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(73) Patenthaver: **Oekag Wassertechnik (Schweiz) AG, Bodenhof-Terrasse 13a, 6005 Luzern, Schweiz**

(72) Opfinder: **Morandini, Giorgio, Bodenhof-Terrasse 13a, 6005 Luzern, Schweiz**

(74) Fuldmægtig i Danmark: **PATRADE A/S, Fredens Torv 3A, 8000 Århus C, Danmark**

(54) Benævnelse: **Indretning for tilbageholdelse af opstigende varm luft, lodret monterbar på rør, slanger eller kanaler**

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DE-C1- 19 510 502
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Description

[0001] The invention relates to a device which can be mounted vertically on pipes, hoses, or ducts for retaining rising hot air and rising duct gases in pipes, hoses, or ducts in openings in building shells or at the entry of loaded air in accordance with the preamble of claim 1.

[0002] Pipes, hoses, and ducts in domestic engineering and flat roof runoffs are functional openings, and, as a rule, are open and lead to the outside without being insulated from the heated internal area. The interior environment heats the air column in the interior of the pipe by heat transmission, and causes this to rise by convection and escape into the surrounding area. The energy loss from a sanitary ventilating pipe with a diameter of 110 mm during a heating period for a single-family house is between 50-100 litres of heating oil equivalent.

[0003] With an open drop and a ventilating pipe over the roof, underpressure or overpressure states, such as occur in drainage systems, are prevented. Underpressure would prevent siphoning (drawing out the water block) and with overpressure duct gases could enter into the sanitation area.

[0004] Even with roof gullies conducted through the roof insulation, the heat leakage due to the hot air loss has up to now been underestimated or even disregarded. Such a pipe can incur transmission losses per heating period of up to 100-140 litres of heating oil equivalent.

Roof gullies are, as a rule, installed open, with only a leaf catchment grille. The interior environment heats the air column in the interior of the pipe by heat transmission and allows this to rise by convection and escape into the surrounding area. The rain downpipe penetrates the roof insulation like a chimney and connects the interior environment with the outside air. With the increasing thickness of the insulation of the building shell in particular, the energy loss potential is becoming greater. Moreover, the widely used underpressure water drainage systems allow for the largely drop-free laying of rain downpipes in the interior of the building. The heat-side pipe deployment therefore becomes greater, and therefore also the transmission loss becomes correspondingly greater. Such pipes are provided as standard with only minimal condensation water insulation in a thickness of 1-2 cm, or embedded in concrete without insulation. Comparable energy loss sources are ventilation ducts leading to the outside, for room ventilation and air extraction

in a state of rest and with closure devices which allow for air escape. In multiple-occupation buildings, rooms in the interior have air extracted individually by ventilators.

[0005] For about 30 years underpressure valves have been used as substitutes for open sanitary ventilating pipes. These valves are located in the interiors of buildings on the drop pipes. In the event of underpressure in the drop pipe, a flap opens and room air is drawn in. These valves are one-way valves, since they only relieve the underpressure and then close again immediately. Overpressure in the drainage system can no longer escape, and for this reason they are not universally approved. In certain cases, if underpressure valves are used, the drainage system must nevertheless be vented via the roof, with the main pipe open, such that the protection against heat loss is missing in that area.

[0006] Odour burden due to high-rising drainage system air vents from sanitary ventilation pipes in the vicinity of terraces, balconies, or roof dormer windows etc. are everyday occurrences. Later rectification incurs a great deal of effort and expense. Also familiar is the relatively substantial effort involved in separating duct gases at rainwater downpipe connections to the mixed drainage system. For this purpose, siphoned shafts are installed in the footing area of the rain water downpipe. If maintenance is insufficient these may become blocked. This shaft causes duct gases to be retained. The corrosive duct gases, as well as causing bad odours, also have a corrosive effect on the metal downpipes. Diaphragm valves are likewise suitable for preventing undesirable air ingress into buildings or machines.

[0007] From WO 95/18899 a pipe valve is known which comprises a circular diaphragm made of rubber, which is secured by a screw in the centre of the diaphragm to a grille. Due to rising hot air, conducted by a fan, the diaphragm can be raised off the grille, and the air therefore blown out. As soon as the fan is switched off, the diaphragm settles back onto the grille and closes off the air column in the pipe upwards. The blowing off of air from toilets and other sanitation areas is thereby ensured, and also the prevention of sustained air exchange from the pipe. With this arrangement, however, it is not possible for air to be drawn in, when the toilet is flushed, for example. As a result it may happen that the siphon in the toilet empties and, as a result, duct odour may rise. Similar devices are known from US-A-4,416,415 and US-A-6,149,516.

[0008] From EP-A1 568946 a device is also known, in accordance with the preamble of claim 1, for the retention of rising hot air, with which a diaphragm is slit in a star shape and held along its periphery on the ventilation pipe. The diaphragm is inserted horizontally into the pipe. The circular cut-outs formed by the slots can bend upwards under overpressure, and so allow for air extraction. In the event of underpressure, for example after a toilet is flushed, the circular cut-outs bend downwards, and in this way prevent a vacuum in the ventilation pipe. It has transpired, however, that no material can be found for the diaphragm which will always bend back into the plane, and not bend downwards, due to its own weight or due to creepage caused by successive imposition of vacuum or due to ageing of the material, which then no longer allows for tight closure.

[0009] The object of the invention is therefore to provide a device which can be mounted vertically on pipes or ducts, which will prevent odour burdens, corrosive duct gases, and/or unnecessary hot air discharge or the ingress of laden air.

[0010] This object is solved by a device which can be mounted vertically on pipes or ducts in accordance with the features of claim 1.

[0011] The invention allows for the closure flap, due to the shaping of the slot and the bending lines which function as joints and due to the material properties of the diaphragm, as well as the flowing through of water and drawing in of air from the outside, after the ending of precipitation or a flushing process, to pivot back immediately into the initial position. With a slight water flow, the closure flap opens slightly; with substantial water impingement, the closure flap is opened fully by the fluid flow. In the closed state, the closure flap incurs a hot air build-up. The hot air forms a hot air plug beneath the closure flap, which efficiently prevents the constant energy outflow due to the rising hot air to the outside. The energy loss is reduced to the cooling effect which occurs on the surface between the cold side of the closure flap and diaphragm and the hot-side hot air plug at the closure flap. The pipe cross-section loss is then negligible. The hot air build-up heats the diaphragm and prevents the closure flap from freezing in the winter. A hydrophobic material, a protection flap, and the vertical position support the functional performance in winter.

[0012] If the closure flap is installed in sanitary ventilation pipes, overpressure can escape to the outside, since, as the pressure rises, the closure flap is only pressed outwards to the extent that the pressure can escape. After the pressure

equalization, which is established after a few seconds, the closure flap closes again. If underpressure occurs in the sanitary downpipe due to outflowing water, the closure flap opens, in that the flap segments deform inwards and open the cross-section in slit fashion, and air is sucked in. The closure flap can be used in combination with conventional underpressure valves.

With a vertical arrangement of the flaps, in the form of small doors, heating of the material has no effect on the sealing tightness of the closure flap, and, in the event of frost, the icing-up and therefore the closing of the closure flap is excluded due to the fact that condensation water always runs downwards along the edges of the closure flap and collects in the acute-angled corners located lower down, where the effect of icing is negligible. Due to the pressure differentials, the diaphragm surface tension changes. The contact zone of the flaps to the diaphragm is small, and is restricted to the thickness of the diaphragm. This provides additional support for functional performance in winter. By the insertion or adhesive bonding of fine spring-elastic wires, metal or plastic rods, or the casting in of micro-materials or nano-materials into the diaphragm, the strength of the closure flap can be increased without its elasticity for opening being substantially impaired. The effective valve surface can be determined by the vertical diaphragm arrangement and a free choice of the closure flap height, independently of the cross-section of the duct or pipe. The effective valve surfaces can therefore be much larger than the pipe cross-section. As a consequence, it is possible for closure flaps of suitably large dimensions to be arranged even in pipes and ducts of very small dimensions. At the same time, the transfer of sound in sound-conducting air columns located adjacent to one another, for example in multiple-occupation buildings, can be interrupted by these closure flaps, and therefore airborne sounds or noises can be prevented coming from sheet covers enveloping the pipes on the roof.

[0013] The closure flaps can be manufactured from an elastic strip in endless format, and the corresponding number of closure flaps can be cut from the strip during make-up, or fitted directly onto diaphragm which is injection-moulded onto the support structure. This allows for extremely economical manufacture to be achieved.

[0014] In combination with suitable support profiles and a plurality of flaps in series, large-surface valve diaphragms can be produced and used in ventilation technology. The flaps do not require any active control or drive unit. Operation is therefore simple, maintenance-free, and economical.

[0015] The invention is explained in greater detail by way of illustrated exemplary embodiments. The drawings show:

Figure 1 a side view of a valve which can be located on a roof,

Figure 2 a cross-section through the valve represented in Figure 1,

Figure 3 a view of an elastic strip with closure flaps,

Figure 4 a horizontal section along the line IV-IV in Figure 3,

Figure 5 a cross-section through a closure flap with external support,

Figure 6 a cross-section through a closure flap with integrated support,

Figure 7 a horizontal section through a closure flap application,

Figure 8 a horizontal section through a closure flap application,

Figure 9 a side view of an insertion module with closure flaps, and

Figure 10 a horizontal section along the line VI-VI through the insertion module according to Figure 9,

Figure 11 further embodiments of closure flaps,

Figure 12 a cross-section through a closure flap with a securing means,

Figure 13 a cross-section through a closure flap with a further type of securing.

[0016] In the roof cut-out according to Figure 1, the reference number 1 represents a ventilation pipe, which penetrates a roof 3. Other roof components which may be present have not represented for the purpose of better overview. The ventilation pipe 1 is connected at the bottom to sanitation fall pipes. The ventilation pipe 1 can also be connected to room air extraction pipes, such as toilet, bathroom, or kitchen air extractors, etc. These pipes are not represented. At the top, a hat 5, or with a plurality of pipes a box, can be placed, which prevents the ingress of rainwater.

[0017] In the ventilation pipe 1, the reference number 11 indicates a surface fabric with a closure flap 19, by which a hot air plug 37 (represented by dots) rising in the direction of the arrow 9 is prevented from emerging to the outside (Figure 2).

[0018] The shaping of the hat 5 can of course be of different design. A protection flap 39 can be arranged beneath the cover hat 5.

[0019] Shown in Figure 3 is a section cut from a strip-shaped flexible surface fabric 11. This can be made from silicone or another flexible plastic material, from rubber, or from a laminate from one of the forenamed materials, with a carrier or reinforcement material 15 such as plastic or steel threads. Preferably, the plastic or metal threads present spring-elastic properties. They can be introduced in the form of a fabric or as parallel fibres, or only in an overall arrangement of individual precisely arranged sheet strips 13. It is also possible for nano-structured or micro-structured materials 41 or magnetic elements 27 to be introduced into the surface fabric 11.

[0020] Introduced into the surface fabric 11 by punching or by cutting with a blade or an energy beam (laser beam or water jet), or by the integration of separation layers during casting, are slits 17, by means of which tongues or flaps 19 are formed. These flaps 19 are further connected along an essentially vertical bending line 21 to the surrounding fabric 11. The bending lines 21 can be purely imaginary lines (see broken dotted line in Figure 3) or, if the fabric 11 is a somewhat stiffer material, notches or grooves 23 or short cuts can be formed along the bending lines 21.

[0021] In the example shown, the flaps 19 are trapezoidal, and the bending lines 21 run along their longest edge (base). Preferably, the two short edges meet the bending line 21 at an acute angle alpha. This ensures that, in the event of condensation forming on the fabric 11, water droplets can flow off downwards along the oblique slit 17, 25, and do not remain adhering inside the slit where they could freeze.

[0022] Other possible shapes, such as triangles, semi-circles, etc. for the cut-out flaps, which exhibit similar properties, are represented in Figure 11.

In Figure 3 it can further be seen that, along the vertical slits 25, magnetic elements 27 are worked into the fabric 11, and, due to their mutually opposed drawing effect, keep the flaps 19 (+) in the position of rest in the plane of the fabric 11 (-) surrounding them, provided that no force is exerted from one side or the

other onto the flaps 19. From Figure 4 it can be seen in schematic form how the flaps 19 can be pivoted out of the plane of the fabric 11 on both sides. In Figure 3 only a section cut out of the strip-shaped fabric is shown. It is possible in each case for a flap 21 to be let into this at specified spacing intervals, or two flaps 19, or a plurality of pairs of flaps, connected by a middle web 29 or to a bending line 21.

[0023] Represented in Figure 5 is a horizontal section along the line IV-IV in Figure 3, through two closure flaps 19, which on one side are in contact on support profiles 31 and on the other side lie on a support grille 33. This prevents the flaps 19 from pivoting outwards in the direction of the support grille 33. The air can therefore only escape in the direction of the arrow 9 (one-way closure).

[0024] In Figures 6, 7 and 8, which show horizontal sections through fabrics 11, the arrangement of the closure flaps 19 can be seen. The closure flaps 19 are always arranged between two support profiles 31, such that the fabric 11 in this region lies flat on one side, and is held under tension on the other side. In this situation it is possible in each case for a support post 31 to be present inside and an adjacent one outside a fabric structure designed to form a polygon (Figures 7 and 8). Further represented in Figure 6 is an arrangement of support posts 31', which lie inside the fabric structure 11, i.e. are either adhesively bonded in, extrude in, or laminated in.

[0025] In Figures 9 and 10, a further embodiment of the arrangement of the closure flaps 19 can be seen. For the placement of the device for retaining rising hot air, in a pipe 35, for example circular, six support posts 31 are arranged, and the fabric 11 is tensioned over their outer edges. This is arranged in such a way that in each case a pair of flaps 19 come to lie between two support posts 31. The theoretical opening ranges of the pair of flaps 19 are represented by fine semicircular lines. This module, ready for use, can be inserted with suitably selected means vertically into a ventilation pipe or air extraction pipe 1. For the purpose of better overview, the retaining means for the module are not represented.

[0026] In Figure 11 variant embodiments of the flaps 19 are shown. Not shown is a parallel arrangement of two flaps 19, in pairs, with a common bending line 21.

[0027] Figure 12 shows in horizontal section a further type of securing of the fabric 11 on the support profile 31 by means of a securing means 43 provided with bolts.

[0028] Figure 13 shows a further variant of the securing of the fabric 11 by means of a connection 45 gated onto the support profile 31.

[0029] It has proved to be advantageous for the closure flap 19 and the surface fabric 11 to be made of rubber or plastic, or a laminate of rubber or plastic with a reinforcing means 15. As reinforcing means, fabrics are suitable, strip-shaped inserts, or films made of individual fibres or strips of suitable plastic or metal, these materials exhibiting self-resetting properties.

[0030] The surface fabric 11 with the closure flaps 19 can be made from hydrophobic material or by coating, the addition of substances, or surface processing to become hydrophobic or super-hydrophobic.

Patentkrav

1. Indretning, som kan monteres lodret på rør, slanger eller kanaler, til at tilbageholde opstigende varm luft og opstigende kanalgasser fra bygninger og til at hindre indgang af partikelladet eller gasladet luft gennem åbninger i bygningsskaller, omfattende et elastisk pladeformet emne (11) med en eller flere lukkeklapper, som kan aktiveres ved et trykfald mellem de to overflader (yderside og inderside) af lukkeklapperne (19), **kendetegnet ved, at** den mindst ene lukkeklap (19) af indretningen består af et pladeformet emne (11) med tilbageføringsegenskaber, og at den mindst ene udsvingelige lukkeklap (19) er dannet af en gennemgående slids (18) i det pladeformede emne (11) og kan svinges langs en bukkelinie (21), som forbinder de to ender af slidsen (17).

2. Indretning ifølge krav 1, **kendetegnet ved, at** det pladeformede emne (11) består af gummi eller plast eller et laminat af gummi eller plast med et armeringsmiddel (15).

3. Indretning ifølge krav 2, **kendetegnet ved, at** armeringsmidlet (15) består af et vævet materiale, strimmelformede indlæg eller folier bestående af enkeltfibre eller strimler af egnet plast eller metal, som har selvtilbageførende egenskaber for lukning af klapperne (19).

4. Indretning ifølge ethvert af krav 1 til 3, **kendetegnet ved, at** det pladeformede emne (11) med lukkeklappen (19) er ført over støtteprofiler (31), er fastgjort til støtteprofiler eller forstærket af disse, sådan at der er dannet et plan, og det pladeformede emne (11) er udspændt.

5. Indretning ifølge krav 4, **kendetegnet ved, at** lukkeklappen (19) kan udbøjes udad om bukkeliniens (21) akse mod tilbageføringskraften fra materialet, der danner lukkeklappen (19).

6. Indretning ifølge et af krav 1 til 5, **kendetegnet ved, at** lukkeklappens (19) bukkelinie (21) og en slids (17), der løber langs bunden, mødes i en spids vinkel (alfa) ved skæringspunktet.

7. Indretning ifølge krav 6, **kendetegnet ved, at** lukkeklappen (19) har en smal, stående form som en trapez, et cirkel- eller ellipsesegment eller en trekant med

en lodret bukkelinie (21) og en gennemgående slids (17), hvori længden af bukkelinien er flere gange større end klapbredden (19), f.eks. med et sideforhold på 2:1 eller 3:1 eller større.

8. Indretning ifølge et af krav 1 til 7, **kendetegnet ved, at** den mindst ene lukkeklap (19) er indført i eller udspændt hen over et støtteelement (31), der som helhed kan skubbes ind i en luftkanal, et vandrør eller en slange.

9. Indretning ifølge et af krav 4 til 6, **kendetegnet ved, at** understøtningen sker udvendigt i det pladeformede emne med på lukkeklappen anliggende stænger (31), plader eller ved midler (43, 45), der er indbygget eller ligger an på det pladeformede emne.

10. Indretning ifølge krav 9, **kendetegnet ved, at** tilstødende plane pladeformede emner (11) med lukkeklapper (19) findes i form af en polygon.

11. Indretning ifølge et af krav 1 til 10, **kendetegnet ved, at** lukkeklappen (19) som envejsventil på den ene side er dækket af et støttegitter (33) eller et overtræk.

12. Indretning ifølge et af krav 1 til 11, **kendetegnet ved, at** magnetiske elementer (27) er indført i lukkeklappen (19) og ved siden i slidserne (17) i det pladeformede emne (11).

13. Indretning ifølge et af krav 1 til 12, **kendetegnet ved, at** det pladeformede emne (11) med lukkeklapperne (19) er lavet af hydrofobisk materiale eller gjort hydrofobisk eller superhydrofobisk med belægning, tilførsel af stoffer eller ved overfladebehandling.

14. Indretning ifølge et af krav 1 til 13, **kendetegnet ved, at** det pladeformede emne (11) med lukkeklapperne (19) er beskyttet mod varme og mod vindtryk og støvregn med en beskyttelseskappe (39).

15. Indretning ifølge et af krav 1 til 14, **kendetegnet ved, at** indretningen er beskyttet mod vejrpåvirkninger med en påsat beskyttelseshætte (5) lavet af metalplade eller plast.

Fig. 1

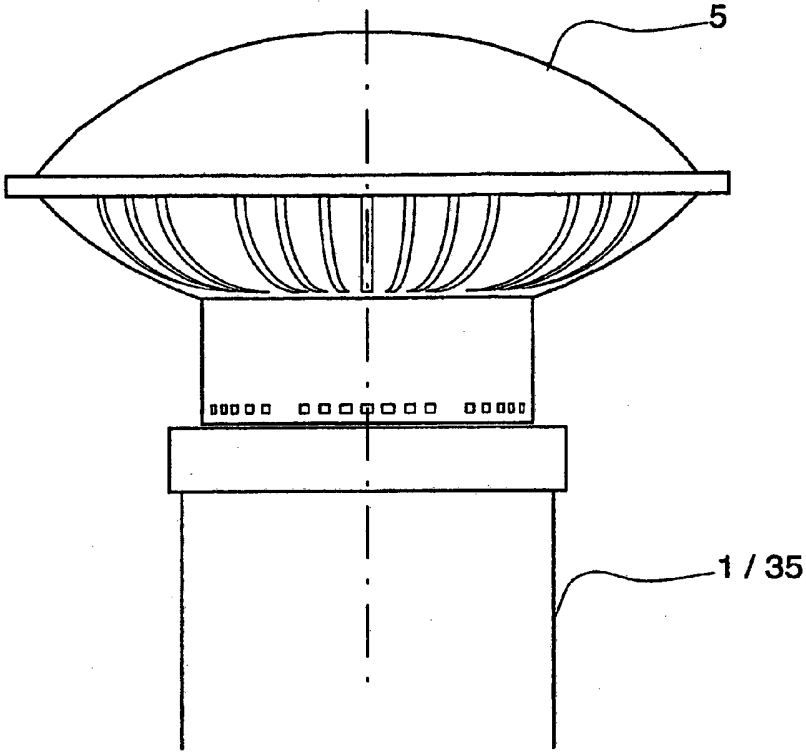

Fig. 2

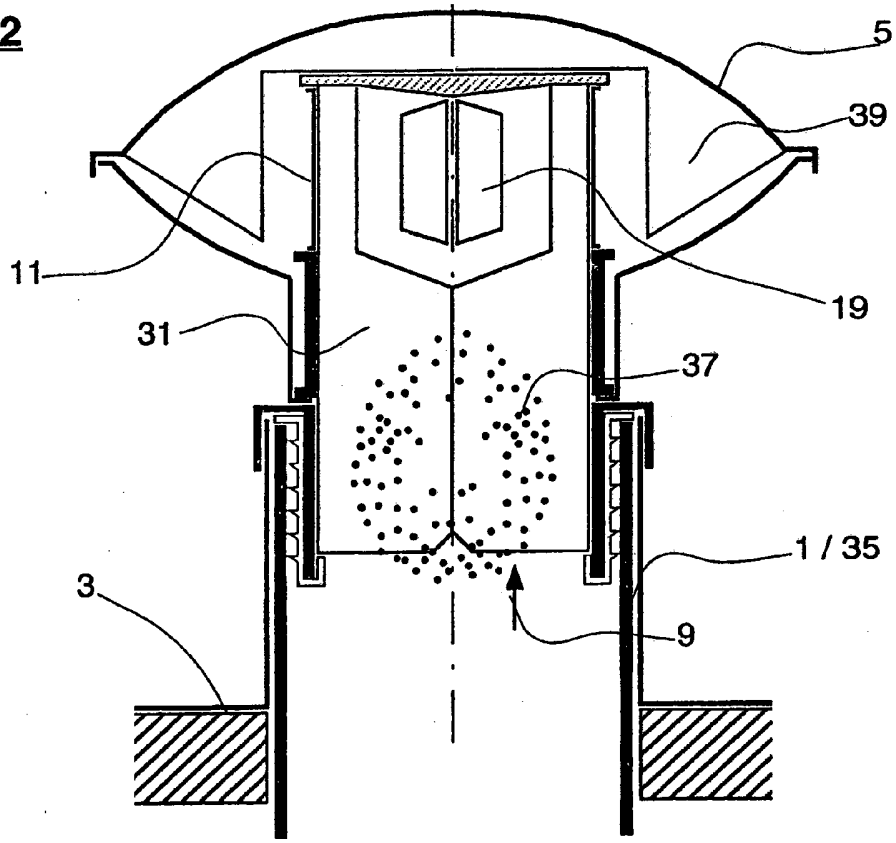

Fig. 3

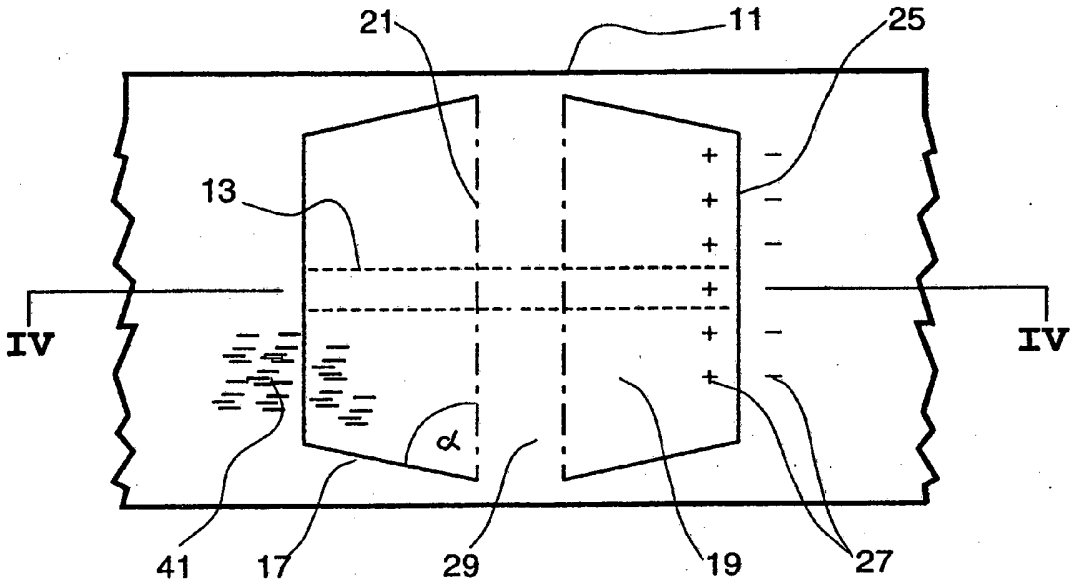

Fig. 4

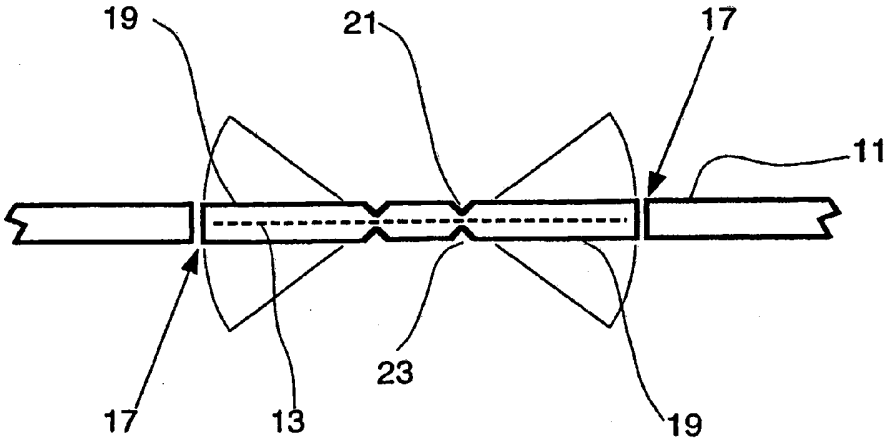

Fig. 5

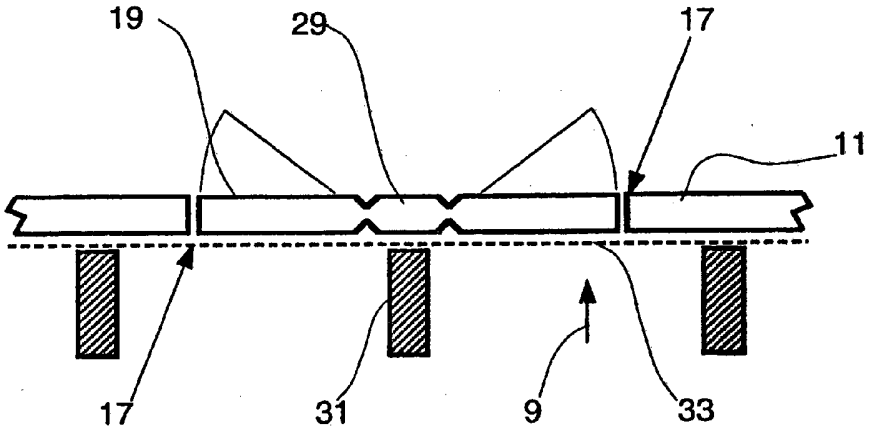

Fig. 6

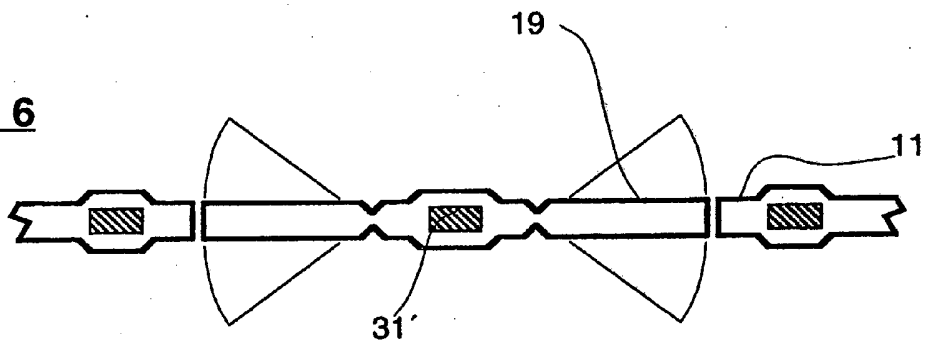

Fig. 7

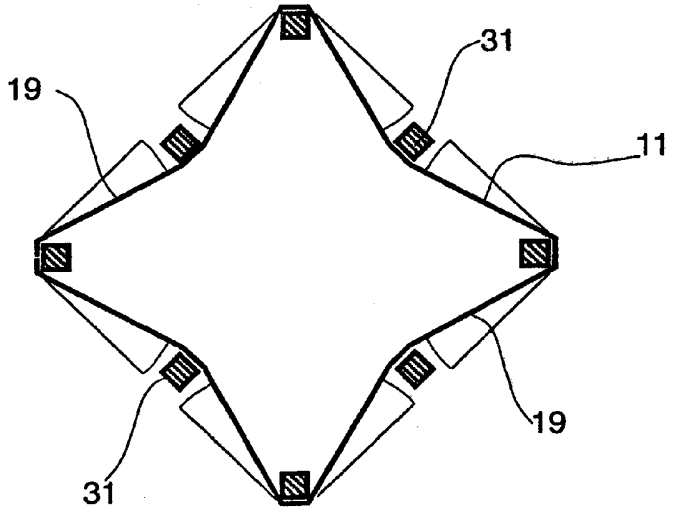

Fig. 8

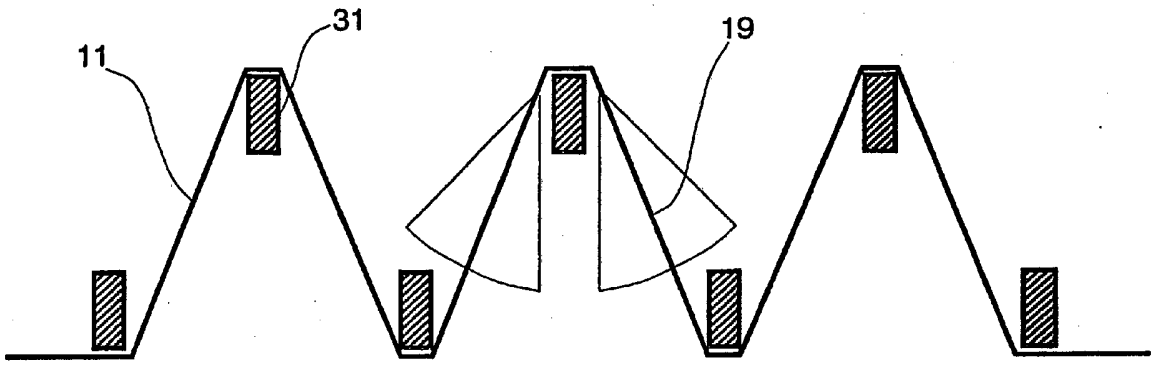

Fig. 9

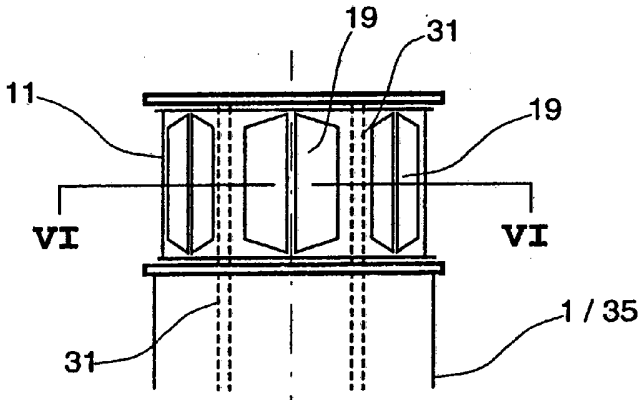

Fig. 10

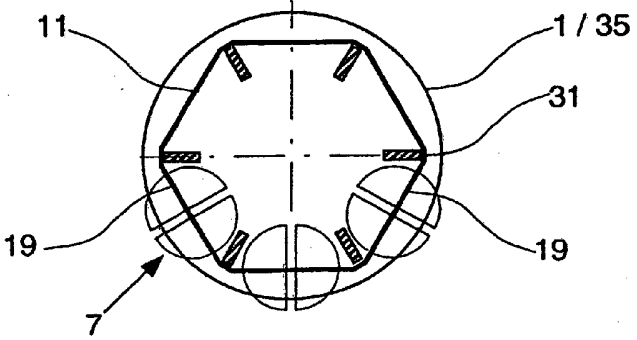

Fig. 11

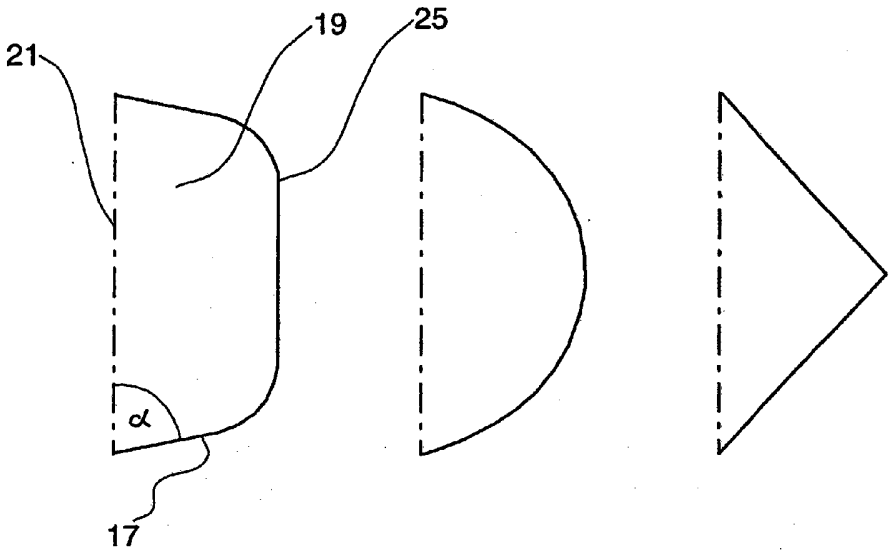

Fig. 12

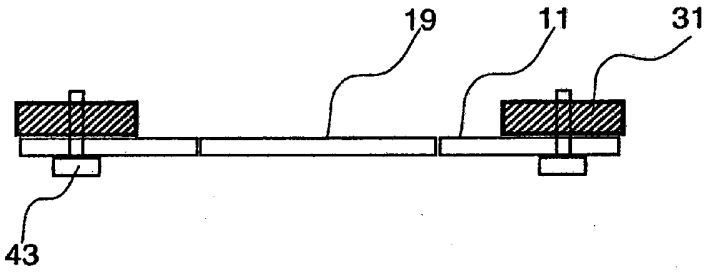

Fig. 13