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(54) **Structural cell defined by air walls and architectural structure obtained with a plurality of said cells**

(57) A new structural cell for creating architectural structures, formed by elongated hollow elements (2,3), having one or more slots (4), and connected with a air currents generator plant. The slots (4) emit towards the outside air jets and air sheets (4a, 4b), that extend according to substantially two-dimensional surfaces and define together a three-dimensional insulated space. The elongated elements preferably form a structure comprising upright elements (2a,2b,2c,2d) and horizontal elements (3) connected to one another. The cells allow heat insulation and soundproofing without the use of physical walls, through a not much expensive technology and easy to carry into effect, thus obtaining final structures that are light and which can be easily carried, "clothed" and/or disassembled. Through a cell or a plurality of them a structure can be defined that protects a portion of space defined by air walls that cover the inside of the cells by the cold, by the heat and also by the wind, allow the use of the structure during all the year.

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Description

Field of the invention

[0001] The present invention relates to a new type of structural cell that makes possible the creation of innovative architectural structures that carry out heat insulation and soundproofing without the use of walls.

Brief description of the prior art

[0002] It is great the interest of architectural researchers towards new expressive shapes that are innovative from the stylistic point of view but that can also solve more and more complex structural problems.

[0003] A general problem to be solved is to shelter spaces which can be used by the public in a way as light as possible, alternatively to classical structures formed by load-bearing elements closed by walls.

[0004] A particularly felt problem is for example to build theatres and auditorium with a good acoustics: the most important limit is the presence, unavoidable, of the walls. In fact they are obstacles for the sound waves and are responsible of the echo of these waves that causes distortion and bad sound quality for the audience.

[0005] Even with modern technologies this problem can be solved only after analysing the frequency of the structure, and for this it is necessary to make models of the building and, with mathematical calculus, to determine the path of the sound waves through the closed space. This method requires a very expensive design and the use of complicated apparatus for the adjustment and the control of the acoustics as well as maintenance and operating costs, owing to the need of skilled and expensive operators.

[0006] A second problem is to limit the impact of the building with the environment, by adapting the structure to the environment itself.

[0007] The fulfilment of this need is the more difficult the more the construction is close to nature or the more it is close to historical sites that are characterised by precise architectural styles. In these cases the differences between the modern construction and the existing landscape can be striking and unacceptable.

[0008] Other drawbacks are the need of making coverings for large areas, very cumbersome and heavy, sometimes on not suitable grounds, i.e. because not enough strong.

[0009] With the modern techniques these problems are overcome only with expensive works modifying the geological sites with the consequence of damages to the environment.

[0010] Finally, the modern constructions have the drawback of being not much adaptable and can be fully exploited only for the activities provided for by the designers. It is, in fact, laborious to displace the walls of these constructions for changing the shape and the size of the rooms in order to use them in a way compatible

with new needs.

[0011] It is therefore felt the need for a technology and for structural techniques capable of covering and defining spaces which are soundproof and heat insulated, which can be used in the above cited cases and are able to overcome the above described and other problems.

[0012] This technology should be not too much expensive with respect to the existing solutions, easy to carry out, with resulting structure that is light and can be easily displaced and/or disassembled.

Summary of the invention

[0013] It is an object of the present invention to provide a new structural cell for making new architectural structures that carry out heat insulation and soundproofing without the need of walls.

[0014] It is another object of the present invention to provide such a structural modular cell that generates a architectural technique that is not much expensive with respect to other modern solutions and easy to carry into effect.

[0015] It is a further object of the present invention to provide such a technology capable of making structures which are light and that can be easily carried and/or disassembled.

[0016] It is besides an object of the present invention to provide modular elements of this kind that can be "clothed", that is can be covered by shapes of design, but at the same time practical.

[0017] These and other objects are achieved by the structural cell according to the present invention whose characteristic is that it is formed by elongated hollow elements, having one or more slots, and connected with a generator of air currents. Through the slots air jets and air sheets are emitted towards the outside that extend according to substantially two-dimensional surfaces thus defining three-dimensional insulated spaces.

[0018] The elongated elements preferably form a structure comprising upright elements and horizontal elements connected to one another. The upright elements emit air sheets according to vertical planes and the horizontal elements emit air sheets according to horizontal planes.

[0019] Alternatively, the elongated elements comprise horizontal elements that emit air sheets according to oblique or vertical planes.

[0020] The horizontal elements can rotate with respect to the upright elements, as well as they can be flexible and inflatable and kept in horizontal position substantially by the pressure of the air that is emitted by them.

[0021] The upright elements can either be mounted on fixed bases or be mobile on wheels and the horizontal elements can be flexible, whereby each cell can be folded such as an accordion. To increase the flexibility of the structure the upright and/or horizontal elements can

be disassembled, with advantages also for designing not permanent or itinerant constructions. The latter object is reached also if these upright elements are arranged, for example, on pallets which can be carried.

[0022] By means of a cell or a plurality of them a portion of space can be defined by air walls that enable a both an acoustic and a heat insulation. In particular, the acoustics of this space is not jeopardised since the absence of walls actually eliminates the above explained problems of sound waves reflection. At the same time, the air walls shelter the inside of the cells protecting them from cold, from heat and also from wind, thus allowing the use of the structure during all the year.

[0023] The isolated space can be defined by using one or more structural cells, and only some of them can be active. Besides, in order to enhance the insulation, more levels in succession and overlapping, or only part of them, can be provided for.

[0024] The different embodiments are chosen according to the different problems, i.e. stylistic and/or practical, that the designer should solve in order to make the structure. In particular, the cells and the whole structure comprising a plurality of cells is subject to architectural choices in addition to purely structural choices, among which, for example, the position of the cells and the shapes or clothing of the elements.

[0025] To generate the air current and create the air sheets that make the walls of this structure an air current generator plant is provided for, for example comprising air compressors. The air can be at room temperature or adequately heated

[0026] All the elements that emit air may be linked to this plant that is suitably sized concerning both concentrated and distributed flow resistance.

[0027] An alternative choice is to provide for a compressor for every element or group of elements. Advantageously, this plant, combined with a device controlled by electro-valves, has the possibility of selectively excluding one or more upright and/or horizontal elements so that a structure is created formed by one or more cells or by part of them. This way the problem of the adaptability of the structure is solved with the possibility of varying the size and the shape of the rooms according to the particular needs of the specific case.

[0028] Advantageously, the electro-valves and the air currents generators can be operated automatically, by means of sensors, such as for example photocells.

Brief description of the drawings

[0029] Further characteristics and the advantages of the structural cell that allows the creation of architectural innovative structures, according to the present invention, will be made clearer with the following description of some of its exemplifying embodiments, but not limitative, with reference to attached drawings, wherein:

- figure 1 shows a perspective view of a structural cell formed by horizontal and vertical elements placed according to the sides of a parallelepiped;
- figure 2 shows a top plan view of a structure formed by a plurality of adjacent cells according to figure 1 having common upright elements;
- figures 3 and 3A show a second embodiment of structural cell formed by a elevated horizontal element that emits air sheets downwards according to diverging oblique planes;
- figures 4 and 4A show a third embodiment of a structural cell formed by horizontal elements that emit air sheets upwards according to converging oblique planes.
- figure 5 shows a fourth embodiment of structural cell comprising horizontal elements that emit air sheets in horizontal and vertical planes.
- figure 6 shows a fifth embodiment of structural cell comprising horizontal curved closed elements that emit air sheets according to vertical directions.
- Figure 7 shows a horizontal element which can be oriented that emits air in a horizontal plane.
- figures 8A and 8B show a sixth embodiment of structural cell formed by two opposite units, each formed by both horizontal and vertical elements that emit air according to horizontal and vertical planes;
- figures 9 and 9A show a seventh embodiment of structural cell formed by a elevated horizontal element that emits air sheets downwards in converging oblique planes and by horizontal elements that emit air upwards according to vertical planes;
- figure 10 shows a perspective view of a structure formed by a plurality of an eighth embodiment of structural cells formed by a horizontal element and a vertical element that emit air sheets on horizontal and vertical planes;
- figure 11 shows a perspective view of a structure of cells formed by a plurality of elements according to the eighth embodiment of structural cell;
- figure 12 shows, according to a ninth embodiment of structural cell, an elevational view of a vertical element fixed on a base mobile on wheels and a horizontal flexible and foldable element;
- figure 13 shows a perspective view of a cell structure formed by a plurality of elements according to the ninth embodiment of structural cell of figure 12.

Description of a preferred embodiment

[0030] With reference to figure 1, a structural cell 1, according to the present invention, comprises horizontal elements 2A, 2B, 2C, 2D and vertical elements 3 that emits air in the direction indicated by the arrows, through apertures 4. In this case, the apertures are elongated but they could have different shape and size to make a better distribution of the air flow and less flow resistance.

[0031] For simplicity, in the other drawings the schemes of structural cells do not show these but it is clear that they are shaped and sized adequately in each described embodiment.

[0032] The shown structure is able to shelter a closed space even if it is not physically defined by walls. This space is defined by air sheets emitted according to horizontal and vertical planes, shown from the respective arrows 4a and 4b and by the ground.

[0033] In this embodiment the elements are placed according to the sides of a parallelepiped, but two angular elements may be eliminated without reducing the efficiency of the cells. In fact, as can be seen in figures 8A and 8B, a structural cell 13 of similar shape can be obtained eliminating the elements 2a and 2b, without however reducing the insulation efficiency of the air walls. The embodiments of figures 8A and 8B are equivalent, the former emits air sheets in a vertical plane with horizontal air sheets, the second emitting air sheets in a vertical plane with air sheets directed downwards.

[0034] In figure 2, a plurality of cells, according to the embodiment of figure 1, have been linked to one another to create the structure 5. This structure is fed by the compressors 6 that are linked to the principal joints 6A of the construction. In the diagram these joints are external but it is apparent that their position depends on how the air distribution device is designed and that the feeding joints could be, for example, also in the centre.

[0035] The main characteristic of this structure is the possibility of changing the shape of the closed space defined by the air walls acting on electro-valves placed at every connecting joint 6b of the elements. For example from the structure shown the reduction shown by the dotted area 7 can be obtained.

[0036] The electro-valves or the air currents generators can be selectively operated by sensors that detect the presence of people, for example photocells located at transit points. Such sensors have not been shown in detail, since can be installed without problems by a person skilled in the art.

[0037] In figure 3 a second embodiment of structural cell 8, according to the present invention, is formed by an elevated horizontal element 15, supported by post 16, that emits air sheets downwards according to oblique diverging planes 9, indicated by dotted lines 10, and according to a vertical plane 11 orthogonal to the previous. Figure 3A shows a diagrammatic side view of this embodiment.

[0038] This configuration is obtained also with the embodiment 12 of figures 9 and 9A, in which the air that forms the vertical sheet 11, orthogonal to the two oblique planes 9, comes from below.

[0039] In figure 4, a third embodiment 13 of structural cell, according to the present invention, is formed by horizontal elements 14a and 14b that emit air sheets upwards, respectively, according to converging oblique planes 9 and vertical planes 11, orthogonal to the previous.

[0040] In figure 5, a fourth embodiment 20 of structural cell, according to the present invention, comprises horizontal elements 17A, located at the sides of a rectangle, which emit air sheets in vertical planes, and another horizontal element 17B that emits air sheets in a horizontal plane. This elevated horizontal element is supported by two posts 16.

[0041] Figure 6 shows a fifth embodiment 21 of the structural cell comprising horizontal closed curved elements 18, supported by vertical post 16, that emits air sheets according to vertical directions 19. In this way cylindrical spaces can be defined.

[0042] Figure 7 shows a structure 22 of a horizontal element which can be oriented that emits air in a horizontal plane defining a surface of circular shape. This structure comprises a base 25, a supporting post 26 at whose top end the articulated joint 27 is located to which element 27 is linked. This articulated joint carries out a sliding sealing thus allowing the distribution of pressurised air. The structure shown has the characteristic that element 27 rotates owing to the thrust of the emitted air.

[0043] Figure 10 shows a perspective view of a structure 23 formed by a plurality of structural cells according to a further embodiment formed by a horizontal element 29 and by a vertical element 30 that emit air sheets on horizontal and vertical planes. A particular vertical angular element 30A emits air on two planes orthogonal to each other.

[0044] Figure 11 shows a perspective view of a structure 23 of cells formed by a plurality of elements according to the embodiment of figure 10. The borders that each T-shaped cell ideally defines have been shown with dotted lines.

[0045] With reference, then, to figure 12, upright elements 32 can be mounted on wheeled bases 33, and connected by flexible horizontal elements 34, for example inflatable. In that way, structures can be obtained capable of covering large surfaces, but gathered so that they do not occupy much space when not used. In a particularly preferred way, the upright elements are linked along a line 36 and can be extended, as shown in figure 13. From such configuration, when not used, they can be gathered in the position 37 and put into trailers 35, which can be pulled. The trailers 35 can also comprise air current generators, communicating with the elements through a flexible tube 38.

[0046] According to preferred embodiments, the cells formed by the elements above described can have also architectural shape different from those shown in the figures by 1 a 12. In particular, design shapes can be obtained if the elements of the cells are suitably covered of material, without, obviously, covering outlets for the air sheets.

[0047] In addition, by making structures with the cells according to the invention it is, in particular, possible:

- to render a space open, for example a square, a

street, enjoyable all the year;

- to render an outdoor market as heated room;
- create heated room about outdoor tables, for example of pubs, restaurants;
- replace the inflatable shields covering swimming pools and heating the surrounding space.

[0048] The foregoing description of specific embodiments will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such embodiments without further research and without departing from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiments. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

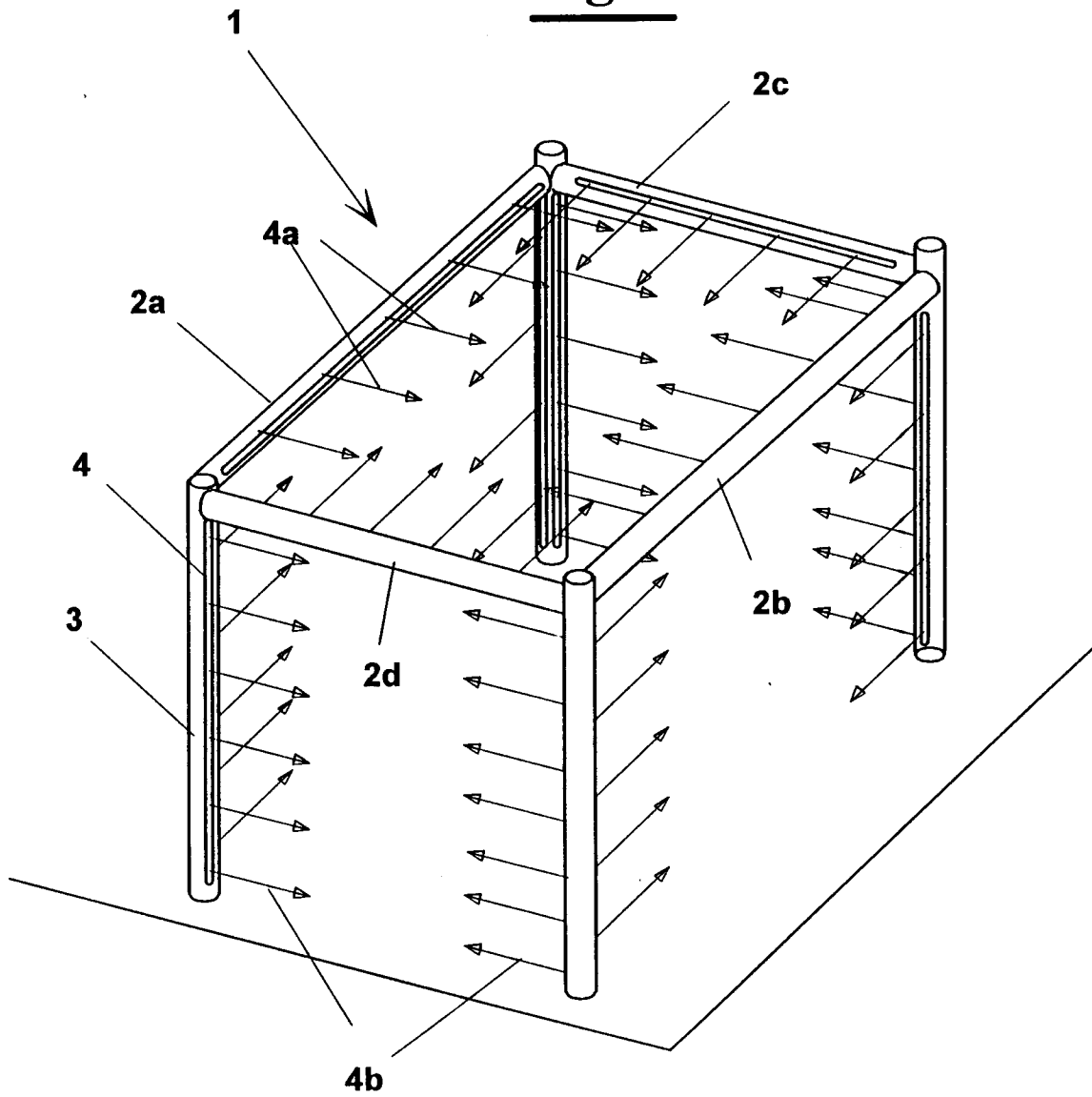
Claims

1. Structural cell characterised in that it comprises elongated elements having one or more slots, said elements being hollow and connected to a generator of air currents, said slots emitting towards the outside air jets and air sheets, said air jets and sheets extending according to substantially two-dimensional and defining together three-dimensional insulated spaces.
2. Structural cell according to claim 1 wherein said elongated elements form a structure comprising upright elements and horizontal elements connected to one another, said upright elements emitting said air sheets according to vertical planes and said horizontal elements emitting said air sheets according to horizontal planes.
3. Structural cell according to claim 1 wherein said elongated elements comprise horizontal elements that emit said air sheets according to oblique or vertical planes.
4. Structural cell according to the previous claims, wherein said horizontal elements are rotatable with respect to said upright elements.
5. Structural cell according to claims from 1 to 4, wherein said horizontal elements are flexible and inflatable and are kept in substantially horizontal position by the pressure of the air that is emitted by them.
6. Structural cell according to claim 1, wherein said air

currents generator comprises a plurality of valves suitable for selectively choking each of said elements, sensors being provided for that operate automatically said electro-valves and/or said generator.

7. Structural cell according to claim 1, wherein the air emitted by said elements is heated.
8. Structural cell according to the previous claims, wherein said upright elements are put on wheels and said horizontal elements are flexible, whereby said cells can be folded such as an accordion.
9. Structural cell according to claim 8, wherein a plurality of said upright elements are linked along a line through said horizontal flexible elements and can be placed in extended position or in a gathered accordion position, trailers being provided for which can be pulled, comprising air current generators, and suitable for carrying said elements gathered.
10. Architectural structure characterised in that it constructed by a plurality of cells according to the previous claims.

Fig. 1



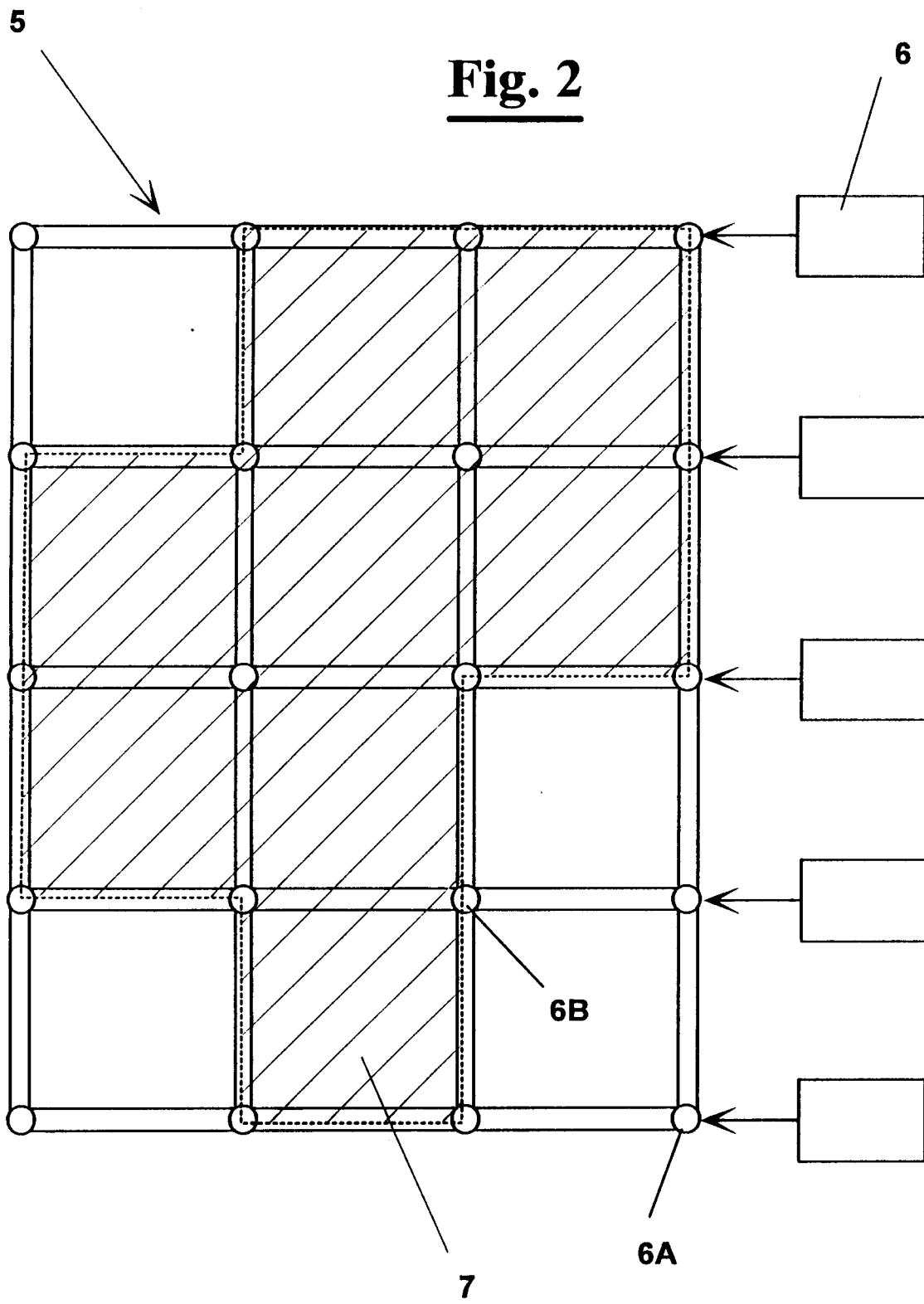


Fig. 3

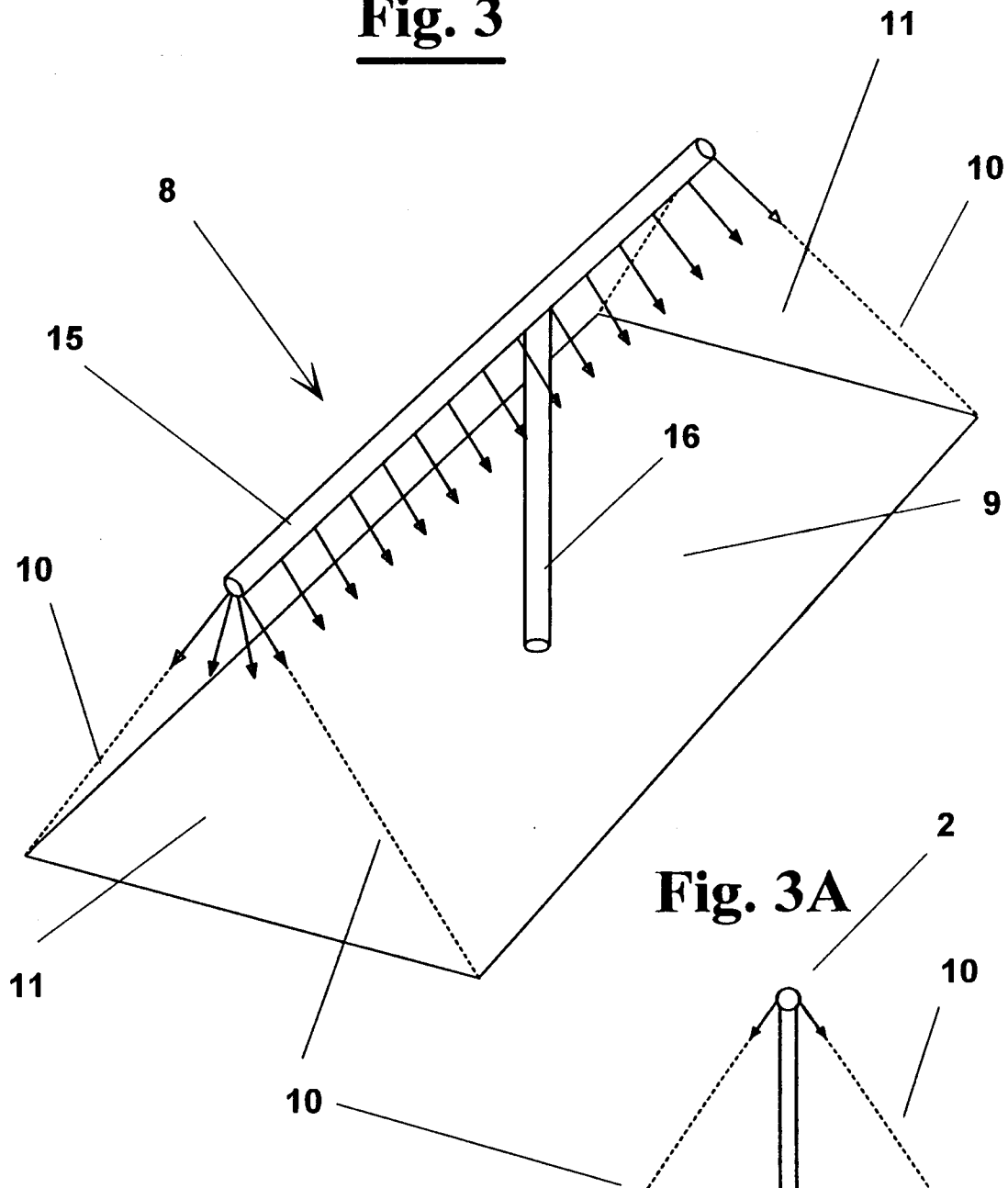


Fig. 3A

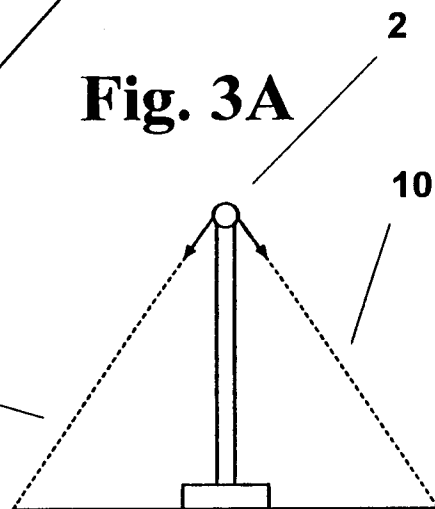


Fig. 4

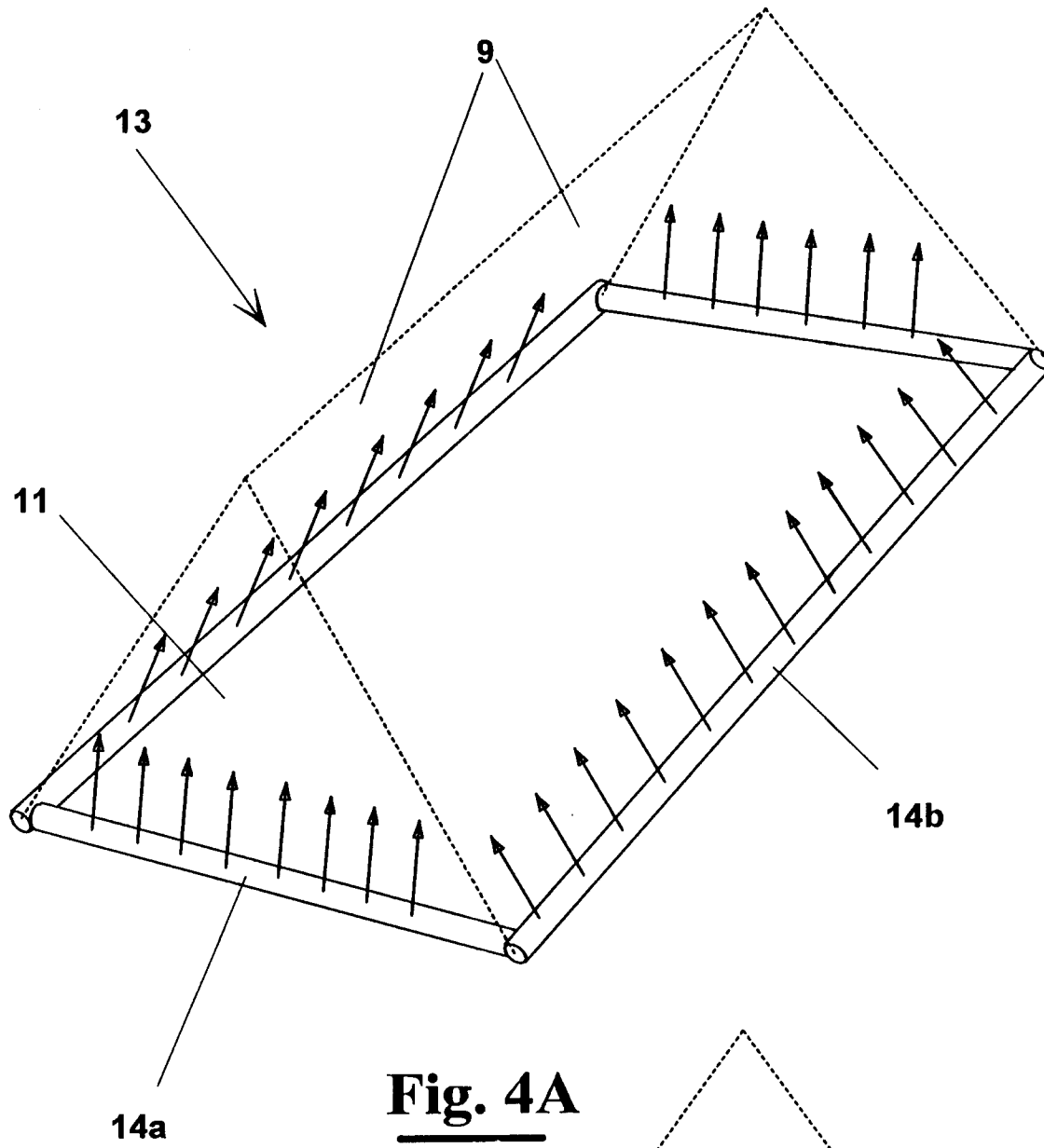


Fig. 4A

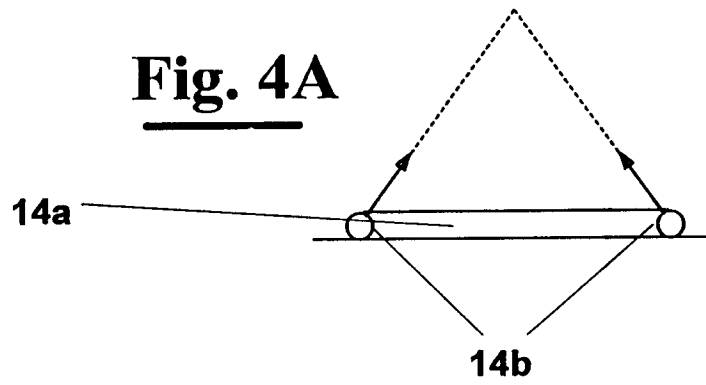


Fig. 5

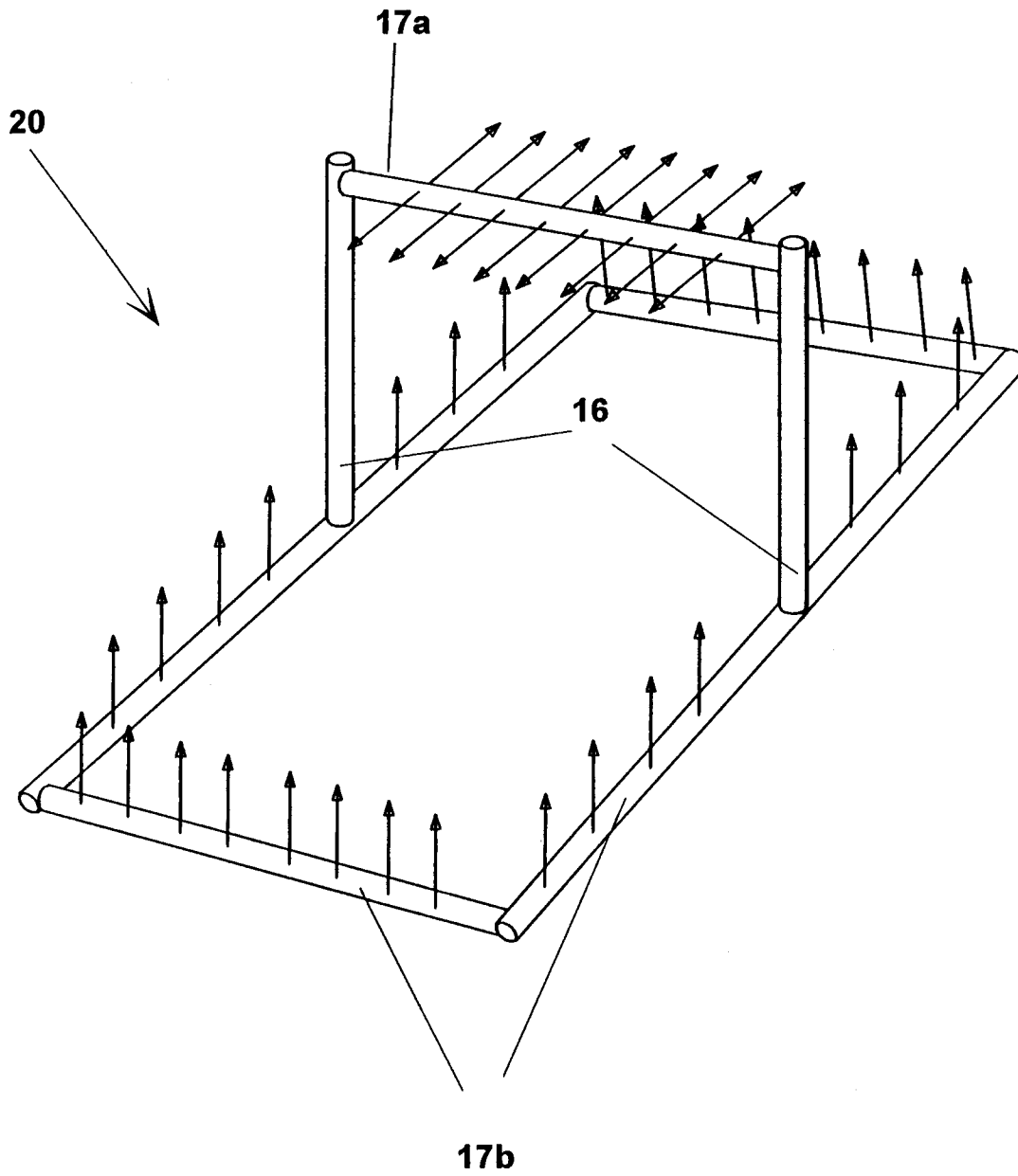


Fig. 6

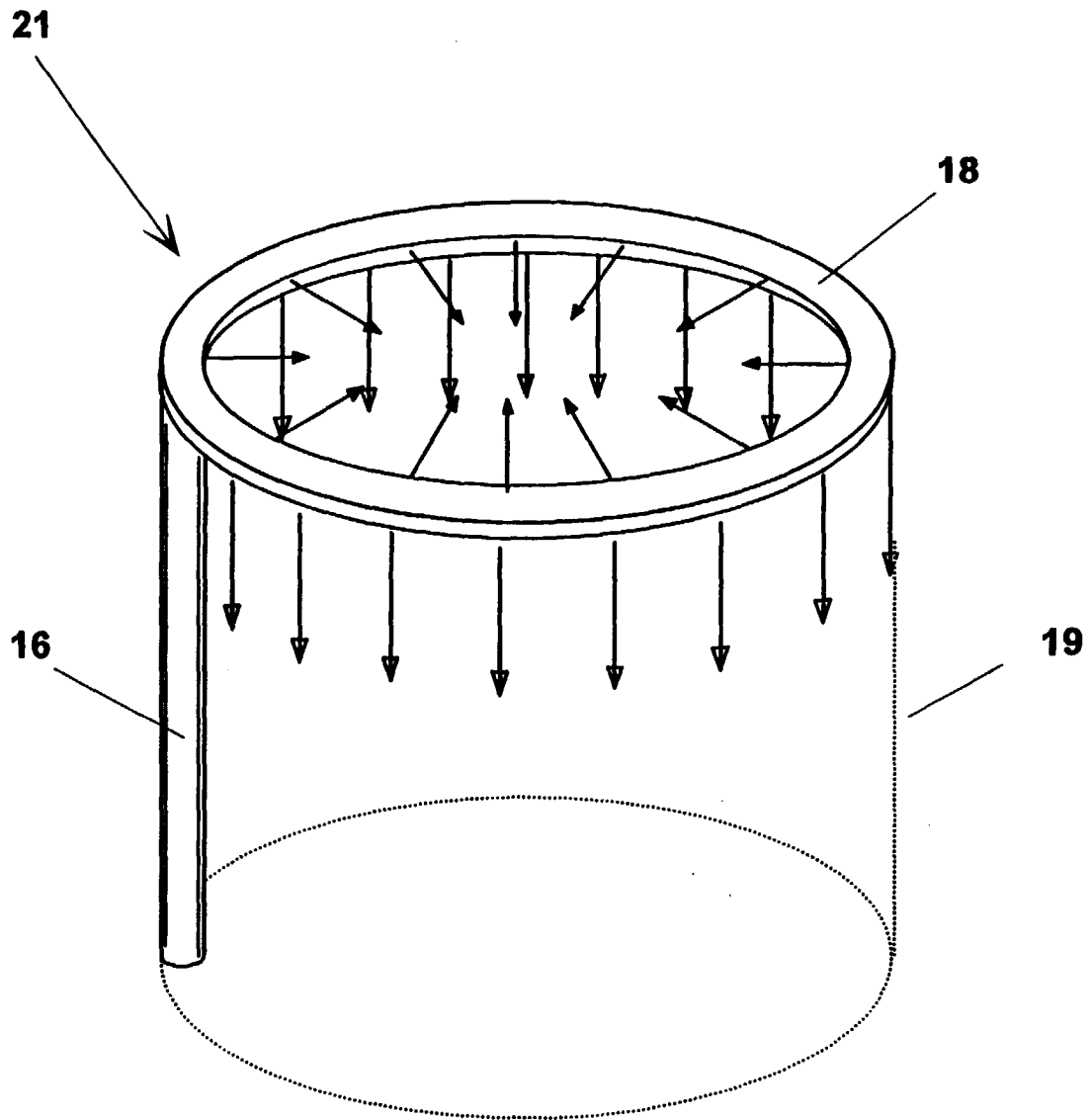
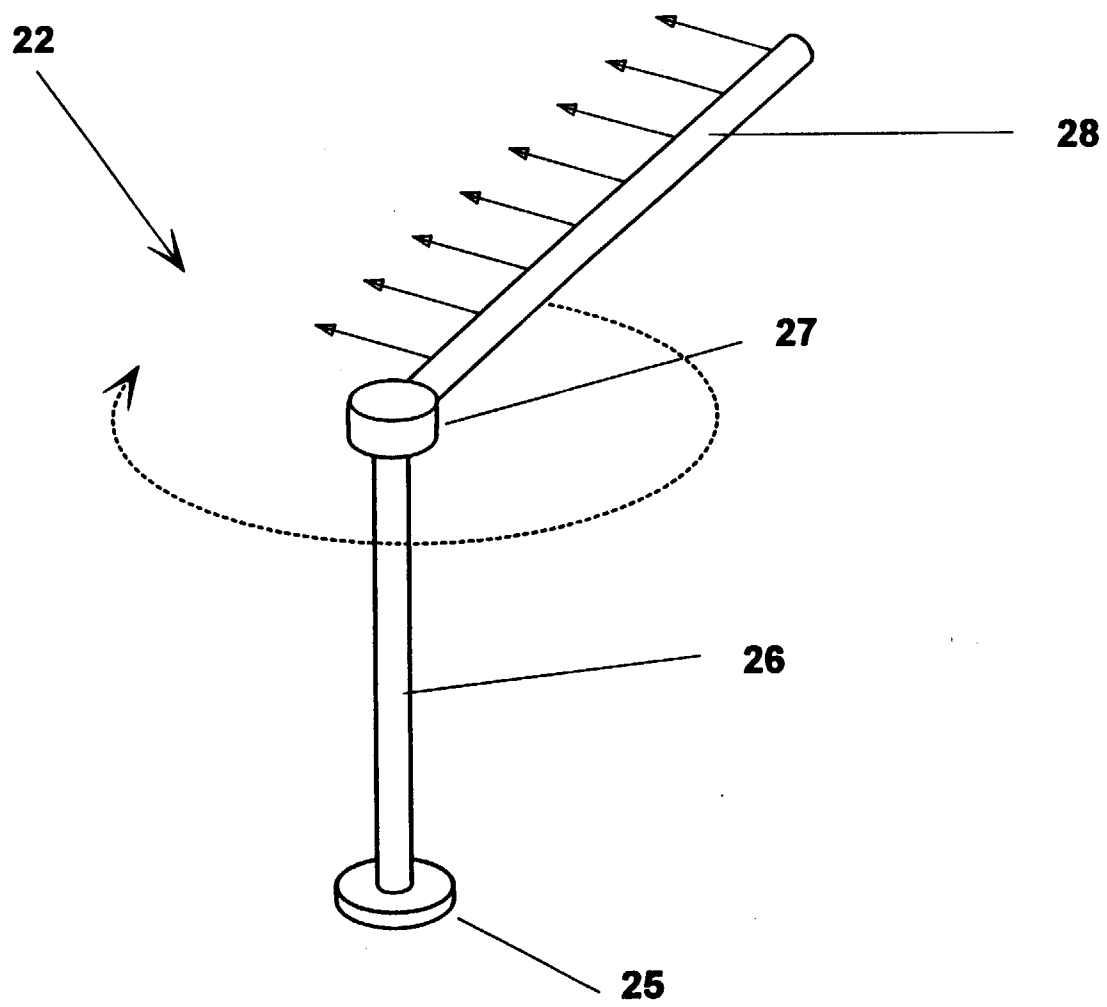


Fig. 7



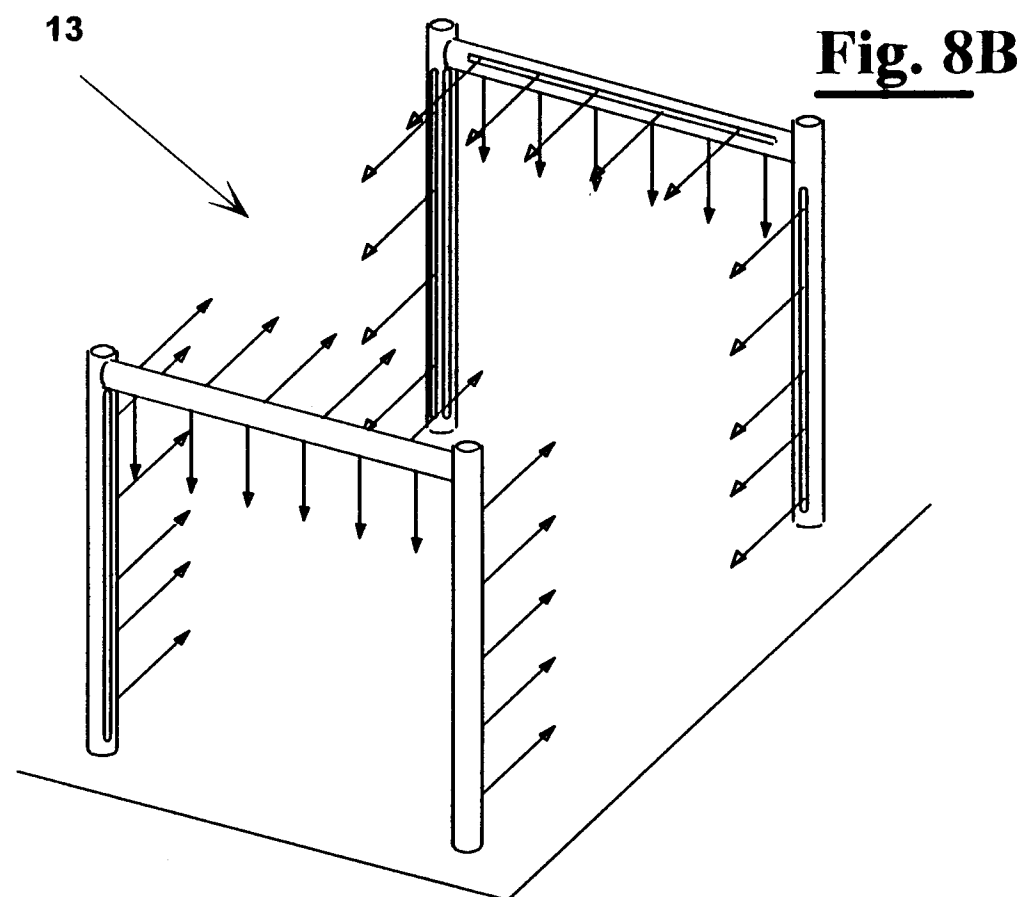
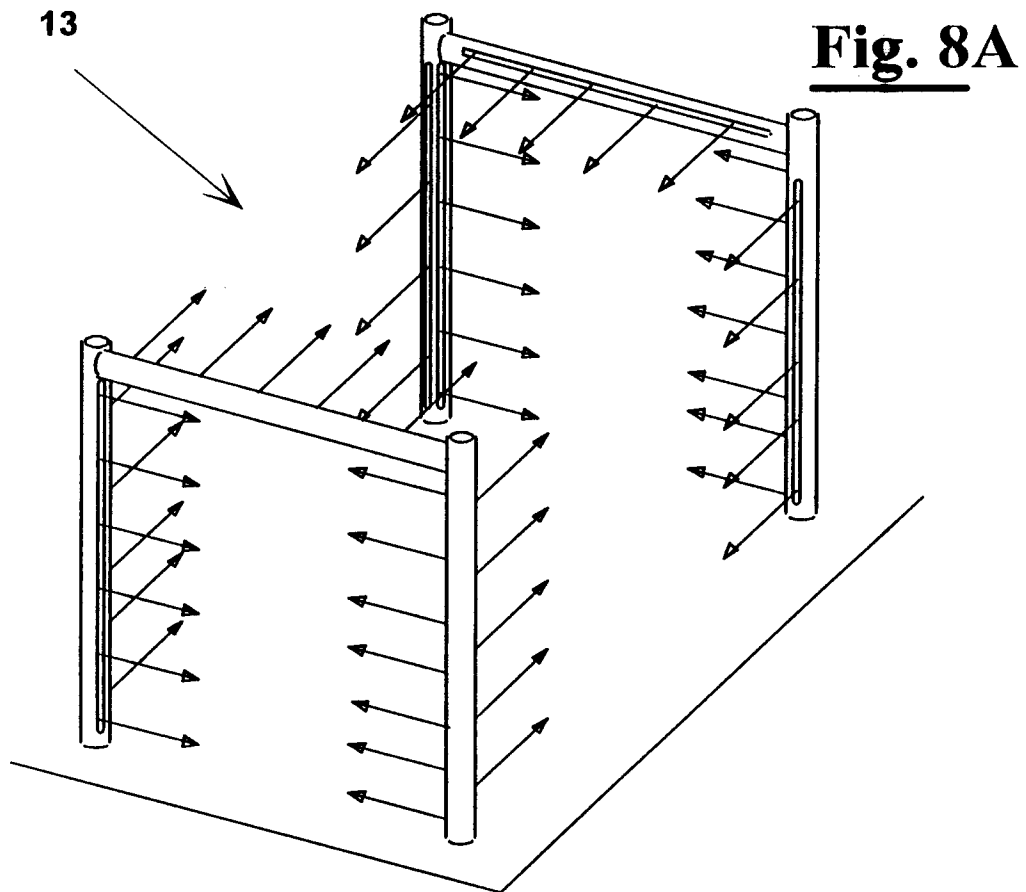


Fig. 9

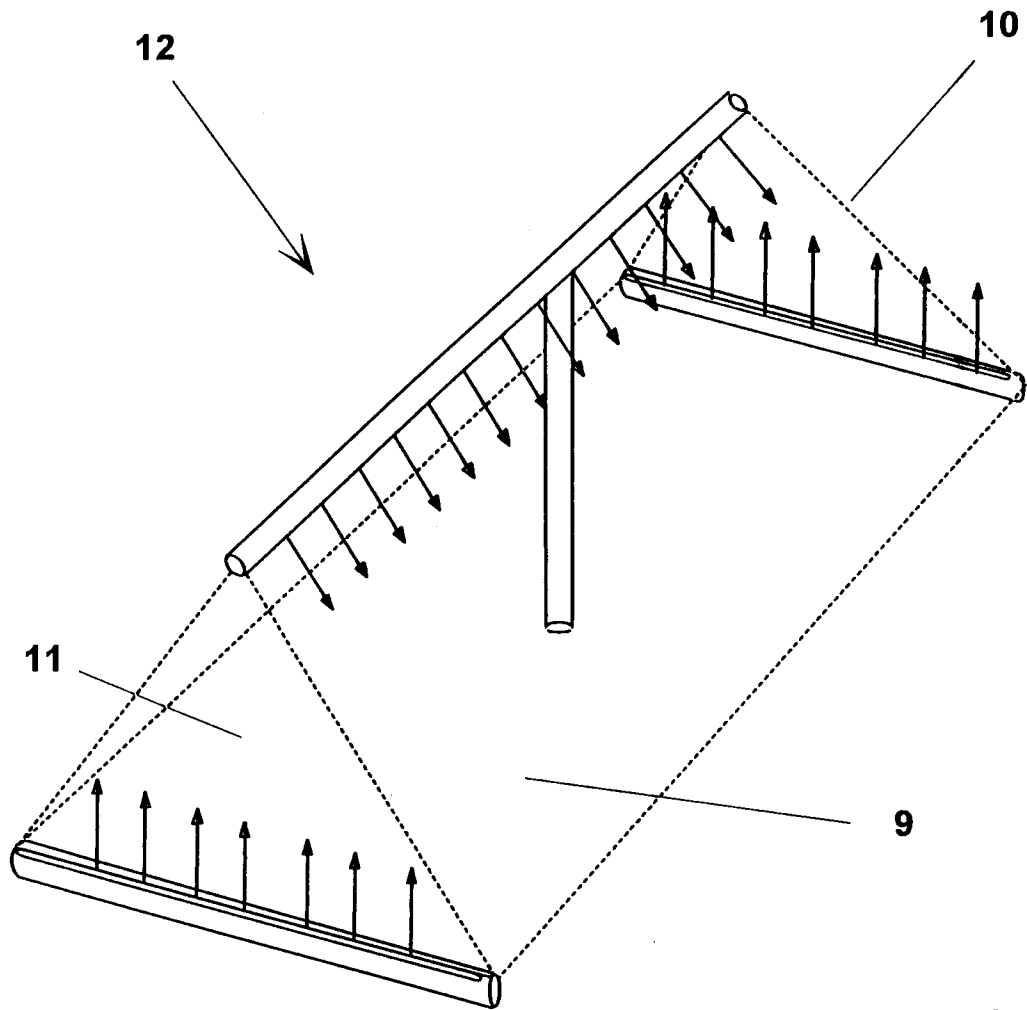


Fig. 9A

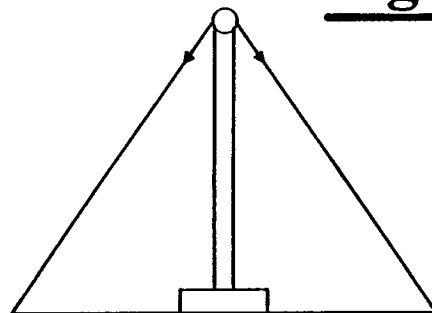


Fig. 10

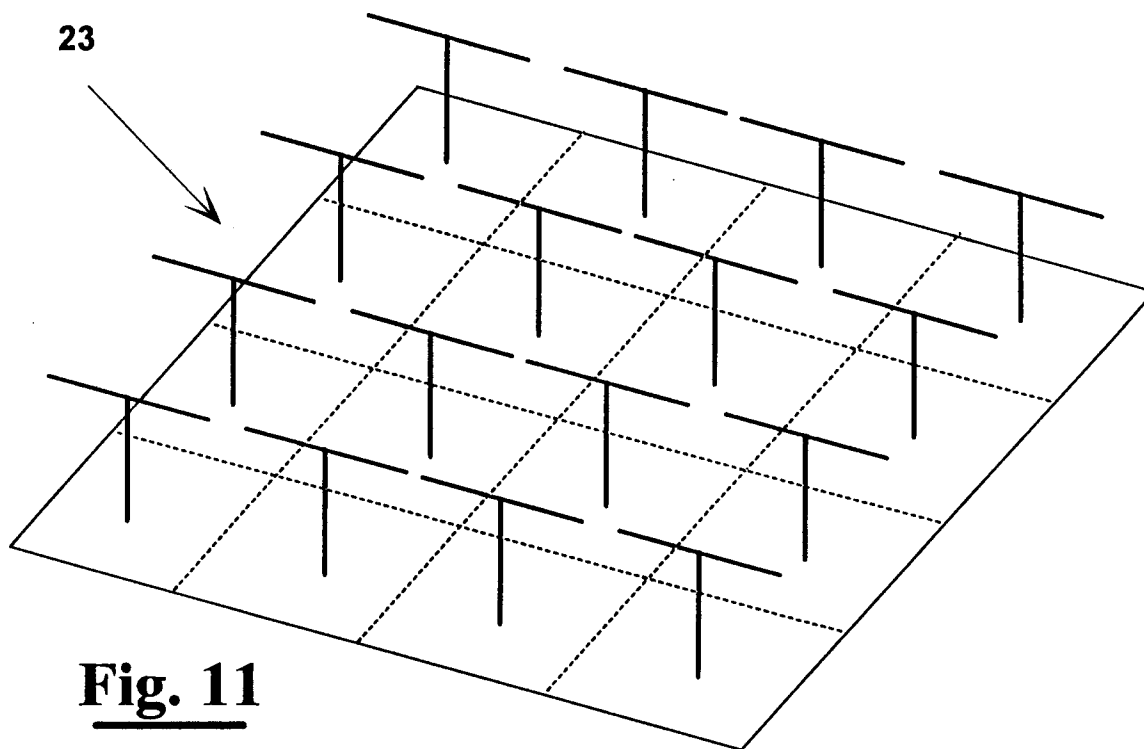
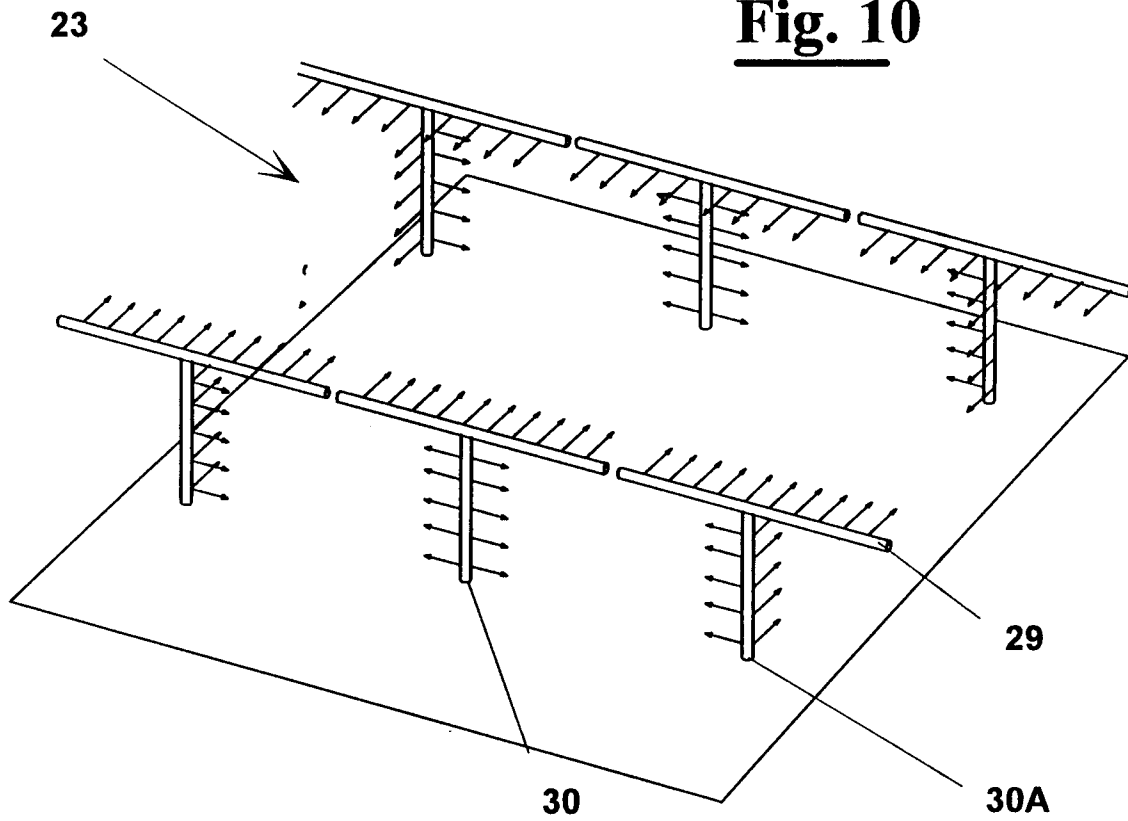


Fig. 11

Fig. 12

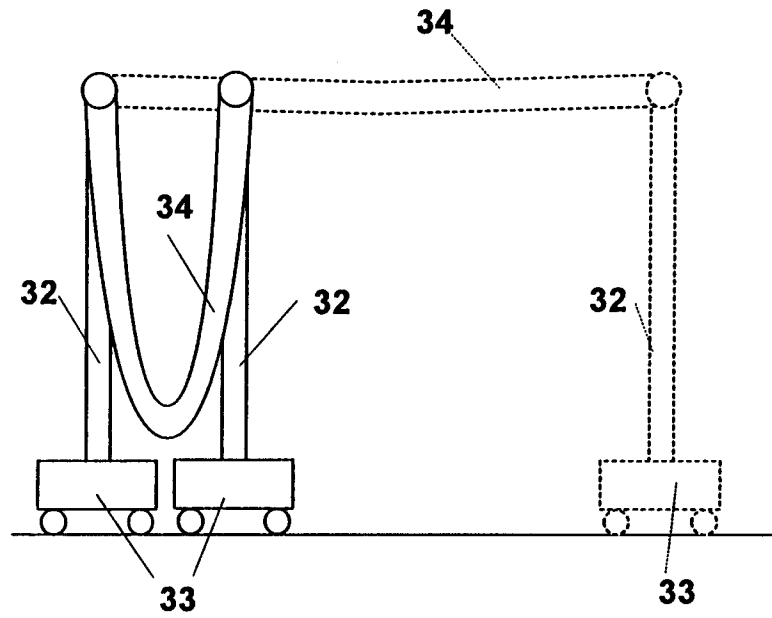
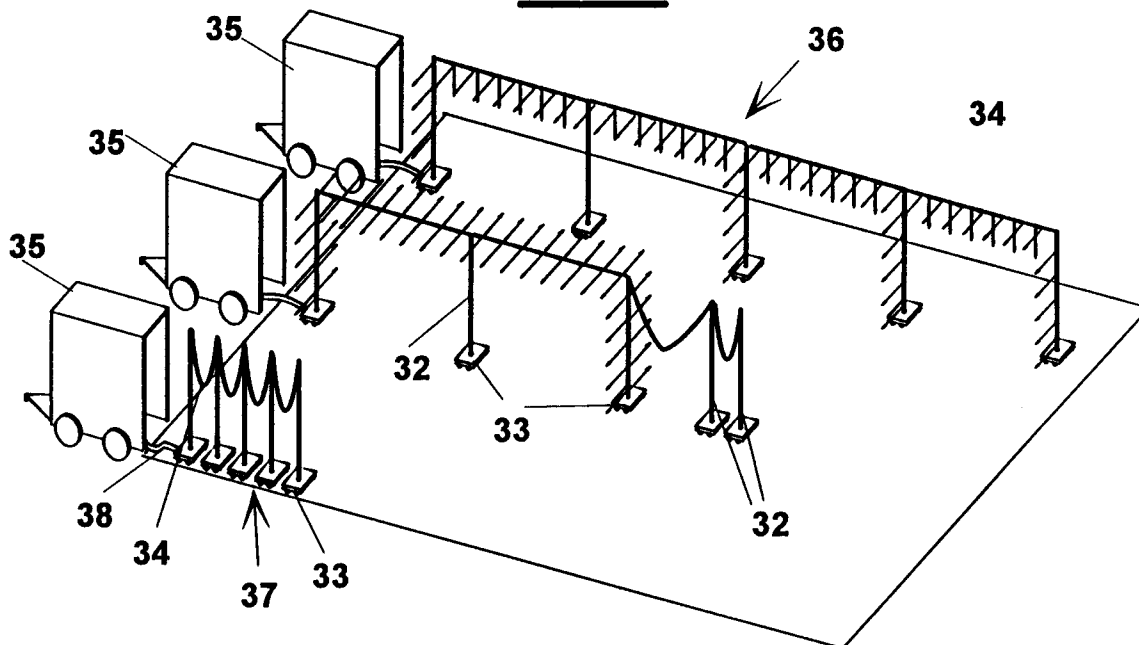


Fig. 13





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0111

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 97 11664 A (HILL ROM CO INC) 3 April 1997	1,3,6,7	E04H1/00
A	* abstract; figures 2-4 *	8	E04B1/99
	---		F24F9/00
X	US 4 315 456 A (HAYASHI TARO ET AL) 16 February 1982	1	
A	* column 3, line 25 - column 4, line 13 *	8	
	* column 5, line 10 - line 29 *		
	* figures 1,2,5 *		

A	EP 0 511 576 A (MITSUBISHI HEAVY IND LTD ;CHURYO ENG (JP)) 4 November 1992	1,10	
	* column 3, line 57 - column 4, line 32 *		
	* figures 1,5 *		

A	GB 2 151 349 A (ZAMBOLIN MARCO) 17 July 1985	1,2	
	* the whole document *		

The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) E04H E04B F24F
Place of search		Date of completion of the search	Examiner
THE HAGUE		20 July 1998	Vrugt, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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