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(54) Benævnelse: **Luftkonditioneringsdiffusor til luftfordeling**

(56) Fremdragne publikationer:
EP-A1- 2 578 957
EP-A2- 2 357 294
EP-A2- 2 573 479
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DESCRIPTION

Field of the invention

[0001] The present invention relates to an air-conditioning diffuser according to the preamble of claim 1.

Background of the invention

[0002] The known flat air-conditioning diffusers, which constitute the prior art concerned and serve for distributing air, are typically made of woven or non-woven fabrics or foils and consist of a framework structure covered with a textile stuffing material (ceiling or wall based diffusors). The outlet wall of a diffusor may be perforated or provided with through-holes, the air distribution taking place through such perforation or holes. Distributing air in a proper manner is one of the most important functions of an air conditioning distribution system.

[0003] While straight ducting elements are typically required to enable that the air exits them in a direction, which is perpendicular to the walls of such elements, the use of ceiling or wall based diffusors makes it desirable that the exiting air streams flow in diverse directions.

[0004] One of the drawbacks, which mainly relate to the known framework structures comprising textile diffusors, consists in that an undesirable draught can develop in the case that the distributed air is flowing in a single direction from such a diffusor.

[0005] In ceiling and wall based diffusers, the outlet orifices formed by perforated or micro-perforated sections are mostly insufficient with regard to the distributed air volume.

[0006] The objective of the present invention is to develop an air-conditioning ducting element in the form of a ceiling or wall based diffuser for distributing air, which diffuser has to be simple with regard to design and manufacturing, and enable to direct the outlet air flow in a manner that will cause the distributed air to enter a room in a desired direction without causing a draught. At the same time, all the advantages of a textile or foil distribution system must be maintained, particularly its lightweight structure and the possibility to machine-wash the same.

An air conditioning diffuser with features defined in the preamble of claim 1 is known from US20120006442, a diffuser mountable in lowered ceiling is known from WO2006102996.

Summary of the invention

[0007] The above specified objective is achieved with an air-conditioning diffuser as defined in claim 1.

[0008] Preferably, the air deflecting pocket assumes a shape corresponding to a part of the shell of a truncated cone.

[0009] Preferably, the air-conditioning diffuser further comprises an array of auxiliary holes formed in the outlet wall, wherein it is advantageous, when at least some of the auxiliary holes have an area ranging between 0.1 to 1 mm^2, particularly between 0.1 and 0.3 mm^2 and when at least some of the through-holes have an area which is larger than that of the auxiliary holes.

[0010] Advantageously, the air-conditioning diffuser is constituted by a ceiling or wall based diffuser, the array of auxiliary holes is arranged in a circular and the through-holes with the corresponding air deflecting pockets are adapted for directing the air flow in a direction tangential with respect to at least one circle that is concentric with the circular plane containing the auxiliary holes.

[0011] The air deflecting pocket may open towards the space adjoining at least some of the auxiliary holes belonging to said array of auxiliary holes in order to direct the air stream flowing via the through-hole into the air stream flowing out of at least some of the auxiliary holes.

[0012] The air-conditioning diffuser is constituted by an air-conditioning diffuser comprising an inlet orifice for feeding air, an outlet orifice for leading port of the air away and an outlet wall for distributing the air into surrounding environment.

Brief description of the drawings

[0013] For more detail, the present invention will be further described with reference to the accompanying drawings showing exemplifying embodiments, wherein Fig. 1A shows an outlet wall of the air-conditioning diffuser according to a first exemplary embodiment, Fig. 1B shows an outlet wall of the air-conditioning diffuser according to a second exemplary embodiment, Fig. 1C shows an outlet wall of the air-conditioning diffuser according to a third exemplary embodiment and Fig. 1D shows an outlet wall of the air-conditioning diffuser according to a fourth exemplary embodiment, Fig. 2A shows a first exemplary embodiment of an air deflecting pocket and Fig. 2B shows a second exemplary embodiment of an air deflecting pocket in a perspective view, Fig. 3 schematically indicates the direction of the air flow exiting the air-conditioning diffuser according to the present invention, Fig. 4 schematically indicates possible shapes of the air deflecting pocket in a side view, Fig. 5 shows a diffuser according to the present invention in a perspective top side view, the diffuser having a downward facing outlet wall, Fig. 6 shows the diffuser of Fig, 5 in a sectional view, Fig. 7 shows a particularly preferred embodiment of the diffuser wall, Fig. 8 shows another preferred embodiment of the air deflecting pocket and the through-hole, and Fig. 9 shows another preferred embodiment of the outlet wall of a ceiling or wall based diffuser.

Description of the exemplary embodiments

[0014] The first exemplary embodiment of the present invention relates to an air-conditioning duct. As illustrated in Figs. 1A to 1D, the outlet wall 20 of the air-conditioning duct described herein comprises an array of through-holes 22 for distributing air into the environment surrounding the duct, on the one hand, and an array of auxiliary holes 21, which are arranged upstream the array of through-holes 22 with respect to the direction of the air flow, on the other hand. An air deflecting pocket 23 is assigned to each through-hole 22, said pocket being attached to the outer surface of the corresponding wall of the air-conditioning duct. When viewed in a projection which is perpendicular to the outlet wall 20 of the air-conditioning duct, the air deflecting pocket 23 entirely covers the corresponding through-hole 22 from the outside. The through-hole 22 leads into a hollow space that is formed between the corresponding air deflecting pocket 23 and the outlet wall 20 of the air-conditioning duct. The air deflecting pocket 23 widens towards the array of auxiliary holes 21 and it is also open towards the array of auxiliary holes 21. Preferably, the air deflecting pocket 23 may assume a shape that is shown in Figs. 2A and 2B, namely a shape corresponding to a partial lateral area of a cone or truncated cone. Nevertheless, other shapes are also feasible, such as those corresponding to a partial lateral area of a pyramid, truncated pyramid, of a sphere or the like. Possible shapes of the air deflecting pocket 23, including the indication of the direction of the airflow, which has exited the corresponding through-hole 22 and has been deflected by such pocket 23, are illustrated in Fig. 4. In order to ensure a consistent shape and a proper function of the air deflecting pocket 23, the lateral sides of the same are attached to the wall of the air-conditioning duct. The lateral sides of the air deflecting pockets 23 shown in the right-hand column in Fig. 4 surround the entire circumference of the corresponding through-hole 22, thus substantially forming a shape of an oblique truncated cone. The shapes of the air deflecting pockets 23, which are shown in the left-hand and middle columns in Fig. 4 or, as the case may be in other figures, are more preferable from the structural point of view, wherein the air deflecting pocket 23 only surrounds a portion of the circumference of the corresponding through-hole 22 and does not extend into the area between the particular through-hole 22 and the respective auxiliary holes 21.

[0015] Preferably, the through-hole **22** is larger than the auxiliary hole **21**, i.e. the cross-sectional area or the diameter of the through-hole 22 is larger than those of the auxiliary holes 21.

[0016] It may be also useful to make the cross-sectional area of the through-hole 22 smaller in comparison to the cross-sectional area of the perpendicular projection of the corresponding air deflecting pocket 23 on the plane of the outlet wall 20.

[0017] A single through-hole 22 with the corresponding air deflecting pocket 23 can be assigned to a single row of the related auxiliary holes 21 (as illustrated in Figs. 1C and 1D) or to multiple rows of the related auxiliary holes 21 (as illustrated in Figs. 1A and 1B). In either case, it is preferable to assign each through-hole 22 with the corresponding air deflecting

pocket 23 to an array of the auxiliary holes 21.

[0018] The air-conditioning duct according to the present technical solution works in the following way: The inlet 30 of the air-conditioning duct is supplied with air. The latter flows through the air-conditioning duct towards the outlet 31, the direction of such air flow being indicated by means of a wide arrow in Fig. 3. A certain portion of the airflow, however, is exiting the duct via the auxiliary holes 21. The direction of such partial air streams intersects that of the main air flow, which is being fed towards the auxiliary holes 21 inside the air-conditioning duct, at an obtuse angle. The air flow, which is exiting via a through-hole 22, is directed by the corresponding air deflecting pocket 23 into a space facing the auxiliary holes 21 on the outer side. The direction of the air flow exiting the air deflecting pocket 23 intersects that of the main air flow, which is being fed towards the corresponding auxiliary hole 21 inside the air-conditioning duct, at an acute angle. Consequently, the air flow, which is exiting via the through-hole 22, will strike the air, which is leaving the auxiliary holes 21, causing the same to swirl or rectifying the direction of the same towards radial (perpendicular) direction.

[0019] Another exemplary embodiment of the present invention is described with reference to Figs. 5 to 8. As clearly seen in the relevant drawings, a ceiling or wall based air-conditioning diffuser is concerned herein. This diffuser comprises the chamber 10 provided with the inlet orifice 30 for feeding air or for connecting an air supply pipework 6. Preferably, the chamber 10 is made of a woven or non-woven fabric or foil.

[0020] In accordance with the present technical solution, the chamber 10 further comprises the outlet wall 20, which is also made of a woven or non-woven fabric or foil, and an array of the through-holes 22 for distributing the air from the chamber 10 into the surrounding environment.

[0021] An air deflecting pocket 23 is assigned to each through-hole 22, said pocket being attached to the outer surface of the outlet wall 20 of the air-conditioning diffuser. Similarly to the above described first embodiment, the air deflecting pocket 23 entirely covers the corresponding through-hole 22 from the outside when viewed in a projection which is perpendicular to the outlet wall 20. The through-hole 22 leads into an open hollow space that is formed between the corresponding air deflecting pocket 23 and the outlet wall 20 of the air-conditioning diffuser. The air deflecting pocket 23 widens towards its outlet orifice. Again, the air deflecting pocket 23 may preferably assume a shape that is shown in Fig. 4 or in Fig. 8, namely a shape corresponding to a partial lateral area of a cone or to that of a truncated cone. Nevertheless, other shapes are also feasible, such as those corresponding to a partial lateral area of a pyramid, truncated pyramid, sphere or the like. In order to ensure a consistent shape and, thus, a proper function of the air deflecting pocket 23, the lateral sides of the same are attached to the wall of the air-conditioning duct.

[0022] The arrangement of the individual air deflecting pockets 23 enables the respective air streams to be deflected in different directions. Preferably, the air should flow out from the array of the air deflecting pockets 23 in different lateral directions, at least in the area adjoining the corresponding outlet wall 20. More preferably, the directions of the individual air streams

should extend tangentially with respect to a common circle or to a pair or a plurality of concentric circles. In Fig. 7, the direction of the air flow exiting the air deflecting pockets 23 is indicated by means of dashed-line arrows. Alternatively, the arrangement of the air deflecting pockets 23 may be adapted to deflect the air streams exiting from the through-holes 22 perpendicularly to the edges of the corresponding outlet wall 20 and/or radially with respect to a circle having its centre in the central area of the outlet wall 20.

[0023] The air deflecting pockets 23 according to the present exemplary embodiment are generally adapted for diverting the air stream flowing out of the respective through-hole 21 away from the direction, which is perpendicular to the plane of the outlet wall 20, or for aligning such air stream with the plane of the outlet wall 20. Again, each individual air deflecting pocket 23 preferably directs the corresponding air stream in a different direction.

[0024] Preferably, the cross-sectional areas of the through-holes 22 are as large as possible. For example, the cross-sectional area of each through-hole may correspond to the area of the perpendicular projection of the hollow space inside the respective air deflecting pocket 23. In a further preferred embodiment, at least some of the through-holes 22 may have their cross-sectional areas smaller in comparison to the areas of the perpendicular projections of the respective assigned air deflecting pockets 23.

[0025] In order to increase the flow rate of the air passing through the outlet wall 20, the array of the through-holes 22 with the corresponding air deflecting pockets 23 may be supplemented with auxiliary holes 21, which are not provided with air deflecting pockets 23 assigned to them. Preferably, the auxiliary holes 21 are smaller than the through-holes 22. This means that the auxiliary holes 21 may be formed by providing the outlet wall 20 with a micro-perforated or perforated portion. Preferably, each basic hole 21 has a cross-sectional area ranging between 0.1 and 1 mm^2, more preferably between 0. 1 5 and 0.3 mm^2.

[0026] In the exemplary embodiment shown in Fig. 7, the auxiliary holes 21 are arranged so as to form two arrays, the one array being deployed in a circular plane and the other one being deployed along the circumference of the outlet wall 20. In the present exemplary embodiment, the through-holes 22 are also arranged in two arrays, the one array being deployed inside the circular plane containing the auxiliary holes 21 and the other one being deployed along the circumference of said circular plane.

[0027] The air deflecting pockets 23, which are arranged outside the circular plane containing the auxiliary holes 21, preferably divert the individual air streams in a substantially tangential direction with respect to a circle that is concentric with the circular plane containing the basic through-holes 22.

[0028] The air deflecting pockets 23, which are arranged inside said circular plane containing the auxiliary holes 21, preferably divert the individual air streams in mutually concurrent directions, such concurrent directions being mutually perpendicular ones in the present exemplary embodiment. Nevertheless, said air deflecting pockets may also be seen as

diverting the air in directions extending tangentially with respect to a circle that is concentric with the circular plane containing the auxiliary holes 21.

[0029] The air-conditioning diffuser according to the present embodiment works in the following way: The inlet 30 of the chamber 10 is supplied with the air which subsequently reaches the air-conditioned room via the holes 21, 22. A certain amount of the air exits via the auxiliary through-holes 21, the direction of the corresponding air streams being perpendicular to the outlet wall 20. The air streams, which exit via the through-holes 22, are redirected by the respective air deflecting pockets 23 into a space adjoining the outlet wall 20, the directions of the individual air streams being different. Simultaneously, said air streams entrap at least a partial amount of the air flowing out of the auxiliary holes 21. Thereby, a predominantly swirling or centrifugal direction of the overall air stream flowing out of the air-conditioning diffuser is achieved.

[0030] Fig. 9 shows another exemplary embodiment of the outlet wall 20 of the air-conditioning diffuser according to the present invention. The outlet wall 20 comprises an array of through-holes 22 and an array of auxiliary through-holes 21. The outlet wall 20 has a rectangular shape and the through-holes 22 are arranged in two rows, which are parallel to the longer lateral edges of the outlet wall 20 and provided with the air deflecting pockets 23, the outlet orifices of the air deflecting pockets facing said longer lateral edges of the outlet wall 20 in order to direct the air streams flowing out of the individual through-holes 22, namely such that the individual air streams conically widen along the plane of the outlet wall 20.

[0031] The exemplary embodiment shown in Figs. 5 to 9 enables the desired air flow to be achieved via the above described holes arranged in the outlet wall 20 of the ceiling or wall based diffuser. The mere perforation of the outlet wall 20 would mostly not ensure a sufficient air flow to be achieved. Although a simple increase in the number and/or size of the holes provided in the outlet wall 20 would enable an increase of a flow rate of the air passing through the outlet wall 20, such an increase would be connected with an additional risk of occurrence of draughts. In contrast to that, the air deflecting pockets 23 according to the present invention cause the air streams flowing out of the corresponding holes to dissipate or to swirl in the area adjoining the plane of the outlet wall 20.

[0032] Although the use of the auxiliary through-holes 21 is not necessary in any of the above mentioned embodiments, it is considered to be favourable, thus constituting a feature of a preferred embodiment. In the case of an air-conditioning element without the auxiliary through-holes 21, the air deflecting pockets 23 are determinative with respect to the directions of the corresponding air streams. In the case of an air-conditioning element provided with the auxiliary through-holes 21, the air deflecting pockets 23 are typically not determinative. Nevertheless, they will considerably influence the resulting directions of the corresponding air streams.

[0033] The air-conditioning diffuser including the air deflecting pockets according to the present invention is made of a woven or non-woven fabric or foil. Thus, it is machine-washable

and has a lower weight when compared to an air-conditioning element made of a metallic material.

[0034] Although multiple exemplary embodiments are described above, it is obvious that those skilled in the art would easily appreciate further possible alternatives to those embodiments. Hence, the scope of the present invention is not limited to the above exemplary embodiments, but it is rather defined by the appended claims.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US20120006442A [0006]
- WO2006102996A [0006]

Krav:

1. Luftkonditioneringsdiffusor til at fordele luft, og omfattende et kammer (10) forsynet med en indløbsåbning (30) til at tilføre luft og med en udløbsvæg (20) fremstillet af et vævet eller ikke-vævet stof eller folie, udløbsvæggen (20) omfattende mindst en række gennemgående huller (22) til at fordele luft ind i det omgivende miljø, hvori den yderligere omfatter flere luftafbøjningslommer (23) til at omdirigere luften, der strømmer gennem de gennemgående huller (22), ud af luftkonditioneringsdiffusoren, hver luftafbøjningslomme (23) er fastgjort til udløbsvæggen (20) på ydersiden denne og er åben mod rummet, der støder op til udløbsvæggen (20), **kendetegnet ved** at hver luftafbøjningslomme (23) overlapper mindst et gennemgående hul (22) samtidig med, at den er i afstand fra det gennemgående hul, hvori luftafbøjningslommen (23) er fastgjort til udløbsvæggen (20) ved hjælp af et par af dens sidekanter, der indbyrdes danner en spids vinkel, og/eller luftafbøjningslommen (23) definerer et hulrum, der udvider sig mod luftafbøjningslommens udløbsåbning.

2. Luftkonditioneringsdiffusor ifølge krav 1, **kendetegnet ved** at luftafbøjningslommen (23) antager en form svarende til en del af en keglestubs skal.

3. Luftkonditioneringsdiffusor ifølge ethvert af de foregående krav, **kendetegnet ved** at den yderligere omfatter en række hjælpehuller (21) dannet i udløbsvæggen (20).

4. Luftkonditioneringsdiffusor ifølge krav 3, **kendetegnet ved** at mindst nogle af hjælpehullerne (22) har et areal i området fra 0,1 til 1 mm^2, især fra 0,1 og 0,3 mm^2.

5. Luftkonditioneringsdiffusor ifølge krav 3 eller 4, **kendetegnet ved** at mindst nogle af de gennemgående huller (22) har et areal, der er større end det for hjælpehullerne (21).

6. Luftkonditioneringsdiffusor ifølge ethvert af kravene 3 til 5, **kendetegnet ved** at luftafbøjningslommen (23) åbner sig mod rummet, der støder op til i det mindste nogle af hjælpehullerne (21), der hører til nævnte række af hjælpehuller, for at lede luftstrømmen, der via de gennemgående huller (22) strømmer ind i luftstrømmen, der strømmer ud af i mindst nogle af hjælpehullerne (21).

7. Luftkonditioneringsdiffusor ifølge ethvert af kravene 1 til 6, **kendetegnet ved** at luftkonditioneringsdiffusoren udgøres af en loft- eller vægbaseret diffusor, luftafbøjningslommerne (23) er indrettede til at lede luftstrømmen i mindst to indbyrdes

divergerende retninger, især i indbyrdes divergerende retninger.

8. Luftkonditioneringsdiffusor ifølge krav 7, **kendetegnet ved** at rækken af hjælpehuller (21) er arrangeret i et cirkulært plan.

9. Luftkonditioneringsdiffusor ifølge krav 7 eller 8, **kendetegnet ved** at de gennemgående huller (22) med de tilsvarende luftafbøjningslommer (23) er indrettede til at lede luftstrømmen i en tangentiel retning i forhold til mindst en cirkel, der har sin midte i udløbsvæggens (20) centrale område, og/eller til en cirkel, der er koncentrisk med det cirkulære plan, der indeholder hjælpehullerne (21).

10. Luftkonditioneringsdiffusor ifølge krav 7, **kendetegnet ved** at hver luftafbøjningslomme (23), der er tildelt det respektive gennemgående hul (22), er indrettet til at lede luftstrømmen på en måde, der får luftstrømmen, der strømmer ud af nævnte luftafbøjningslomme (23), til at udvide sig konisk langs udløbsvæggens plan (20).

11. Luftkonditioneringsdiffusor ifølge ethvert af kravene 1 til 6, **kendetegnet ved** at luftkonditioneringsdiffusoren udgøres af en airconditioneringskanal, der omfatter en indløbsåbning (30) til at tilføre luft, en udløbsvæg (20) til at fordele luft og, valgfrit en udløbsåbning (31) til at føre en del af luften væk.

DRAWINGS

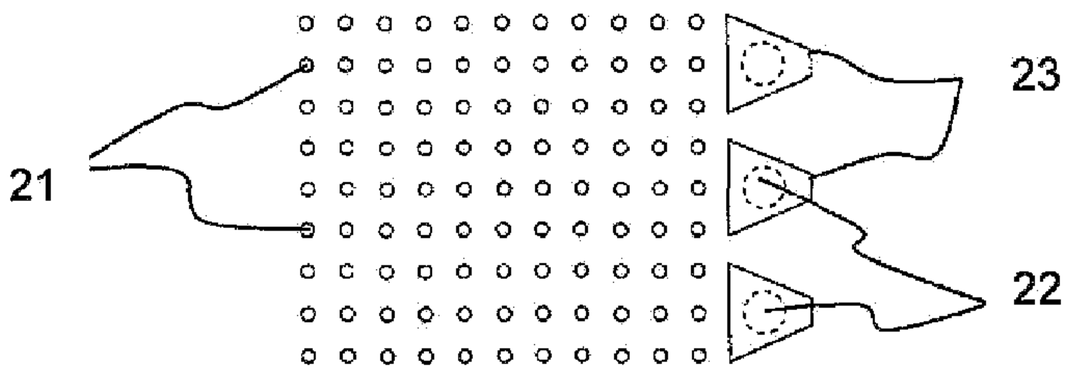

Fig. 1A

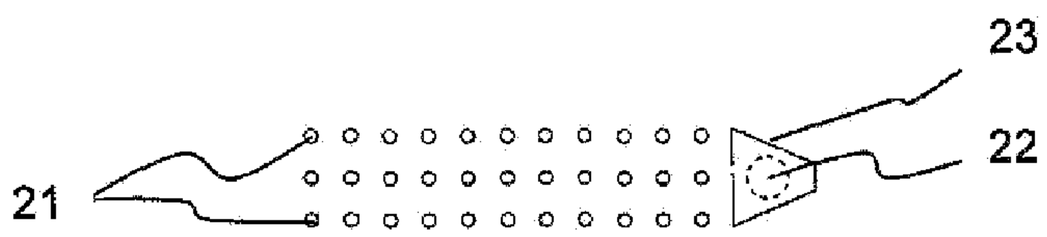

Fig. 1B

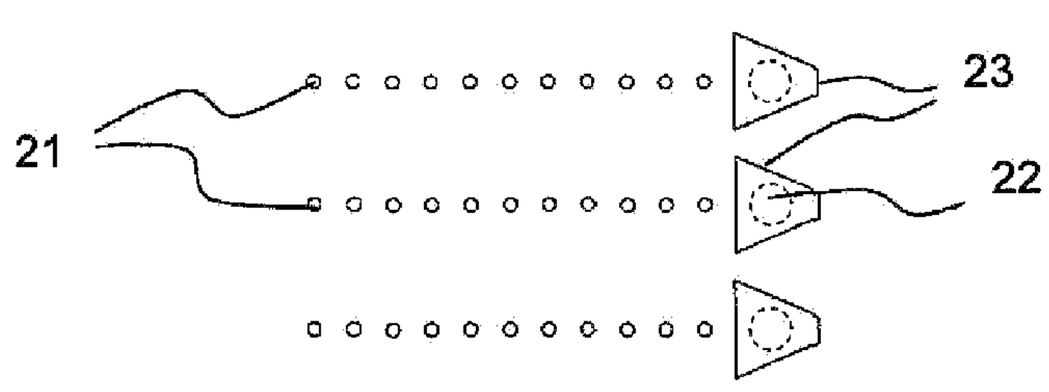

Fig. 1C

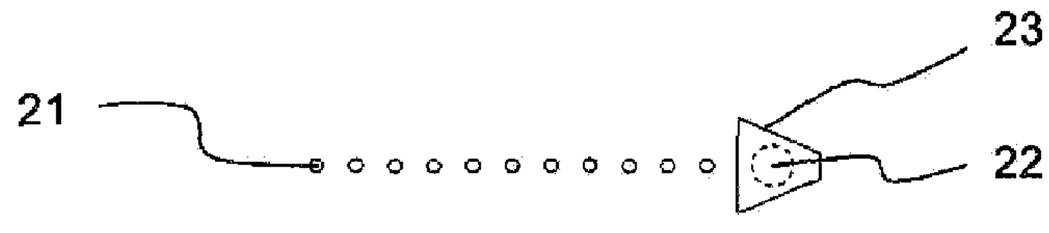

Fig. 1D

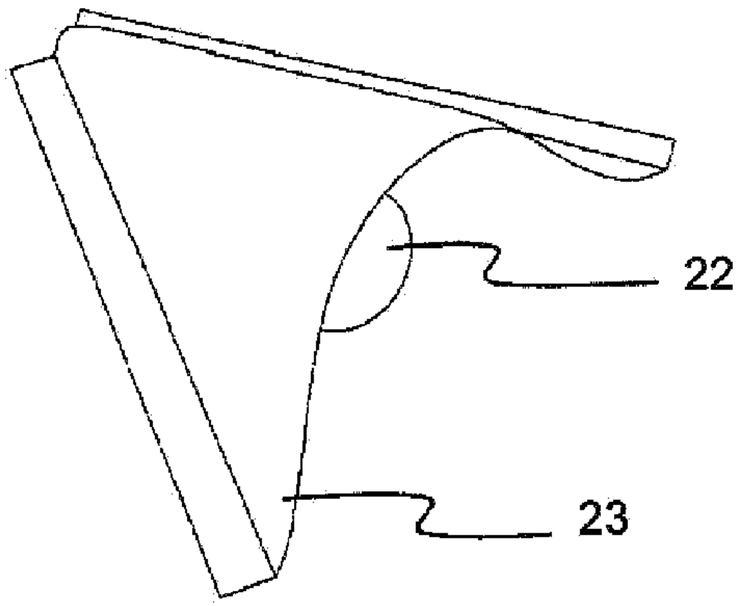

Fig. 2A

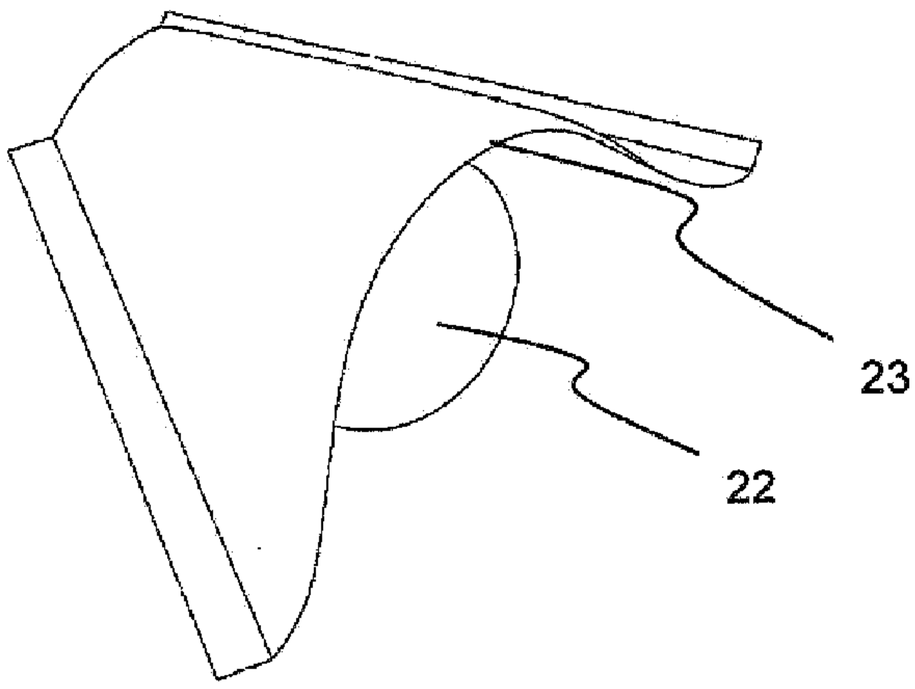

Fig. 2B

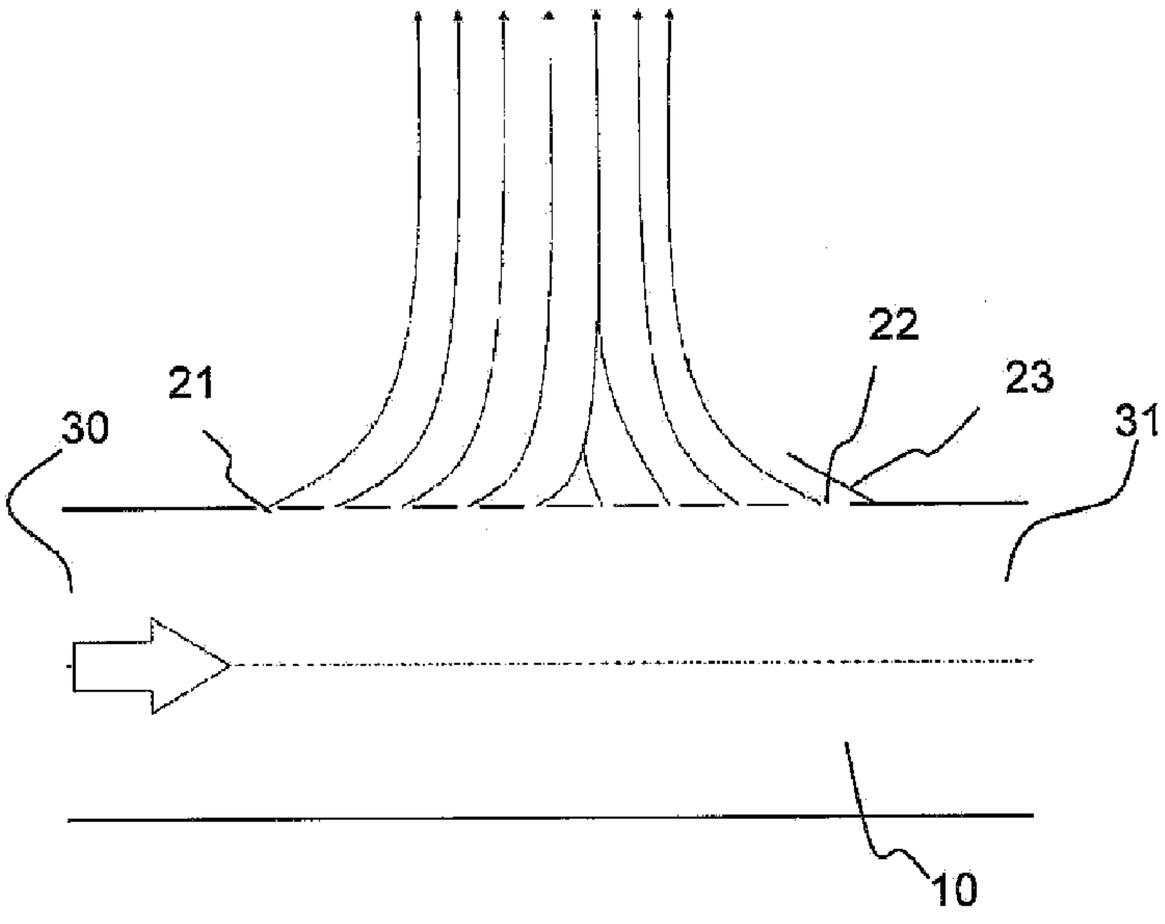

Fig. 3

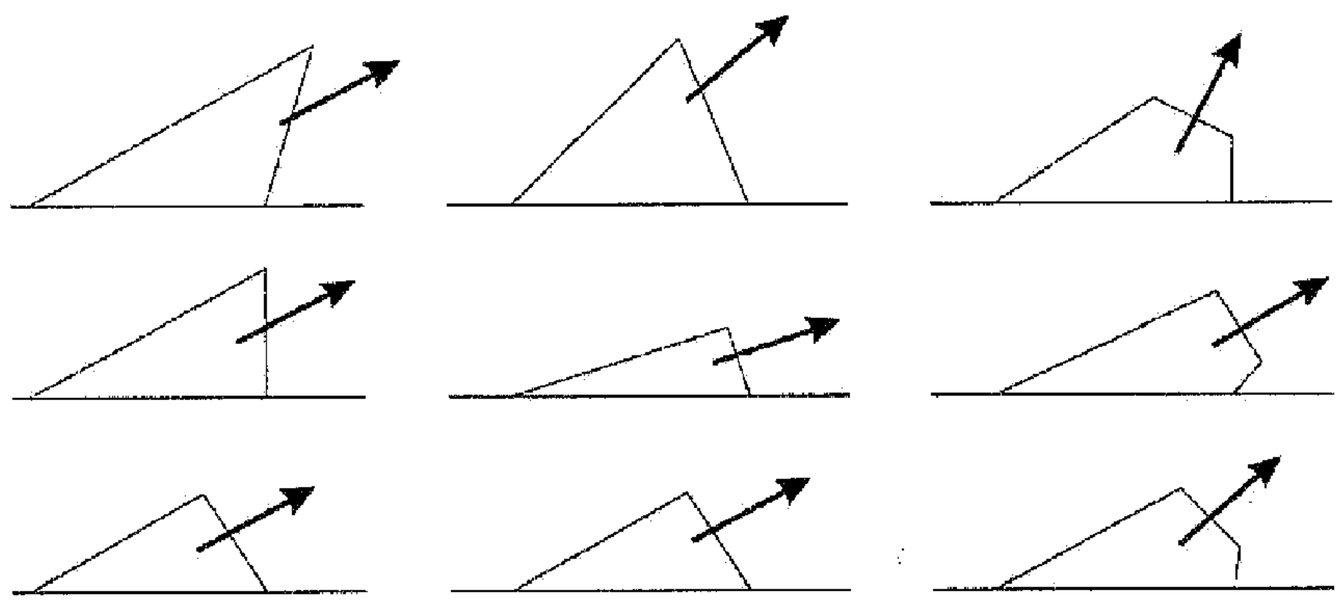

Fig. 4

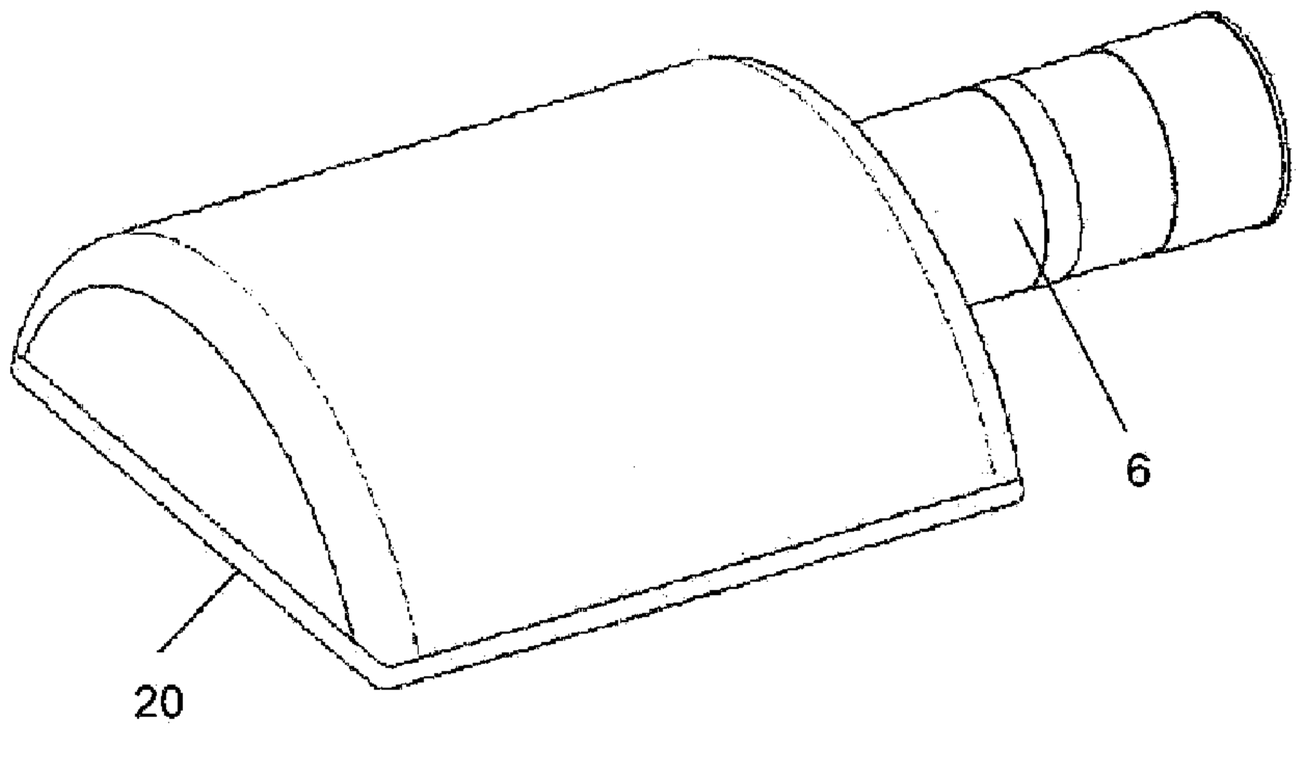

Fig. 5

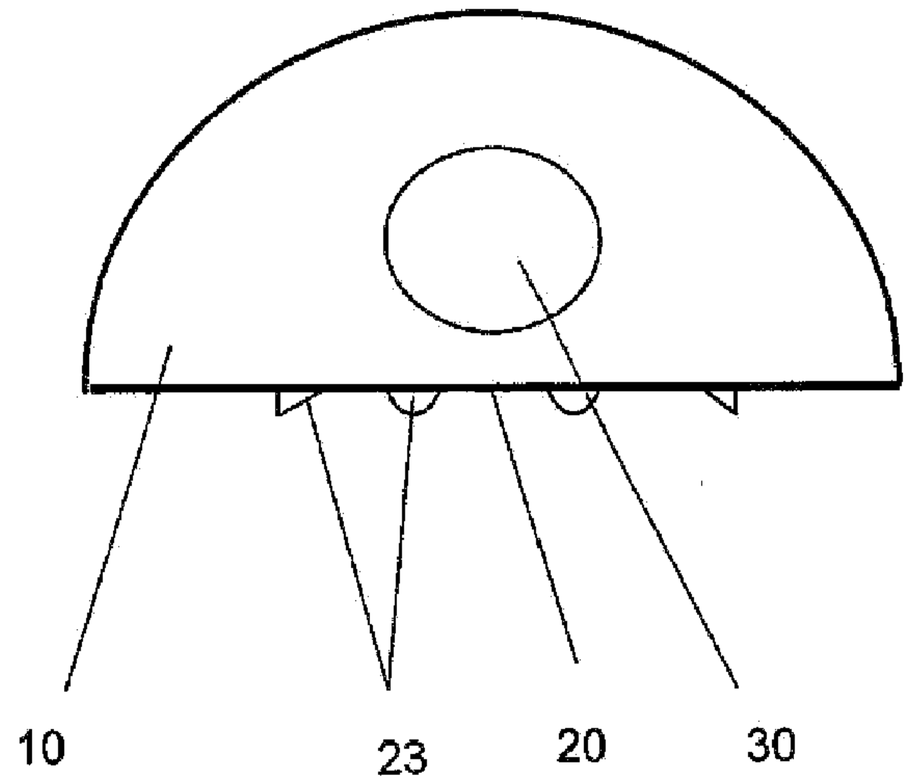

Fig. 6

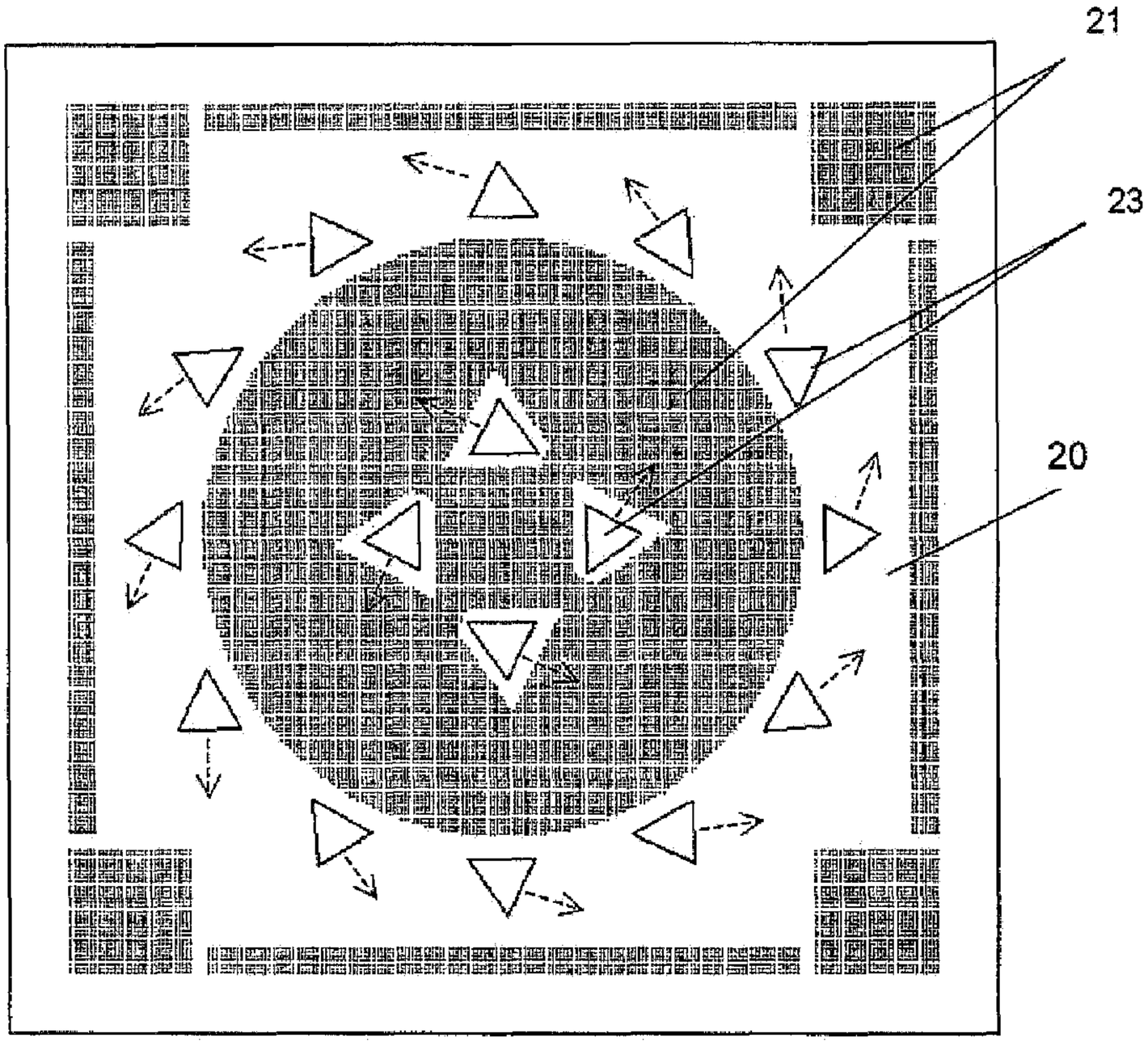

Fig. 7

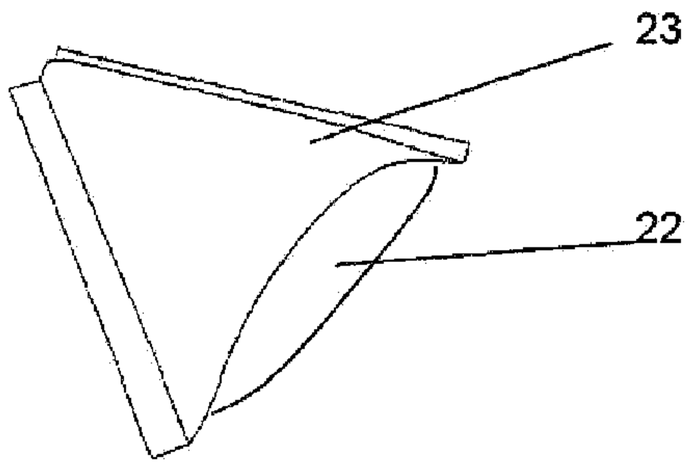

Fig. 8

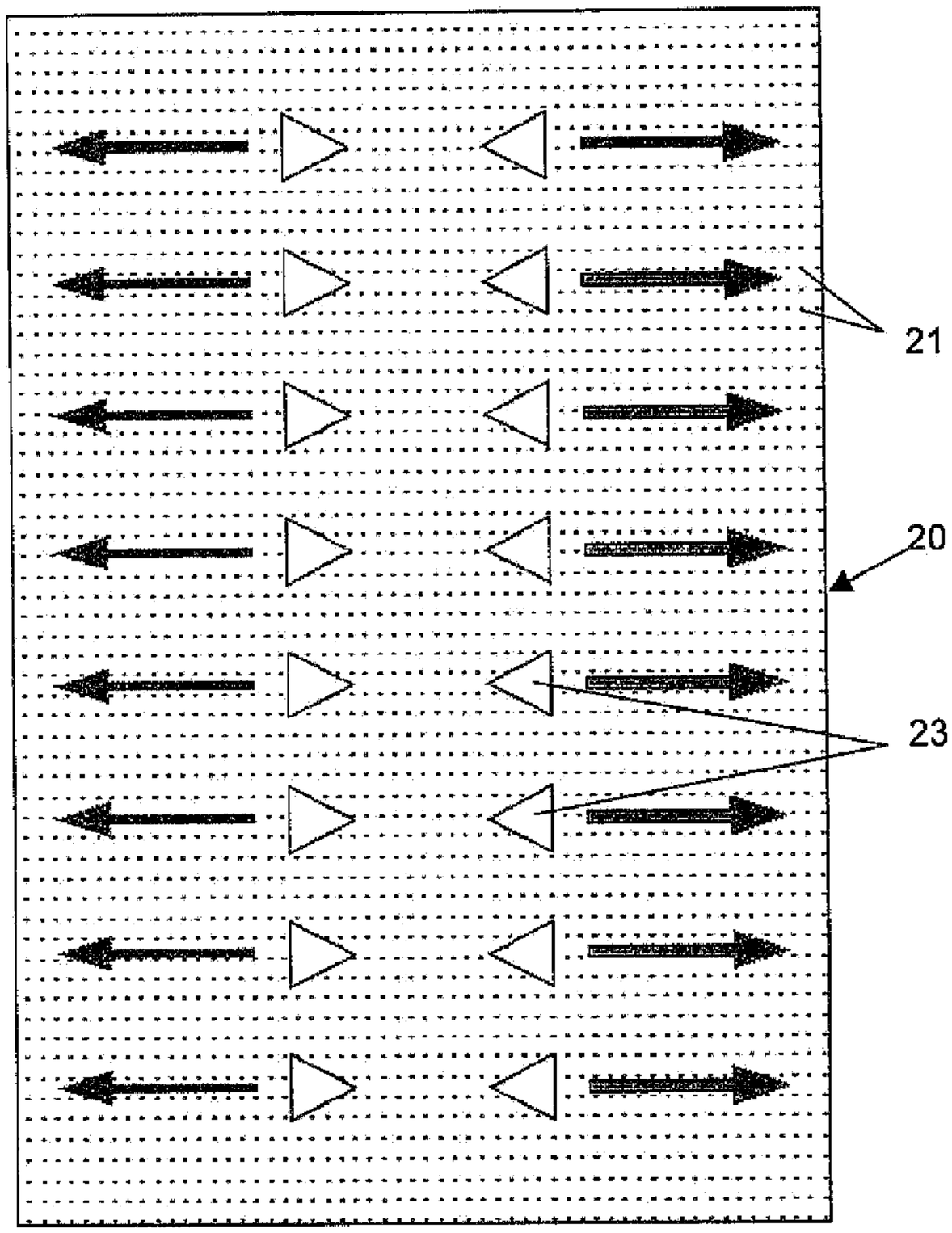

Fig. 9