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(54) **CHIMNEY ELEMENT**

(57) It is disclosed a chimney element (17; 19; 27) and a method for assembly thereof, comprising at least one housing suitable for a chimney liner (13, 18) formed by four quadrangular side panels (1, 2, 20, 21, 28, 29, 30), each having two vertical edges and upper and lower horizontal edges, interfacing with each other along their vertical edges, wherein the panels are kept together by a lower connecting plate (10) in engagement with the lower horizontal edges of the side panels and an upper connecting plate (5) in engagement with the lower horizontal edges of the side panels, and that the housing comprises a lower centralizer (8) and the upper connecting plate (5) serving as an upper centralizer both with apertures (9) embracing the chimney liner (13, 18), said chimney liner (13, 18) being substantially of the same height as the housing and having connecting means (15) at one or both ends.

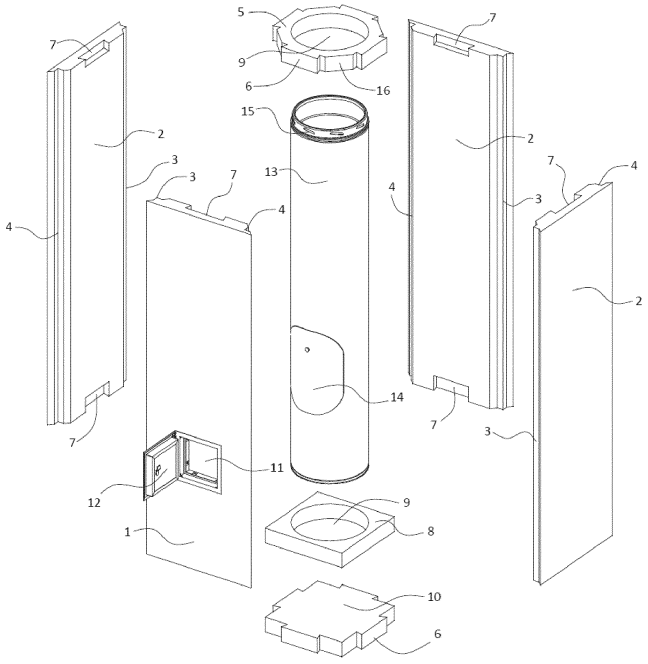

Fig. 1

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Description

Technical Field

[0001] The present invention relates generally to a chimney, in particular a modular chimney element, for residential or industrial buildings in which a fireplace is to be or already is installed.

Background

[0002] In cold climates, most buildings require some sort of heat source to maintain a comfortable inside temperature. For centuries, the fireplace has been the preferred choice for many, and still is today, possibly because of the easily accessible fuel, wood, in addition to its aesthetic features and the delightful atmosphere created by the flaming logs. The downside to the combustion is the unwanted by-product of smoke. During the 16th and 17th centuries chimneys became commonly used in houses to get rid of the toxic gases covering the interior with soot.

[0003] Chimneys were traditionally built by bricklaying, a laborious and time-consuming technique resulting in a heavy construction. A reduction of the construction weight was achieved by the development of lightweight expanded clay aggregate (LECA), yet the technique basically remained the same.

[0004] An alternative to the on-site masonry is a prefabricated chimney, which will save time on-site. However, they require special transportation to the construction site and the installation involves heavy lifting with crane.

[0005] Something in between is the solution as described by patent application CN 103821323 A, where prefabricated elements are assembled on-site. Two side panels with L-shaped cross-sections are interfacing each other along their vertical edges to form a chimney housing. The side panels are slidably connected by longitudinal groves along their side edges to avoid the use of nails. Alternatively, four quadrangular side panels form a housing by being clamped together with clips around the corners of the housing. The chimney is then raised by stacking housings on top of each other until the required height is reached. In order to increase the stability of the structure, a protrusion is provided on the inner surface of one end of the side panels. These protrusions of a first housing are mating a second adjoining housing at its opposite end. In the transition between two stories, a support is utilized to connect the chimney housings at each side of the floor.

[0006] There are some disadvantageous aspects to the solution disclosed by patent application CN 103821323 A. Even though the chimney is delivered in pieces, it is not optimized for packing, as the positioning rib of the side panels unable the desirable coincidently stacking of items. Further, the positioning ribs and the longitudinal grooves/dovetails are susceptible for damages during handling and shipping, due to their thin and projecting geometry. Damages to the longitudinal grooves or dovetails will prevent their intended sliding connection, as this system relies on very small tolerances in order to be tight. Less susceptible for damages is the second embodiment with four quadrangular side panels clamped together by clips. This embodiment, however, is of a less aesthetic character with its visible clips. For proper securement, the barbs of the clips should pierce into the surface of the side panels. Chimney elements are typically made of brittle materials which will benefit from not being pierced, as this could initiate cracking. During assembly of a chimney the celling height is a crucial parameter to account for. As this parameter varies in different buildings, length adjustment of the side panels must thus be expected. These side panels are not adapted to such adjustments. When cutting a side panel to the appropriate length, the protrusion provided on its inner surface is lost, hence also the mating facility between two adjoining chimney housings. To facilitate the continuation of the chimney housing into the above story, two supports are utilized. The supports interface both housings, but do not mechanically connect them. Further, the supports must be attached to the floor to ensure stability (yet only restricting one degree of freedom), and they rely on tight tolerances and a sealing strip in order to create a leak-proof interface.

[0007] Newly built chimneys have been required by building codes to have a chimney liner. Chimney liners are typically made of clay tile, metal, concrete tiles, or poured in place concrete. The prior art DE 20115295 U1 and CH 696912 A5 discloses modular chimneys intended for the insertion of a chimney liner. The chimney liner is typically being inserted from atop the completed chimney as one continuous item.

[0008] A disadvantage with the above-mentioned solutions is that that the chimney liner must be installed after the completion of the entire chimney housing. This means that there must be given some tolerance for a little play between the liner and the housing, in order for the liner to be inserted. Because of this one cannot control where or to which extent the liner is in contact with the surrounding housing.

Summary of the Invention

[0009] The present invention has the objective of providing an improved chimney element of the above-mentioned type, which solves the identified disadvantages.

[0010] Said objectives are fully or partially achieved by a chimney element, chimney, method, kit, and use according to the independent claims. Preferred embodiments are set forth in the dependent claims.

[0011] According to a first aspect, the invention relates to a chimney element comprising at least one housing, suitable for a chimney liner, which is formed by four quadrangular side panels, where each side panel has two vertical edges and upper and lower horizontal edges, interfacing with each other along their vertical edges. The

side panels are kept together by a lower connecting plate in engagement with the lower horizontal edges of the side panels, and an upper connecting plate in engagement with the upper horizontal edges of the side panels. The housing further comprises a lower centralizer and the upper connecting plate serving as an upper centralizer both with apertures embracing the chimney liner. The chimney liner has substantially of the same height as the housing and having connecting means at one or both ends.

[0012] During assembling of the described chimney element, the engagement between the horizontal edges of the side panels and the upper/lower connecting plates will hold it together until the chimney liner is in place. This is a robust construction which do not require nails, clips or long and vulnerable connecting grooves. Chances of damage during assembly are minimal. The geometry makes the items ideal for packing and shipping as there are small chances for damaging and the panels can be stacked consecutively. Additionally, the upper/lower connecting plates facilitates the process of joining the side panels with adhesive, if applicable, as they keep all side plates in position during the setting time. By having chimney liner elements of substantially the same length as the chimney housings, they can be installed in the chimney element consecutively during the build of a chimney. Upper/lower centralizers keep the chimney liners sturdily in place.

[0013] Another advantage of the invention is that a plurality of housings can share two common side panels, thus forming several lines within the same chimney.

[0014] A further advantage of the invention is that an upper connecting plate can serve as the lower connecting plate to an adjoining chimney element. The stacked chimney elements are interlocked in such a way that all five degrees of freedom are restricted, thus optimizing their stability.

[0015] The connecting plates engage with the horizontal edges of the side panels by use of dovetails or similar geometrical means of interlocking. By having the connection at the horizontal edges of the side panels, the groove can be short and wide, which makes it robust. A further advantage is the lower requirement for tolerances.

[0016] The connecting plates engage each other by use of groove and tongue type joints. If adhesive is applicable, the joint will provide contact surfaces in several directions on a larger contact area, which will increase the adhesion. On a long contact area like the sides of the side panels, a sliding connection will scrape away most of the applied adhesive. The joint will also provide contact surfaces in several directions on a larger contact area, which will increase the adhesion.

[0017] Connecting the side panels (inner chimney divider), of a dual housing chimney element, by use of recess type joints will mechanically hold them in place between their respective (front and back) side panels.

[0018] The engaging components can be further secured with adhesive or fasteners to enhance the strength of the structure.

[0019] In a preferred embodiment of the invention, the side panels are provided with trace lines for cutting with associated recesses. This provides the possibility to easily adjust a side panel to a range of heights while still maintaining its functionality, thus eliminating the need for additional support.

[0020] In a further preferred embodiment of the invention, each additional housing is intended for a chimney liner, ventilation duct, cables or other installation equipment, enhancing the utility of the chimney element.

[0021] According to a second aspect, the invention relates to a chimney comprising the chimney elements assembled on top of each other. A complete self-contained chimney can be built with the disclosed chimney elements, a build simplified compared to the ones of prior art.

[0022] According to a third aspect, the invention relates to a method for assembly of the chimney element comprising for each housing at least the steps of:

- placing and fastening the lower connecting plate to a level floor;
- installing the lower horizontal edge of a side panel on the lower connecting plate in a locking relationship;
- installing the lower horizontal edges of two side panels on the lower connecting plate in a locking relationship;
- placing and fastening the lower centralizer on top of the lower connecting plate, the centralizer having an aperture;
- positioning the chimney liner within the aperture of the lower centralizer;
- installing the lower horizontal edge of a forth side panel to the lower connecting plate; and
- entering an upper connecting plate onto the end of the chimney liner and engaging it on the upper horizontal edges of all four side panels in a locking relationship.

[0023] Some of the advantages of this method are that it can be performed by one person. Further, the chimney liner can be installed, and chimney liners with cleanout door can be adjusted, prior to closing the housing with a fourth side panel.

[0024] According to a fourth aspect, the invention relates to a kit of component parts for performing the method, comprising:

- four quadrangular side panels,
- a chimney liner,
- an upper connecting plate,
- a lower connecting plate and
- a lower centralizer,

wherein the component parts are wrapped into an upright package for shipment to the building site or storage.

[0025] The design of the chimney element makes it

especially suited for cold climates, as the low U-value of the components prevents thermal bridges and air infiltration, ensuring a good draft and an insulates chimney liner. The design also allows an easy and safe connection of a fireplace. Further, the design of the chimney element provides a light weight chimney, which entail simpler requirements to the construction base. In an embodiment of the invention with a single housing setup, where the side panels are 120x40 cm, the average weight of a completed chimney would be approximately 34 kg per/m. A traditional chimney (e.g. made of LECA) will in comparison have an average weight of 140-150 kg/m. The above-mentioned side panel would have a weight of approximately 7 kg, which makes manual handling easy, resulting in a fast and safe assembly process. A kit of components for a chimney element (at the preferred height of 120 cm) would weight approximately 45 kg including packaging, wherein no component exceeds 15 kg.

[0026] The invention also comprises an embodiment wherein the chimney liner is replaced by conduits for one or more of ventilation, heating, water or electrical supply, wastewater, and telecommunications, or other services benefiting from a fire resistant enclosure.

Brief Description of Figures

[0027] The invention will now be described with reference to the exemplifying embodiments shown in the accompanying drawings, wherein:

Fig. 1 shows an exploded view of a bottom chimney element,
Fig. 2 show the bottom chimney assembled,
Fig. 3 shows a vertical cross-section of the bottom chimney element,
Fig. 4 shows a horizontal cross-section of the bottom chimney element,
Fig. 5 shows a horizontal cross-section of the bottom chimney element,
Fig. 6 shows a horizontal cross-section of the bottom chimney element,
Fig. 7 shows a horizontal cross-section of the bottom chimney element,
Fig. 8 shows an exploded view of the middle chimney element,
Fig. 9 show the middle chimney assembled,
Fig. 10 shows a vertical cross-section of the middle chimney element,
Fig. 11 shows a horizontal cross-section of the middle chimney element,
Fig. 12 shows a horizontal cross-section of the middle chimney element,
Fig. 13 shows a horizontal cross-section of the middle chimney element,
Fig. 14 shows an exploded view of the top chimney element,
Fig. 15 show the top chimney assembled,
Fig. 16 shows a vertical cross-section of the top chimney element,
Fig. 17 shows a horizontal cross-section of the top chimney element,
Fig. 18 shows a horizontal cross-section of the top chimney element,
Fig. 19 shows a horizontal cross-section of the top chimney element,
Fig. 20 shows a horizontal cross-section of the top chimney element,
Fig. 21 shows a complete chimney,
Fig. 22 shows an exploded view of a second embodiment of the bottom chimney element,
Fig. 23 show the second embodiment of the bottom chimney assembled,
Fig. 24 shows a vertical cross-section of the second embodiment of the bottom chimney element,
Fig. 25 shows a horizontal cross-section of the second embodiment of the bottom chimney element,
Fig. 26 shows a horizontal cross-section of the second embodiment of the bottom chimney element,
Fig. 27 shows a horizontal cross-section of the second embodiment of the bottom chimney element,
Fig. 28 shows a horizontal cross-section of the second embodiment of the bottom chimney element, and
Fig. 29 shows a horizontal cross-section of the second embodiment of the bottom chimney element.

Detailed Description

[0028] In the disclosed figures, three different embodiments of a chimney element 17, 19, 27 are illustrated, which combined will form an entire chimney. A chimney element can be set up with one or several housings. These particular chimney elements have a single housing setup. The housing is typically used with a chimney liner 13, 18, but can also be used for ventilation purposes, for running cables or other equipment or installations.

[0029] Fig.1-7 shows an embodiment of a chimney element 17 which is intended to form the bottom part of the chimney, positioned on the floor/foundation/ground.

[0030] Fig. 8-13 shows an embodiment of a chimney element 19 which is intended to form the middle part(s) of the chimney, positioned above the bottom chimney element 17.

[0031] Fig. 14-20 shows an embodiment of a chimney element 27 which is intended to form the top part of the chimney, positioned above the middle part(s) 19 and extending through the roof.

[0032] Fig. 21 shows a complete chimney comprising the bottom chimney element 17, the middle chimney element 19 and the top chimney element 27.

[0033] Fig.1 shows an exploded view of the bottom chimney element 17, whereas fig. 2 shows the bottom chimney element 17 assembled. The bottom chimney element 17 comprises a housing which is defined by four perpendicularly connected side panels 1, 2, a lower con-

necting plate 10, and an upper connecting plate 5.

[0034] The side panels 1, 2 come in different formats, but they are all the same height (preferably 120 cm), primarily flat and quadrangular, with two horizontal edges and two vertical edges. Their outwardly facing surface is preferably smooth. Along the vertical edges, joints can be arranged. The construction does not rely on these joints, but it will improve the locking and ease the assembling process. With joints applied, a builder will easier see where the side panels are going relative to each other, and they will mate together smoothly during the assembly. By having a type of joint with male on one edge, and female on the opposite edge, one can avoid one side panel being installed upside down relative to the others. If adhesive is applicable, the joint will provide contact surfaces in several directions on a larger contact area, which will increase the adhesion. In the disclosed embodiment, a tongue 3 and groove 4 type joint is illustrated in the disclosed embodiment for the side panels 1, 2 which form the outside of the chimney element 17. Each side panel 1, 2 has a groove 4 on one vertical edge and a tongue 3 on the opposite vertical edge. The horizontal edges of the side panels 1, 2 can be bevelled to a 45° angel, which will improve the aesthetics of the chimney. The illustrated embodiment has a quadric cross-section; however, oblong cross-section could also be used. In an embodiment with a quadric cross-section, the side panels 1, 2 will have the same width. All side panels 1, 2 are preferably of the same thickness, regardless of cross-section.

[0035] A cut-out 11 can be made in the side panel 1, into which a cleanout door 12 or inspection door 12 can be inserted. The cleanout door 12 or inspection door 12 may have heat shields. These parts can be manufactured out of steel, cast iron or aluminum or other suitable materials and may vary in design, size, shape and form.

[0036] On the horizontal edges of the side panels 1, 2 a dovetail shaped recess 7 is centrally positioned. This recess 7 opens inwardly through the inside surface of the side panel 1, 2. The recess 7 can alternatively be shaped differently, e.g. T-shaped, as long as it serves to mechanically engage with the upper connecting plate 5 and the lower connecting plate 10.

[0037] The lower connecting plate 10 and the upper connecting plate 5 are both flat and have a matching thickness. Their geometry is based on a square with protrusions 6 from all four side edges. These protrusions 6 are adapted to interlock with the recess 7 of the side panels 1, 2. By lowering the protrusion 6 into the recess 7 in a slidable connection, or vice versa, the achieved connection will mechanically restrict five degrees of freedom (swaying, heaving, rolling, pitching and yawing). The last degree of freedom (heaving) can be restricted by use of for instance adhesive. Suitable fasteners such as nails, screws, brackets, straps, bars, clips or rods could be used. If fasteners are to be used, predrilled holes will simplify the assembling procedure. Stacking of further chimney elements 19, 27 onto of the upper connecting plate 5 will apply weight which also restricts the last degree of freedom. In the present embodiment, these protrusions 6 are dovetail shaped; however, other geometries are also suitable. The sliding connection only calls for a short travel, making it less tolerance sensitive. The protrusion 6 can preferably have a larger width relative to its length. Such a robust geometry will make the protrusion 6 less susceptible to damage during handling, transportation or storage.

[0038] The lower connecting plate 10 is only in engagement with four side panels 1, 2 from the bottom chimney element 17, whereas the upper connecting plate 5 is in engagement with eight side panels 1, 2, 20 four from the bottom chimney element 17 and four from the middle chimney element 19. For the side panels 1, 2 to be vertically aligned with the bottom of the lower connecting plate 10, the depth of the recess 7 in their lower horizontal edges must correspond to the thickness of the lower connecting plate 10. For one upper connecting plate 5 to be shared by both the bottom chimney element 17 and the middle chimney element 19, the recesses 7 on the upper horizontal edges of the side panels 1, 2 should have a depth corresponding to approximately half the thickness of the upper connecting plate 5. Half the thickness of the upper connecting plate 5 is protruding above the upper horizontal edge of the side panels 1, 2 of the bottom chimney element 17. Said protrusion of the upper connecting plate 5, will serve the same purpose for the middle chimney element 19, as the lower connecting plate 10 does for the bottom chimney element 17.

[0039] The lower connecting plate 10 may have attachment means for secure attachment to the floor, foundation, ground or similar. The upper connecting plate 5 has chamfered corners 16 (airgaps) to allow fresh air supply for combustion when used for chimney liners 13, 18. An aperture 9, adapted to embrace a chimney liner 13, 18, is provided in the centre region of the upper connecting plate 5. Said aperture 9 is centralizing the chimney liner 13, 18 in the housing. In the bottom chimney element 17, the chimney liner 13 is centralized in two places, in the upper region by an upper centralizer (upper connecting plate 5) and in the lower region by a lower centralizer 8. The lower centralizer 8 is a flat plate, with an aperture 9 adapted to embrace a chimney liner 13 provided in its central region. The lower centralizer 8 has a geometry matching the inner cross-section of the housing, in which to be used. The lower centralizer 8 is typically placed onto the lower connecting plate 10. The lower centralizer 8 may have a containment device at the bottom for soot and condensation accumulation and drain. In addition to centralizing the chimney liner 13, 18, the aperture 9 will allow chimney liners, ventilation ducts, cables or other equipment or installations to run through the centralizer 5, 8 and thus through the chimney element 17, 19, 27. In the disclosed embodiment, the apertures 9 of both the upper connecting plate 5 serving as an upper centralizer and the lower centralizer 8 are circular and have a slightly larger diameter than the chimney liner 13, 18.

[0040] The chimney liner 13, 18 is typically circular and elongated, preferably to the same height as the side panels 1, 2. When being placed onto the lower connecting plate 10, a chimney liner 13, 18 of the same height as the side panels 1, 2 will protrude from the upper connecting plate 5. At one or both ends of the chimney liner 13, 18 a turn lock 15 is provided. The turn lock 15 will facilitate a locking connection between two adjoining chimney liners 13, 18 with a turning motion, typically having external threads in one end and internal threads in the opposite end of the chimney liner 13, 18. Other possible alternatives for connecting two adjoining chimney liners 13, 18 are press fit, collar band or adhesive. When installed in a chimney housing, the entire turn lock 15 should preferably be available in the region of the chimney liner 13, 18 protruding from the upper connecting plate 5. Availability of the turn lock 15 will ease the assembly process. In the lower region of the chimney liner 13 a cleanout door 14 can be installed in alignment with the cleanout door 12 of the (front) side panel 1. The cleanout door 14 is made of steel, cast iron or aluminum or other suitable materials. A chimney liner 13, 18 comprise an inner tube, an outer tube, an insulation layer between the inner and outer tubes, and possibly an outer insulation layer outside the outer tube. The inner and outer tubes may be manufactured out of steel, ceramic material, chamotte, or other suitable materials.

[0041] The side panels 1, 2, upper connecting plate 5, lower connecting plate 10 and lower centralizer 8 may for instance be milled out of panels of porous concrete (e.g. Siporex / Ytong), calcium silicate, which is the preferred material, magnesium oxide (Magnesium Oxide Board e.g. MagO Board or ECCO Board) or equivalent or other suitable materials with fire resistance. Parts also may be molded from similar or other suitable materials. The side panels may have, or applied, a surface of for example cement boards, plaster, fillers or other similar products.

[0042] The components of the bottom chimney element 17 can be delivered to the construction site as a kit. All parts of the bottom chimney element 17, including the chimney liner 13, are suited for wrapping into a preferably upright package for shipment to the building site or storage.

[0043] All chimney elements 17, 19, 27 can preferably be assembled on site. During assembly, the bottom chimney element 17 is the first element to be installed. The following steps will describe a preferred method for assembly of the bottom chimney element 17. Additional actions may be taken at any time during the method.

- Position the lower locking plate 10 on a level base (floor, foundation, ground etc.). For correct positioning of a lower locking plate 10, a template can be used. Such a template must take into account the distance from one or several adjoining walls. The (back) side panel 2 can serve as a template.
- Once the appropriate position of the lower connecting plate 10 is found it can be securely attached to the base.
- Install the lower horizontal edge of the (back) side panel 2 on the lower connecting plate 10 in a locking relationship. In the disclosed embodiment, a dovetail joint provides the locking relationship. The recesses 7 of the side panel 2 are slid onto the protrusions 6 of the lower connecting plate 10.
- Install the lower horizontal edges of two side panels 2 on the lower connecting plate 10 in a locking relationship.
- Place and fasten one lower centralizer 8 on top of the lower connecting plate 10.
- If applicable, position the chimney liner 13 within the aperture 9 of the lower centralizer 8. In the bottom chimney element 17, a chimney liner 13 with cleanout door 14 must be used. Once inserted in the aperture 9, the chimney liner 13 can be rotated in order to achieve correct orientation of the cleanout door 14. Other equipment can also preferably be installed in the housing at this stage.
- Install the lower horizontal edge of the (front) side panel 1 on the lower connecting plate 10 in a locking relationship.
- For each housing, install an upper connecting plate 5 on the upper horizontal edges of all four side panels 1, 2 in a locking relationship. When chimney liner 13 is used, the aperture 9 of the upper connecting plate 5 must first be entered onto the end of the chimney liner 13.

[0044] Adhesive (e.g. cement-based adhesive) can be applied to relevant interfaces at any given stage of the method. Such interfaces can be the joints between the side panels 1, 2, the joints between the lower connecting plate 10 and the side panels 1, 2, the joints between the upper connecting plate 5 and the side plates 1, 2, the contact surface between the lower connecting plate 10 and the base, the contact surface between the lower centralizer 8 and the lower connecting plate 10. Once all components are assembled, they will keep together without further actions, enabling setting of the adhesive. The joints between the side panels 1, 2 may be secured by screw or other mechanical means.

[0045] Fig. 3-7 shows a series of cross-sections of the bottom chimney element 17. Fig. 3 is a vertical cross-section through the centre of a housing. This illustrates how the (front) side panel 1 and the (back) side panel 2 interfaces the lower connecting plate 10, the lower centralizer 8 and the upper connecting plate 5. Further, the two openings of the housing are shown. One opening in the lower part of the (front) side panel 1 for the cleanout door or inspection door 14, and one opening in the top for continuation of the housing. Along an imaginary centre line are located two concentric apertures 9 for centralizing of the chimney liner 13 (not shown). The bottom surface of the lower connecting plate 10 is in line with the lower horizontal edges of the side panels 1, 2. The

upper connecting plate 5 protrudes above the upper horizontal edges of the side panels 1, 2.

[0046] Fig. 4 is a horizontal cross-section through the centre of the upper connecting plate 5. This illustrates how the upper connecting plate 5 interfaces the side panels 1, 2, with dovetail type joints, and how the side panels 1, 2 interface each other, with tongue and groove type joints. There may be used other variations of tongue and groove joints, dovetail joints or other suitable solutions for joining the parts.

[0047] Fig. 5 is a horizontal cross-section through the centre of the opening for cleanout door 11 in the (front) side panel 1. This housing may be used for chimney liners, ventilation ducts, cables or other installations or equipment in different combinations. The size of this housing can be adjusted according to its purposes. The ventilation duct may be manufactured out of galvanized steel, steel, aluminum, polyurethane and phenolic insulation panels (pre-insulated air ducts), fiberglass duct board (pre-insulated non-metallic ductwork), or other suitable materials for ventilation ducts. Ventilation ducts may have insulation of suitable insulation materials.

[0048] Fig. 6 is a horizontal cross-section through the centre of the lower centralizer 8. In cross-section, the lower centralizer 8 matches the inside of the housing.

[0049] Fig. 7 is a horizontal cross-section through the centre of the lower connecting plate 10. This illustrates how the lower connecting plate 10 interfaces the side panels 1, 2, with dovetail type joints.

[0050] Fig.8 shows an exploded view of the middle chimney element 19, whereas fig. 9 shows the middle chimney element 19 assembled. The middle chimney element 19 comprises a housing, which housing is defined by four perpendicularly connected side panels 20, and an upper connecting plate 5.

[0051] The side panels 20 of the middle chimney element 19 are basically similar to the side panels 1, 2 of the bottom chimney element 17 with some exceptions: the (front) side panel 20 of the middle chimney element 19 doesn't have an opening for cleanout door or inspection door 11, and the recesses 7 in the lower horizontal edges of all side panels 20 has a depth corresponding to approximately half the thickness of the upper connecting plate 5.

[0052] The chimney liner 18 of the middle chimney element 19 is basically similar to the chimney liner 13 of the bottom chimney element 17, except for the lack of a cleanout door 14.

[0053] Further differences between the middle chimney element 19 and the bottom chimney element 17 are that the middle chimney element 19 doesn't comprise the lower connecting plate 10 or the lower centralizer 8. The purposes of the lower connecting plate 10 and the lower centralizer 8 are served by the upper connecting plate 5 of the below adjoining chimney element 17, 19.

[0054] During assembly, the second chimney element to be installed is the middle chimney element 19. Further middle chimney elements 19 can be stacked on top of each other until an appropriate height is reached. The following steps will describe a preferred method for assembly of the middle chimney element 19. Additional actions may be taken at any time during the method.

- The protruding upper connecting plate 5 of the below adjoining chimney element 17, 19 forms the base for the assembly of the middle chimney element 19.
- Install the lower horizontal edges of three side panels 20 on the upper connecting plate 5 of the below adjoining chimney element 17, 19 in a locking relationship. The recesses 7 of the side panels 20 are slid onto the protrusions 6 of the upper connecting plate 5.
- If applicable, enter a chimney liner 18 onto the chimney liner 13, 18 of the below adjoining chimney element 17, 19. Then, securely connect the chimney liners 13, 18 with the turn lock 15 or other suitable means (e.g. adhesive). Other equipment can also preferably be installed in the housing at this stage.
- Install the lower horizontal edge of the (front) side panel 20 on the upper connecting plate 5 in a locking relationship.
- Install an upper connecting plate 5 on the upper horizontal edges of all four side panels 20 in a locking relationship. On housings with chimney liner 18, the aperture 9 of the upper connecting plate 5 must first be entered onto the end of the chimney liner 18.

[0055] As with the bottom chimney element 17, adhesive (e.g. cement-based adhesive) can be applied to relevant interfaces of the middle chimney element 19 at any given stage of the method. Once all components are assembled, they will keep together without further actions, enabling setting of the adhesive.

[0056] Fig. 10-13 shows a series of cross-sections of the middle chimney element 19. Fig. 10 is a vertical cross-section through the centre of a housing. The aperture 9 of the upper connecting plate 5 of the middle chimney element 19 is concentric with the aperture 9 of the upper connecting plate 5 of the below adjoining chimney element 17, 19 (not shown). Fig. 11 is a horizontal cross-section through the centre of the upper connecting plate 5. This cross-section is similar to the one of the bottom chimney element 17. Fig. 12 is a horizontal cross-section through the middle part of the middle chimney element 19. This cross-section is similar to the one of the bottom chimney element 17, except without the opening for cleanout door or inspection door 11. Fig. 13 is a horizontal cross-section through the part of the middle chimney element 19 interfacing the upper connecting plate 5 of the below adjoining chimney element 17 (not shown).

[0057] Fig. 14 shows an exploded view of the top chimney element 27, whereas Fig. 15 shows the top chimney element 27 assembled. The top chimney element 27 comprises a housing, which housing is defined by four perpendicularly connected side panels 21 and an upper connecting plate 5.

[0058] The side panels 21 of the upper chimney element 27 are basically similar to the side panels 20 of the middle chimney element 19 except the added recesses for height adjustment 25 and the trace lines for cutting 26.

[0059] The horizontally oriented recesses for height adjustment 25 and the trace lines for cutting 26 provide the possibility to adjust the length of the top chimney element 27, while still maintaining its functionality. Three trace lines for cutting 26 indicates three different places where the builder preferably can cut the side panels 21. All side panels 21 must be cut to the same length. The trace lines for cutting 26 will ease the cutting process, providing the builder with a guide line to follow during cutting as well as predefined lengths to choose between. The first trace line for cutting 26 is positioned parallel to the lower horizontal edge of the side panel 21 at a distance equal to 1/6 of the total height of said side panel 21. The second trace line for cutting 26 is positioned parallel to the lower horizontal edge at a distance equal to 2/6 of the total height of the side panel 21. The third trace line for cutting 26 is positioned parallel to the lower horizontal edge at a distance equal to 3/6 of the total height of the side panel 21. With one single cut, the builder can achieve five different height adjustments to the side panel 21, namely 5/6, 4/6, 3/6, 2/6 and 1/6 of the initial total height. The trace lines for cutting 26 can be markings, slots or both. Markings preferably have a contrasting colour.

[0060] The recesses for height adjustment 25 are positioned with their imaginary horizontal centre lines coincident with the trace lines for cutting 26, and their imaginary vertical centre lines coincident with the ones of the lower/upper recesses 7. Each part of the recesses for height adjustment 25 on either side of the trace line for cutting 26 are sized equal to the lower/upper recess 7. After a cut has been made along the trace line for cutting 26, the recess for height adjustment 25 is split in two, forming one upper recess 7 and one lower recess 7.

[0061] The chimney liner 18 of the top chimney element 27 is identical to the chimney liner 18 of the middle chimney element 19.

[0062] A flashing 22 is used on top of the housings for protection against rain and to ensure opening for fresh air supply for combustion when used for chimney liners 18. The flashing 22 may be manufactured out of steel, aluminium or other suitable materials and may vary in design, size, shape and format. The flashing 22 has a quadrangular and primarily flat portion with four edges, along said edges are provided protrusions extending vertically downwards to embrace the housings. On the flat portion of the flashing 22, apertures are provided concentric to the apertures 9 of the upper connecting plate 5. Along the edge of the aperture is provided a protrusion extending vertically upwards embracing the top hat with adaptor sleeve 23.

[0063] The top hat with adaptor sleeve 23 protects against rain and wind down in the shaft. The top hat 23 has a sleeve for adaption to the chimney liner 18, ventilation duct, shaft or other installations or equipment. The sleeve has a diameter sized to providing a tight fit inside the aperture of the flashing 22. The end of the sleeve may be adapted for connection to the turn lock 15 of the chimney liner 13, 18. The top hat 23 is delivered as one item and may be manufactured out of steel, aluminum or other suitable materials and may vary in design, size, shape and format.

[0064] During assembly, the top chimney element 27 is the last element to be installed. The following steps will describe a preferred method for assembly of the top chimney element 27. Additional actions may be taken at any time during the method.

- The protruding upper connecting plate 5 of the below adjoining chimney element 19 forms the base for the assembly of the top chimney element 27.
- Determine the need for height adjustment of the top chimney element 27. If adjustment is required, cut all side panels 21 along the appropriate trace line for cutting 26.
- Install the lower horizontal edges of three side panels 21 on the upper connecting plate 5 of the below adjoining chimney element 19 in a locking relationship. The recesses 7, 25 of the side panels 21 are slid onto the protrusions 6 of the upper connecting plate 5.
- If applicable, enter a chimney liner 18 onto the chimney liner 18 of the below adjoining chimney element 19. Then, securely connect the chimney liners 18 with the turn lock 15 or other suitable means (e.g. adhesive). Other equipment can also preferably be installed in the housing at this stage.
- Install the lower horizontal edge of the (front) side panel 21 on the upper connecting plate 5 in a locking relationship.
- Install an upper connecting plate 5 on the upper horizontal edges of all four side panels 21 in a locking relationship. On housings with chimney liner 18, the aperture 9 of the upper connecting plate 5 must first be entered onto the end of the chimney liner 18.
- Install the flashing 22 on top of the upper connecting plate 5. Ensure the flashing 22 embrace the side panels 21 and that the apertures of the flashing 22 align with the apertures 9 of the upper connecting plate 5. Can be fixed with fasteners, adhesive or both.
- Install the top hat 23 in the aperture of the flashing. Where applicable, connect the top hat 23 to the turn lock 15 of the chimney liner 18. Can be fixed with fasteners, adhesive or both.

[0065] As with the other chimney elements 17, 19, adhesive (e.g. cement-based adhesive) can be applied to relevant interfaces of the top chimney element 27 at any given stage of the method. Once all components are assembled, they will keep together without further actions, enabling setting of the adhesive.

[0066] Fig. 16-20 shows a series of cross-sections of the top chimney element 27. Fig. 16 is a vertical cross-section through the centre of a housing. The aperture of the flashing 22 is concentric with and has an approximately equal diameter as the aperture 9 of the upper connecting plate 5. The flashing 22 abuts the upper connecting plate 5. The vertical protrusion of the flashing 22 extending downwards embraces the outside of the side panels 21. Fig. 17 is a horizontal cross-section through the centre of the upper connecting plate 5. This cross-section is similar to the ones of the other chimney elements 17, 19, except the embracing flashing 22. Fig. 18 is a horizontal cross-section through the upper half of the top chimney element 27. This cross-section is similar to the one of the middle chimney element 19. Fig.19 shows a horizontal cross-section through a recess for height adjustment 25. This cross-section is equal to the cross-section of Fig.20. Fig. 20 is a horizontal cross-section through the part of the top chimney element 27 interfacing the upper connecting plate 5 of the below adjoining chimney element 17, 19 (not shown). This cross-section is equal to the one of the middle chimney element 19.

[0067] Fig. 21 shows a complete chimney viewed from the front. The chimney comprises one bottom chimney element 17, a plurality of middle chimney elements 19 and one top chimney element 27, the bottom chimney element 17 being the lowermost and the top chimney element 27 being the uppermost.

[0068] Fig. 22 shows an exploded view of an embodiment of the bottom chimney element 33 with dual housing, whereas fig. 23 shows the bottom chimney element 33 with dual housing assembled. The bottom chimney element 33 comprises two housings, which housings are both defined by four perpendicularly connected side panels 28, 2, 29, 30, a lower connecting plate 10 and an upper connecting plate 5.

[0069] The components and the construction of the bottom chimney element 33 with dual housing is basically similar to the components and construction of the bottom chimney element with single housing 17, with some exceptions. The (front) side panel 28 and the (back) side panel 29 of the bottom chimney element 33 with dual housing are wider than the side panels 1, 2, used in the single housing setup, as they are shared by two housings. Further, the (front and back) side panels 28, 29 have a dual set of lower and upper recesses 7, one for each housing. The (front) side panel 28 also has a dual set of cut-outs 11 for cleanout door 12 or inspection door 12. Along the longitudinal middle inside surface area of the (front and back) side panels 28, 29, two recesses 32 are applied. Two additional side panels 30 (inner chimney dividers) are introduced for the forming of the dual housing setup. These side panels 30 (inner chimney dividers) have no grooves applied on their vertical edges, and will mate with their connecting (front and back) side panels 28, 29 in the recesses 32, forming a recess type joints. At the upper and lower horizontal edges of the side panels 30 (inner chimney dividers) recesses 7 are provided, similar to those of the other side panels 28, 2, 29.

[0070] In the embodiment of the bottom chimney element 33 with dual housing, a shaft, which can be regarded as a third housing, is provided between the two housings by the inner dividers 30. A bottom piece 31 with a geometry matching the cross-section of the inner shaft is forming the bottom of the shaft. The dual housing setup also calls for a dual set of lower connecting plates 10, lower centralizers 8, upper connecting plates 5 and alternatively chimney liners 13, one for each of the housings.

[0071] The following steps will describe a preferred method for assembly of the bottom chimney element 33. Additional actions may be taken at any time during the method.

- Position the lower locking plate 10 on a level base (floor, foundation, ground etc.). Each of the housings will require one lower locking plate 10. For correct positioning of a plurality of lower locking plates 10, a template can be used. Such a template must take into account the mutual distance between the lower connecting plates 10 and their distance from one or several adjoining walls. The (back) side panel 29 can serve as a template.
- Once the appropriate positions of the lower connecting plates 10 are found they can be securely attached to the base.
- Install the lower horizontal edge of the (back) side panel 29 on the lower connecting plates 10 in a locking relationship. In the disclosed embodiment, a dovetail joint provides the locking relationship. The recesses 7 of the side panel 29 are slid onto the protrusions 6 of the lower connecting plates 10. Only one (back) side plate 29 shall be used.
- Install the lower horizontal edges of two side panels 2, 30 on each lower connecting plate 10 in a locking relationship.
- Install a bottom piece 13 between the (inner) side panels 30 of the two adjoining housings.
- Place and fasten one lower centralizer 8 on top of each lower connecting plate 10.
- If applicable, position the chimney liner 13 within the aperture 9 of the lower centralizer 8. Once inserted in the aperture 9, the chimney liner(s) 13 can be rotated in order to achieve correct orientation of the cleanout door 14. Other equipment can also preferably be installed in the housing at this stage.
- Install the lower horizontal edge of the (front) side panel 28 on the lower connecting plates 10 in a locking relationship. Only one (front) side plate 29 shall be used.
- For each housing, install an upper connecting plate 5 on the upper horizontal edges of all four side panels 28, 2, 29, 30 in a locking relationship. On housings with chimney liner 13, the aperture 9 of the upper connecting plate 5 must first be entered onto the end of the chimney liner 13.

[0072] Fig. 24-28 shows a series of cross-sections of the bottom chimney element with dual housing 33.

[0073] Fig. 24 is a vertical cross-section through the centre of a housing, which is identical for both the single and the dual housing setup.

[0074] Fig. 25 is a horizontal cross-section through the centre of the upper connecting plate 5. This illustrates how the side panels 28,29, 30 interface each other with recess type joints. The other connections are similar to those of the single housing setup.

[0075] Fig. 26 is a horizontal cross-section through the centre of the openings for cleanout door 11 in the (front) side panel 28. Shown are the two housings of the bottom chimney element 33 with one of said openings each. Between the two housings are formed a shaft. This shaft may also be used for chimney liner, ventilation duct, cables or other installations or equipment in different combinations. The size of the shaft can be adjusted according to its purposes. The ventilation duct may be manufactured out of galvanized steel, steel, aluminum, polyurethane and phenolic insulation panels (pre-insulated air ducts), fiberglass duct board (pre-insulated non-metallic ductwork), or other suitable materials for ventilation ducts. Ventilation ducts may have insulation of suitable insulation materials.

[0076] Fig. 27 is a horizontal cross-section through the centre of the lower centralizer 8. In cross-section, the lower centralizer 8 matches the inside of the housing.

[0077] Fig. 28 is a horizontal cross-section through the centre of the lower connecting plate 10. This illustrates how the bottom piece 13 in cross-section matches the inside of the shaft, thus forming the bottom of the shaft.

[0078] Although not shown in the drawings, it will be understood that the invention comprises dual middle and top chimney elements similar to the middle and top top elements illustrated in Figures 8-21.

Listing of reference numerals

[0079]

1 - Side panel (front) for the bottom chimney element, with opening for cleanout door or inspection door
2 - Side panel for bottom chimney element
3 - Tongue for tongue and groove joint
4 - Groove for tongue and groove joint
5 - Upper connecting plate (also serving as an upper centralizer)
6 - Protrusion for dovetail joint
7 - Recess for dovetail joint
8 - Lower centralizer
9 - Aperture
10 - Lower connecting plate
11 - Cutout for cleanout door or inspection door
12 - Cleanout door or inspection door
13 - Chimney liner for bottom chimney element, with opening for cleanout door
14 - Cleanout door for chimney liner
15 - Turn lock for chimney liner connection
16 - Chamfered corner (airgap)
17 - Bottom chimney element
18 - Chimney liner for middle chimney element and top chimney element
19 - Middle chimney element
20 - Side panel (front) for middle chimney element
21 - Side panel for top chimney element
22 - Flashing
23 - Top hat with adaptor sleeve
25 - Recess for height adjustment
26 - Trace line for cutting (height adjustment)
27 - Top chimney element
28 - Side panel (front) for the bottom chimney element with dual housing, with opening for cleanout door or inspection door
29 - Side panel (back) for bottom chimney element with dual housing
30 - Side panel (inner chimney divider) for bottom chimney element with dual housing
31 - Bottom piece for inner shaft (dual housing)
32 - Recess for side panel (inner chimney divider) (dual housing)
33 - Bottom chimney element with dual housing

Claims

1. A chimney element (17; 19; 27), comprising at least one housing suitable for a chimney liner (13, 18) formed by four quadrangular side panels (1, 2, 20, 21, 28, 29, 30), each having two vertical edges and upper and lower horizontal edges, interfacing with each other along their vertical edges,
characterized in that the panels are kept together by a lower connecting plate (10) in engagement with the lower horizontal edges of the side panels and an upper connecting plate (5) in engagement with the upper horizontal edges of the side panels, and that the housing comprises a lower centralizer (8) and the upper connecting plate (5) serving as an upper centralizer, both with apertures (9) embracing a chimney liner (13, 18), said chimney liner (13, 18) being substantially of the same height as the housing and having connecting means (15) at one or both ends.

2. A chimney element according to one of the preceding claims,
wherein a plurality of housings share two common side panels (28, 29).

3. A chimney element according to one of the preceding claims,
wherein an upper connecting plate (5) serves as the lower connecting plate (10) to an above adjoining chimney element.

4. A chimney element according to one of the preceding claims,
wherein the connecting plates (5, 10) engage with the horizontal edges of the side panels (1, 2, 20, 21, 28, 29, 30), by use of dovetails.

5. A chimney element according to one of the preceding claims,
wherein the side panels (1, 2, 20, 21, 28, 29, 30) engage each other, by use of groove (3) and tongue (4) joints, or by use of recess type joints.

6. A chimney element according to claim 5,
wherein the side panels (1, 2, 20, 21, 28, 29, 30) are further secured each other with adhesive or fasteners.

7. A chimney element according to one of the preceding claims,
wherein the side panels (1, 2, 20, 21, 28, 29, 30), have trace lines (26) for cutting in order to adjust the height of said element.

8. A chimney element according to claim 8,
wherein a recess (25) is provided on each trace line (26).

9. A chimney element according to one of the preceding claims, comprising one or more housings intended for a ventilation duct, cables or other installation equipment.

10. A chimney comprising the chimney elements referred to in one of the claims 1-10 assembled on top of each other.

11. A method for assembly of a chimney element (17; 19; 27), comprising at least one housing suitable for a chimney liner (13, 18) formed by four quadrangular side panels (1, 2, 20, 21, 28, 29, 30), each having two vertical edges and upper and lower horizontal edges, interfacing with each other along their vertical edges,
characterized in that said method comprises for each housing at least the steps of:

- placing and fastening a lower connecting plate (10) to a level floor;
- installing a lower horizontal edge of a side panel (2, 20, 21, 29) on the lower connecting plate (10) in a locking relationship;
- installing the lower horizontal edges of two side panels (2, 20, 21, 30) on the lower connecting plate (10) in a locking relationship;
- placing and fastening the lower centralizer (8) on top of the lower connecting plate (10), the centralizer having an aperture (9);
- positioning the chimney liner (13, 18) within the aperture (9) of the lower centralizer (8);
- installing the lower horizontal edge of a forth side panel (1, 20, 21, 28) to the lower connecting plate (10); and
- entering an upper connecting plate (5) onto the end of the chimney liner (13, 18) and engaging it on the upper horizontal edges of all four side panels (1, 2, 20, 21, 28, 29, 30) in a locking relationship.

12. A kit of component parts for performing the method according to claim 12, comprising:

- four quadrangular side panels (1, 2, 20, 21, 28, 29),
- a chimney liner (13, 18),
- an upper connecting plate (5),
- a lower connecting plate (10), and
- a lower centralizer (8).

13. A kit according to claim 13, further comprising:

- two quadrangular inner chimney dividing side panels (30),
- optionally one additional chimney liner (13, 18),
- one additional upper connecting plate (5),
- one additional lower connecting plate (10)
- one additional lower centralizer (8), and
- one bottom piece (31).

14. A kit according to claim 13 or 14, wherein the component parts are wrapped into a preferably upright package for shipment to the building site or storage.

15. The use of a chimney element according to one of claims 1-10, wherein the chimney liner is replaced by conduits for one or more of ventilation, heating, water or electrical supply, wastewater, and telecommunications.

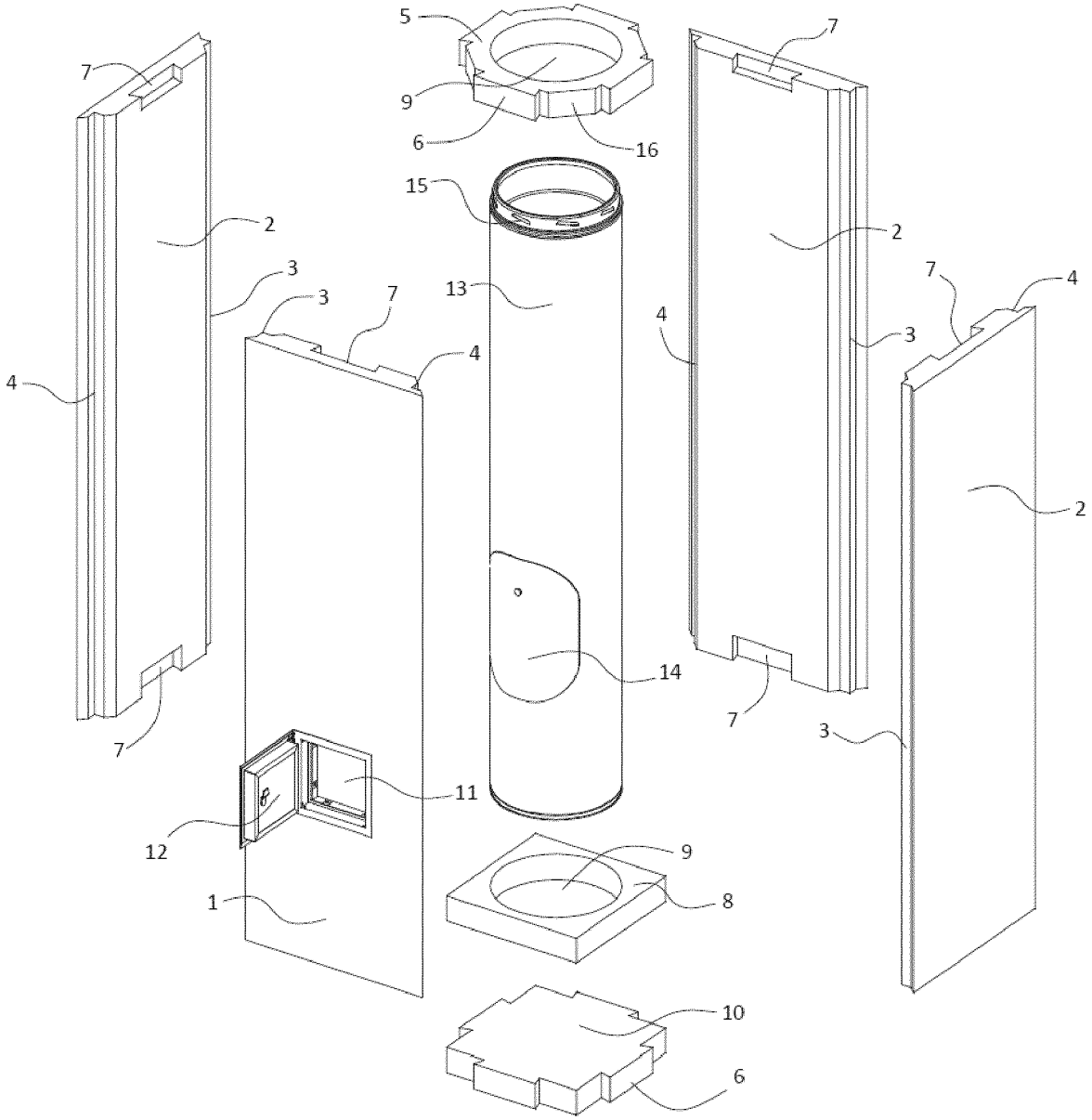

Fig. 1

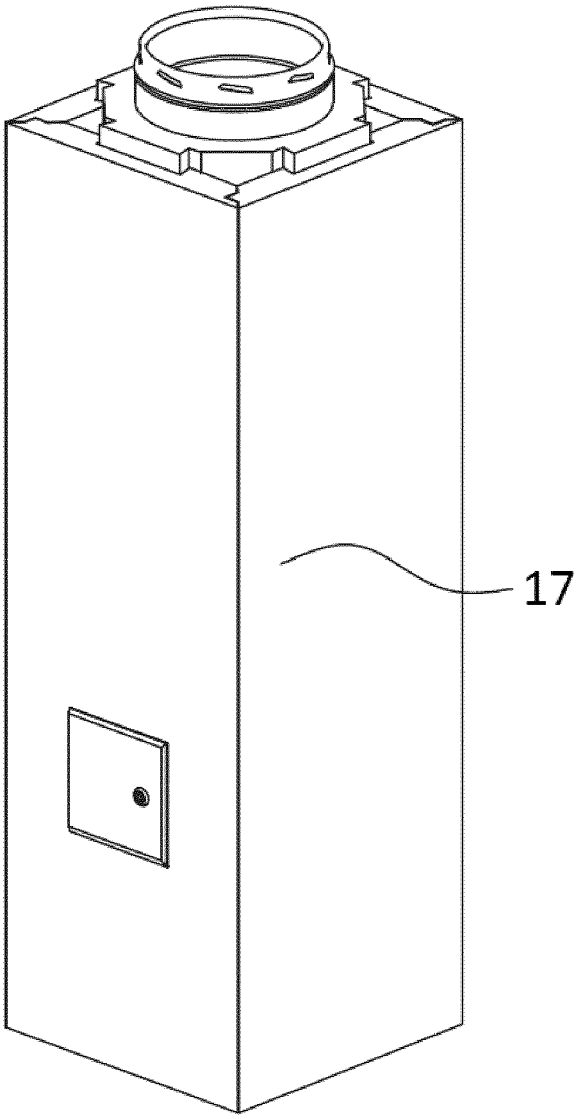

Fig. 2

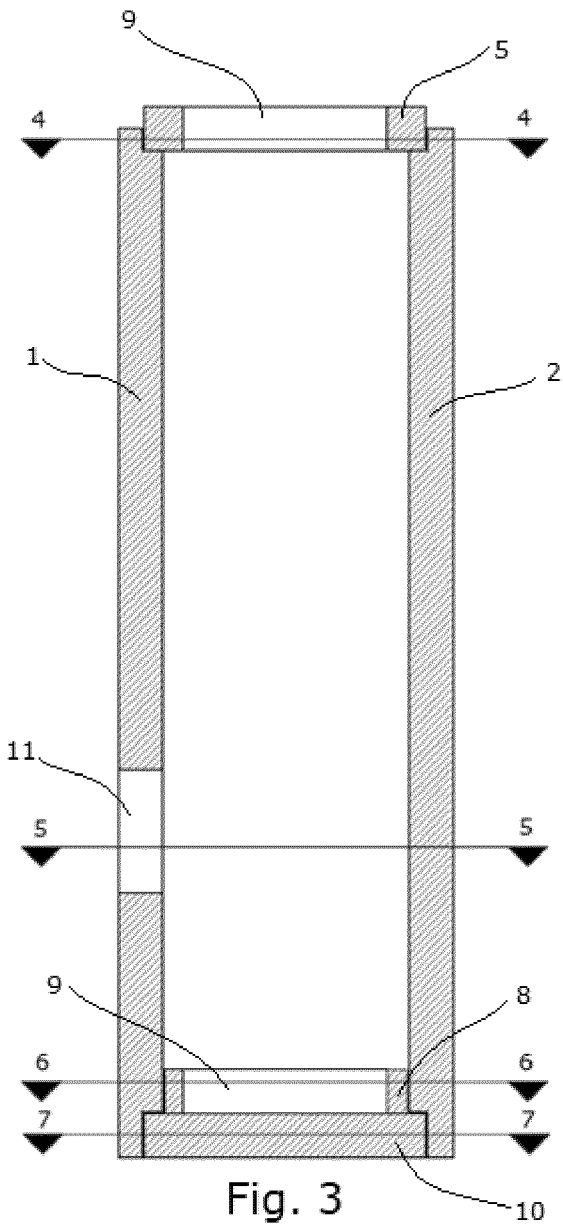

Fig. 3

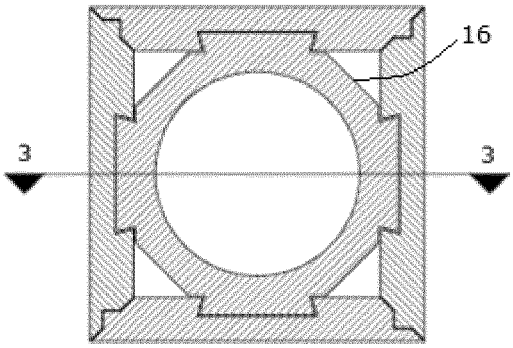

Fig. 4

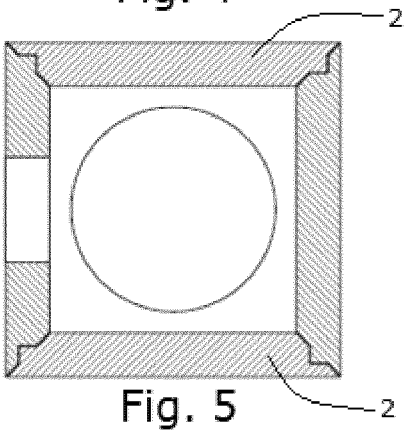

Fig. 5

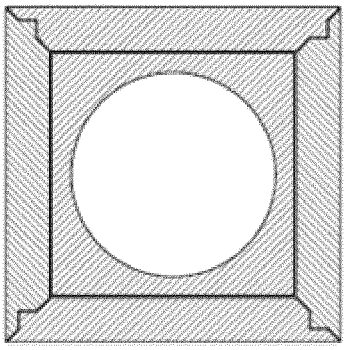

Fig. 6

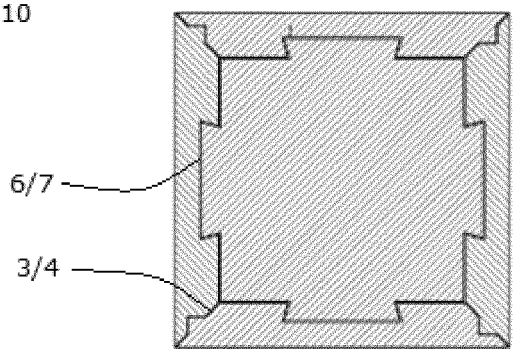

Fig. 7

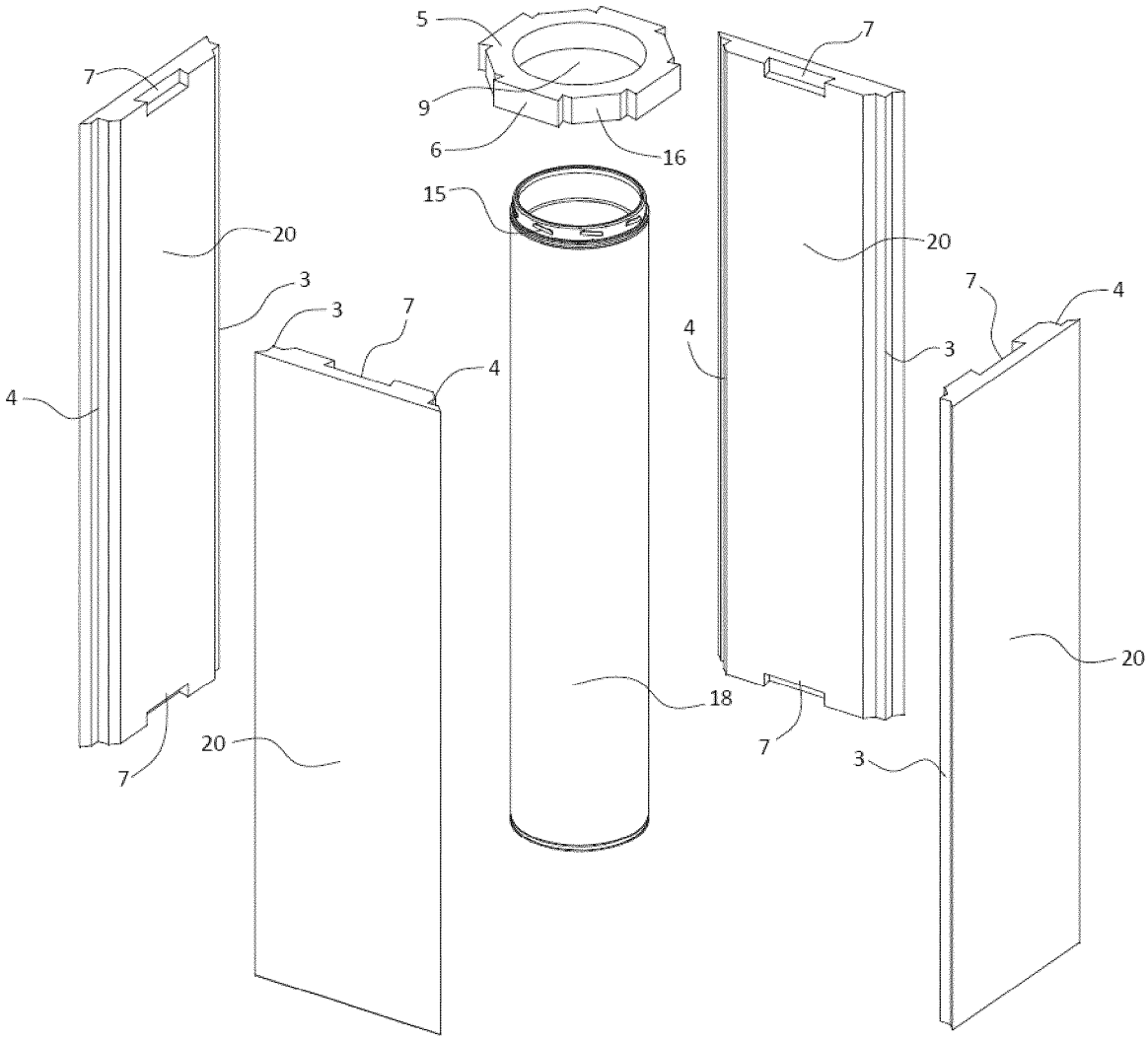

Fig. 8

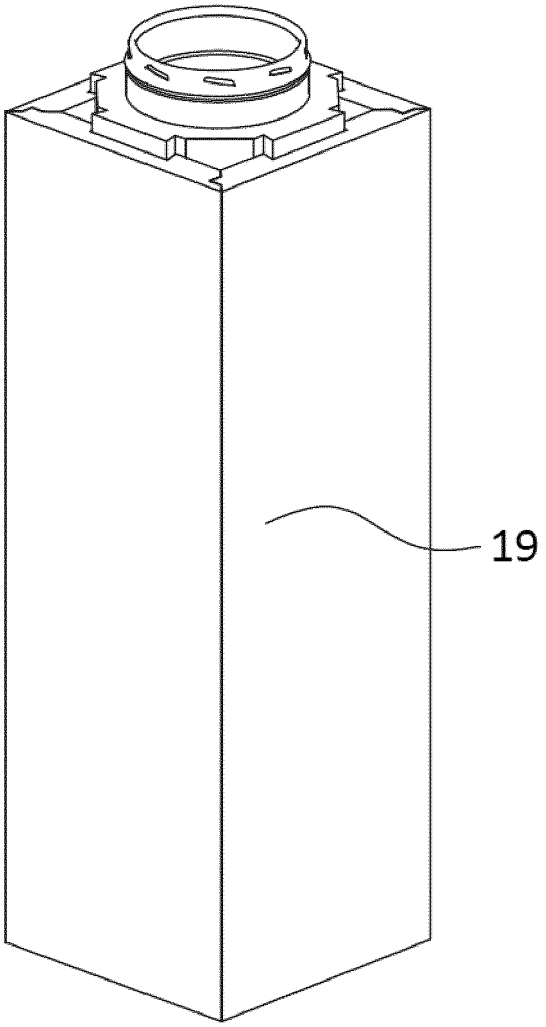

Fig. 9

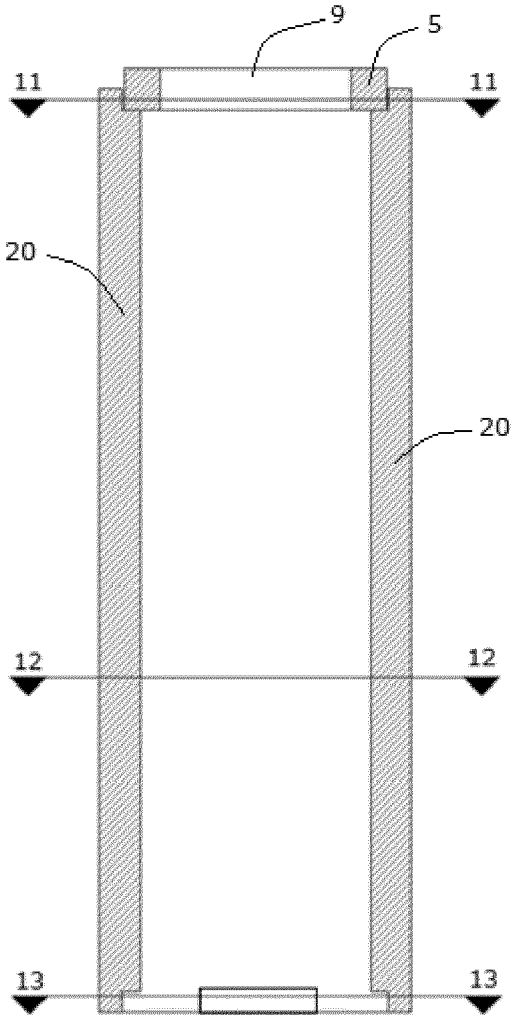

Fig. 10

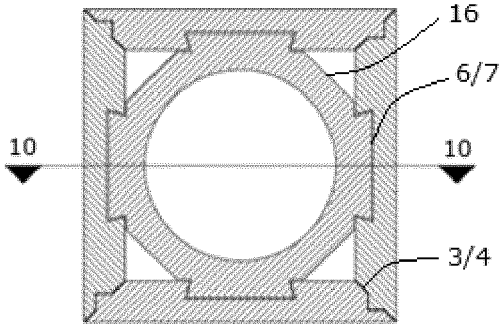

Fig. 11

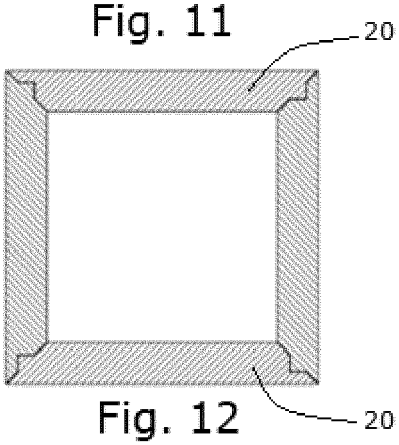

Fig. 12

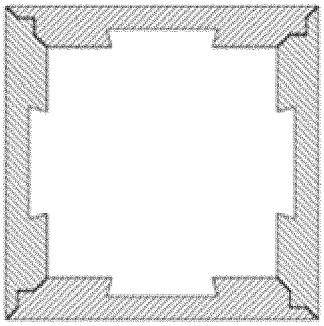

Fig. 13

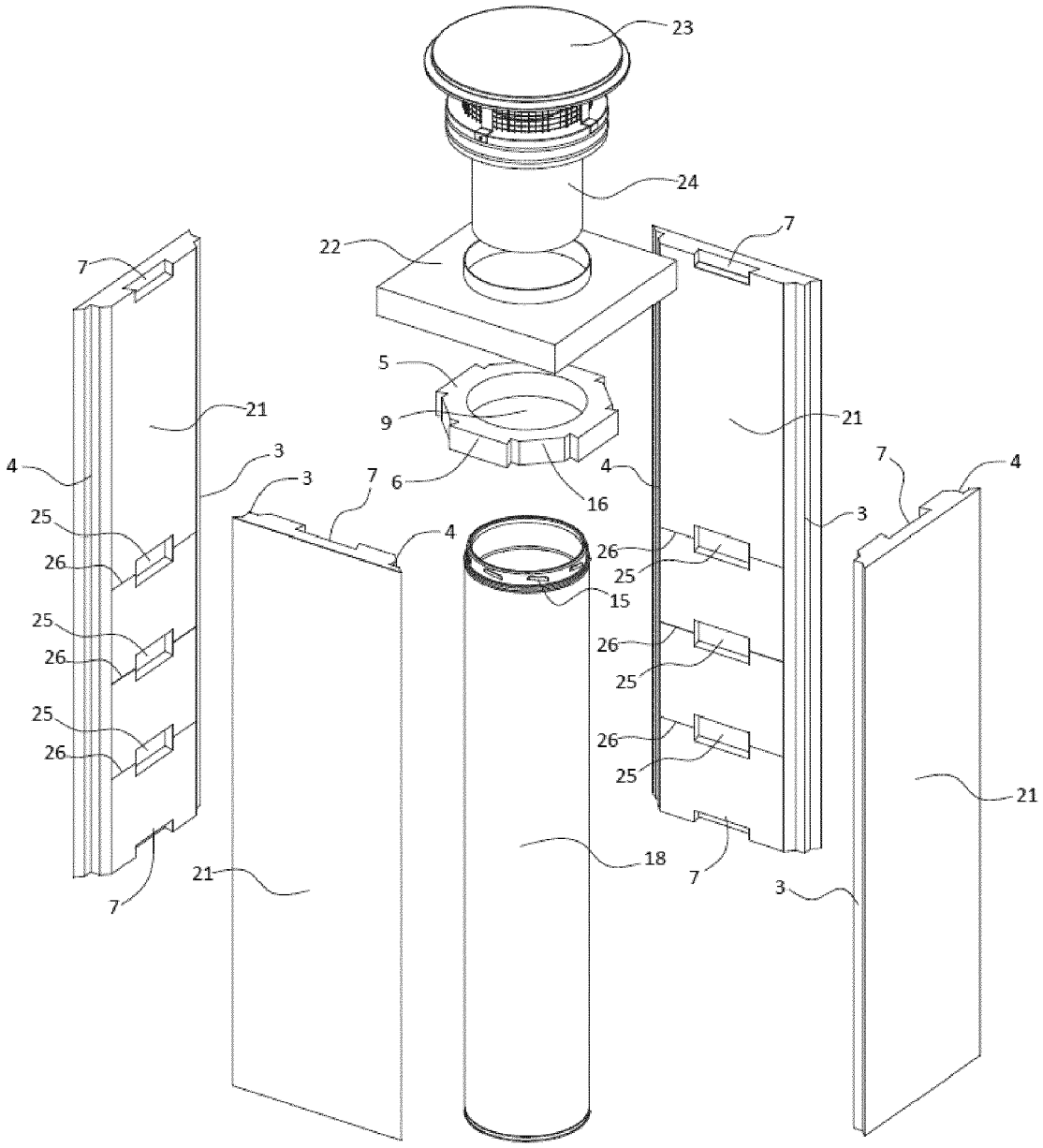

Fig. 14

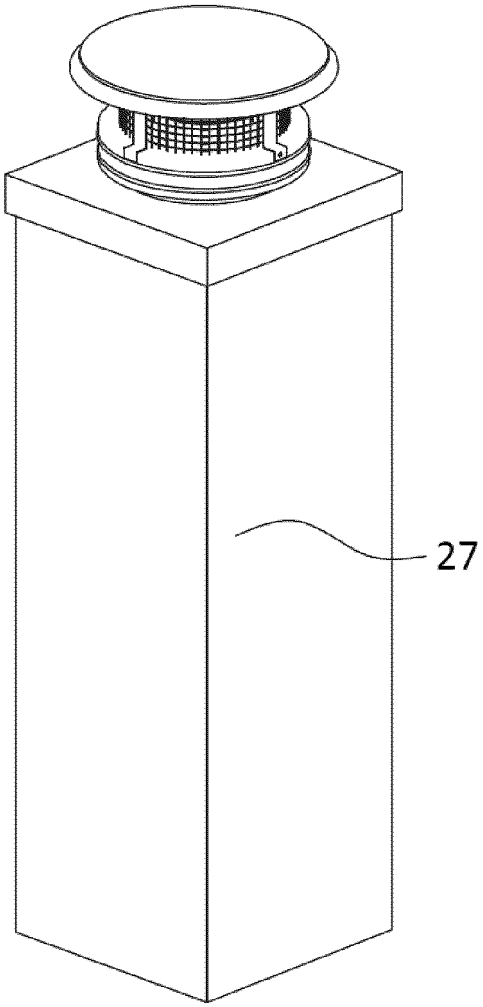

Fig. 15

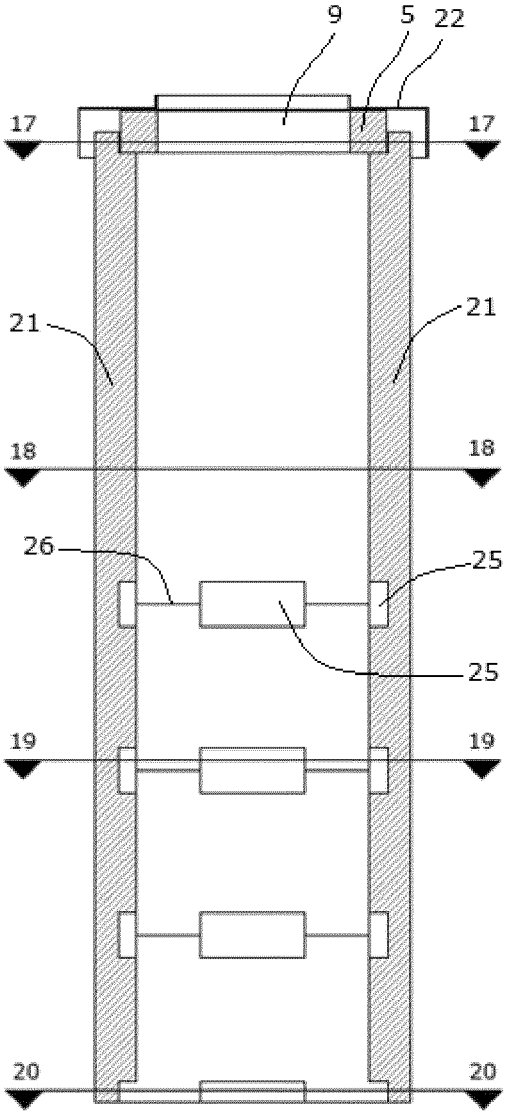

Fig. 16

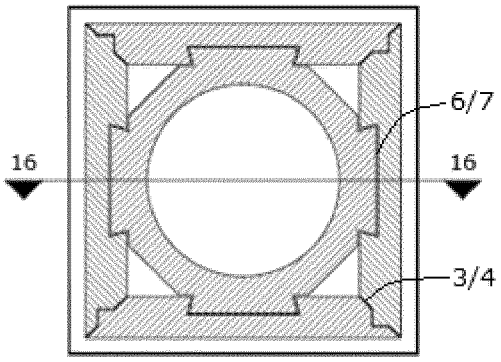

Fig. 17

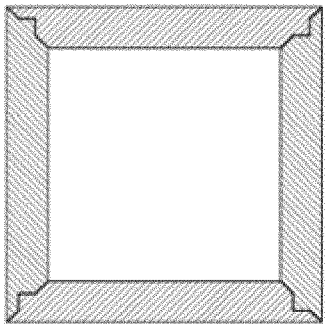

Fig. 18

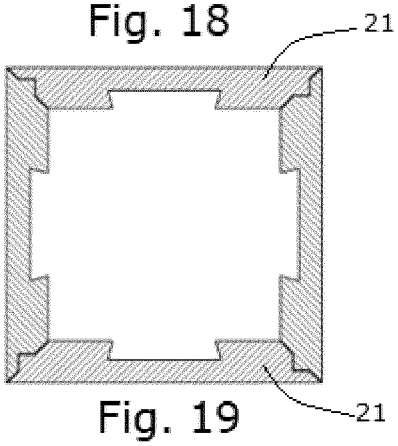

Fig. 19

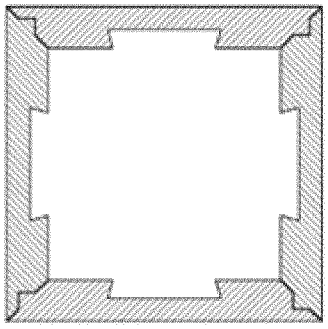

Fig. 20

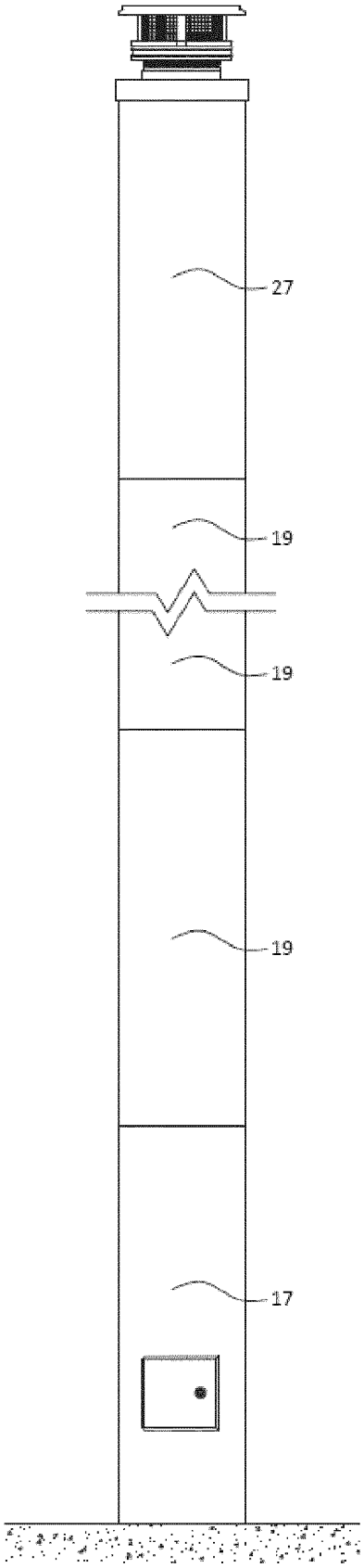

Fig. 21

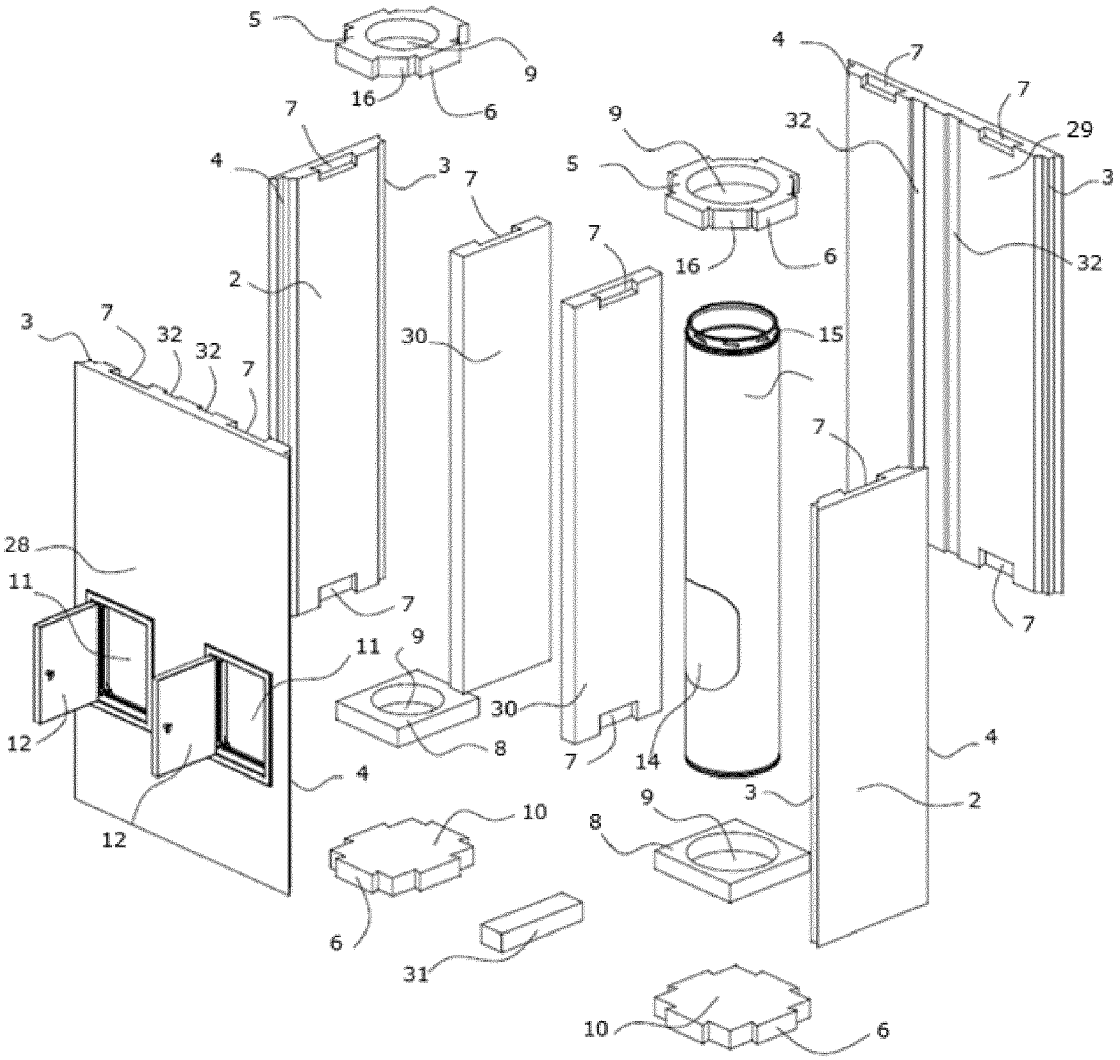

Fig. 22

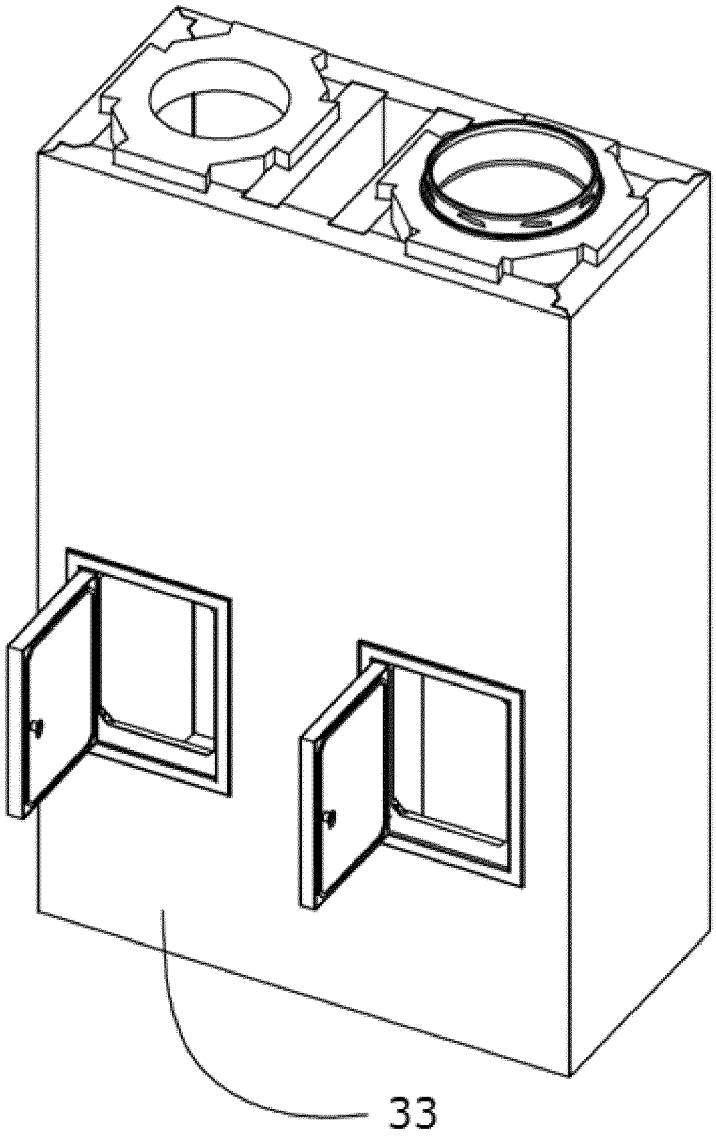

Fig. 23

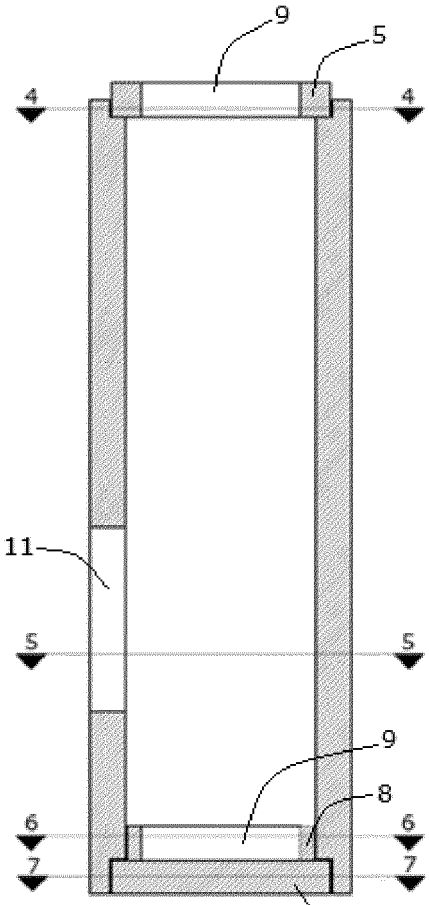

Fig. 24

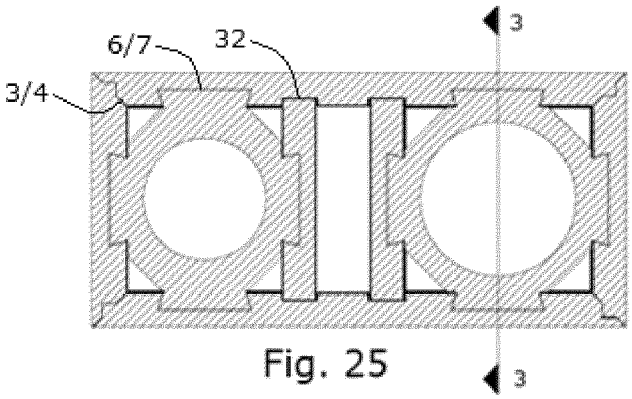

Fig. 25

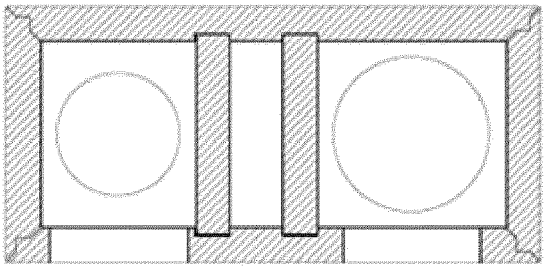

Fig. 26

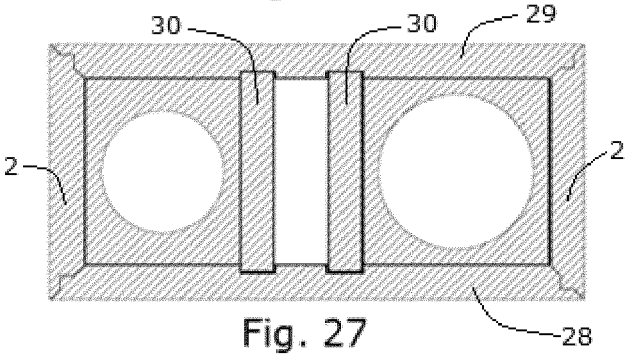

Fig. 27

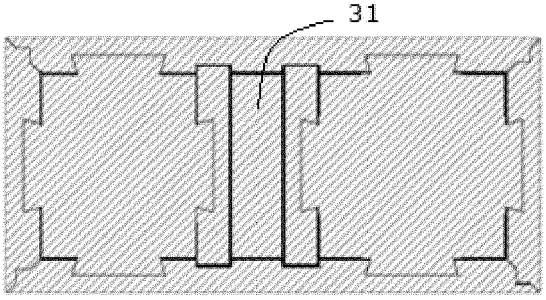

Fig. 28

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 2781

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 731 967 A (MCLAUGHLIN STEPHEN D [US]) 22 March 1988 (1988-03-22)	1,3,5-15	INV.
Y	* figures 1,2,3,6,9,11 *	2	E04F19/00
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Y	CN 201 850 741 U (FUXIANG GE) 1 June 2011 (2011-06-01) * figure 2 *	2	E04F17/04 E04F17/08 E04C1/39 E04C2/52 E04C2/00 E04H12/28 E04H14/00 E04B1/61

TECHNICAL FIELDS SEARCHED (IPC)

E04F
E04C
E04H
E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 December 2017	Topcuoglu, Sadik Cem

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REFERENCES CITED IN THE DESCRIPTION

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