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(54) **A method and device for rotating prisms in a panel for multiple messages.**

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Description

Multiple message panels are well known and used in many activity areas, whenever it is necessary to display repetitive information, generally in the form of images integrated with alphanumeric messages. Besides the inexpensiveness of their operation, the essential requirements of these type of panels are to a great extent determined by the environment where these panels will be operable; as in general this environment is outdoors, the panels must be able to operate in the most variable conditions, even in extreme conditions, such as in a temperature range from - 20 degrees to +50 degrees centigrade, in the presence of strong winds (i.e. with gusts of wind generating thrusts up to 150 kg/m^2) or in the presence of sand and dust. In addition, said panels must be easily visible, remotedly operable, easily maintenable, and they should not need a protective window for the message surface.

Among the various types of available panels, those which better satisfy the above indicated requirements are the so-called "prism" panels, that is, panels comprising rotating prism elements, generally of triangular or square section (see for example FR-A-2602898 and CH-A-662897). Many prisms are provided side by side, whose faces are positioned towards the external part of the panel, adjacent and flanked to each other, to form the representative surface of the panel.

In order to change the message displayed by such representative surface, same or all of the prisms are rotated until a new selected message is obtained; however this rotation is the source of the main inconvenience shown by these panels.

Actually, while the rotation of flanked prisms having a triangular section does not show any difficulty, some problems occur when such prism section is square or has more than four sides. In fact, in this case, two adjacent prisms must be spaced at least of a minimum value, below which value the rotation is made physically impossible by the prism geometry.

As better shown in figure 1, in order to perform a simultaneous rotation of two square section adjacent prisms, the two flanked sides 3a and 4a of those prisms must be spaced from each other at least of a "λ" value equal to the difference between the diagonal of the prism section and one of its sides.

Actually, if "l" is the length value of one side of the prism square section, the following relationship should be valid:

$$\lambda \geq \ell(\sqrt{2}-1) \qquad (1)$$

Obviously the empty spaces that are thus formed between two prisms negatively affect the quality of the displayed message. If the representative efficiency of a panel is defined as the ratio between the area effectively used for the message and the available area, it is found that in the above disclosed case the representative efficiency is lower than 70 %, which is an excessively low value.

As an alternative, it has been thought to successively rotate the prisms in two groups each formed by non-adjacent prisms: that is to rotate alternate prisms, first rotating the prisms located in the even positions and then rotating the ones in the odd positions (or viceversa).

However, even if in this way the distance required to allow the rotation, is halved, the panel representative efficiency is still lower than 78 %. Moreover, the control of this type of rotation is uselessly too complex and elaborate for the modest gain in the representative efficiency.

Therefore, there is the need for a method and a device to rotate prisms with four or more sides in a multiple message panel that allow to perform such rotation even in panels with high representative efficiency.

The object of this invention is to provide a method and a device which solve the above mentioned problems, allowing the rotation of prisms with four sides or more in a multiple message panel having a high representative efficiency, that is in a panel where such prisms are positioned substantially in close contact one with each other.

More particularly, this invention relates to a method for rotating the prisms composing the representative surface of a multiple message panel, characterised in that it comprises the following steps: moving a group of non-adjacent alternately positioned prisms away from said panel rapresentative surface; rotating at least a part of the prisms during or after said movement; and re-approaching the moved prisms, aligning them with the others, during or after said rotation, to recompose said representative surface with a new message.

The invention further concerns a new device for rotating of prisms with four or more sides and forming the representative surface of a multiple message signalling panel, characterised in that it comprises: means to move a group of non-adjacent alternately positioned prisms away from said panel representative surface; means to rotate at least a part of the prisms during or after said movement; and means to re-approach the moved prisms, aligning them with the others, during of after said rotation, to recompose the representative surface.

Moreover, the present invention concerns a multiple message signalling panel of the type described and provided with a representative surface composed of prisms with four or more sides,

characterised in that it uses a prism rotation method and device of the type described above.

The invention will be now described more in detail with reference to the attached drawings, wherein:

- Figure 1 is a schematic perspective view of a prism panel according to the state of the art;
- Figure 2 is a schematic perspective view of a panel embodiment according to the invention;
- Figures 3, 4, 5 and 6 illustrate the phases of prism rotation in a modified embodiment;
- Fig 7 is a perspective schematic view of a device according to the invention;
- Figure 8 shows a graph of the transmission ratio in a part of the device of Figure 7;
- Figure 9 is a partial section view of a further embodiment of the invention; and
- Figure 10 is a partial view of an embodiment analogous to that shown in Fig 9, with pentagonal section prisms.

As previously indicated, in the embodiment according to the state of the art as schematically shown in Figure 1, a number of square section prisms define a panel representative surface for showing multiple message signals, said prisms being placed adjacent to each other and aligned in such a way that all the faces towards the panel outer part lie on the same plane forming said panel representative surface.

To be able to rotate the prisms in order to change the shown message on the representative surface, it is necessary that such prisms are spaced apart for a value sufficient to allow an alternate or simultaneous rotation. In the first case, the distance between two opposite faces, 3a and 4a, of two adjacent prisms must be at least equal to the difference between the diagonal and the side of the prism square section; if the prisms are rotated in alternate groups, that is in the case where the prisms located in even positions are rotated first and then the prisms located in odd positions are rotated (or viceversa), the distance as necessary for allowing the prism rotation is halved with respect to the previous one. The present invention allows to use panels formed by adjacent prisms of four or more sides, keeping the distance between them to a minimum as necessary for a translation movement of each prism with reference to the adjacent ones, as illustrated in Fig. 2.

In fact, the method according to this invention foresees the use of narrowly adjacent prisms and the movement of a part of them in a direction perpendicular to the plane of the representative surface before the rotation of all the prisms.

As better shown in Figure 2 with the dashed lines 1' and 3', one of two groups, each formed by non-adjacent prisms, is moved away, that is the group formed by prisms 1 and 3, while the prisms 2 and 4 are rotated only.

The steps of the method according to this invention are shown in figures 3 to 6, where a preferred embodiment, in alternative to that of figure 2, is shown.

Actually, the panel of fig. 3 comprises prisms 1 and 3, which will be moved away, having a section of sizes lower than those of the corresponding section of prisms 2 and 4, that are rotated only: this allows the prisms 1 and 3 to be translated for a distance lower than that necessary in the panel of figure 2.

In the preferred embodiment of figure 3, the prisms 1 and 3, that should be moved away and re-approched, are connected to a frame 5 in order to obtain an identical and simultaneous movement; as it can be noticed, the faces of all the prisms are flanked strictly next to each other, contributing to form a first message, that has been sketched by indicating such faces with the letter A.

When it is necessary to change the shown message, the prism group 1 and 3 is moved away (figure 4) by a predetermined distance and then a preferably simultaneous rotation of the two prisms groups 1, 3 and 2, 4 is carried-out (figure 5).

In the example shown in figures 3 to 6, such rotation has an amplitude of 90 degrees, so that at the end thereof all the prisms faces turned towards the outer part of the panel, i.e. those turned towards the right part of the drawing, are marked with B. At this point the prisms 1 and 3 are re-approached and aligned to the prisms 2 and 4 (figure 6) to form a second message, different from the one previously shown.

The method indicated above can be performed essentially with two different procedures; the first procedure foresees to carry out in time sequence, the three steps of: moving away the prisms, rotating the prisms and re-approaching the moved prisms, while the second procedure foresees that such operations are performed simultaneously.

In the first case, the device for controlling the prism rotation must comprise, besides the necessary means to move and rotate the prisms on the panel, also sensors or analogous means of detect the position of the mobile prisms in a longitudinal direction, to regulate in sequence the operation of the prism moving away, rotating and re-approaching means.

However, since this solution involves the necessity of interlocked movements as controlled by sensors, it is difficult to warrant a sufficient reliability in the previously mentioned different conditions of panel use. This in why the second solution is preferred.

As already indicated, in this second case the operations of moving away, re-approaching and rotating the prisms are performed with continuous

movements, with a cyclic separation-approaching speed and with a variable rotation speed. In particular, it will be necessary that the rotation speed, which is in general the same for all the prisms, will be minimum when the prisms 1 and 3 are still positioned between the prisms 2 and 4 (that is at the beginning of the prism separation movement and at the end of the re-approaching movement), and that said rotation speed will gradually increase when such prisms 1 and 3 are moved away from the, panel surface.

Said rotational speed will be then maximum when the two prism groups are at the maximum distance therebetween, i.e. at the end of the separation movement and at the start of the re-approaching movement.

A device to perform the above described movements is preferably of the type with a fully mechanical operation, and one possible embodiment thereof is schematically shown in figure 7. The device shown in figure 7 comprises a motor 11 that activates a driving shaft 12 with two outputs; the first output controls the spreading away-approaching movement at a given speed and comprises a crank gear 15 fixed to the already described frame 5 coupled to prisms 1 and 3 that are mobile in a direction perpendicular to the panel plane.

The second output controls the described continuous rotation movement at a multiple speed; such output consists of a transmission system with elliptical gears, as shown by two wheels 16 and 17 having an elliptical shape. The elliptical gear 16 is attached to the driving shaft 12 and therefore it has a constant rotational speed, while the second wheel 17 is attached to a transmission shaft 18 and its rotational speed varies in a way typical of the elliptical gear systems, that is from a minimum value to a maximum value and then again to a minimum value, in relation to the angular position between the gears 16 and 17.

This speed variation is better represented in the graph of figure 8, where the rotation angle of the driving shaft 12 (and therefore of wheel 16) is reported on the abscissa axis, while on the ordinate axis is reported the τ value, which is the ratio between the angular velocity of wheel 17 and that of wheel 16 (therefore that of the driving shaft 12).

Of course, any other type of gear system can be used providing that it gives a similar type of speed graph. Now, coming back to the device of figure 7, the rotating motion of shaft 18 is transmitted to others shafts 19 and 21 through an angular gear transmission system 20, that may be formed, for example, by cone shaped gears (not shown). As shown by the dashed line 19', the shaft 19 can move longitudinally through the transmission system 20. The shaft 21 is instead "fixed", in that it can only rotate around its own longitudinal axis to control the rotation of prisms 2 and 4 by means of conical gear pairs 24 and 25. The shaft 19 controls the rotation of another shaft 22, parallel to shaft 21, through a transmission system or conical gear pair 23; this shaft 22 in turn controls the rotation of prisms 1 and 3 by means of conical gear pairs 26 and 27, in a manner similar to that of prisms 2 and 4.

Then all prisms rotate with the same angular speed, which is the one of shaft 18.

On the basis of what has been illustrated, said frame 5 comprises shafts 19 and 22 and preferably also an extra stiffening element 28, which does not rotate but runs longitudinally through a support 29.

Figure 9 and 10 show in cross-section two further possible embodiments of the invention, where at least a part of the prisms has a pentagonal section. In figure 10 both the prisms of greater sizes 7, 7' (i.e. the prisms exposed to the rotation movement only) and the prisms of lower sizes 9, are of pentagonal section. In this way it is possible to obtain the display of at least five different messages; as it can be noticed, the side faces of prisms 7 and 7' are concave, to be able to house between them the prisms of lower section 9. In this case, the operation is the same of the four sides already described type.

In figure 9, between two pentagonal prisms 6 and 6' with concave faces, a square section prism 8 is positioned. In this case one of the faces of prism 8 is used for two different functions: to execute a message and to contribute to form a void message, that is the prisms show no understandable message. For example, the face 10' of prism 8 corresponds to the faces 10 and 14 of prism 6 (and to the equivalent face of prism 6'). The exact reciprocal positioning of faces 10' and 14 is obtained by rotating for four positions in the same direction the prisms 6, 6' and 8; by reversely rotating these prisms for an equal number of positions the original position is again obtained, with alignment of faces 10 and 10'.

Claims

1. A method for rotating the prisms with four or more faces composing the representative surface of a multiple message panel, characterized in that it comprises the following steps: moving a group of non-adjacent alternately positioned prisms away from said panel rapresentative surface; rotating at least a part of the prisms during or after said movement; and re-approaching the moved prisms, aligning them with the others, during or after said rotation, to recompose said representative surface with a new message.

2. A method according to claim 1, characterized in that the steps of spreading apart, rotating and re-approaching the prisms are carried-out in a time sequence; and in that one or more sensors detect the positions of said prisms in order to control the passage from one step to the next one.

3. A method according to claim 1, characterized in that said moving and rotating steps are carried-out simultaneously, with a continuous movement and with a speed variable rotation speed to avoid interference between the prisms in motion.

4. A method according to claim 3, characterized in that said rotation speed has a minimum value in correspondence to the beginning of the prism away movement and to the end of the re-approaching movement, and in that said rotation speed has a maximum value at the end of the prism separation movement and the start of the re-approaching movement.

5. A device for rotating prisms with four or more sides and forming the representative surface of a multiple message signalling panel, characterized in that it comprises: means to move a group of non-adjacent alternately positioned prisms away from said panel representative surface; means to rotate at least a part of the prisms during or after said movement; and means to re-approach the moved prisms, aligning them with the others, during or after said rotation, to recompose the representative surface.

6. A device according to claim 5, characterized in that said means for separating and approaching the prisms include a frame holding the prisms designed to be moved, said frame being movable in a direction perpendicular to the panel plane.

7. A device according to claim 5, characterized in that it includes one or more sensors for detecting the positions of said prisms, in order to control in sequence the operation of said prism separating, re-approaching and rotating means.

8. A device according to claim 5, characterized in that said separating, re-approaching and rotating means operate in a simultaneous manner, with a continuous movement and with a separation-reapproching speed which is cyclic and a variable rotation speed, to avoid interferences between the prisms in motion.

9. A device according to claim 8, characterized in that such means include a driving shaft having two outputs and at least an elliptical gear transmission system.

10. A device according to claim 9, characterized in that one of said driving shaft outputs controls a continuous prism separation and re-approaching movement with a cyclic speed and the other shaft output controls a continuous rotation movement at a variable speed, such controls operating by means of said elliptical gear system.

11. A multiple messages signalling panel, of the type having a representative surface defined by prisms having fours or more sides, characterized in that it comprises a prism rotating device according to one of claims 5 to 10, and in that said rotation is carried-out following a method according to one of claims 1 to 4.

12. A panel according to claim 11, characterized in that those prisms carrying-out said separation-reapproaching movement present a cross-section having sizes lower than the cross-section of prisms carrying-out a rotation movement only.

13. A panel according to claim 12, characterized in that said prisms having a greater section are prisms with pentagonal sections, and said prisms with a lower section are prisms with square sections.

14. A panel according to claim 12, characterized in that all the prisms have a pentagonal section and in that the prisms with greater sections have concave faces.

Patentansprüche

1. Ein Verfahren zum Drehen der Prismen mit vier oder mehr Flächen, die die repräsentative Oberfläche einer Tafel für Mehrfachnachrichten zusammensetzen, dadurch gekennzeichnet, daß es die folgenden Stufen umfaßt:
Bewegen einer Gruppe nicht-benachbarter abwechselnd positionierter Prismen weg von dieser für die Tafel repräsentativen Oberfläche;
Drehen wenigstens eines Teils der Prismen während oder nach dieser Bewegung;
und Wiederannähern der bewegten Prismen, deren Ausrichten bezüglich der anderen während oder nach dieser Drehung, um diese repräsentative Oberfläche mit einer neuen Nachricht wieder zusammenzusetzen.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Stufen des Auseinanderfahrens, Drehens und Wiederannäherns der Prismen in einer zeitlichen Sequenz durchgeführt werden; und daß einer oder mehrere Sensoren die Positionen dieser Prismen erfassen, um den Durchgang von einer Stufe zur nächsten zu regeln.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß diese Bewegungs- und Rotationsschritte gleichzeitig durchgeführt werden mit einer kontinuierlichen Bewegung und mit einer geschwindigkeitsvariablen Drehgeschwindigkeit, um Störung zwischen den in Bewegung befindlichen Prismen zu vermeiden.

4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß diese Drehgeschwindigkeit einen Minimalwert entsprechend dem Beginn der Prismenfortbewegung und dem Ende der Wiederannäherungsbewegung hat, und daß diese Drehgeschwindigkeit einen Maximalwert am Ende der Prismentrennbewegung und dem Start der Wiederannäherungsbewegung hat.

5. Vorrichtung zum Drehen von Prismen mit vier oder mehr Seiten und Bilden der repräsentativen Fläche einer Signaltafel für Mehrfachnachrichten, dadurch gekennzeichnet, daß sie umfaßt:
Mittel zur Bewegung einer Gruppe nicht-benachbarter abwechselnd positionierter Prismen von dieser tafelrepräsentativen Fläche fort;
Mittel zum Drehen wenigstens eines Teils der Prismen während oder nach dieser Bewegung;
und Mittel zur wiederannäherung der bewegten Prismen, zu ihrer Ausrichtung bezüglich der anderen während oder nach dieser Drehung, um die repräsentative Fläche erneut zusammenzusetzen.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß diese Mittel zum Trennen und Annähern der Prismen ein die zu bewegenden Prismen haltendes Gestell umfassen, wobei dieses Gestell in einer Richtung senkrecht zur Tafelebene beweglich ist.

7. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß sie einen oder mehrere Sensoren zum Erfassen der Positionen dieser Prismen umfaßt, um aufeinanderfolgend die Arbeitsweise dieser Prismentrenn-, Wiederannäherungs- und Drehmittel regelt.

8. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß diese Trenn-, Wiederannäherungs- und Drehmittel gleichzeitig mit einer kontinuierlichen Bewegung und mit einer Trenn-Wiederannäherungsbewegung arbeiten, die zyklisch ist und mit einer variablen Drehgeschwindigkeit arbeiten, um Störungen zwischen den in Bewegung befindlichen Prismen zu vermeiden.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß diese Mittel eine Antriebswelle mit zwei Ausgängen und wenigstens einem elliptischen Zahnradgetriebeübertragungssystem umfassen.

10. Vorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß dieser eine dieser Antriebswellenausgänge eine kontinuierliche Prismentrenn- und Wiederannäherungsbewegung mit einer zyklischen Geschwindigkeit regelt und der andere Wellenausgang eine kontinuierliche Drehgeschwindigkeit bei variabler Geschwindigkeit regelt, wobei diese Regelungen vermittels dieses elliptischen Zahnradsystems ablaufen.

11. Eine Mehrfach-Nachrichten signalisierende Tafel vom Typ mit einer durch Prismen mit vier oder mehr Flächen gebildeten repräsentativen Fläche, dadurch gekennzeichnet, daß sie eine Prismendrehvorrichtung nach einem der Ansprüche 5 bis 10 umfaßt und daß diese Drehung gemäß einem Verfahren eines der Ansprüche 1 bis 4 durchgeführt wird.

12. Tafel nach Anspruch 11, dadurch gekennzeichnet, daß jene Prismen, die diese Trenn- und Wiederannäherungsbewegung ausführen, einen Querschnitt von Größen geringer als den Querschnitt der Prismen aufweisen, die nur eine Drehbewegung durchführen.

13. Tafel nach Anspruch 12, dadurch gekennzeichnet, daß diese Prismen mit einem größeren Querschnitt Prismen mit pentagonalen Querschnitten sind und daß diese Prismen mit einem geringeren Querschnitt Prismen mit quadratischen Querschnitten sind.

14. Tafel nach Anspruch 12, dadurch gekennzeichnet, daß sämtliche Prismen einen pentagonalen Querschnitt haben und daß die Prismen mit größeren Querschnitten konkave Flächen haben.

Revendications

1. Procédé pour faire tourner les prismes équipés de quatre ou d'un plus grand nombre de faces

et composant la surface représentative d'un panneau d'affichage de messages multiples, caractérisé en ce qu'il comprend les étapes suivantes : écarter un groupe de prismes non adjacents, positionnés d'une manière alternée, à partir de ladite surface représentative du panneau; faire tourner au moins une partie des prismes pendant ou après ledit déplacement; et approcher à nouveau les prismes déplacés, les aligner avec les autres, pendant ou après ladite rotation, pour reconstituer ladite surface représentative avec un nouveau message.

2. Procédé selon la revendication 1, caractérisé en ce que les étapes d'écartement, de rotation et de nouveau rapprochement des prismes sont exécutées selon une séquence temporelle, et en ce qu'un ou plusieurs capteurs détectent les positions desdits prismes de manière à commander le message d'une étape à la suivante.

3. Procédé selon la revendication 1, caractérisé en ce que lesdites étapes de déplacement et de rotation sont exécutées simultanément, avec un déplacement continu et une vitesse de rotation variable afin d'éviter toute interférence entre les prismes en déplacement.

4. Procédé selon la revendication 3, caractérisé en ce que ladite vitesse de rotation possède une valeur minimale en correspondance avec le début du mouvement d'écartement des prismes et avec la fin du mouvement de rapprochement, et en ce que ladite vitesse de rotation possède une valeur maximale à la fin du mouvement de séparation des prismes et du démarrage du mouvement de rapprochement.

5. Dispositif pour faire tourner des prismes comportant quatre ou un plus grand nombre de côtés et formant la surface représentative d'un panneau de signalisation de messages multiples, caractérisé en ce qu'il comprend : des moyens pour écarter un groupe de prismes non adjacents, disposés de façon alternée, à partir de ladite surface représentative du panneau; des moyens pour faire tourner au moins une partie des prismes pendant ou après ledit déplacement; et des moyens pour rapprocher les prismes déplacés, les aligner avec les autres, pendant ou après ladite rotation, pour reconstituer la surface représentative.

6. Dispositif selon la revendication 5, caractérisé en ce que lesdits moyens pour séparer et rapprocher les prismes comprennent un cadre retenant les prismes agencés de manière à être déplacés, ledit cadre étant déplaçable dans une direction perpendiculaire au plan du panneau.

7. Dispositif selon la revendication 5, caractérisé en ce qu'il comprend un ou plusieurs capteurs servant à détecter les positions desdits prismes, de manière à commander en séquence le fonctionnement desdits moyens de séparation, de rapprochement et de rotation des prismes.

8. Dispositif selon la revendication 5, caractérisé en ce que lesdits moyens de séparation, rapprochement et rotation agissent de façon simultanée, avec un déplacement continu et une vitesse de séparation-rapprochement qui est cyclique et une vitesse de rotation variable pour éviter des interférences entre les prismes en déplacement.

9. Dispositif selon la revendication 8, caractérisé en ce que de tels moyens comprennent un arbre d'entraînement possédant deux sorties et au moins un système de transmission à pignons elliptiques.

10. Dispositif selon la revendication 9, caractérisé en ce que l'une desdites sorties de l'arbre d'entraînement commande un mouvement continu d'écartement et de rapprochement du prisme avec une vitesse cyclique, et l'autre sortie de l'arbre commande un mouvement de rotation continu et une vitesse variable, une telle commande agissant par l'intermédiaire dudit système de pignons elliptiques.

11. Panneau de signalisation de messages multiples du type comportant une surface représentative définie par des prismes possédant quatre ou un plus grand nombre de côtés, caractérisé en ce qu'il comprend un dispositif d'entraînement en rotation des prismes selon l'une des revendications 5 à 10, et en ce que ladite rotation est exécutée conformément à un procédé selon l'une des revendications 1 à 4.

12. Panneau selon la revendication 11, caractérisé en ce que les prismes, qui exécutent ledit mouvement de séparation-rapprochement, possèdent une section transversale ayant des dimensions inférieures à la section transversale de prismes exécutant uniquement un mouvement de rotation.

13. Panneau selon la revendication 12, caractérisé en ce que lesdits prismes possédant une section supérieure sont des prismes possédant

des sections pentagonales, et lesdits prismes possédant une section inférieure sont des prismes possédant des sections carrées.

14. Panneau selon la revendication 12, caractérisé en ce que tous les prismes possèdent une section pentagonale et en ce que les prismes ayant des sections supérieures possèdent des faces concaves.

Fig.1

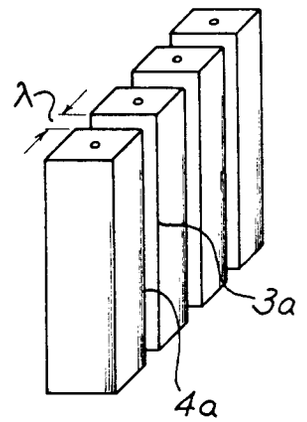


Fig.2

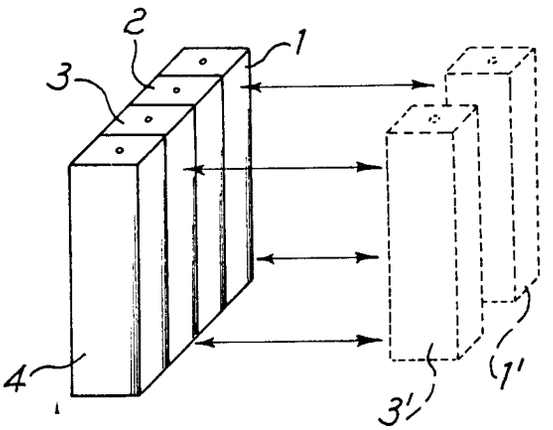


Fig.3

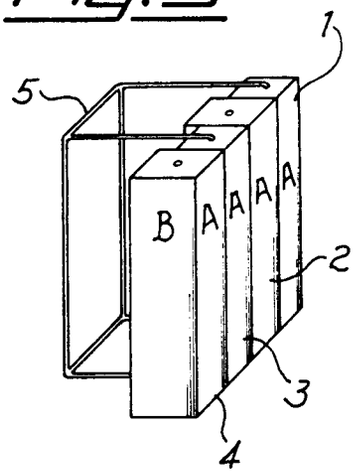


Fig.4

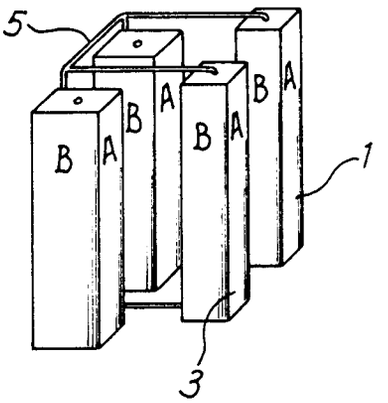


Fig.5

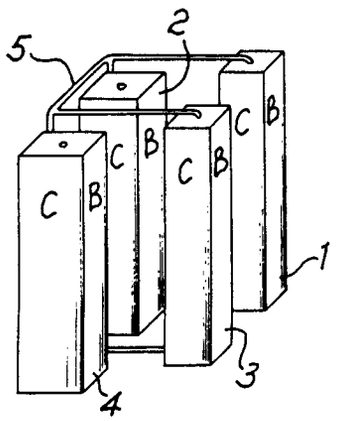
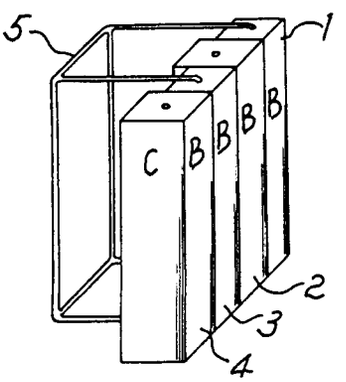


Fig.6



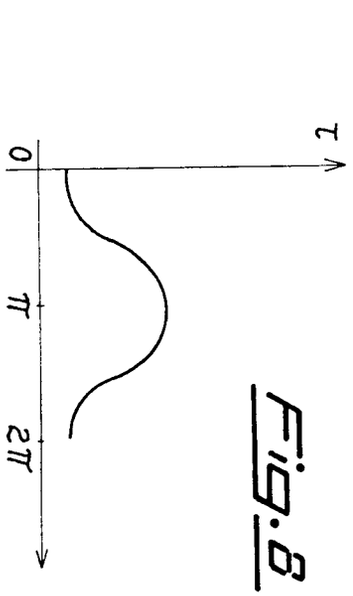


Fig.8

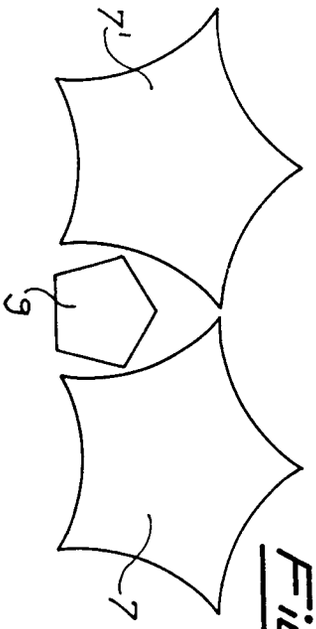


Fig.10

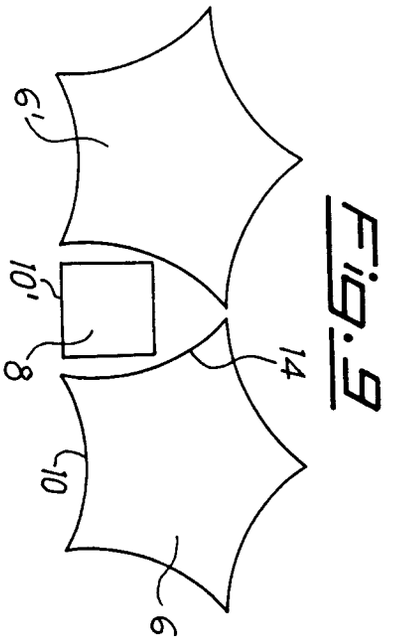


Fig.9

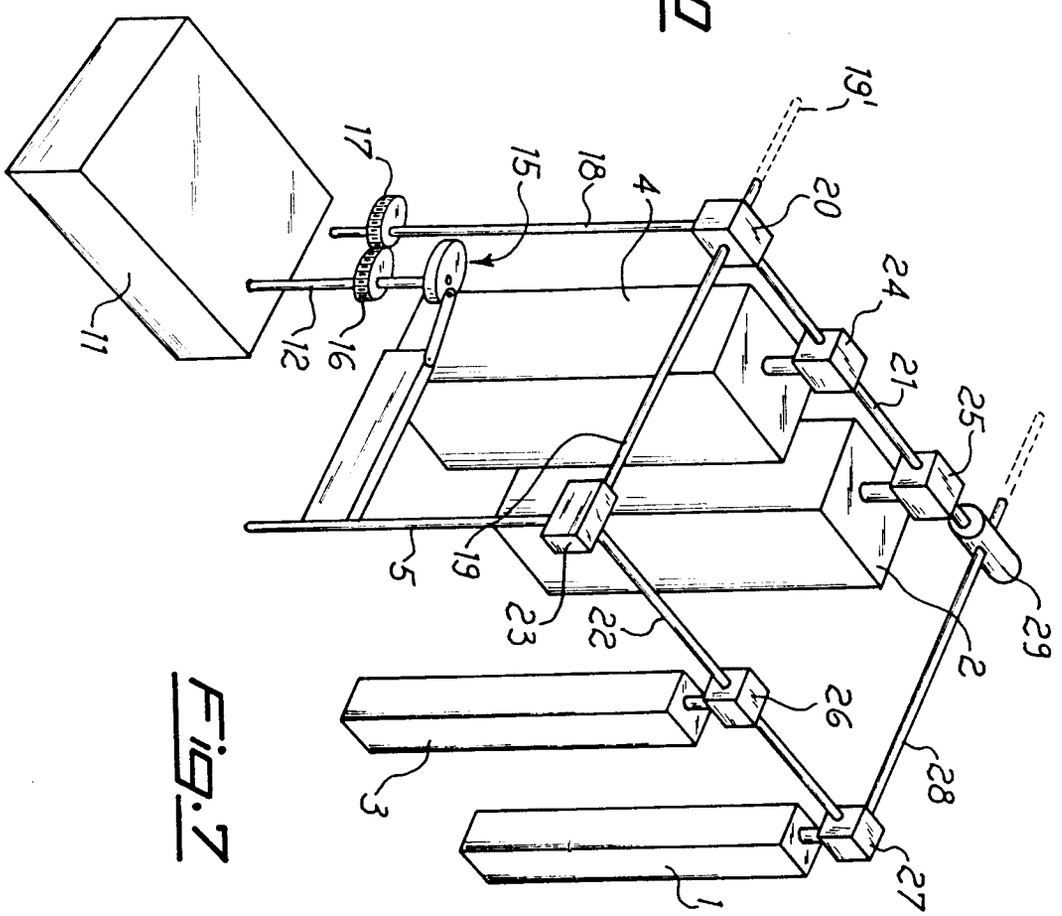


Fig.7