by the input opening (2) outside a groundplan of the input opening (2); the axis of rotation is parallel with a tangent to a circumference of the input opening (2);
whereby two opposite edges of the wing (4) are designed for an adjacent contact with a lateral side (6) of the body (1) or one edge of the wing (4) and one line on a surface of the wing (4) are designed for the adjacent contact with the neighboring wing (4).

2. The air chamber with the adjustable element for the regulation and/or direction of the flow according to the claim 1 **is characterized by the fact,** that the wing (4) has a length that is longer than a width of the wing (4), preferably the length is 1,5 times the width of the wing (4), especially preferably the length is 2 times the width of the wing (4).

3. The air chamber with the adjustable element for the regulation and/or direction of the flow according to the claim 1 or 2 **is characterized by the fact,** that it includes two wings (4) with parallel axes of rotation, where the wings (4) are placed oppositely by sides of the input opening (2); each wing (4) has two lateral sides (42) adjacently placed by the lateral walls (6) of the body, whereby both base sides (41) of the wings (4) are outside the groundplan of the input opening (2) and the axes of rotation of the wings (4) are perpendicular onto the lateral walls (6).

4. The air chamber with the adjustable element for the regulation and/or direction of the flow according to the claim 3 **is characterized by the fact,** that the rotation of the wings (4) is mechanically and/or electromechanically coupled for mutual regular contrary motion of outflow sides (43).

5. The air chamber with the adjustable element for the regulation and/or direction of the flow according to the claim 3 or 4 **is characterized by the fact,** that the wing (4) is equipped by sealing for sealing the contact with the lateral wall (6).

6. The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 3 to 5 **is characterized by the fact**, that projections of the outflow sides (43) of the wings (4) into a plane of the base wall (5) are symmetrical to the axis of the input opening (2), preferably in the extreme open position of the wings (4) their projections are outside the surface of the input opening (2).

7. The air chamber with the adjustable element for the

regulation and/or direction of the flow according to the claim 5 to 6 **is characterized by the fact,** that the body (1) has a shape of a cuboid or a cube with the parallel lateral walls (6) or the body (1) has two non-rectangular opposite lateral walls (6) to which the wings (4) align from an inner side, whereby the lateral walls (6) are parallel.

**8.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 1 to 7 **is characterized by the fact,** that the wing (4) or both wings (4) have a curvature (7), where the curvature (7) produces a fold on the outflow side (43) of the wing, where the fold is oriented outside from the axis of the input opening (2), preferably the curvature (7) runs towards the base side (41), whereby it tightens conically or pyramidically in the direction towards the base side (41).

**9.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 1 to 8 **is characterized by the fact,** that it has a slider (8) on and end of which connecting draw rods (9) are attached; opposite ends of the connecting draw rods (9) are connected to the wings (4), preferably the slider (8) has grooves into which a stop (10) for arresting a set position of the slider (8) falls.

**10.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 1, 2, 6 and 9 **is characterized by the fact,** that it has a segmented spatial shade which includes at least six or at least eight wings (4), where the axes of the rotation of the wings (4) are regularly distributed by the outer circumference of the input opening (2), preferably the length of the wings (4) is three times the width of the wings (4).

**11.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the claim 10 **is characterized by the fact,** that the wings (4) have an edge of the lateral sides (4) deviating from a perpendicular line led onto the axis of the rotation, and at the same time the wings (4) are curved into a shape of a part of a cylindrical surface.

**12.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the claim 11 **is characterized by the fact,** that a rounding of the edge of the outflow side (43) of the wing (4) corresponds to a radius of the outflow opening in the extreme position, preferably the diameter of the outflow opening is at least 90% of the diameter of the input opening (2).

**13.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 10 to 12 **is characterized by the fact,** that it has a circumferential spring which from an outer side withdraws all the wings (4) into the closed position.

**14.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 1 to 13 **is characterized by the fact,** that an output wall with at least one output opening (3) is equipped by the muffling material (11) which is placed against the outflow of the air from the adjustable regulation element.

**15.** The air chamber with the adjustable element for the regulation and/or direction of the flow according to the any of the claims 1 to 14 **is characterized by the fact**, that it has a measurement cross placed in the input opening (2), preferably pipes from the measurement cross are led next to the body (1) to a place approachable during an installation or maintenance.

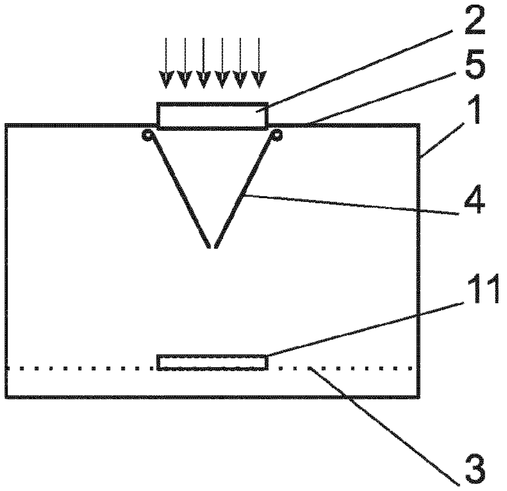



Fig. 1

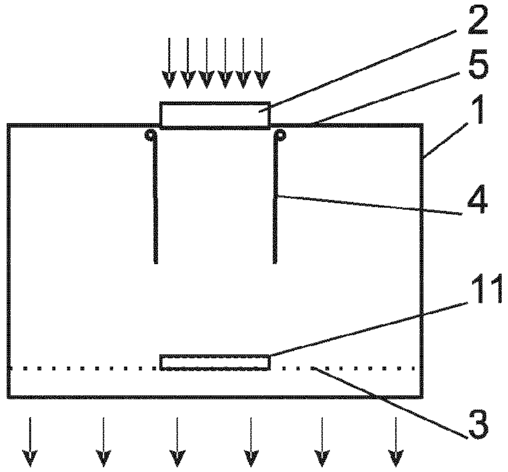



Fig. 2

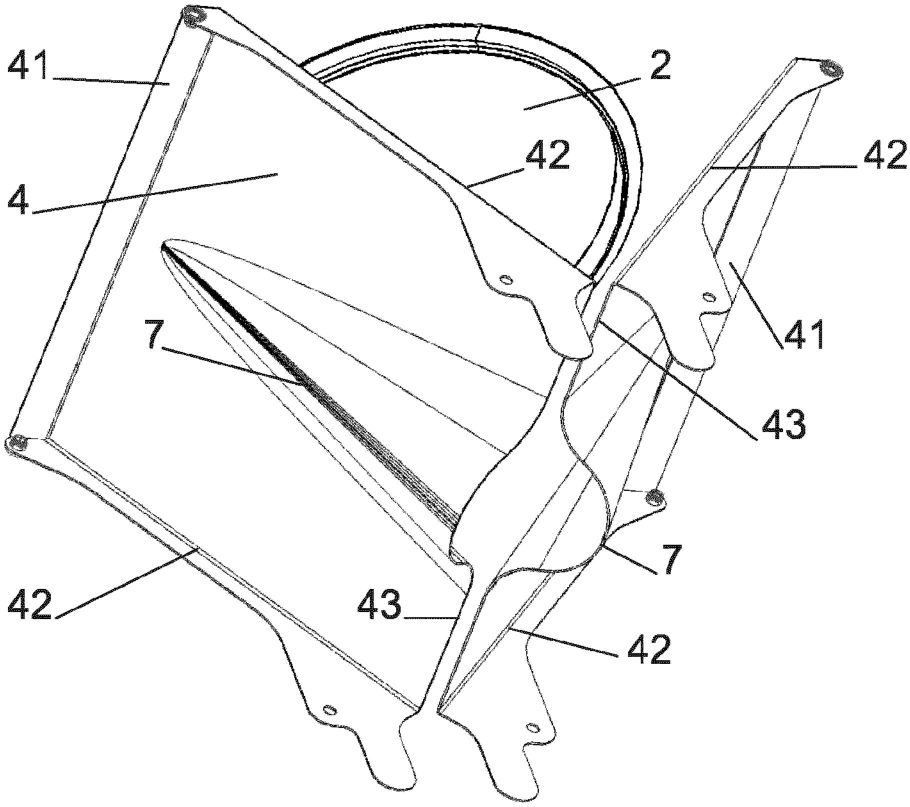



Fig. 3

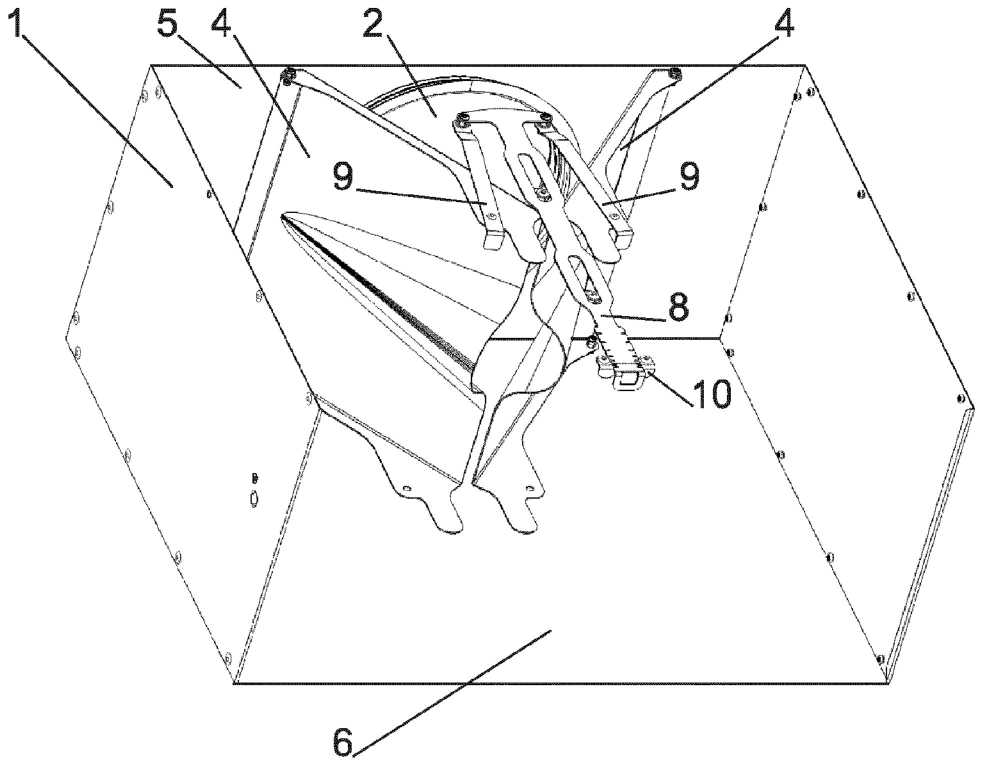



Fig. 4

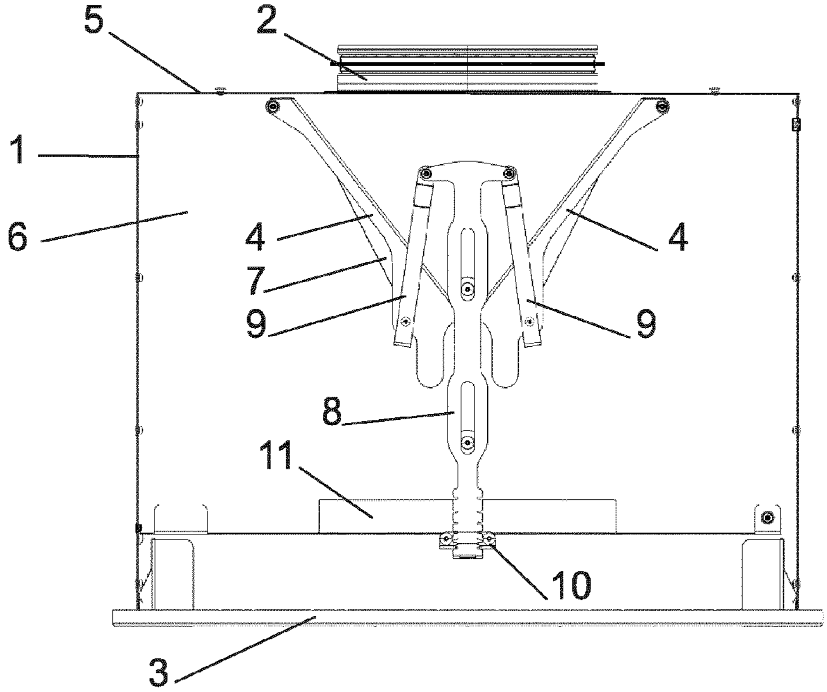



Fig. 5

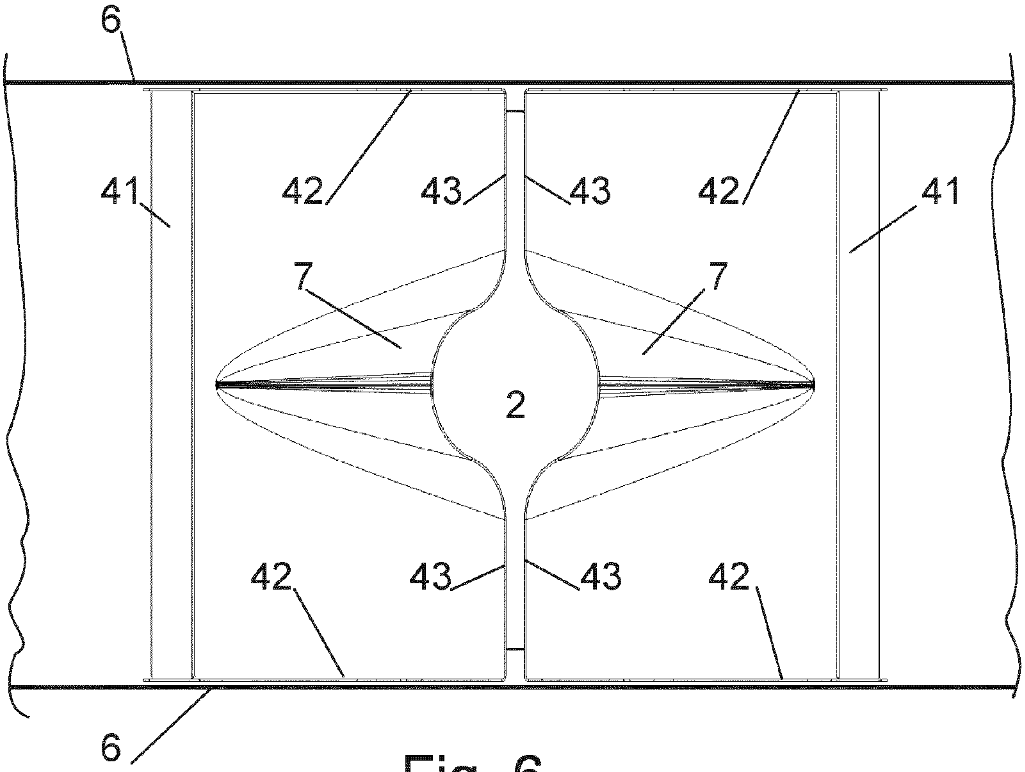



Fig. 6

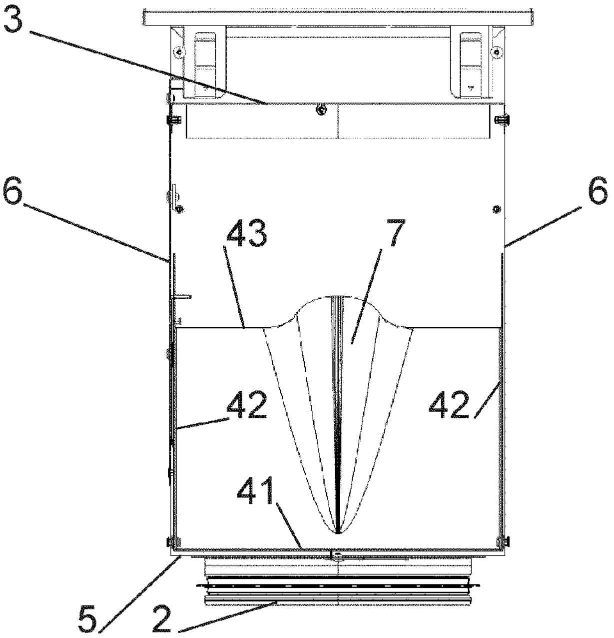



Fig. 7

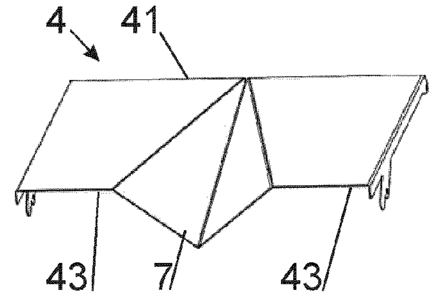



Fig. 8

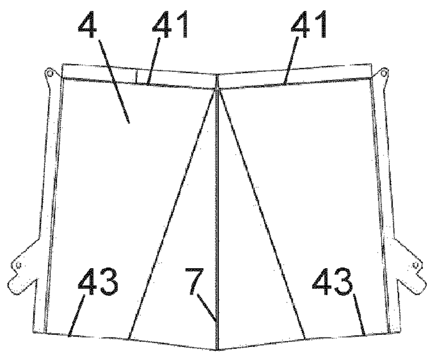



Fig. 9

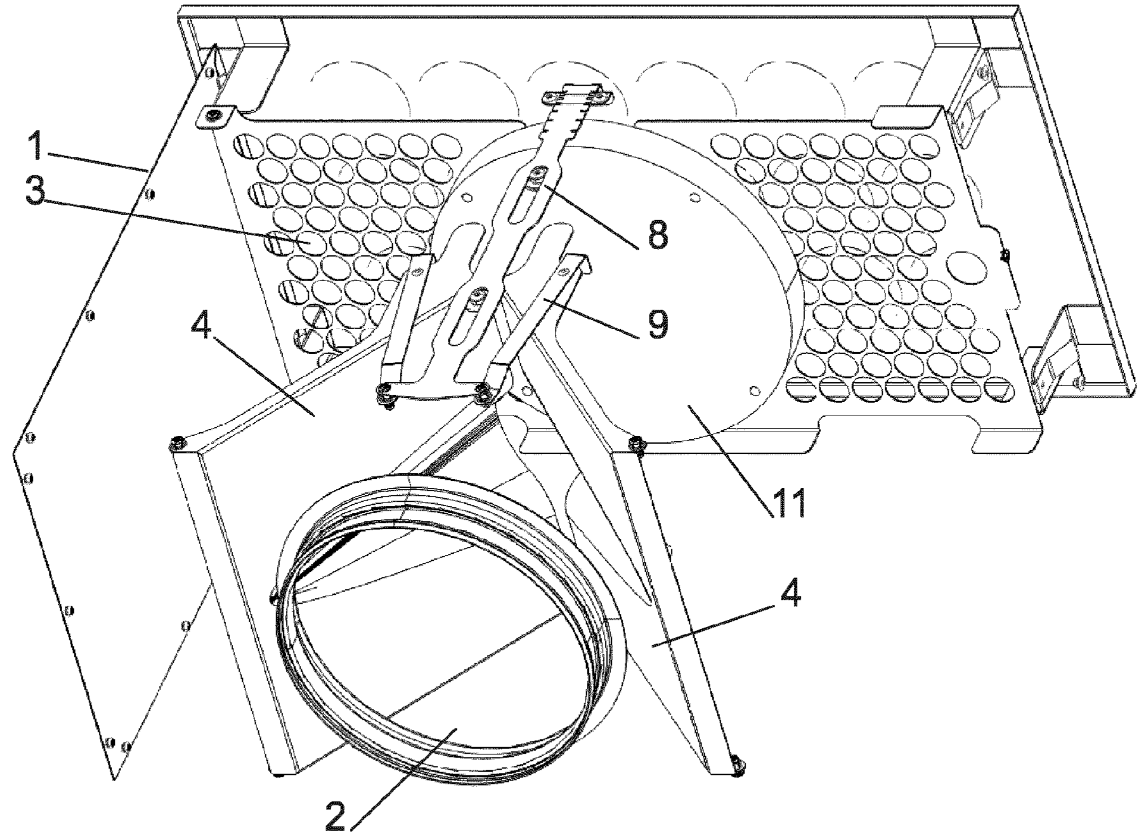



Fig. 10

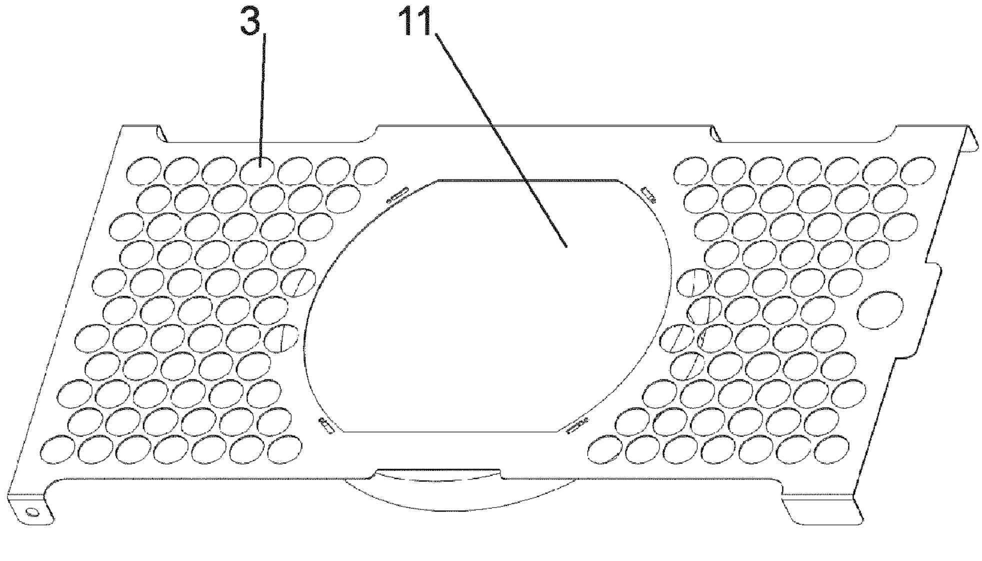



Fig. 11

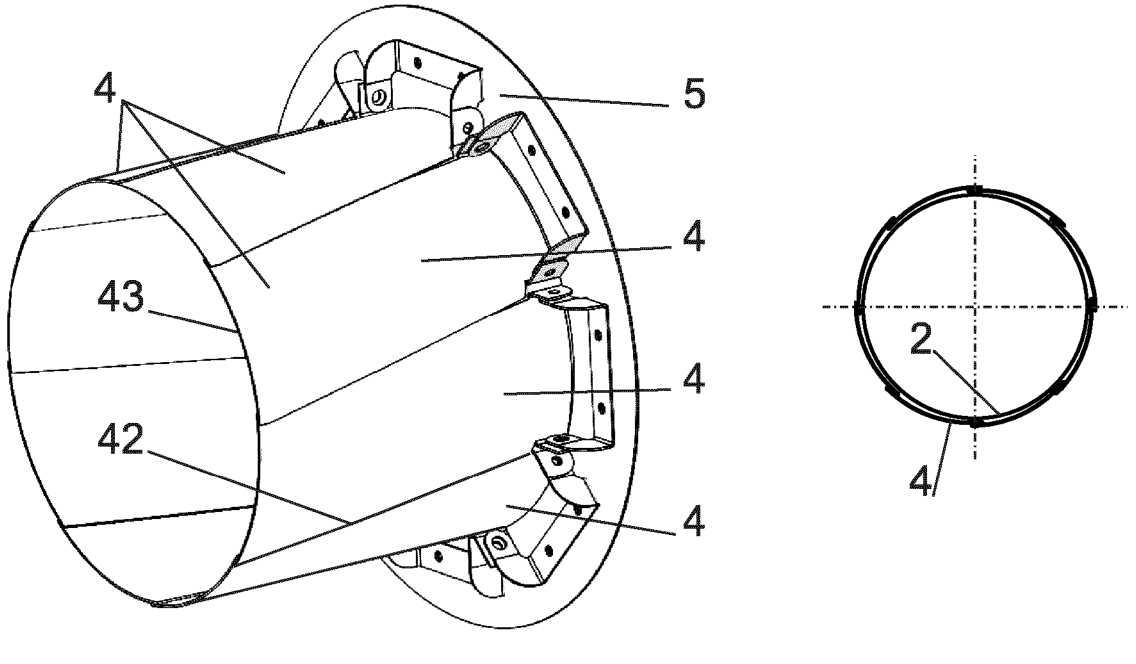



Fig. 12

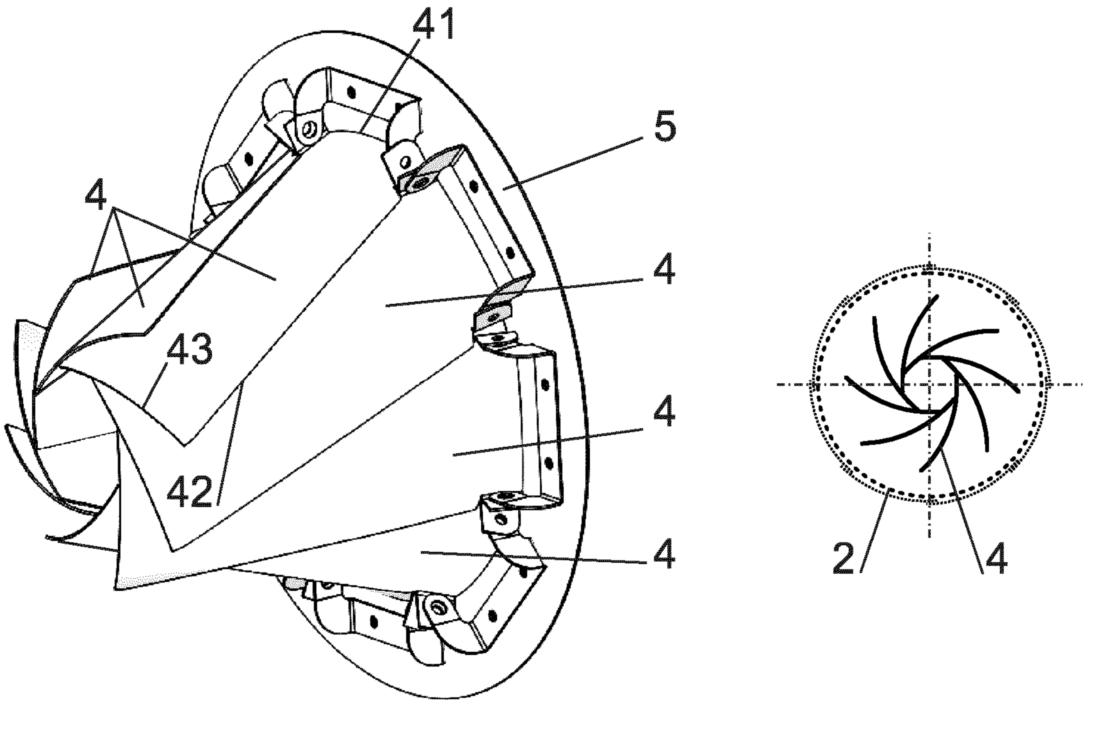
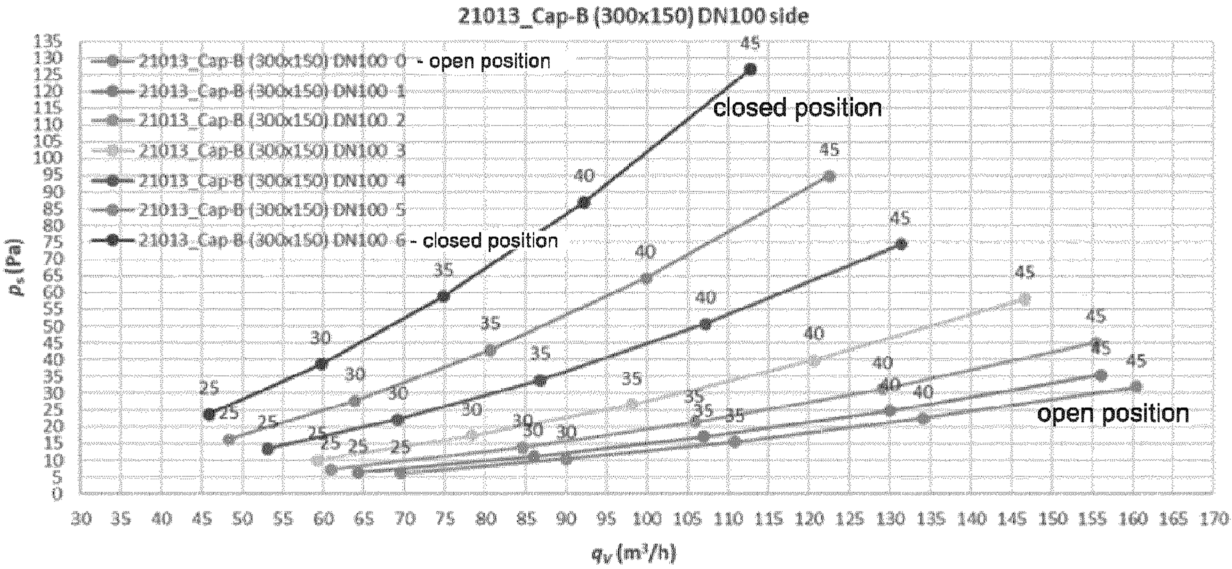



Fig. 13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21013_Cap-B (300x150) DN100 0 - open position
21013_Cap-B (300x150) DN100 1
21013_Cap-B (300x150) DN100 2
21013_Cap-B (300x150) DN100 3
21013_Cap-B (300x150) DN100 4
21013_Cap-B (300x150) DN100 5
21013_Cap-B (300x150) DN100 6 - closed position
closed position
open position
$p_s$ (Pa)
$q_V$ (m³/h)

Fig. 14

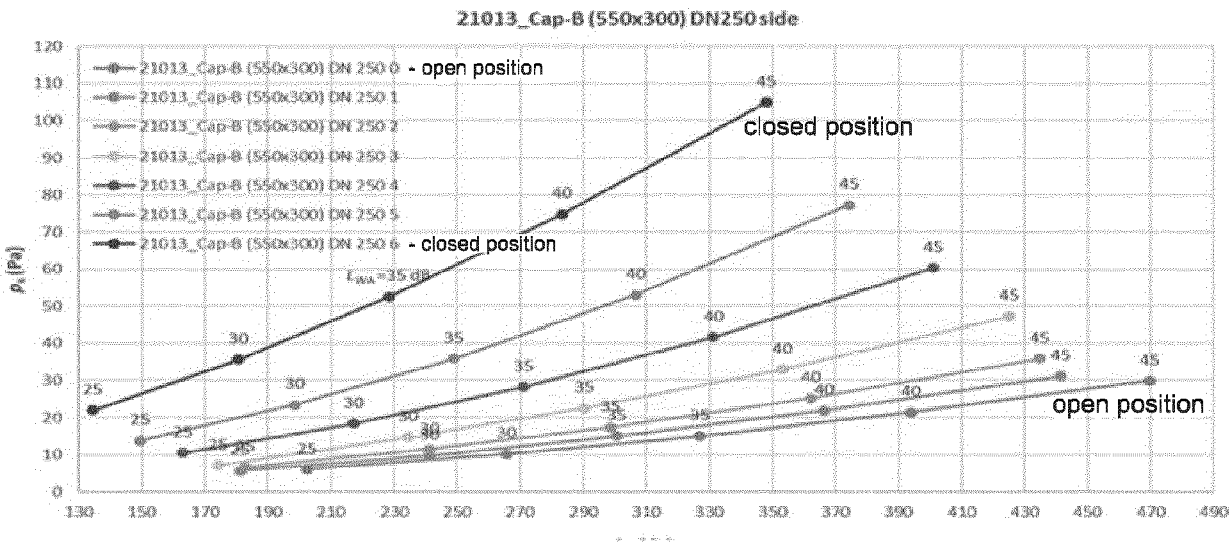
21013_Cap-B (550x300) DN250 side
21013_Cap-B (550x300) DN 250 0 - open position
21013_Cap-B (550x300) DN 250 1
21013_Cap-B (550x300) DN 250 2
21013_Cap-B (550x300) DN 250 3
21013_Cap-B (550x300) DN 250 4
21013_Cap-B (550x300) DN 250 5
21013_Cap-B (550x300) DN 250 6 - closed position
closed position
open position
$p_s$ (Pa)

Fig. 15

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Application Number
EP 23 21 7243

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The present search report has been drawn up for all claims

1

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EPO FORM 1503 03.82 (P04C01)

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