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(54) **A movie theatre construction**

(57) A movie theatre construction comprising a floor (2) on which seats (3) are installed and a projector (4) oriented towards a screen (6), said floor (2) being substantially continuously inclined with a slope of 5 to 10% and wherein said screen (6) is mounted at a distance in

height of said floor (2) and inclined towards said projector (4) in such a manner that a main axis of a light beam (5) leaving said projector (4) is incident on a substantially right angle on said screen (6).

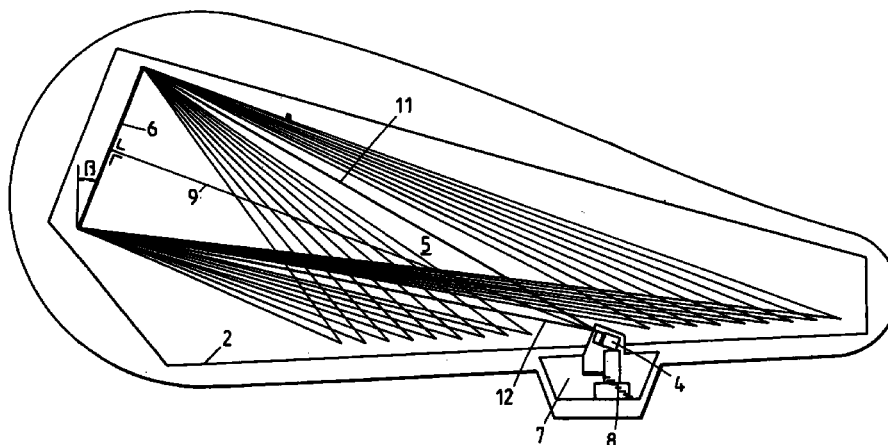


Fig. 2

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Description

[0001] The invention relates to a movie theatre construction comprising a floor on which seats are installed and a projector oriented towards a screen.

[0002] Such a movie theatre is well known and widely spread. Generally the seats are arranged in a stepped construction and the projector is placed at the back of the theatre so as to project the movie from the back over the whole area on the screen.

[0003] A drawback of the known movie theatre is that due to the position of the projector vis à vis the screen the light beam incident on top of the screen and the one on the bottom of the screen are incident under substantially different angles. This necessitates a careful construction of the screen, generally a bending of the screen, in order to limit the deformation of the projected image due to that angle difference. The projection of the image on the screen and the construction of the screen as well as the position of the seats must also be adjusted to each other in order to fulfil the imposed requirements and enable the spectator to see an image with limited deformation.

[0004] It is an object of the present invention to realise a movie theatre construction where the deformation of the projected image is even more reduced.

[0005] A movie theatre construction according to the present invention is therefore characterised in that said floor is substantially continuously inclined with a slope of 5 to 10 % and wherein said screen is mounted at a distance in height of said floor and inclined towards said projector in such a manner that a main axis of a light beam leaving said projector is incident on a substantially right angle on said screen. The inclination of the screen enables to project the main axis of the light beam of the projected image substantially perpendicular on the screen. Therefore the light beam on the bottom of the screen is incident on substantially the same angle as the one on top of the screen. This limits the deformation of the image as the light beam reaching the bottom and the one reaching the top of the screen have travelled substantially the same distance.

[0006] A first preferred embodiment of a movie theatre construction according to the present invention is characterised in that said projector is placed on said floor. The placement of the projector on an inclined floor facilitates the construction of the theatre as no stepped construction is required thus increasing the security. The placement of the projector on the floor further facilitates the construction and creates a large degree of freedom in adjusting the correct orientation of screen and projector.

[0007] A second preferred embodiment of a movie theatre construction according to the present invention is characterised in that said projector is placed in an area surrounded by said seats. This enables to find an optimum between the screen dimension and the position of the projector.

[0008] A third preferred embodiment of a movie theatre construction according to the present invention is characterised in that said seats have at least an inclinable back provided for inclining said back towards a position substantially parallel with said screen. This enables to increase the comfort of the spectators and improves their view of the image.

[0009] Preferably said seat is inclinable under control of a command signal generated under control of said projector upon starting a projection. In such a manner the seats are only inclined when the movie runs, which facilitates access to and from the seats.

[0010] The invention also relates to a method for equipping a movie theatre comprising a building of a floor on which seats are mounted and an installation of a screen and a projector oriented towards said screen. The method according to the invention is characterised in that said floor is built with a slope situated between 5 and 10 % and wherein said projector is placed on said floor and said screen is placed at a distance in height from said floor and inclined towards said projector, said projector and said screen being oriented with respect to each other in such a manner that a main axis of a light beam leaving said projector is incident on a substantially right angle on said screen.

[0011] The invention will now be described in more details by means of an example illustrated in the drawings. In the drawings:

figure 1 shows a top view of a movie theatre construction according to the present invention;
figure 2 shows a cross-sectional view according to a line II-II" of a movie theatre construction according to the present invention;
figure 3 illustrates how the position of the projector within the theatre is determined; and
figure 4 illustrates the inclination of the seats.

[0012] In the drawings a same reference sign has been assigned to a same or analogous element.

[0013] The movie theatre construction 1 according to the present invention and of which an example is illustrated in figure 1, comprises a floor 2 on which a number of seats 3 are installed. The number of seats is of course determined by the dimensions of the theatre. The seats are preferably so arranged that the distance between the spectators is 140 cm lengthwise and 60 cm breadthwise. The dimensions of the theatre are preferably chosen in such a manner that the minimum and maximum distances of the seats to a screen 6 are approximately equal to 0,7 and 1,8 times the screen width.

[0014] The projector 4 is installed in a central area of the theatre and is surrounded by the seats 3. The light beam 5 emitted by the projector is incident on the screen 6. The projector is preferably mounted on the floor 2 or in a cavity 7 of the floor as illustrated in figure 2. In the latter case a staircase 8 is provided to access

the projector 4. According to another embodiment the projector could also be mounted on a support arm fixed on the roof of the theatre.

[0015] The determination of the position of the projector in the theatre is illustrated in figure 3. For the sake of clarity the theatre 1 has been presented as being rectangular. However other geometric configurations, such as for example the one shown in figure 1, are also possible. A reference system x, y having its origin 0 in the middle of the rectangle has been assigned to the theatre 1. The rectangle 1 has a length equal $2(a+b)$ and a width $2(c+d)$. A further area 10 with length a' wherein

$$a' \leq \frac{1}{2}(a+b)$$

and width

$$b' \leq \frac{1}{2}(c+d)$$

is now drawn around the origin 0. The dimension of the area 10 is chosen in such a manner that: $c \leq d$ and $a \leq b$ and area 10 has a maximum surface $\max(a' \times b') = 2a \times 2c$. The projector 4 is installed in the area 10 i.e. among the spectators.

[0016] As illustrated in figure 2, the screen 6 is inclined with respect to the surface of the floor 2 and raised from the floor. The tilt angle β over which the screen 6 is inclined is situated between 25° and 40° depending on the dimensions and the configuration of the theatre. The projector 4 is also inclined in such a manner that a main axis 9 of the light beam 5 leaving the projector 4 is incident on a substantially right angle on the screen 6, in particular on the centre of the screen. Upon installing the theatre the projector is first installed and then the screen is tilted in such a manner that the main axis 9 is incident on a substantially right angle.

[0017] The distance between the projector and the screen is at least 3 times the height of the screen and the bottom of the screen is mounted at a height of at least 1,5 m, preferably 2 m of the floor. The screen has a curving of 5,8 times its width. By orienting screen and projector as described, the angle between the lowest beam 12 reaching the bottom of the screen and the highest beam 11 reaching the top of the screen is less than 20° , in particular 16° . By raising the screen and tilting it towards the spectator an optimum view angle is obtained for both the closest and the remotest spectator. The maximum angle between the sightline to the top of the screen and the spectator's straight viewing direction is reduced to approximately 20° , which constitutes only half of what the SMPTE (Security of Motion Picture and Television Engineers) norm currently allows. This set-up of screen and projector enables the spectator to see the entire screen from a much smaller visual angle, without having to turn his head or move his eyes. The viewing comfort of the spectator is therefore substantially increased.

[0018] As can be seen from figure 2, the floor of the

movie theatre according to the present invention is not the usual stepped construction but a substantially continuously inclined floor with a slope of 5 to 10 % in an upward direction from the screen towards the end of the theatre. Since the screen is raised with respect to the floor it is no longer needed to use the stepped construction as the spectator looks up to and no longer down on the screen. The inclined floor offers a considerable security advantage in case of emergency since the spectators no longer have to go down the staircase when the theatre has to be evacuated. Moreover such an inclined construction is less expensive to build and offers a better accessibility.

[0019] Preferably provisions are made in the floor for persons in wheelchairs by creating a number of counter-slopes enabling such a person to see the movie in a similar circumstance and comfort as another spectator. These counter-slopes will enable the person in a wheelchair to sit in a backward inclined position substantially parallel to the inclination of the screen.

[0020] The seats 3 will also be inclinable in order to enable the spectator to sit in a recumbent position as illustrated in figure 4. The seat is therefore equipped with adjusting means enabling to incline at least the back thereof towards a position substantially parallel with the screen. The angle α over which the back will be inclined will therefore vary according to a range $\beta - 10^\circ < \alpha < \beta + 10^\circ$ where β is the tilt angle of the screen. The exact value of the angle α will be determined by the slope of the floor and the position of the seat on the floor. This inclination is obtainable by either only inclining the back of the seat or by a combined inclination of both parts of the seat.

[0021] Preferably the seat is inclinable under control of a command signal generated under control of the projector upon starting the projection of the movie. Therefore the seats are equipped with an electrical motor which receives the command signal and inclines the seat from an upright position to the programmed inclined position. As soon as the movie is over, the projector generates another command signal to bring the seat back in his upright position. The upright position facilitates the access to the seat and therefore the comfort of the spectator is increased when he or she can leave the seat or sit down on it when the seat is in upright position. As soon as the movie starts, the seat is inclined, bringing the spectator in a comfortable position to see the movie.

[0022] The inclined position has the advantage that the body weight is carried with a more uniformly spread charge by the seat which is much more comfortable for the spectator. The spectator's body weight is equally distributed over the entire area of the seat what reduces local stresses and contractions which are generally associated with long periods of being seated in a same traditional sitting position. Moreover in this relaxed position the spectator's awareness and receptivity are increased what enables him to enjoy the movie even

more.

[0023] The inclined position of the seat in combination with the inclination of the screen offers the possibility to further reduce the maximum angle between the sight-line to the top of the screen and the spectator's straight viewing direction. The minimum free height between the upper side of the spectator's head on a preceding row and the lowest viewline towards the screen is approximately 14 cm due to the seat inclination.

[0024] By having the seats and the screen inclined and the main axis 9 of the light beam being substantially perpendicularly incident on the screen, care is taken that the light incident on the screen is reflected towards the spectator with a minimum of light intensity loss. The spectator looks perpendicularly to the screen so that he looks under substantially the same angle as the one on which the main axis of the light beam is incident. Thus this set up enables to reduce the light scattering to a minimum to provide a clear image to the spectator.

[0025] According to a further embodiment the theatre is installed in a housing mounted on support pillars which enable to mount the theatre even on an inclined soil and to make the theatre suitable for transportation.

Claims

1. A movie theatre construction comprising a floor on which seats are installed and a projector oriented towards a screen, characterised in that said floor is substantially continuously inclined with a slope of 5 to 10 % and wherein said screen is mounted at a distance in height of said floor and inclined towards said projector in such a manner that a main axis of a light beam leaving said projector is incident on a substantially right angle on said screen.
2. A movie theatre as claimed in claim 1, characterised in that said projector is placed on said floor.
3. A movie theatre as claimed in claim 2, characterised in that said projector is placed in an area surrounded by said seats.
4. A movie theatre as claimed in claims 2 or 3, characterised in that said area is rectangular and situated around a centre of said theatre, said area having an abscise and an ordinate which are at the most half of the abscise and ordinate of said theatre.
5. A movie theatre as claimed in claim 1 - 4, characterised in that said seats have at least an inclinable back provided for inclining said back towards a position substantially parallel with said screen.
6. A movie theatre as claimed in anyone of the claims 1-5, characterised in that said projector has a projection angle of at most 20°.
7. A movie theatre as claimed in claim 5, characterised in that said seat is inclinable under control of a command signal generated under control of said projector upon starting a projection.
8. A movie theatre as claimed in any one of the claims 1 - 7, characterised in that said theatre is installed in a housing mounted on support pillars.
9. A method for equipping a movie theatre comprising a building of a floor on which seats are mounted and an installation of a screen and a projector oriented towards said screen, characterised in that said floor is built with a slope situated between 5 and 10 % and wherein said projector is placed on said floor and said screen is placed at a distance in height from said floor and inclined towards said projector, said projector and said screen being oriented with respect to each other in such a manner that a main axis of a light beam leaving said projector is incident on a substantially right angle on said screen.

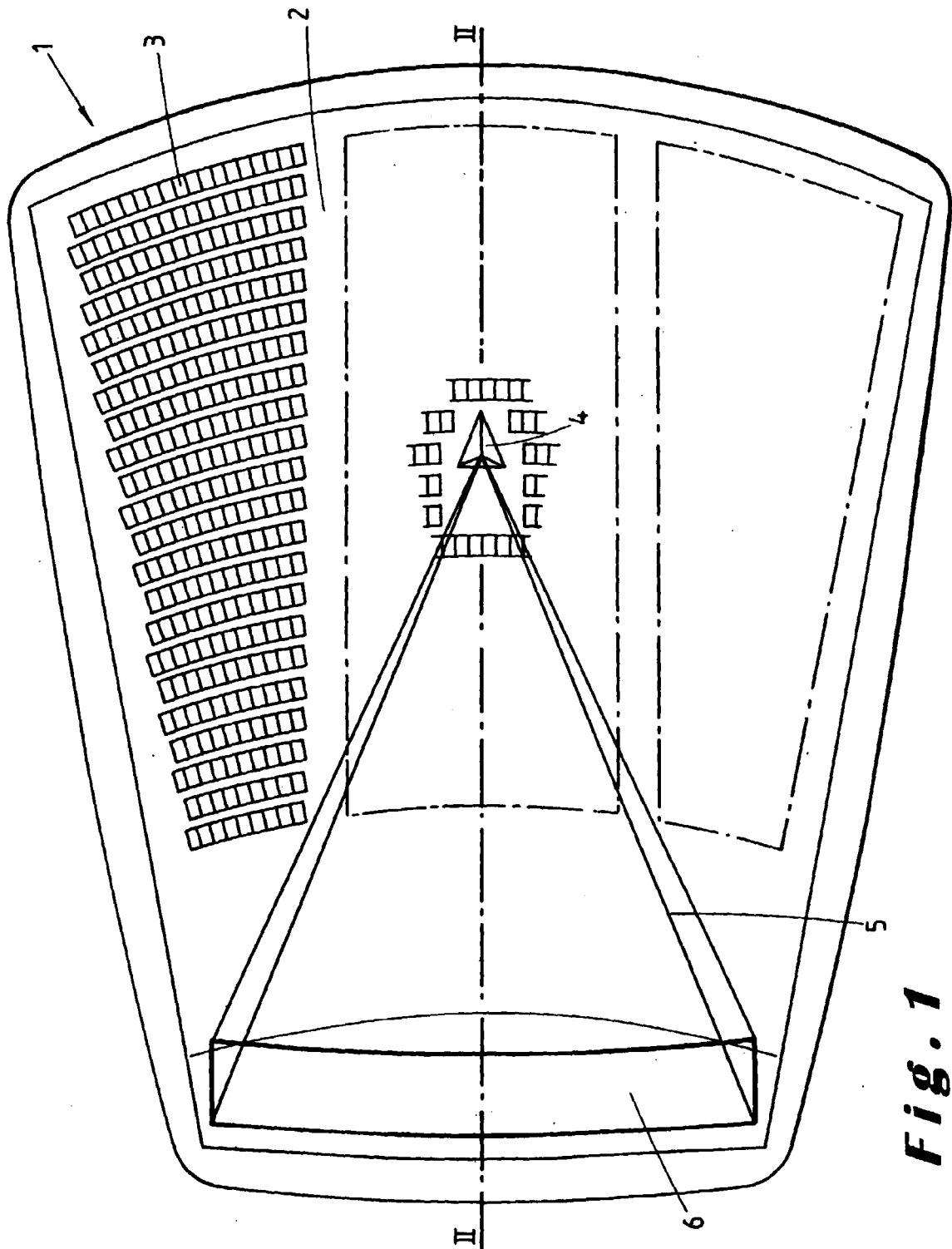


Fig. 1

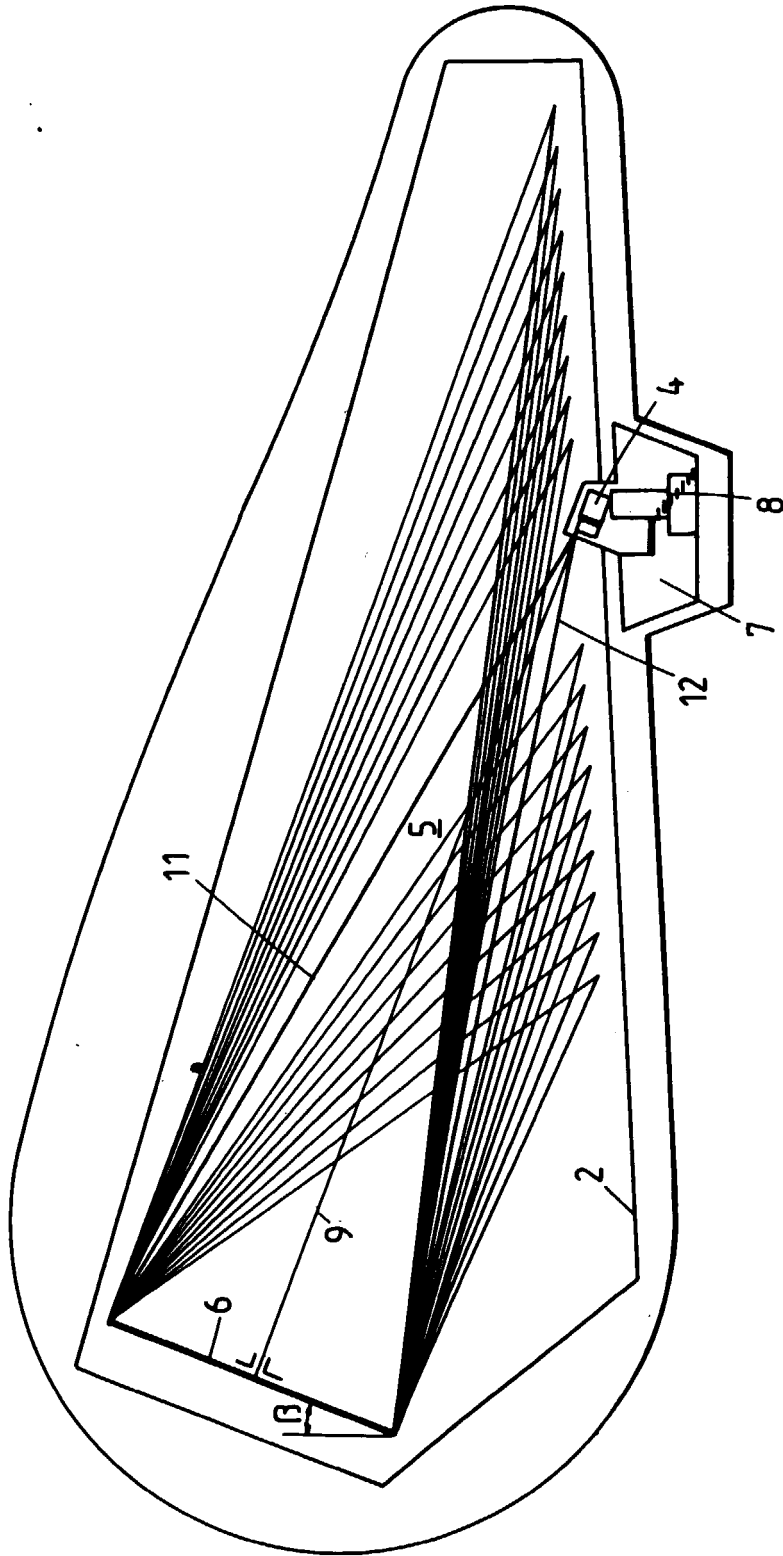


Fig. 2

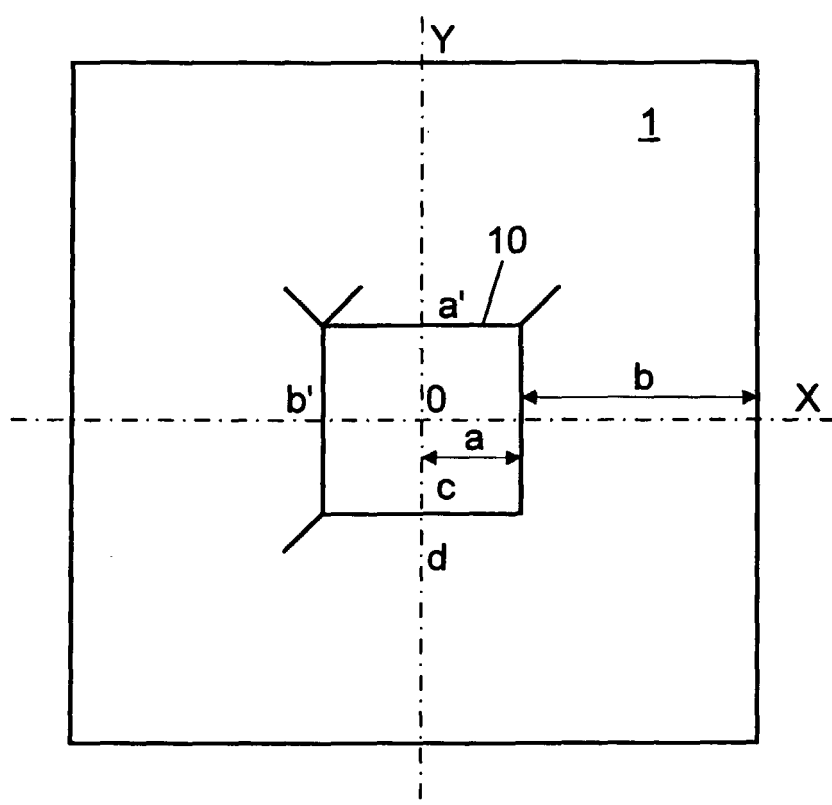


Fig. 3

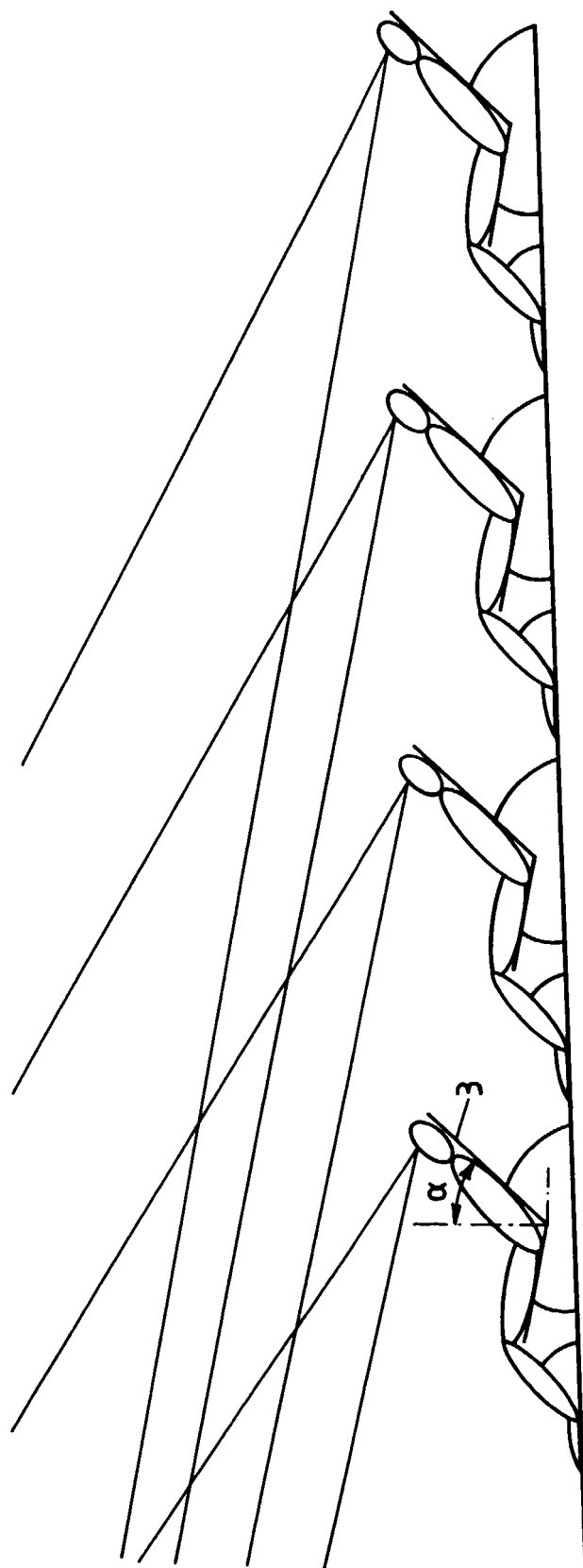


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 3110

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	SUTHERLAND LYLE: "The Cinema Architecture of Fletcher Priest" IMAGE TECHNOLOGY, vol. 73, no. 10, October 1991, pages 81-86, XP000227315 LONDON, GB * page 82; figure 2 *	1,2,8,9	E04H3/22 E04H3/30
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 February 1999	Examiner Kriekoukis, 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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 98 20 3110

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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11-02-1999

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