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(54) **WALL SLEEVE SYSTEM FOR A VENTILATION SYSTEM**

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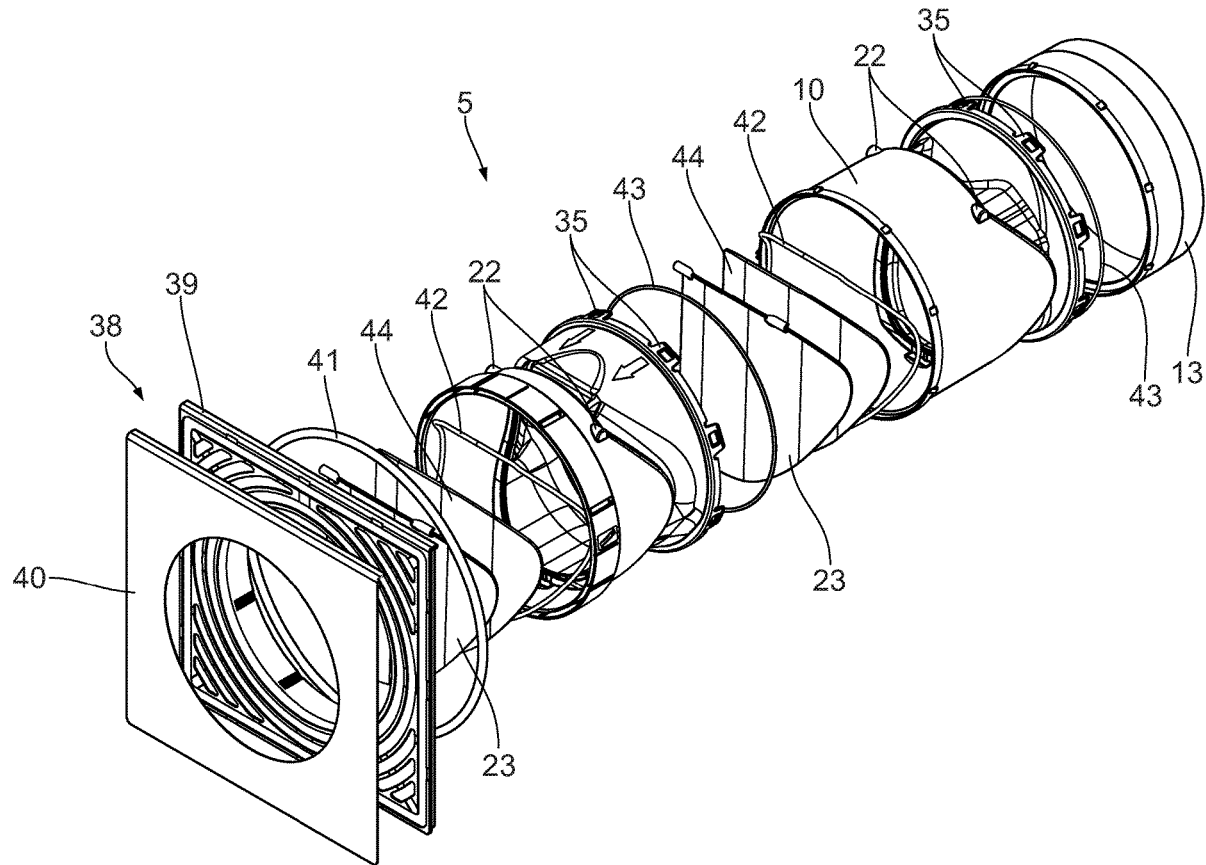
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(57) **ABSTRACT**

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A wall sleeve system for a ventilation system comprises one or more assemblies constituted in a modular manner, which can be flexibly combined with one another.



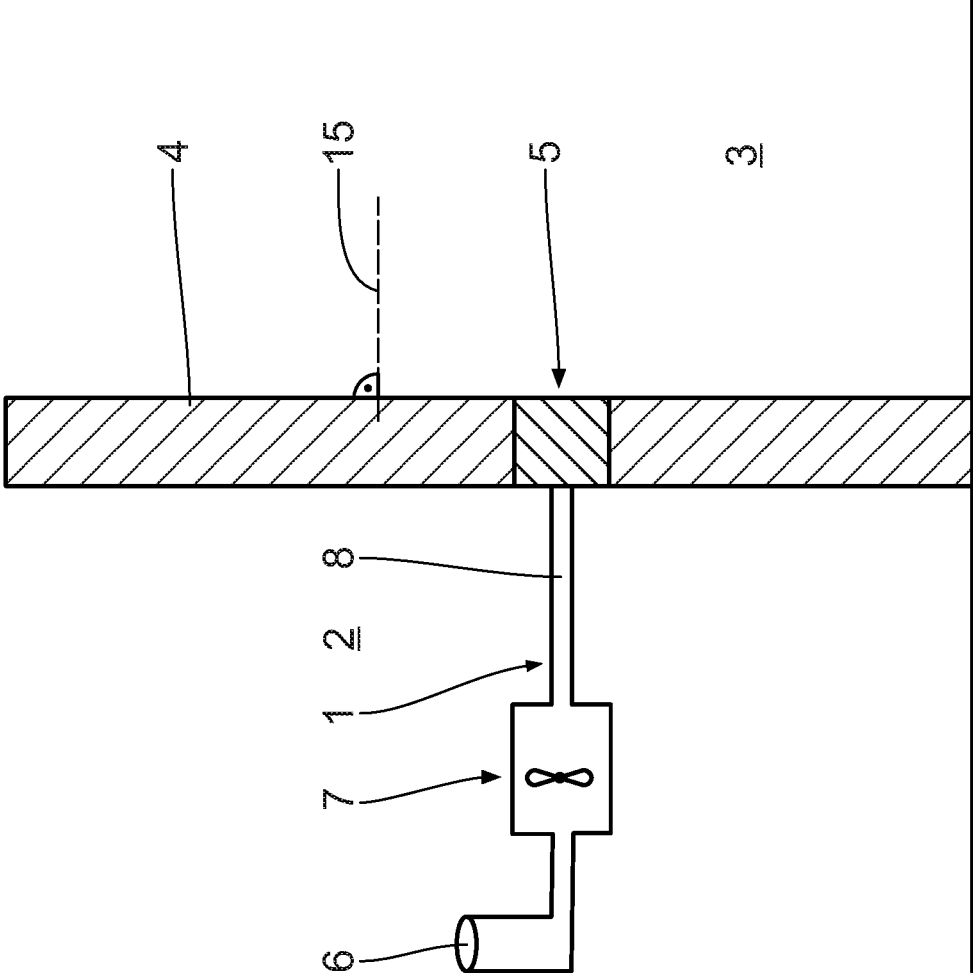


Fig. 1

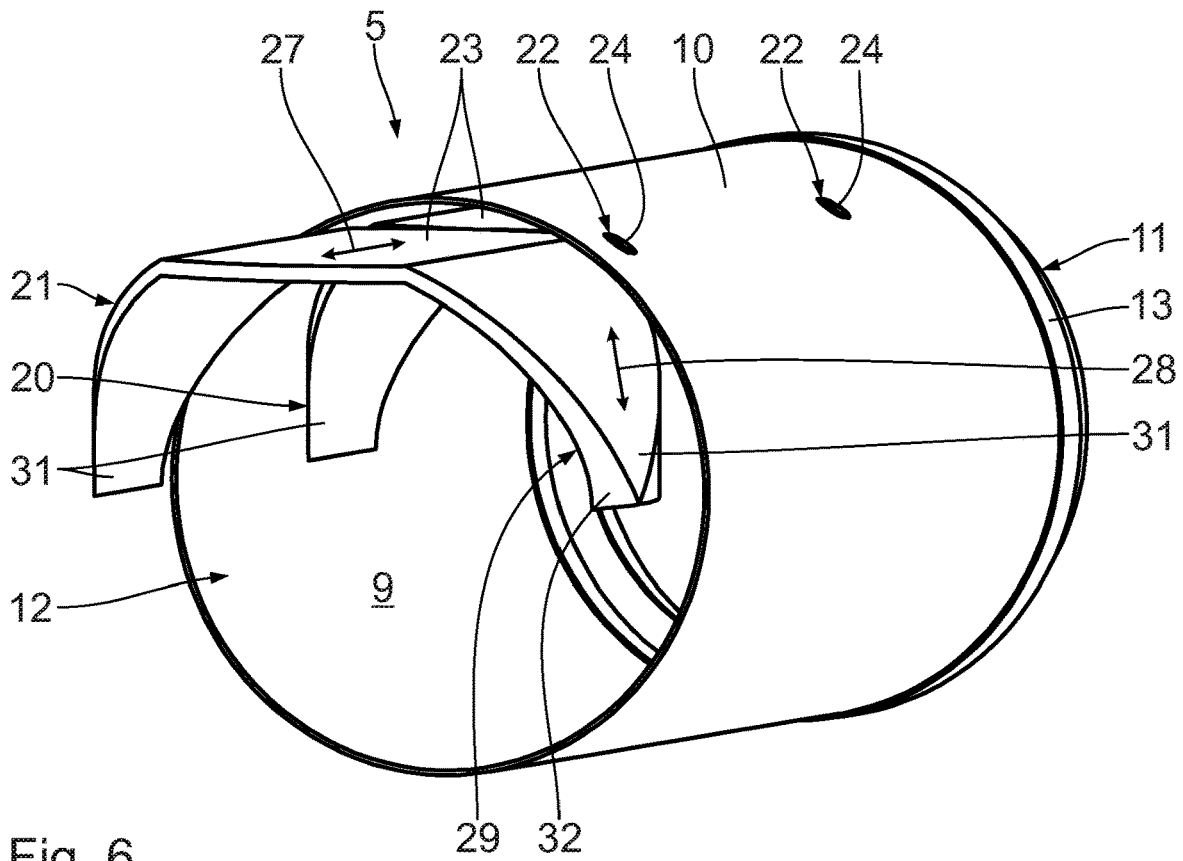


Fig. 6

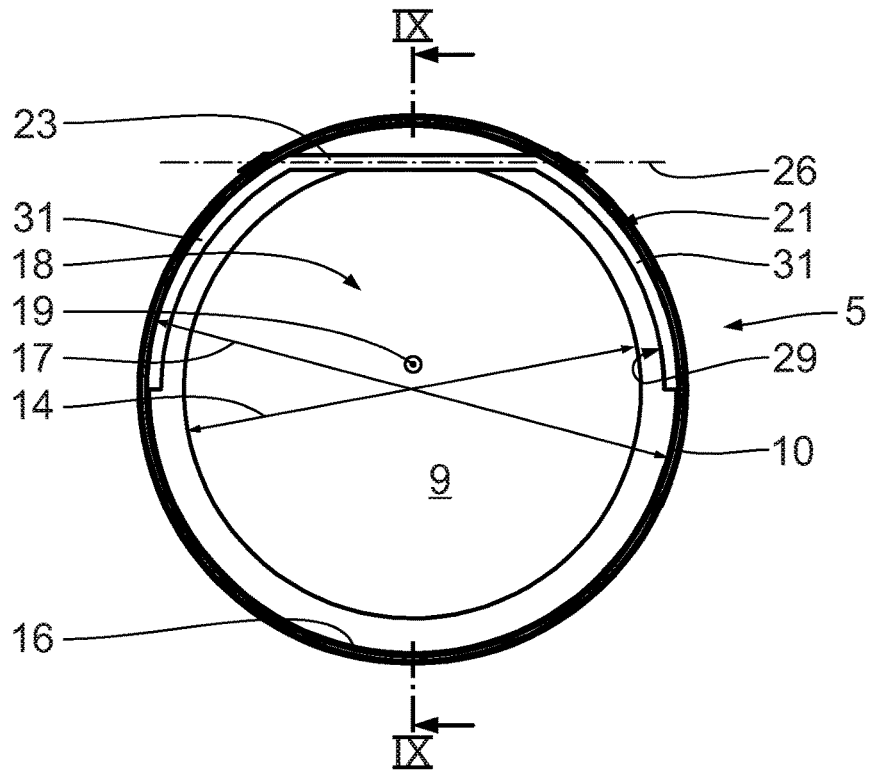


Fig. 7

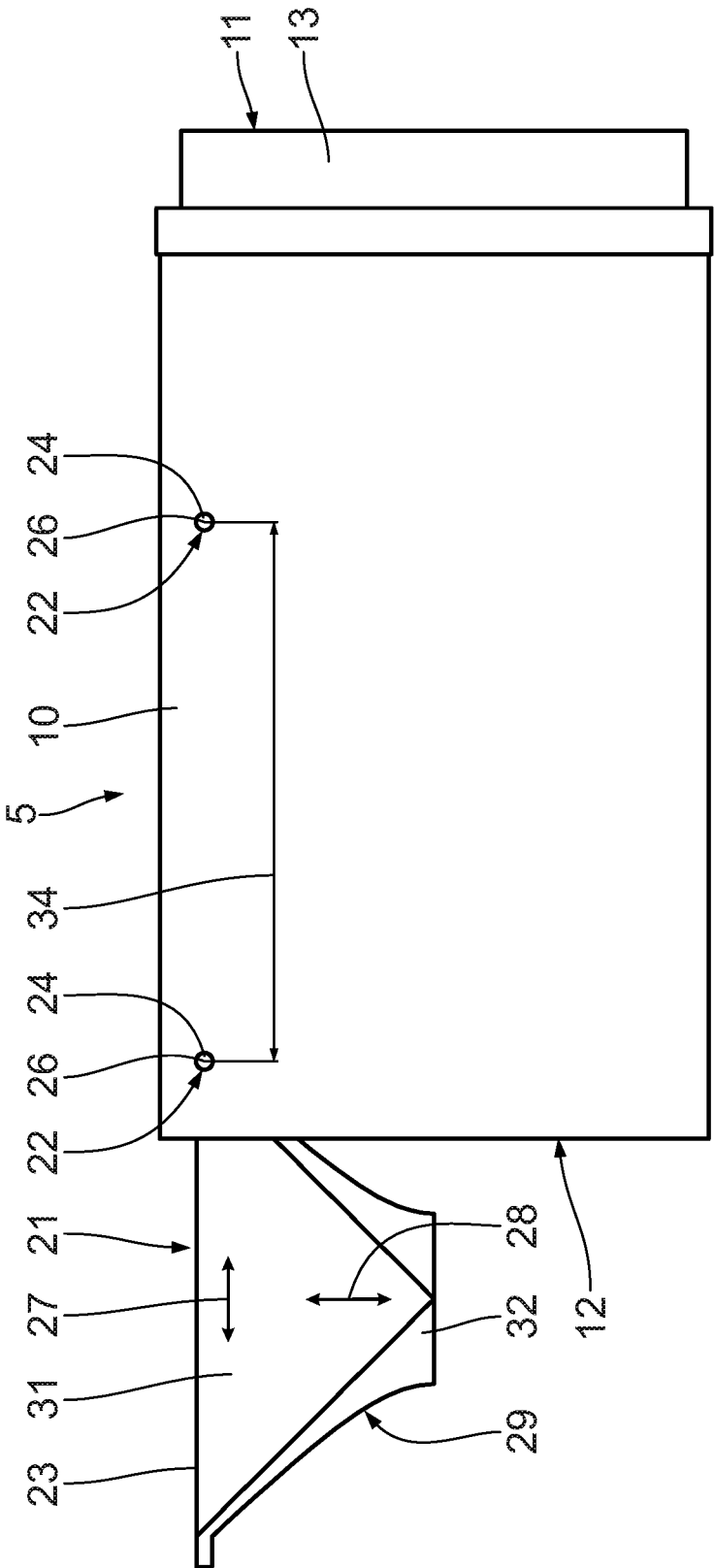


Fig. 8

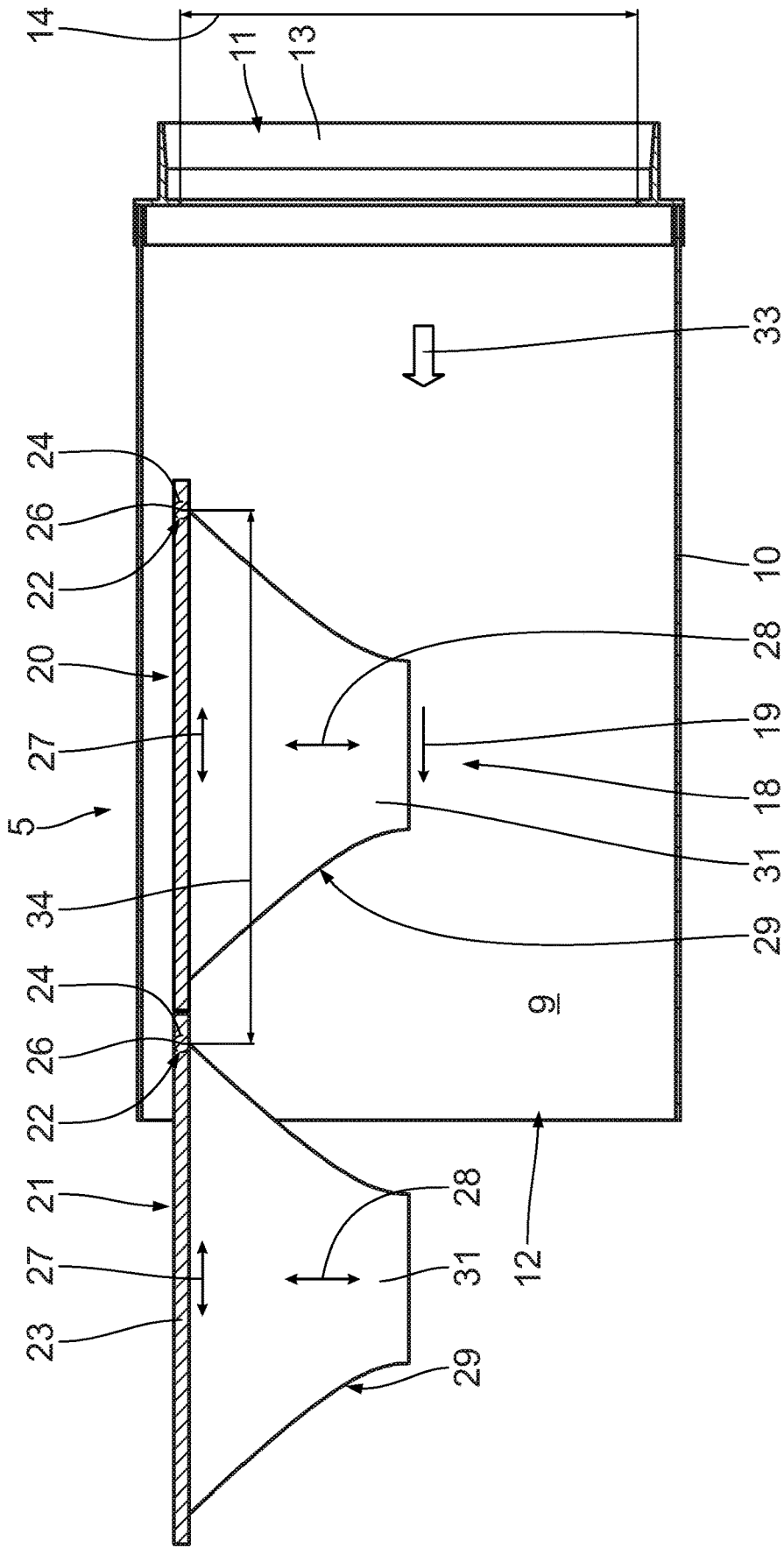


Fig. 9

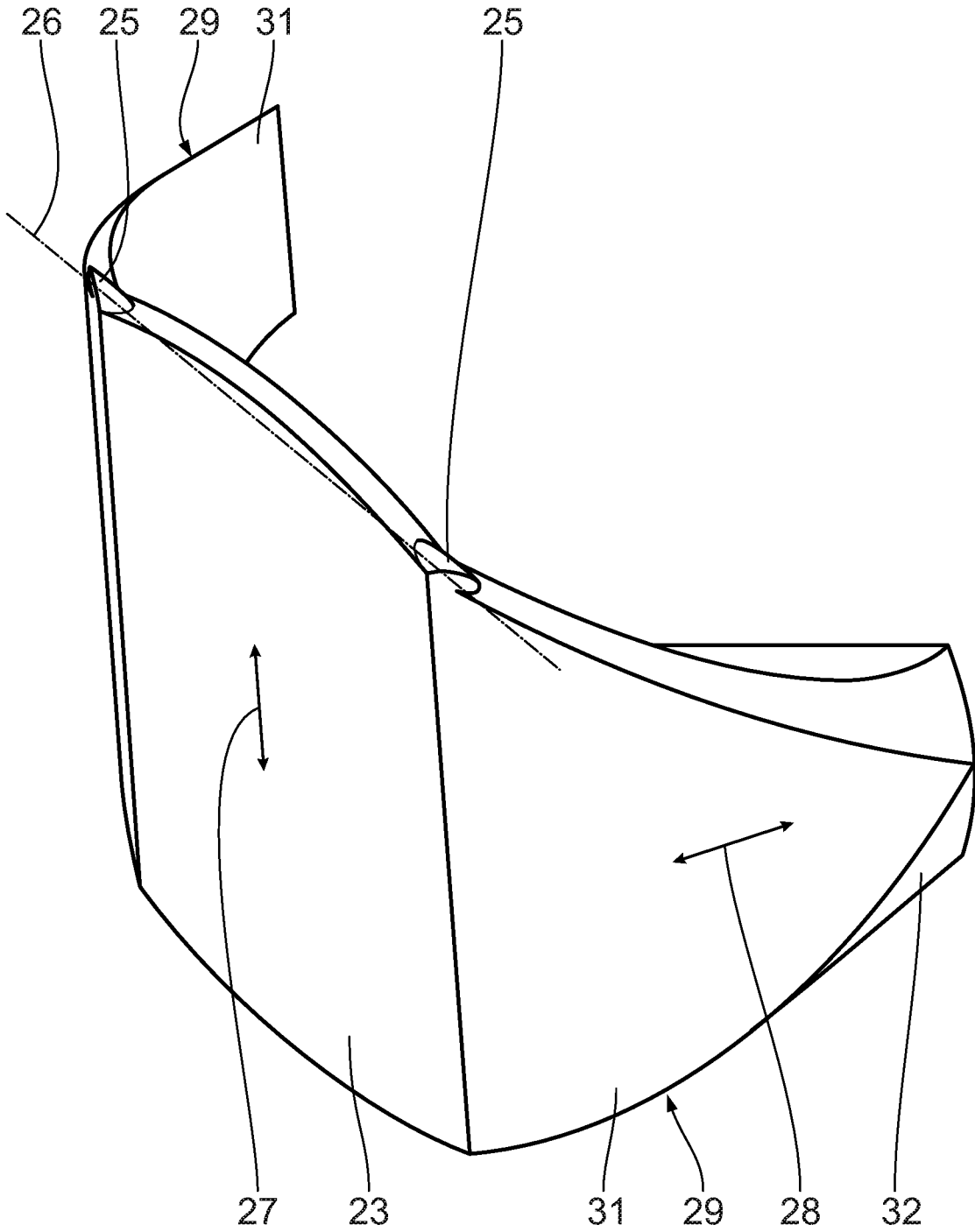


Fig. 10

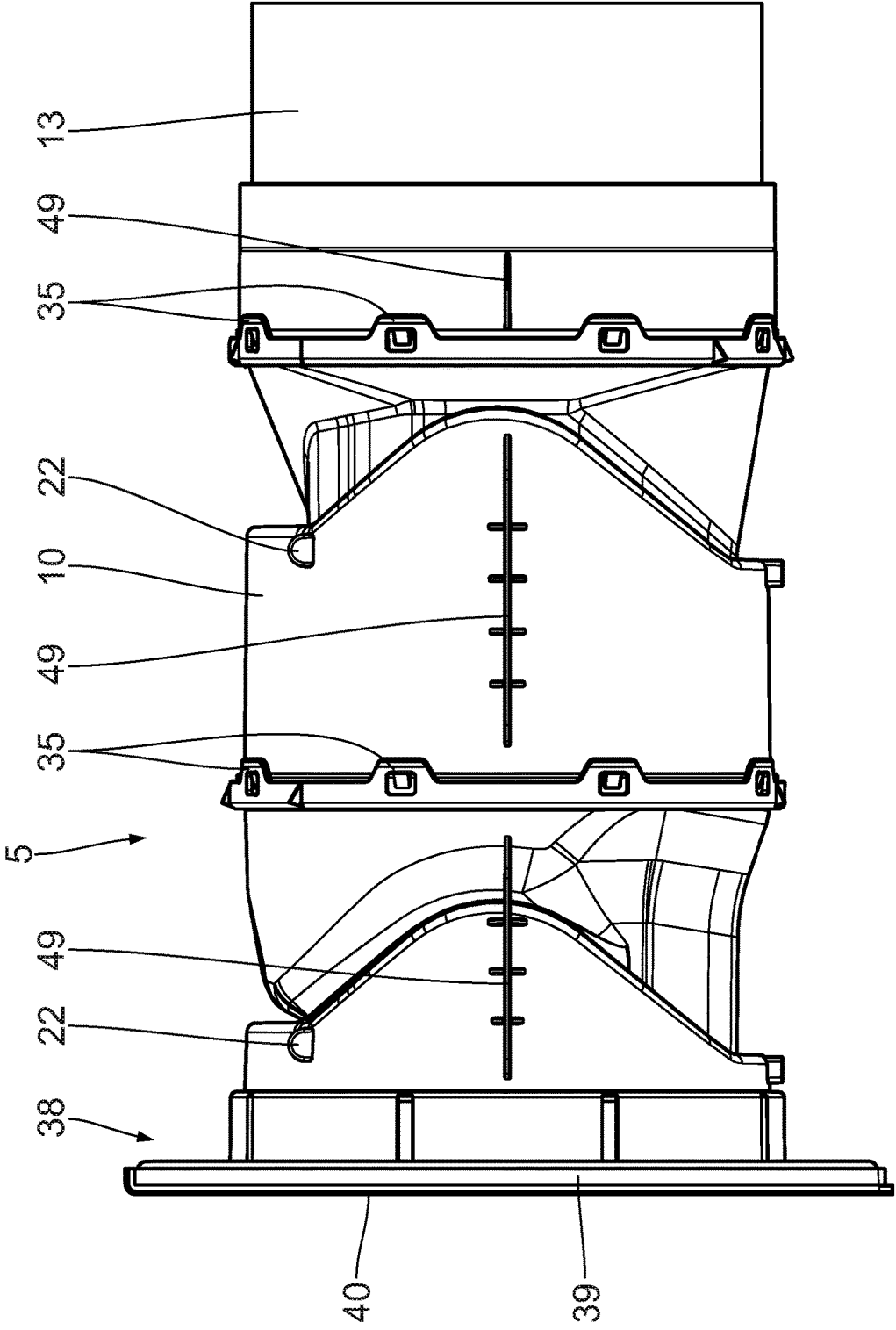


Fig. 11

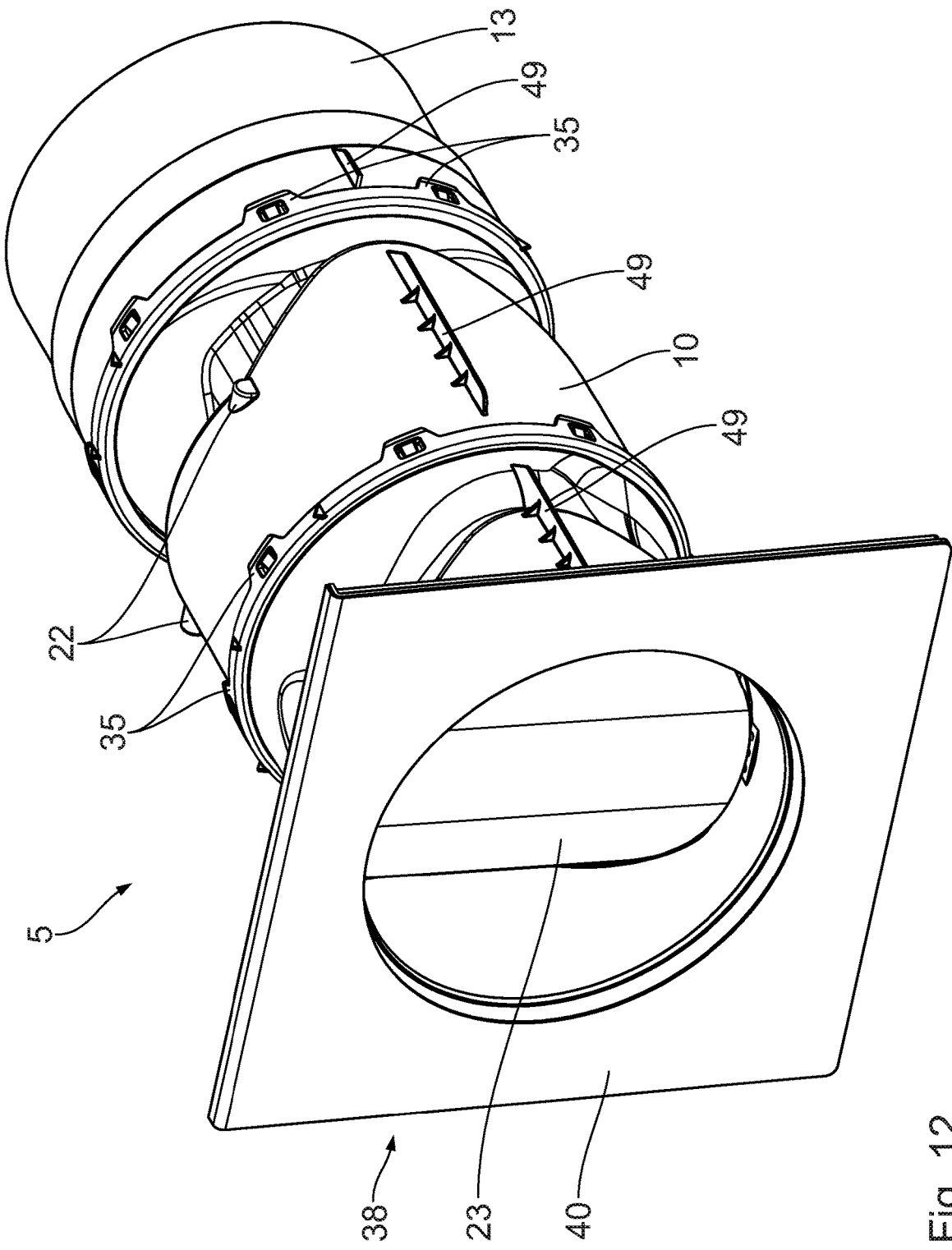


Fig. 12

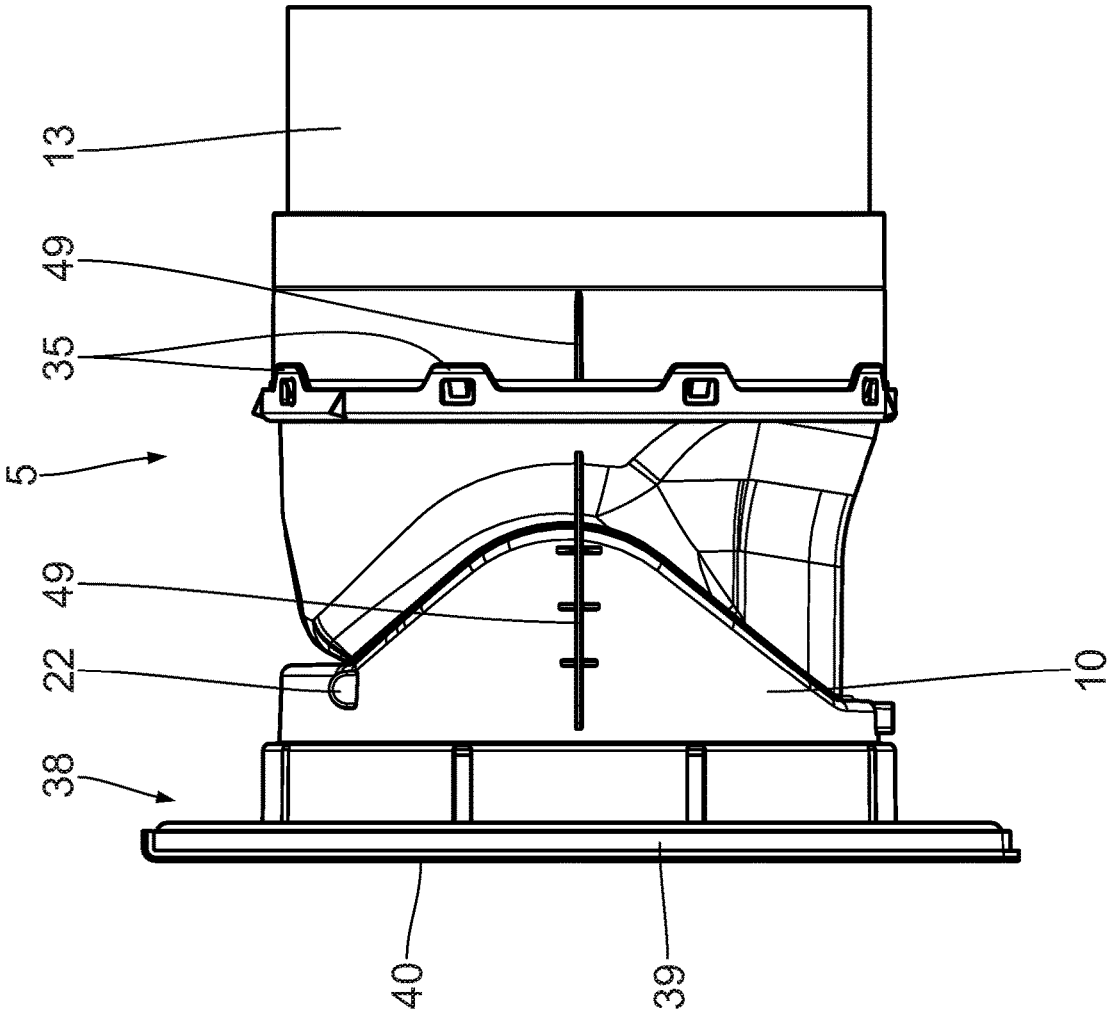


Fig. 13

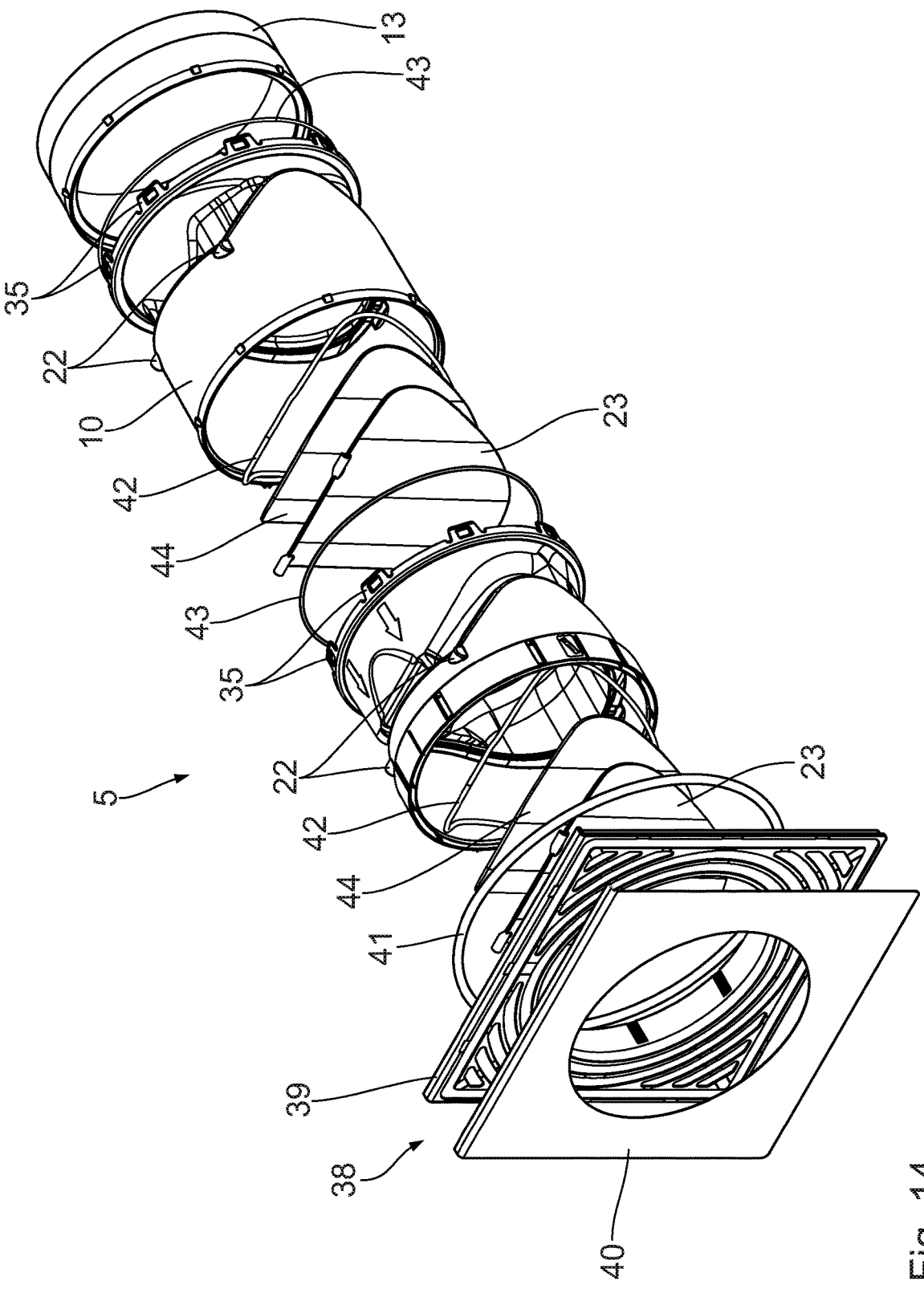


Fig. 14

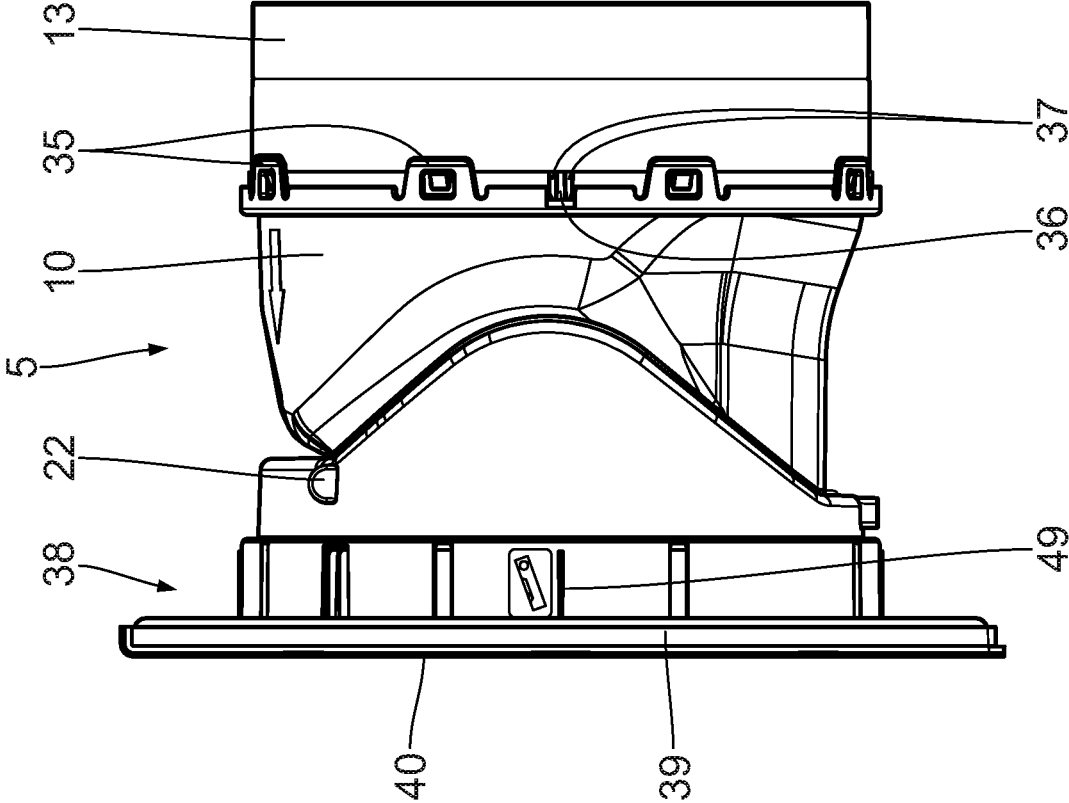


Fig. 16

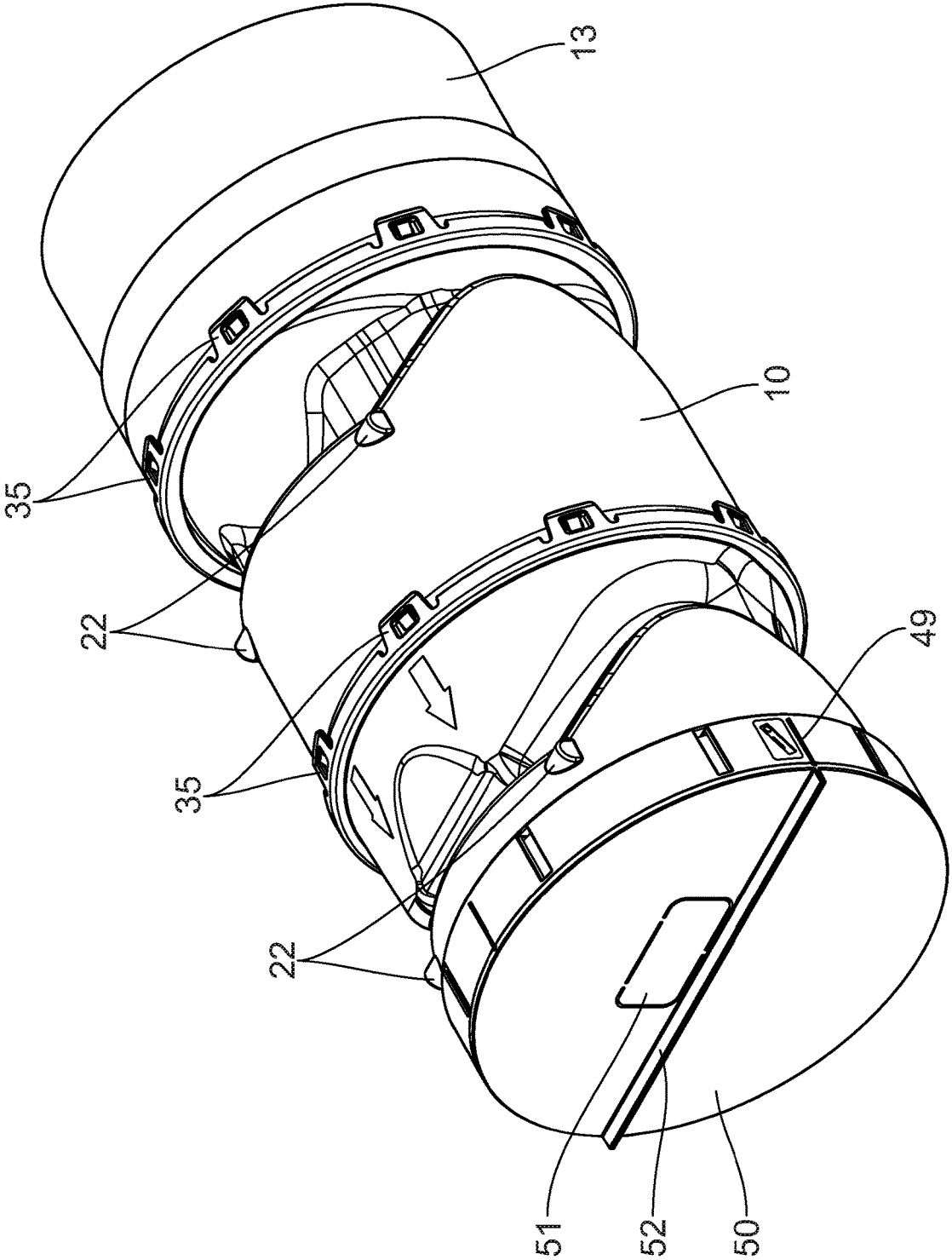


Fig. 17

WALL SLEEVE SYSTEM FOR A VENTILATION SYSTEM

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims the priority of German Patent Application, Serial No. 10 2018 215 410.4, filed Sep. 11, 2018, pursuant to 35 U.S.C. 119(a)-(d), the content of which is incorporated herein by reference in its entirety as if fully set forth herein.

FIELD OF THE INVENTION

[0002] The invention relates to a wall sleeve system for a ventilation system. The invention further relates to a wall sleeve. Finally, the invention relates to a ventilation system and the arrangement of a wall sleeve in an external wall of a building.

BACKGROUND OF THE INVENTION

[0003] Wall sleeves are used in particular in the ventilation of kitchens by means of an extractor fan or controlled domestic ventilation. A wall sleeve is known for example from DE 10 2014 113 210 A1. Extractor fans for extracting cooking fumes are described for example in DE 20 2007 000 610 U1 and DE 20 2011 005 698 U1.

SUMMARY OF THE INVENTION

[0004] It is a problem of the invention to provide, in particular to improve, a wall sleeve system.

[0005] This problem is solved by a wall sleeve system for a ventilation system, comprising one or more assemblies constituted in a modular manner, wherein at least two different selections from the assemblies can be combined with one another to produce different wall sleeves, and wherein different assemblies can be connected to one another in an arbitrary sequence.

[0006] The essence of the invention consists in constituting a wall sleeve system in a modular manner. This should be understood to mean that the wall sleeve system comprises one or more assemblies constituted in a modular manner, which can be combined with one another in different ways.

[0007] Flexibility thus results. In particular, it is possible with the aid of the wall sleeve system to adapt a wall sleeve to be produced from the assemblies in a targeted manner to the given circumstances and/or requirements.

[0008] On account of the modularity, the wall sleeve system can be extended in a straightforward manner. Account can thus also be taken for example of previously not yet known or not yet recognized requirements.

[0009] Different assemblies of the wall sleeve system can be connected to one another in an arbitrary sequence. For example, individual of the different assemblies, in particular one or more housing assemblies and one or more flap assemblies, can be connected to one another in an arbitrary sequence. It is also possible that all different assemblies can be connected to one another in an arbitrary sequence. The wall sleeve system allows for the production of different wall sleeves not only by a different selection of assemblies, but also by their respective arrangement. The resulting wall sleeve can be adapted to the given circumstances and/or requirements in a particularly good and easy manner.

[0010] The different assemblies can be connected to one another in an arbitrary sequence in particular along a flow

direction of an air flow through the wall sleeve to be produced. The connection of the different assemblies in an arbitrary sequence can, for example, be realized in that the respective assemblies are able to be fitted mutually into one another. In particular, the connection of the different assemblies in an arbitrary sequence can be provided by respectively corresponding connection sections of the different assemblies, in particular connection sections which are arranged at respective ends of the assemblies in the flow direction. For example, each of the different assemblies, which can be connected to one another in an arbitrary sequence, may comprise at least one connection element at a first end face and at least one corresponding counter connection element at a second end face opposite to the first end face. The at least one connection element of a first assembly can be connected to the at least one counter connection element of a second assembly. In order to reverse the sequence, the at least one connection element of the second assembly can be connected to the at least one counter connection element of the first assembly. The connection elements and the counter connection elements may be formed as external threads and internal threads, respectively. Preferably, the connection elements and the counter connection elements are formed as latching elements for mutual latching.

[0011] According to one aspect of the invention, the wall sleeve system comprises assemblies which are selected from the following list: at least one shutter assembly, at least one filter assembly, at least one electrical assembly, at least one insulation assembly, at least one blocking assembly, at least one housing assembly, at least one flap assembly, at least one installation aid assembly, at least one cover assembly, at least one connection assembly and at least one adapter assembly.

[0012] The different assemblies can in particular have different functions.

[0013] The at least one shutter assembly is used in particular for shutting off the wall sleeve, in particular at the external side of a building.

[0014] The shutter assembly can be constituted as a sandwich component. It can in particular comprise a plastic panel as a support element. It can in particular comprise a stainless-steel panel as a privacy screen.

[0015] The shutter assembly can be connected in particular to the housing assembly and/or the flap assembly, in particular connected in a flow-tight manner. It can in particular be latchable to the housing assembly and/or the flap assembly. This will be explained in greater detail below.

[0016] The at least one housing assembly is used in particular as a wall lead-through. It can in particular have a circular or at least essentially circular flow cross section and/or outer diameter. It can thus be arranged in a straightforward manner in a drilled core hole.

[0017] The wall sleeve system preferably comprises a plurality of housing assemblies with different installation lengths. This is advantageous for the production of different wall sleeves for different wall thicknesses.

[0018] The at least one flap assembly comprises at least one flap arrangement for the reversible closure of a flow region. The flap arrangement is used in particular as a valve, in particular as a flap or non-return valve.

[0019] According to a variant, the flap assembly comprises a housing assembly with one or more flap arrange-

ments arranged therein. Conversely, the flap assembly can be converted into a housing assembly by removing the flap arrangements.

[0020] The flap assembly is described in greater detail below.

[0021] A filter assembly is used for filtering specific materials. It comprises in particular one or more filter elements. This can be particularly advantageous if the wall sleeve is intended for special applications, in particular for conveying waste air with special impurities.

[0022] An electrical assembly can comprise electrical connections and/or components. For example, an electrical assembly can comprise a lighting element, a camera, a transmitting and/or receiving device or other electrical or electronic components.

[0023] An insulation assembly is used to improve the insulation properties of the wall sleeve. It can be arranged in particular at the periphery with respect to a housing and/or flap assembly.

[0024] A blocking assembly is used to block out vermin. With the aid of a blocking assembly, the penetration of insects and/or rodents into the ventilation system is in particular reliably prevented.

[0025] The at least one installation aid assembly is used to facilitate the installation of the wall sleeve in a wall, in particular an external wall of a building. It can in particular comprise installation aids, for example support elements for supporting a spirit level, which facilitate the alignment of the wall sleeve during the assembly.

[0026] The at least one cover assembly is used to cover an assembly arranged in a wall during a shell construction phase. With the aid of the cover assembly, it is possible to prevent the wall sleeve from getting dirty due to plastering or painting work or suchlike. By means of the cover assembly, damage to the wall sleeve or its components can in particular be prevented.

[0027] After completion of the building work, the cover assembly can be removed. It can be replaced in particular by a shutter assembly.

[0028] The at least one connection assembly is used to connect a ventilation channel, in particular a ventilation pipe. It can be used, like the at least one adapter assembly, as a transition element between channel or pipe elements with different internal or external diameters.

[0029] With the aid of the adapter assembly, it is possible to equip the wall sleeve with further components and/or functions.

[0030] According to a further aspect of the invention, the wall sleeve system comprises at least one housing assembly with a housing bounding an interior space with an inlet for an airstream and an outlet for an airstream. It has been recognized that it is advantageous for the reduction of the flow resistance if $A/K > 2/\pi$ applies for an area A of the cross section of the interior space perpendicular to the flow direction, wherein K indicates an area of a single circle with the smallest possible radius that completely covers the cross section of the interior space.

[0031] The housing assembly has in particular a circular interior space cross section. As an alternative to this, the housing assembly can have an interior space cross section approaching a circular shape, in particular a polygonal interior space cross section with at least 5, in particular at least 6, in particular at least 8 corners. Each of the corners can be rounded off here. By means of a polygonal formation

of the interior space cross section, the stability, in particular the flexural strength, of the housing assembly can be improved.

[0032] The cross section of the interior space can remain constant or can vary along the flow direction. In any event, the cross section satisfies the condition according to equation (1), wherein the precise value of A/K can vary. The enveloping circle completely covers the cross-sectional interior space. The following applies: $1 \leq A/K$. Area K of the enveloping circle therefore represents an upper limit for area A of the cross section of the interior space. Area K of the circle thus represents the largest possible cross-sectional area with a given maximum diameter of the interior space of the wall sleeve. The condition

$$A/K = 2/\pi \approx 0.6367$$

applies to a square cross section. The cross section of the interior space deviates from a simple, essentially rectangular shape. With a given maximum diameter, the cross section has an area A that is enlarged compared to a rectangle. With a given maximum diameter of the interior space, which can correlate with maximum external dimensions of the wall sleeve, a large area A of the cross section of the interior space is guaranteed, which produces a better ventilation and a lower flow resistance. The following preferably applies: $A/K > 0.7$, in particular $A/K > 0.8$, in particular $A/K > 0.9$, in particular $A/K > 0.95$, in particular $A/K > 0.975$.

[0033] An outer contour of the housing can diverge from the cross-sectional contour of the interior space. Preferably, however, the outer contour of the housing essentially corresponds to the cross-sectional contour of the interior space. For this purpose, the housing can have a constant wall thickness along the periphery of a housing cross section. This ensures small external dimensions of the wall sleeve relative to area A of the cross section of the interior space. An outer contour of the housing essentially corresponding to the cross-sectional contour of the interior space also has the advantage that an area of a circle enveloping the outer contour of the housing is largely filled. Suitable wall thicknesses lie for example between 1 mm and 30 mm, they amount in particular to a maximum of 20 mm, in particular to a maximum of 10 mm, in particular to a maximum of 5 mm, preferably to approximately 2.5 mm.

[0034] A wall breakthrough required for the installation of the wall sleeve in the masonry can thus be carried out in a straightforward manner with core hole drilling. The wall sleeve is easy to install. In addition, the wall sleeve largely fills a drilling cross section of the drilled core hole, unlike a box-shaped wall sleeve. A smaller wall breakthrough in relation to the cross section of the interior space, which is available for the ventilation, can thus be provided. For example, the diameter of the wall breakthrough exceeds the maximum diameter of the wall sleeve at most by 30%, in particular at most by 25%, preferably by at most 20%, particularly preferably by at most 15%. The assembly of the wall sleeve is simple and effective.

[0035] Laborious fitting of the wall sleeve in the wall breakthrough is avoided. In addition, the insulation cost for insulating the wall breakthrough is reduced.

[0036] A cross section of the inlet can have an arbitrary shape. The shape of the cross section of the inlet preferably corresponds to the shape of the cross section of a ventilation pipe to be attached to the wall sleeve, for example a ventilation channel, in particular a flat channel, or preferably

a round pipe. Particularly preferably, the cross section of the inlet essentially corresponds to the cross section of the interior space. As a result of matching the cross sections of the ventilation pipe, the inlet and the interior space, turbulence in the airstream, especially in the region of the inlet, is reduced. The fluid dynamics of the airstream in the wall sleeve are improved.

[0037] The cross section of the outlet can diverge from the cross section of the inlet and/or the cross section of the interior space. The cross section of the outlet can in particular be enlarged compared to the cross section of the inlet. The cross sections of the outlet and of the inlet preferably have the same shape. The fluid dynamics of the airstream in the open position of the flap of the at least one flap arrangement are thus stabilized in the entire wall sleeve. Turbulence in the airstream along the flow direction, in particular in the region of the outlet, is reduced.

[0038] According to a further aspect of the invention, the wall sleeve system comprises at least one flap assembly with at least one flap arrangement, wherein a flap arranged in a swivellable manner on a suspension is constituted such that, at least in the open position, it has a flap contour which is matched to the cross-sectional contour of the interior space. In particular, the flap is constituted in such a way that, in the open position, it is in surface-to-surface contact with the housing of the flap assembly at least in sections, preferably over its entire surface. The flap can in particular lie extensively over its area against the inner wall of the housing of the flap assembly. This leads to particularly favourable flow-mechanical properties.

[0039] On account of the cross-sectional contour of the interior space, which—as described above—diverges from a simple rectangular shape, swivelling of the flap out of the closed position, in particular out of the flow region, is generally made difficult. This is especially the case when precisely one flap is provided per flap arrangement. In the wall sleeve according to the invention, this problem is solved by the flap contour defined at least in the open position of the flap, which flap contour, in the regions adjacent to the swivel axis, is matched to the cross-sectional contour of the interior space in the corresponding regions adjacent to the swivel axis. The matching of the flap contour means that the external dimensions of the flap contour essentially correspond in the corresponding regions to the internal dimensions of the cross-sectional contour of the interior space. This is essentially to be understood to mean that, despite the matching of the external dimensions of the flap contour to the internal dimensions of the cross-sectional contour, sufficient play is present such that an, in particular friction-free, swivelling of the flap from the closed position into the open position and back is ensured.

[0040] The matching of the flap contour makes it possible for the flap to be easily swivelled from the closed position into the open position and back even in an interior space diverging from a rectangular cross section. In particular, it is possible for the flap of the at least one flap arrangement in the open position to be swivelled largely out of the flow region. This thus prevents the flap of the at least one flap arrangement in the open position coming to lie wholly or in substantial parts inside the flow region. A flow resistance caused by the at least one flap arrangement, in particular the flap of the at least one flap arrangement, is reduced. This improves the fluid dynamics of the airstream in the wall sleeve. Disturbing noises, which the airstream causes when

it flows round the flap of the at least one flap arrangement, are reduced. The flow resistance of the wall sleeve in the open position is further reduced.

[0041] Since the cross sectional contour of the interior space diverges from a simple rectangular shape, the flap of the at least one flap arrangement at least in the open position also does not have a simple flap contour, but a three-dimensional flap contour. The flap of the at least one flap arrangement is in particular not flat or plate-shaped at least in the open position. On account of the three-dimensional flap contour, the flap at least in the open position has an extension in a contour direction. The contour direction runs perpendicular both to the longitudinal direction of the flap and to the swivel axis. The swivel axis, the longitudinal direction and the contour direction span an orthogonal coordinate system, in relation to which the contour and shape of the flaps can be measured. This coordinate system is fixed with respect to the given flap and is swivelled with the flap. In the open position, the extension of the flap contour in the direction of the contour direction can amount for example to at least 5%, in particular to at least 10%, in particular to at least 20%, in particular to at least 30%, in particular to at least 40%, preferably to at least 45% of the maximum extension of the flap in the longitudinal direction.

[0042] For the matching of the flap contour in the open position, the flap of the at least one flap arrangement can be flexible or articulated. For example, the flap constituted in a flexible or articulated manner can be pressed for example against the inner side of the housing during the swivelling into the open position, so that matching of the flap contour to the cross-sectional contour of the interior space thus takes place. A stop is preferably provided, which prevents striking with the flap against the inner side of the housing. The stop can in particular be provided in the axis seating. By means of a stop, it is in particular possible to limit the swivelling angle of the flap to less than 90°.

[0043] By means of such a stop, it is possible to reliably prevent the flap from pressing against the inner side of the housing and then remaining in the opened position due to adhesion or on account of mechanical deformation, even when no airstream is present. Alternatively, especially in the case of flaps constituted in an articulated manner, automatic swivelling of the flap parts towards one another can take place during the swivelling into the open position. Preferably, however, the flap is constituted so as to be rigid or dimensionally stable. This means that the flap is permanently contoured, i.e. irrespective of a swivelling position of the flap. This increases the stability and durability of the flap and the reliability during the opening and closing of the flap. The flap can also be produced easily and in a favourable manner.

[0044] The flap contour is preferably matched to the cross-sectional contour in such a way that the flap of the at least one flap arrangement in the closed position lies flush against the cross-sectional contour, in particular flush along the entire cross-sectional contour. The sealing effect of the closed position is thus ensured irrespective of protrusions, sealing means and suchlike. The absence of protrusions, against which the flaps could lie, improves the flow properties. In addition, no dirt can accumulate behind the protrusions. For this purpose, the flap can comprise two contour wings extending in the contour direction. In addition, contour edges, in particular rounded off, can be constituted on

the flap, so that despite the sealing effect sufficient play is present such that the flap can easily be swivelled, in particular friction-free.

[0045] According to a further aspect of the invention, the wall sleeve system comprises at least one flap assembly with two adjacent flap arrangements, wherein a spacing of the swivel axes of the adjacent flap arrangements is at least so large that the flaps in the open position do not have an overlap in the flow direction.

[0046] The effect of this is that an insulating air cushion is formed between the two flap arrangements in the closed position. This leads to a particularly advantageous thermal insulation of the wall sleeve.

[0047] The at least one flap arrangement can comprise a plurality of flaps. In this case, the flaps of a flap arrangement can in particular be arranged beside one another along a common swivel axis or lying opposite with respect to the cross section of the interior space. Preferably, however, the at least one flap arrangement comprises precisely one flap. This ensures an uncomplicated structure of the flap assembly. In addition, the risk of interlocking during swivelling of a plurality of flaps of the at least one flap arrangement is avoided.

[0048] The flap of the at least one flap arrangement has a longitudinal direction. The longitudinal direction of the flap is defined as the direction perpendicular to the swivel axis in which the flap has the greatest extension measured perpendicular to the swivel axis. The longitudinal direction of the flap thus corresponds to the largest diameter of the flap running perpendicular to the swivel axis. The longitudinal direction runs perpendicular to the swivel axis irrespective of a swivelling position of the flaps. In addition, the flap of the at least one flap arrangement has an orientation. The orientation is defined as the plane which extends through the longitudinal direction of the flap and a straight line running parallel to the swivel axis. The orientation of the flap changes with the swivelling of the flap. The flap has different orientations in the closed position and in the open position.

[0049] In the closed position, the flap closes the at least one flap arrangement and the flow region, in particular the entire interior space of the housing in the region of the at least one flap arrangement, in a tight manner, in particular gas-tight. In the closed position, a direct air exchange between the inlet and the outlet is consequently prevented. In particular, the direct air exchange between an outside and an inside of a building through the wall sleeve is prevented in the closed position. In particular, an airstream against the flow direction, i.e. from the outlet to the inlet, is thus prevented. In the closed position, the orientation of the flap and therefore also its longitudinal direction can be essentially perpendicular to the flow direction.

[0050] In the open position of the flap, a fluidic connection is produced between the inlet and the outlet, so that an airstream can flow in the wall sleeve in the flow direction. The airstream essentially flows through the flow region.

[0051] According to a further aspect of the invention, at least two flap assemblies can be arranged one behind the other in the flow direction. In particular, the at least two flap assemblies can be arranged directly behind one another and/or can be connected to one another by one or more housing assemblies. The effect of this is also that a vertical air column is formed as an insulation cushion between the two flaps in a closed position. In particular, the insulation cushion can be formed, without increasing the length of the

individual flap assemblies and/or their respective number of flap arrangements. The insulation properties of the wall sleeve and its length can be adapted flexibly.

[0052] According to a further aspect of the invention, at least one flap assembly comprises at least one flap with an insulation layer. The thermal insulation is also thus improved. In particular, the heat transmission coefficient (U-value) is reduced. A flap assembly with a single flap can have a U-value of less than 4 W/mK, in particular a U-value of less than 3 W/mK. A flap assembly with two flaps has a U-value of less than 3 W/mK, in particular less than 2 W/mK.

[0053] According to a further aspect of the invention the one or more housing assemblies and the one or more flap assemblies can be connected to one another in an arbitrary sequence.

[0054] According to a further aspect of the invention, the assemblies comprise latching elements for mutual latching.

[0055] The assemblies preferably each comprise a symmetry-breaking element in a latching section. Incorrect fitting-together of the assemblies can thus be reliably prevented. The symmetry-breaking element can be constituted for example according to the poka yoke principle.

[0056] By means of the symmetry-breaking element, the number of different relative positions of adjacent assemblies in the latched state can be reduced to a finite number, in particular to one, two or four different positions, in the case of flap assemblies preferably to a single position.

[0057] According to a further aspect of the invention, different assemblies can be connected to one another in each case in a flow-tight manner. For the sealing of assemblies connected to one another, one or more sealing means can be used, for example a sealing cord and/or a foamed seal, in particular an EPDM seal (ethylene-propylene-diene rubber seal) can be provided.

[0058] The different assemblies are able in particular to be fitted into one another. They can thus be fitted together in particular to form a wall sleeve. In the state fitted together, the wall sleeve is stable. The assemblies are in particular secured against unintentional separation from one another. This can be ensured for example by means of the latching elements.

[0059] Alternative measures for securing the connection of adjacent assemblies are also possible. For example, the assemblies can be glued or welded or pressed together. They can also be connected to one another in a form-fit manner. A secure connection, in particular sealing of the connection of adjacent assemblies, can also be achieved by additional elements, for example connecting clips, connecting hoses or by means of adhesive tape.

[0060] According to a further aspect of the invention, the flap of the at least one flap arrangement can be swivelled purely mechanically from the closed position into the open position. The use of a, for example, electrical control of the flap is thereby avoided. This has the advantage of a simple and failsafe mode of operation of the wall sleeve. The wall sleeve is characterized by a currentless mode of operation. Fault-prone electric motors and/or tipping devices, in particular tipping devices between the electric motors and the flap, are not required.

[0061] The mechanical swivelling capability of the flap of the at least one flap arrangement can be implemented for example by springs arranged on the at least one flap arrangement, in particular by wrap springs or spiral springs in the

region of the suspensions. Preferably, however, the flap of the at least one flap arrangement is capable of being swivelled purely in a passive manner. This should be understood to mean that the flap can be swivelled out of the closed position solely by means of an airstream flowing in the flow direction. The flap is capable of being swivelled in particular without the assistance of electrical and/or mechanical aids. This ensures a cost-effective design of the wall sleeve with at the same time a high degree of safety against failure.

[0062] In particular, provision can be made such that the flap can only be swivelled out of the closed position when a flow pressure of the airstream in the flow direction exceeds a predetermined opening pressure. This thus ensures that the flaps are not swivelled out of the closed position when the flow of the airstream in the flow direction is less than the flow pressure. In particular, the flaps can have the function of a non-return valve. This thus ensures that the wall sleeve permits airstreams only in the flow direction. An airstream against the flow direction is reliably prevented.

[0063] It has been shown to be practicable if the opening pressure amounts to between 60 Pa and 90 Pa, in particular between 65 Pa and 75 Pa. Unintentional opening of the flaps is thus prevented. The wall sleeve complies with the so-called "blower door test", which requires tightness with an air draught of 60 Pa. At the same time, the maximum opening pressure of 90 Pa is sufficiently low to prevent overloading of an upstream ventilation system, in particular of a fan.

[0064] According to a preferred variant, the flaps have an adjustable opening pressure. The opening pressure can in particular be adjusted in a straightforward manner by adjusting the relative position of a magnet and a threaded pin interacting therewith.

[0065] Particularly preferably, the flap of the at least one flap arrangement can also be swivelled from the open position into the closed position purely mechanically, in particular purely in a passive manner. This can take place for example by the force of gravity.

[0066] In the closed position, the centre of gravity of the flap of the at least one flap arrangement can be displaced with respect to an area formed by the swivel axis and the direction of the force of gravity. This may thus be accompanied by the fact that the orientation of the flap of the at least one flap arrangement in the closed position is inclined at an angle with respect to a direction of the force of gravity. This can be implemented in that the flap in the closed position lies against a protrusion. This thus ensures that the flap remains in the closed position solely on account of its inherent weight.

[0067] According to a further aspect of the invention, the swivel axis of the at least one flap arrangement is orientated horizontally and arranged in an upper half of the cross section. The upper half of the cross section here is the half of the cross section which, with the intended installation of the wall sleeve, lies with respect to the direction of the force of gravity above the centre of gravity of the cross section area of the interior space. By means of such an arrangement of the swivel axis, swivelling-back of the flap of the at least one flap arrangement out of the open position into the closed position is possible solely by means of the force of gravity. This ensures straightforward and reliable, purely passive swivelling of the flap of the at least one flap arrangement from the open position into the closed position, in particular as soon as the flow pressure of an airstream falls below the

opening pressure. The horizontally orientated swivel axis is preferably arranged in the upper third of the cross section, particularly preferably in the upper quarter of the cross section.

[0068] The flap of the at least one flap arrangement is preferably counterbalanced with respect to the swivel axis. This further increases the swivelling capability of the flap. This counterbalancing of the flap can take place in such a way that a centre of gravity of the flap with respect to the swivel axis has a cantilever arm, which amounts to at most 25%, in particular at most 10%, in particular at most 1% of an extension of the flap measured perpendicular to the respective swivel axis. This thus ensures that swivelling of the flap with a smaller torque is possible. It can in particular be brought about that the flap is always swivelled into an open position with an orientation parallel to the flow direction when an airstream in the flow direction exceeds the opening pressure. The counterbalancing can be brought about for example by the arrangement of suitable counterweights, in particular above the swivel axis.

[0069] According to a further aspect of the invention, the swivel axis of the at least one flap arrangement is arranged at an upper edge of the flow region or above the latter. A swivel axis arranged at the upper edge of the flow region or above the latter advantageously ensures that no component of the associated flap arrangement located in the flow region is swivelled against the airstream. The airstream does not oppose simple swivelling about the swivel axis. This improves the functioning capacity and dynamics of the at least one flap arrangement.

[0070] Especially in the case of a swivel axis arranged above the flow region, the corresponding suspension is arranged outside the flow region. An unfavourable effect on the airstream due to the suspension of the at least one flap arrangement is avoided. In particular, it can thus be brought about that the flap of the at least one flap arrangement in the open position is swivelled for the most part or completely out of the flow region. In contrast with this, a swivel axis arranged inside the cross section, in particular an arrangement of the swivel axis uniformly dividing the cross section vertically or horizontally, is always located in the flow region. Such arrangements of the swivel axis exhibit a much higher, disadvantageous flow resistance.

[0071] The swivelling of the flap of the at least one flap arrangement can also be assisted by a motor. The motorized swivelling of the flap can be coupled in particular with the control of a ventilation system, in particular a ventilator or a fan.

[0072] According to a further aspect of the invention, the flaps of the flap assemblies can in each case be completely swivelled out of the flow region. This leads to a particularly low flow resistance.

[0073] According to a further aspect of the invention, a flap arrangement of the at least one flap arrangement arranged adjacent to the outlet is arranged in such a way that its flap projects out of the outlet in the open position.

[0074] A flap of the flap arrangement arranged adjacent to the outlet that projects from the outlet forms a roof in the open position. Rain and/or dirt in the open position are thus screened off from the outlet. Penetration of rain and/or dirt into the interior space of the wall sleeve is prevented even with the flaps opened. The flap of the flap arrangement arranged adjacent to the outlet in the closed position is preferably arranged completely inside the interior space. An

accumulation of dirt or moisture on the flap is prevented in its closed position. The flap is also protected against wind in its closed position.

[0075] A flap projecting from the wall sleeve in the open position further reduces the length thereof required for the functioning of the wall sleeve. The wall sleeve can have a small length in the flow direction.

[0076] A further problem of the invention consists in improving a wall sleeve.

[0077] This problem is solved by a wall sleeve with at least one assembly comprising the wall sleeve system described above.

[0078] The wall sleeve is able in particular to be adapted very flexibly to the given requirements and circumstances. The wall sleeve can in particular easily be adapted to different wall thicknesses.

[0079] A further problem of the invention consists in improving a ventilation system. This problem is solved by a ventilation system with a wall sleeve according to the preceding description. The advantages emerge from those already described.

[0080] The ventilation system can preferably be an extractor fan system, in particular an extractor fan system for a kitchen. The ventilation system can comprise, apart from the wall sleeve, a ventilator and a ventilation pipe. In particular, it comprises an extractor hood or draw-down extractor, which is also referred to as a hob extractor. The ventilator can for example be a ventilating fan, in particular a radial fan and/or an axial fan. The ventilation pipe can be a round pipe. The ventilation pipe is preferably constituted as a round pipe with a diameter of 150 mm. Alternatively, the ventilation pipe is provided as a ventilation channel, in particular a flat channel.

[0081] A further problem of the invention consists in improving, in particular simplifying, an arrangement of a wall sleeve in an external wall of a building.

[0082] This problem is solved by the arrangement of a wall sleeve as described above.

[0083] In particular, the wall sleeve according to the invention can particularly easily be adapted to the given conditions. Moreover, it can be installed particularly easily and in a particularly precise manner.

[0084] For the arrangement of the wall sleeve in the external wall of the building, provision is in particular made to carry out core hole drilling through the external wall. The diameter of the drilled core hole is preferably at most 30 percent, in particular at most 20 percent, in particular at most 10 percent, preferably at most 5%, particularly preferably at most 2.5% greater than the maximum outer diameter of the wall sleeve. The installation of the wall sleeve and in particular the insulation thereof are thus improved. For example, a wall sleeve with an outer diameter of the housing of 175 mm with the insulation layer can have in total an outer diameter of 180 mm and can be inserted in a corresponding drilled core hole.

[0085] Further details, advantages and features of the invention emerge from the description of an exemplary embodiment on the basis of the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0086] FIG. 1 shows a diagrammatic representation of a ventilation system with a wall sleeve arranged in an external wall,

[0087] FIG. 2 shows a perspective view of an exemplary embodiment of a wall sleeve, wherein flaps of the wall sleeve are represented in a closed position,

[0088] FIG. 3 shows a cross section through the wall sleeve according to FIG. 2,

[0089] FIG. 4 shows a horizontal longitudinal section through the wall sleeve along an intersecting edge IV-IV in FIG. 3,

[0090] FIG. 5 shows a vertical longitudinal section through the wall sleeve along an intersecting edge V-V in FIG. 3,

[0091] FIG. 6 shows a perspective view of the wall sleeve according to FIG. 2, wherein the flaps are represented in an open position,

[0092] FIG. 7 shows a cross section through the wall sleeve according to FIG. 6,

[0093] FIG. 8 shows a side view of the wall sleeve according to FIG. 6,

[0094] FIG. 9 shows a vertical longitudinal section through the wall sleeve along an intersecting edge IX-IX in FIG. 7,

[0095] FIG. 10 shows a perspective view of a flap for the wall sleeve according to FIGS. 2 to 9,

[0096] FIG. 11 shows a side view of a variant of a wall sleeve,

[0097] FIG. 12 shows a perspective view of the wall sleeve according to FIG. 11,

[0098] FIG. 13 shows a further variant of a wall sleeve,

[0099] FIG. 14 shows an exploded representation of the wall sleeve according to FIG. 11,

[0100] FIG. 15 shows a detail representation of a magnetic closure device for a wall sleeve,

[0101] FIG. 16 shows a further detail representation of the wall sleeve according to FIG. 11 and

[0102] FIG. 17 shows a variant of the wall sleeve according to FIG. 11 with a cover assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0103] FIG. 1 shows diagrammatically a ventilation system 1. Ventilation system 1 is used to ventilate a living room 2 of a building in an environment 3 surrounding the building. For this purpose, ventilation system 1 comprises a wall sleeve 5 arranged in an external wall 4 of the building.

[0104] Living room 2 can for example be a kitchen or a kitchen-living room. Ventilation system 1 is an extractor fan system for extracting cooking fumes. It comprises an inlet opening 6 for the cooking fumes to be extracted. Inlet opening 6 is constituted as a draw-down extractor, which is also referred to as a hob extractor. Inlet opening 6 is in a fluidic connection with ventilator 7. Ventilator 7 generates the airstream required to extract the cooking fumes. Ventilator 7 is constituted as a ventilating fan, in particular as a radial fan. A ventilation pipe 8 is arranged connected to ventilator 7. Ventilation pipe 8 provides a fluidic connection between ventilator 7 and wall sleeve 5. The air sucked out of living room 2 through inlet opening 6 with the aid of ventilator 7 and the cooking fumes contained therein are conveyed via ventilation pipe 8 and wall sleeve 5 into surroundings 3.

[0105] Making reference to FIGS. 2 to 17, variants of wall sleeve 5 are described below in detail. As will be explained below in greater detail, the wall sleeve can be composed in particular of assemblies and/or components of a modular

wall sleeve system. This enables great flexibility. In particular, the features and properties of the variants described below can essentially be combined freely with one another. When mention is made below of wall sleeve 5, this is to be understood in each case to mean that the latter is formed from one or more elements or assemblies of the wall sleeve system.

[0106] Wall sleeve 5 comprises a housing 10 bounding an interior space 9. Housing 10 comprises an inlet 11 for an airstream and an outlet 12 for an airstream. A connecting socket 13 is arranged in the region of inlet 11. By means of connecting socket 13, ventilation pipe 8 is connected fluid-tight to wall sleeve 5. Connecting socket 13 is connected detachably to housing 10, so that different connecting sockets 13 can be connected to the wall sleeve depending on the design of ventilation pipe 8. Connecting socket 13 is used as an adapter for connecting ventilation pipe 8.

[0107] In the exemplary embodiment represented, the connecting socket is designed for a ventilation pipe 8 constituted as a round pipe with an inner diameter of 150 mm and an outer diameter of 155 mm. A diameter 14 and cross section of inlet 11 (see FIG. 4, 5, 7 or 9) correspond to the diameter and respectively the cross section of ventilation pipe 8. Diameter 14 of inlet 11 thus amounts to 150 mm. Inlet 11 has a circular cross section. Housing 10 is essentially circular cylinder-shaped. It has a maximum outer diameter of 170 mm.

[0108] Housing 10 is made of a heat-resistant plastic. It has a constant wall thickness between 0.1 mm and 10 mm, in particular of approximately 2.5 mm. On account of the constant wall thickness, interior space 9 also has the shape of a regular cylinder with a circular cross section. A cross section contour 16 of interior space 9 thus corresponds to the circumferential line of a circle with cross section diameter 17 (see FIG. 7). Area A of the cross section of interior space 9 thus corresponds to the area of the circle with diameter 17 and circle circumference 16. By means of this design of interior space 9, optimum use of the space occupied by the wall sleeve inside the masonry of external wall 4 is created. In particular, the cross section of interior space 9 is maximized with respect to the external dimensions of wall sleeve 5, in particular its outer diameter.

[0109] In an alternative not represented, protrusions are formed at the inner side of housing 10, against which flaps 23 lie in their closed position. The closed position is precisely defined by the protrusions. In addition, the insulation in the closed position of flaps 23 is again improved by means of the protrusions, in particular by means of sealing lips arranged on the protrusions or flaps 23. The protrusions can be designed in the form of solid material or in the form of an undercut. Alternatively, flaps 23 can be mounted in a swivellable manner in the region of a widened cross section of interior space 9.

[0110] In the arrangement, shown in FIG. 1, of wall sleeve 5 in external wall 4 of the building inlet 11 with connecting socket 13 is arranged on an inner side of external wall 4 facing living room 2 and outlet 12 is arranged on an outer side of external wall 4 facing surroundings 3. With the intended installation, wall sleeve 5 is orientated horizontally. This means that a central axis of circular-cylindrical housing 10 runs parallel to surface normal 15 of external wall 4. On account of circular-cylindrically constituted housing 10 of wall sleeve 5, its arrangement in the masonry of external wall 4 is simplified. A wall breakthrough required for

insertion of wall sleeve 5 into external wall 4 can be made in a straightforward manner by core hole drilling with a circular drilling cross section. The diameter of the drilled core hole can be matched to the outer diameter of wall sleeve 5. The provision of a square wall breakthrough or partially overlapping drilled core holes, such as is required for the insertion of a, for example, square wall sleeve, is avoided. Particularly preferably, wall sleeve 5 is arranged in a drilled core hole having a larger diameter. An insulating material is then arranged in the intermediate space between wall sleeve 5 and the inner diameter of the drilled core hole. The formation of a heat bridge between wall sleeve 5 and the masonry of external wall 4 is prevented by the insulation material. This makes for good thermal insulation of wall sleeve 5.

[0111] A flow region 18 is defined inside interior space 9 of wall sleeve 5. Flow region 18 connects inlet 11 to outlet 12 in flow direction 19 (see FIG. 4, 5, 7 or 9). Flow direction 19 is defined as the shortest connection from inlet 11 to outlet 12. With interior space 9 constituted as a regular cylinder, flow direction 19 lies perpendicular on the cross-sectional area of inlet 11 and the cross-sectional area of outlet 12. With the intended horizontal installation of wall sleeve 5, flow direction 19 is orientated horizontally. Flow direction 19 is thus parallel both to the central axis of cylindrical housing 10 and also to surface normal 15 of external wall 4.

[0112] Wall sleeve 5 can also advantageously be installed inclined by a few degrees to the horizontal. In particular, it is possible to install wall sleeve 5 in such a way that the lowest boundary of interior space 9 in the direction from inlet 11 to outlet 12 is inclined to the horizontal. The inclination preferably lies in the range from 1° to 10°. In particular, it can amount to at least 2°, in particular at least 3°. It can thus be ensured that fluid possibly collecting undesirably in interior space 9 does not penetrate into the building, but runs away to the exterior.

[0113] Flow region 18 is defined as the volume which is spanned by the length of wall sleeve 5 in flow direction 19 and the cross-sectional area of inlet 11. Flow region 18 is therefore a cylindrical volume with a cross-sectional area corresponding to the cross-sectional area of the inlet. The cross-sectional area of flow region 18 thus also corresponds to the cross-sectional area of ventilation pipe 8. Turbulence is thus effectively prevented.

[0114] Furthermore, wall sleeve 5 comprises an inlet-side flap arrangement 20 and an outlet-side flap arrangement 21. Flap arrangements 20, 21 are designed identically. They each comprise precisely one flap 23 arranged on a suspension 22.

[0115] Flaps 23 are in one piece and dimensionally stable. They each comprise a flap base body of plastic not shown explicitly. In addition, flaps 23 each comprise an insulation layer not represented explicitly. The insulation layer is glued on the flap base body as an insulating material, for example foam or expanded polystyrene, on the side of flaps 23 facing the flow, i.e. in their closed position on the side facing inlet 11. In alternatives not represented, the insulation layer is integrated into flaps 23. In further alternatives of flaps 23 not represented, the insulation layer can also be implemented as a vacuum or air inclusion inside flaps 23. Then again, in other alternatives flaps 23 themselves are produced from insulating material. In several alternatives, flaps 23 each comprise a peripheral sealing lip. The sealing lip is injection

moulded as a soft component on the flap base body. The flap base body is a two-component part.

[0116] Suspensions 22 are implemented as capsule-pin suspensions. Capsules 24 are constituted as drill-holes in housing 10. Pins 25 are formed integrally with flaps 23 (see in particular FIG. 10). Pins 25 and capsules 24 are mirror-polished, as a result of which friction between pins 25 and capsules 24 is reduced. Suspensions 22 enable straightforward swivelling of flaps 23 about a swivel axis 26 defined by respective suspension 22. Swivel axes 26 are arranged perpendicular to flow direction 19 and above flow region 18.

[0117] Flaps 23 each have a longitudinal direction 27. Longitudinal direction 27 is defined as the direction perpendicular to swivel axis 26 in which the flap has the greatest extension. Longitudinal direction 27 runs perpendicular to swivel axis 26 irrespective of a swivelling position of respective flap 23. The plane spanned by swivel axis 26 and longitudinal direction 27 specifies an orientation of flap 23. The orientation of flap 23 changes when flap 23 is swivelled about swivel axis 26.

[0118] In addition, flaps 23 have a contour direction 28. Contour direction 28 runs perpendicular to swivel axis 26 and to longitudinal direction 27. Swivel axis 26, longitudinal direction 27 and contour direction 28 span an orthogonal coordinate system, with respect to which the contour and shape of flaps 23 is fixed. This coordinate system is fixed with respect to respective flap 23 and is swivelled with flap 23. Swivel axis 26 runs horizontally with the intended installation of wall sleeve 5.

[0119] Flaps 23 have a flap contour 29, which is essentially determined by the extension of flap 23 in the directions defined by swivel axis 26, longitudinal direction 27 and contour direction 28. Flap contour 29 is described in detail below in connection with the swivelling capability of flaps 23.

[0120] Flaps 23 can be swivelled about swivel axis 26 between a closed position shown in FIGS. 2 to 5 and an open position shown in FIGS. 6 to 9.

[0121] In the closed position, an orientation of flaps 30 is essentially parallel to the cross-sectional area of inlet 11 or of outlet 12. In the closed position, flaps preferably have an inclination of less than 5° to the cross-sectional area of inlet 11, in particular less than 5° to a vertical plane. They can have an inclination of at least 1°, in particular 2° to the cross-sectional area of inlet 11, in particular to a vertical plane. With the intended horizontal installation of wall sleeve 5 in external wall 4, longitudinal direction 27 of flaps 23 in the closed position essentially runs parallel to a direction of the force of gravity. Contour direction 28 of flaps 23 in the closed position runs parallel to flow direction 19.

[0122] In the closed position, flaps 23 close the entirety of interior space 9 and therefore flow region 18 in a gas-tight manner. In the closed position of flaps 23, a fluidic connection between inlet 11 and outlet 12 is interrupted. In particular, it is thus ensured that an airstream cannot flow from outlet 12 in the direction of inlet 11. The penetration of ambient air into living room 2 is consequently prevented in the closed position of flaps 23. In the closed position, an air cushion 30 is created between flap arrangements 20, 21 (see FIGS. 4 and 5).

[0123] Swivel axes 26 of flap arrangements 20, 21 have a spacing 34 in flow direction 19 which is greater than a maximum extension of flaps 23 in longitudinal direction 27

(see FIGS. 5, 8 and 9). On account of the interrupted air exchange, an air cushion 30 arises between flap arrangements 20, 21 in the closed position of flaps 23, the extension of which air cushion essentially corresponds to spacing 34 of swivel axes 26 of flap arrangements 20, 21 in flow direction 19. Air cushion 30 produces a straightforward and reliable insulation between inlet 11 and outlet 12 of wall sleeve 5. Thermal insulation as well as sound insulation is thus ensured between the inside and outside of external wall 4 of the building. The insulation of wall sleeve 5 is brought about in the closed position by the insulation layer of flaps 23 and air cushion 30.

[0124] In the open position, flaps 23 are swivelled into flow direction 19. In the open position, the orientation of flaps 23 is perpendicular to a direction of the force of gravity. This means that longitudinal direction 27 of flaps 23 runs parallel to flow direction 19. Accordingly, contour direction 28 is parallel to the direction of the force of gravity.

[0125] In the open position, flaps 23 are swivelled in such a way that a fluidic connection is created between inlet 11 and outlet 12. In the open position of flaps 23, an airstream 33 (see FIG. 9) can flow from inlet 11 along flow direction 19 via flow region 18 to outlet 12. Airstream 33 essentially flows inside flow region 18. Flaps 23 in the open position open up the flow region essentially completely. Flap arrangements 20, 21 and their respective flaps 23 are swivelled out of flow region 18 and do not create any flow resistance against airstream 33 flowing in the direction of flow direction 19 from inlet 11 to outlet 12. On account of spacing 34 of swivel axes 26 of flap arrangements 20, 21, it is ensured that flaps 23 do not overlap in the open position. Interlocking of flaps 23 during swivelling out of the closed position into the open position or out of the open position into the closed position is prevented. In particular, outlet-side flap arrangement 21 does not prevent complete swivelling of inlet-side flap arrangement 21.

[0126] Flap contour 29 enables swivelling of flaps 23 constituted in one piece out of flow region 18 and at the same time a gas-tight closure of interior space 9 in the closed position. For this purpose, flap contour 29 is matched to cross-sectional contour 16 of interior space 9. This may be achieved by the fact that the maximum extension of flaps 23 both in longitudinal direction 27 and in a direction parallel to swivel axis 26 is matched in each case to cross-sectional diameter 17 of interior space 9. In addition, a projection of flap contour 29 onto a plane formed from swivel axis 26 and longitudinal direction 27 has a circular shape (see FIG. 3). In the closed position, flap contour 29 lies along entire cross-sectional contour 16 of interior space 9 flush against housing 10. The closed position is thus precisely defined and rattling of flaps 23 in the closed position is prevented.

[0127] In addition, flap contour 29 extends along contour direction 28 in regions adjacent to swivel axis 26. In these regions adjacent to swivel axis 26, flap contour 29 is matched along contour direction 28 with cross-sectional contour 16 of the interior space in the corresponding regions adjacent to swivel axis 26. This may be achieved by the fact that flaps 23 each comprise two contour wings 31. Contour wings 31 are arranged in the direction of swivel axis 26 at the side of pins 25. In a plane spanned by swivel axis 26 and contour direction 28, contour wings 31 have the shape of circular arc segments (see FIGS. 4 and 7). The radius of the circular arcs described by contour wings 31 is dimensioned such that contour wings 31 in the open position lie flush

against regions of housing 10 adjacent to swivel axis 26. This means that the radius of the circular arcs described by contour wings 31 essentially corresponds to the radius of cross-sectional contour 16. Housing 10 forms a stop for contour wings 31 and therefore for flaps 23 in the open position. The open position of flaps 23 is thus precisely fixed. Fluttering and/or rattling of flaps 23 in the open position is prevented. Contour wings 31 have an extension in contour direction 28 which is greater than 40% of the maximum extension of flaps 23 in longitudinal direction 27. [0128] A mechanical stop is preferably provided in the axis seating, which prevents flaps 23 from striking against housing 10.

[0129] In addition, flaps 23 comprise peripheral contour edges 32 (see FIGS. 6, 8 and 10). Contour edges 32 are rounded off in such a way that friction-free swivelling of flaps 23 from the closed position into the open position and back is ensured.

[0130] In the closed position shown in FIGS. 2 to 5, flap 23 of outlet-side flap arrangement 21 is arranged completely inside interior space 9, i.e. completely inside housing 10. In the open position shown in FIGS. 6 to 9, flap 23 of outside flap arrangement 21 projects beyond outlet 12 of housing 10. By means of flap 23 of outside flap arrangement 21, a roof shielding outlet 12 is thus formed in the open position. This thus prevents rainwater from being able to penetrate into interior space 9 of wall sleeve 5 via outlet 12 even in the open position of flaps 23.

[0131] The mechanism for swivelling flaps 23 is described below. Flaps 23 swivel in a purely passive manner. No electric motors and other active actuation mechanisms are thus provided for the swivelling of flaps 23. Flaps 23 swivel solely as a result of airstream 33 generated by ventilator 7. Flaps 23 are always in the closed position when no airstream 33 flows or a flow pressure of airstream 33 is less than a predetermined opening pressure. As soon as the flow pressure of airstream 33 exceeds the predetermined opening pressure, flaps 23 swivel out of the closed position into the open position. If the flow pressure of airstream 33 falls below the opening pressure, airstream 33 completely ebbs away or no airstream at all flows against flow direction 19, the flaps swivelling out of the open position into the closed position purely in a passive manner on account of the force of gravity. Flaps 23 have the function of a non-return valve, so that an airstream from outlet 12 to inlet 11 causes flaps 23 to close. An airstream against flow direction 19 is not therefore possible.

[0132] A practicable opening pressure lies between 15 Pa and 90 Pa, in particular between 50 Pa and 60 Pa. This ensures that unintentional opening of flaps 23 is prevented. At the same time, overloading of ventilator 7 is prevented.

[0133] The swivelling capability of flaps 23 is ensured by their small inherent weight and the small amount of friction produced by mirror-polished capsule-pin suspension 22. This enables swivelling of flaps 23 with a small torque. In addition, it is ensured that flaps 23 are swivelled from the closed position completely into the open position even with a flow pressure of airstream 33 which only slightly exceeds the opening pressure.

[0134] In further alternatives of the wall sleeve, swivelling of the flaps can moreover be assisted by counterbalancing of flaps 23 with respect to swivel axes 26. The counterbalancing of flaps 23 takes place in such a way that a centre of gravity of flaps 23 comprises a cantilever arm with respect

to respective swivel axis 26, which amounts at most to 25%, in particular at most to 10%, in particular at most to 1% of an extension of flaps 23 measured along longitudinal direction 27. This can be brought about for example in that counterweights are provided above suspensions 22.

[0135] In further alternatives of the wall sleeve that are not represented, the housing has the shape of a regular cylinder with a non-circular base area. For example, the base area is a regular polygon with 5 or more corners. The base area can in particular be formed so as to be hexagonal or octagonal. Oval base areas or polygons with rounded edges and corners can also be implemented. The housing can also have a cross section that varies along the flow direction. In all alternatives, however, the following applies to area A of the cross section of the interior space perpendicular to the flow direction:

$$A/K > 2/\pi,$$

wherein K indicates an area of an enveloping circle with the smallest possible radius that covers the cross section of the interior space completely.

[0136] In further alternatives not represented, the flaps are flexible at least in the region of the contour wings. This means that the flaps in the closed position can be plate-shaped and in the open position can be deformed by lying against the housing, so that the flap contour is matched to the cross-sectional contour. Then again, in other alternatives contour wings are connected in an articulated manner to the rest of the flap.

[0137] Further features of wall sleeve 5, in particular its modular structure, are explained in further detail below.

[0138] As already mentioned, wall sleeve 5 is composed of components of a wall sleeve system. In particular, it comprises one or more assemblies constituted in a modular manner. This leads to great flexibility. The modular embodiment of wall sleeve 5 in particular makes it possible to adapt its details flexibly to different circumstances and/or specifications.

[0139] For example, housing 10 can be constituted as a housing assembly. In this case, it need not comprise any flaps 23. A flap assembly, on the other hand, comprises a housing 10 with one or more flap arrangements 20, 21 with one or more flaps 23.

[0140] As indicated by way of example in FIGS. 2 to 5, the variants represented in these figures can be constituted as flap assemblies with two flaps 23. They can also be formed from two flap assemblies with in each case one flap 23.

[0141] The number of latching elements 35 in particular amounts to 8. In general, it can amount to at least 2, in particular at least 3, in particular at least 4, in particular at least 6.

[0142] Connecting socket 13 is a component of a connection assembly. It can also be used as an adapter assembly for the connection of a ventilation pipe 8 which has a different flow cross section, in particular a different diameter from wall sleeve 5.

[0143] In FIGS. 11 to 17, further variants of different assemblies of the wall sleeve system and different possible combinations thereof are represented by way of example. The modular structure of wall sleeve 5 emerges particularly clearly from these figures.

[0144] The different assemblies comprise latching elements, by means of which they can be latched together.

Latching elements **35** can be arranged in particular so as to be distributed equidistantly over the periphery of the different assemblies.

[0145] In particular, wall sleeves **5** with different installation lengths can be produced by a targeted selection of one or more different assemblies. The minimum installation length is essentially limited only by the extension of flap **23** in flow direction **19**. It can lie in the range from 3 cm to 5 cm. Installation lengths in the range from 10 cm to 30 cm are more common, in particular in the range from 14 cm to 25 cm. Larger installation lengths can be provided essentially in an arbitrary manner by adding further assembly modules.

[0146] In order to ensure that adjacent assemblies are connected to one another in a predetermined relative orientation with respect to one another, symmetry-breaking means, for example in the form of a web **36** and a groove **37** matching the latter (see FIG. 16), can be arranged in the latching regions.

[0147] The assemblies can in particular be constructed according to the poka yoke principle.

[0148] The stipulation of a discrete number of connection options between the different assemblies, in particular of a single, definite connection option between two assemblies in each case, can also be achieved by a non-equidistant distribution of latching elements **35** over the periphery of the assemblies.

[0149] As is represented in FIGS. 11 to 14, wall sleeve **5** can also comprise a shutter **38** as a shutter assembly.

[0150] The shutter assembly can be constituted as a sandwich component. It can in particular comprise a plastic panel **39** as a support. Moreover, it can comprise a stainless steel panel **40** as a privacy screen.

[0151] The shutter assembly can be connected, in particular latched, to a housing assembly or a flap assembly. It can in particular be fitted onto a housing **10** of a housing assembly or of a flap assembly and fixed there, in particular detachably, by means of a plurality of toothed latches.

[0152] The variant of wall sleeve **5** represented in FIGS. 11 and 12 comprises 4 assemblies: a connection assembly, two differently constituted flap assemblies and a shutter assembly.

[0153] The wall sleeve represented in FIG. 13 comprises only 3 assemblies. In this variant, the flap assembly provided between the connection assembly and the outer flap assembly according to the variant according to FIGS. 11 and 12 has been dispensed with. The variant of wall sleeve **5** represented in FIG. 13 is thus particularly well suited for walls with smaller wall thicknesses. The variant of wall sleeve **5** represented in FIGS. 11 and 12 is particularly well suited for external walls with larger wall thicknesses. Moreover, on account of the plurality of flap assemblies, it leads to particularly good thermal properties, in particular to a particularly low heat transmission coefficient (U-value).

[0154] The wall sleeve system can comprise different assemblies with different outer diameters. In particular, this makes it possible to adapt wall sleeve **5** flexibly to breakthroughs which possibly are already present, in particular drilled core holes, in external wall **4** of a building. The outer diameter of the wall sleeve or of the different assemblies thereof lies in particular in the range from 3 cm to 50 cm, in particular in the range from 5 cm to 30 cm, in particular in the range from 10 cm to 25 cm. It can lie in particular in the range from 15 cm to 18 cm.

[0155] Depending on whether insulation is present or not at the periphery to interior space **9**, i.e. between interior space **9** and external wall **4**, the diameter, in particular the minimum diameter, of the opening, in particular of the drilled core hole, in which wall sleeve **5** is mounted, is matched to the outer diameter of wall sleeve **5**. If an opening is already present in the external wall for the mounting of wall sleeve **5**, the outer diameter of wall sleeve **5** can of course conversely also be matched to the diameter, in particular the minimum diameter, i.e. the minimum free width, of an opening already present in external wall **4**.

[0156] In particular, one or more insulation assemblies can be provided for the insulation of wall sleeve **5**. The insulation assemblies, can be adapted in particular to the assemblies to be insulated in each case in particular to their external shape.

[0157] One or more sealing means can be provided for the sealing of the connection of two assemblies. In particular, EPDM seals and/or sealing cords can be used as sealing means **43**. The dimensions of the latter are adapted in particular to the geometrical details of the assemblies to be connected in each case.

[0158] Moreover, a sealing cord **41** is represented in FIG. 14, which is arranged on the rear side of shutter **39**. In the assembled state of the shutter assembly, sealing cord **41** is pressed by shutter **38** onto external wall **4**.

[0159] As can be seen from FIG. 14, different housing assemblies can each comprise devices for seating a flap arrangement, in particular a flap **23**. Such housing assemblies can be transformed flexibly into flap assemblies by the arrangement of a flap **23**. Accordingly, flap assemblies can be transformed into housing assemblies by removal of flaps **23**.

[0160] It is of course also possible to constitute the housing assemblies more simply in terms of design, in particular without a seating for a suspension **22** of a flap **23**.

[0161] The flap assemblies in particular each comprise a housing **10**, one or more flaps **23** and the components for the swivellable suspension of flaps **23**. Moreover, they can comprise a flap seal **42**, for example in the form of a sealing ring or a sealing cord.

[0162] The flaps can have a sandwich design. They can in particular comprise actual flap **23** and a flap insulation **44**. The flap insulation can for example be made of polystyrene (BPS, expanded polystyrene) or another insulation material. Flap insulation **44** is matched in its shape to the contour of flap **23**. It can in particular be fixedly connected to flap **23**, for example it can be glued to the latter. For the purpose of simplification, the term flap is understood to mean both a combination of flap **23** and flap insulation **44** as well as a flap **23** without flap insulation **44**.

[0163] Flap **23** can be constituted so as to be dimensionally elastic. It can in particular be compressed for the arrangement in housing **10** or for removal from housing **10**, in particular compressed single-handedly. The spacing, in particular the axial spacing, between the two pins **25** is thereby reduced. This enables a straightforward, in particular tool-less, arrangement and removal of pins **25** from suspension **22**.

[0164] FIG. 15 represents by way of example a closure mechanism **45** for a flap arrangement with a variably adjustable opening pressure. Closure mechanism comprises a magnet **46** and a ferromagnetic element **47** interacting with the latter.

[0165] Magnet 46 can in particular be a permanent magnet.

[0166] Ferromagnetic element 47 can in particular be a threaded pin. The threaded pin can be screwed into a thread 48 in flap 23. The spacing between the threaded pin and magnet 46 can thus be changed. This makes it possible to adjust the force exerted by magnet 46 on the threaded pin and therefore the closing force or opening pressure of flap 23.

[0167] In principle, an electromagnet can also be provided instead of a permanent magnet. In this case, the magnetic force can also be influenced by the current for generating the magnetic field.

[0168] In the variant represented in FIG. 15, magnet 46 and threaded pin 47 are spaced apart from one another in the radial direction, i.e. perpendicular to flow direction 19. According to an alternative, magnet 46 and ferromagnetic element 47 are spaced apart from one another in the axial direction, i.e. in flow direction 19.

[0169] The assemblies can each comprise elements, for example in the form of webs 49, which are used as installation aids. Webs 49, particularly when viewed from the front, can be arranged in a 3 o'clock position and/or a 9 o'clock position. They can be used to support a spirit level during the assembly of wall sleeve 5. They facilitate the precise assembly of wall sleeve 5.

[0170] Webs 49 can also be used as stiffening elements for stiffening housing 10.

[0171] By selecting and/or fitting together one or more assemblies with a total of at least two flaps 23, which are arranged behind one another in flow direction 19, wall sleeve 5 can be constituted as a 3- or multi-chamber system. Wall sleeve 5 can in particular be constituted with at least two heat-insulated flaps 23 and at least one vertical air column in the region between two flaps 23. A particularly low heat transmission coefficient (U-value), i.e. particularly advantageous thermal insulation, is thus possible.

[0172] FIG. 17 represents by way of example a cover assembly with a cover 50. Cover 50 can be fitted on the outlet side onto housing 10, in particular of a housing assembly or flap assembly. Accordingly, it is possible to provide a cover for inlet-side fitting on one of the assemblies.

[0173] Cover 50 is used for the protection of wall sleeve 5 during the shell construction phase. It is used in particular for the protection of wall sleeve 5 during plastering or painting work. In particular, it prevents wall sleeve 5 getting dirty during the construction phase. Cover 50 can be removed, in particular pulled off, after completion of the construction phase. For this purpose, it comprises a shaped element 51 that can be pressed out or a flap. Shaped element 51 can be attached to cover 50 by thin webs.

[0174] After completion of the construction work, the cover assembly can be replaced in particular by a shutter assembly.

[0175] A web 52 is arranged on cover 50. Web 52 is used as an assembly aid, in particular for supporting a spirit level.

1. A wall sleeve system for a ventilation system, comprising
 - one or more assemblies constituted in a modular manner, wherein at least two different selections from the assemblies can be combined with one another to produce different wall sleeves, and

wherein different assemblies can be connected to one another in an arbitrary sequence.

2. The wall sleeve system according to claim 1, wherein the assemblies comprise a selection from the following list: at least one shutter assembly, at least one housing assembly, at least one flap assembly, at least one filter assembly, at least one electrical assembly, at least one insulation assembly, at least one blocking assembly, at least one installation aid assembly, at least one cover assembly, at least one connection assembly and at least one adapter assembly.

3. The wall sleeve system according to claim 1, wherein it comprises at least one housing assembly with a housing bounding an interior space with
 - an inlet for an airstream, and
 - an outlet for an airstream,

wherein a flow region connects the inlet and the outlet in a flow direction,

wherein for an area A of a cross section of the interior space perpendicular to the flow direction, the following applies

$$A/K > 2/\pi,$$

wherein K indicates an area of an enveloping circle with the smallest possible radius that completely covers the cross section of the interior space.

4. The wall sleeve system according to claim 1, wherein it comprises at least one flap assembly with at least one flap arrangement with a flap arranged on a suspension, wherein the flap of the at least one flap arrangement can be swivelled about a swivel axis defined by the suspension between a closed position tightly closing a flow region and an open position,

wherein the flap of the at least one flap arrangement at least in the open position has a flap contour which, in the regions adjacent to the swivel axis, is matched to the cross-sectional contour of the interior space in the respective regions adjacent to the swivel axis.

5. The wall sleeve system according to claim 4, wherein, in the open position, the flap of the at least one flap arrangement is in surface-to-surface contact with a housing of the flap assembly at least in sections in the regions adjacent to the swivel axis.

6. The wall sleeve system according to claim 1, wherein it comprises at least one flap assembly with two adjacent flap arrangements, wherein a spacing of the swivel axes of the adjacent flap arrangements is at least so large that the flaps in the open position do not have an overlap in the flow direction.

7. The wall sleeve system according to claim 1, wherein at least two flap assemblies can be arranged behind one another in the flow direction.

8. The wall sleeve system according to claim 1, wherein it comprises at least one flap assembly with at least one flap, wherein the flap comprises an insulation layer.

9. The wall sleeve system according to claim 1, wherein it comprises a selection of one or more housing assemblies and one or more flap assemblies, which can be connected to one another in an arbitrary sequence.

10. The wall sleeve system according to claim 1, wherein the assemblies comprise latching elements for mutual latching.

11. The wall sleeve system according to claim 1, wherein the assemblies each comprise at least one symmetry-breaking element in a latching section

12. The wall sleeve system according to claim **1**, wherein different assemblies can be connected to one another in each case in a flow-tight manner.

13. The wall sleeve comprising at least one assembly from the wall sleeve system according to claim **1**.

14. A ventilation system with a wall sleeve according to claim **13**.

15. An arrangement of a wall sleeve according to claim **13** in an external wall of a building.

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