



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 158 239 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.11.2001 Bulletin 2001/48

(51) Int Cl.7: **F21S 8/00**, F21W 131/406,
F21V 9/10

(21) Application number: **00119304.4**

(22) Date of filing: **06.09.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Dedoro, Bruno**
46042 Castel Goffredo (Mantova) (IT)

(74) Representative: **Modiano, Guido, Dr.-Ing. et al**
Modiano & Associati SpA
Via Meravigli, 16
20123 Milano (IT)

(30) Priority: **22.05.2000 IT MI201132**

(71) Applicant: **COEMAR S.p.A.**
46042 Castel Goffredo (Mantova) (IT)

(54) **Projector particularly for projecting images in variable dimensions and in infinite colors**

(57) A projector particularly for projecting images in variable dimensions and infinite colors, comprising, on a light beam emitted by a light source (2), a color chang-

er (4) which comprises, for each complementary color, two sectors which have portions which are colored in a complementary color and can be inserted, through motor means, in the light beam.

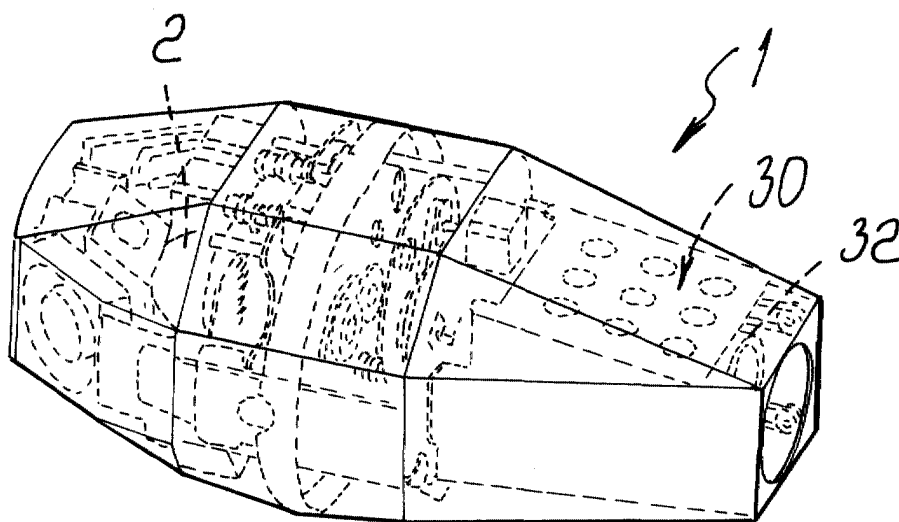


Fig. 1

Description

[0001] The present invention relates to a projector particularly for projecting images in variable dimensions and in infinite colors.

[0002] Conventional projectors used for example in the field of show business generally comprise a light source on the light beam whereof a filtering element is interposed in order to provide the intended coloring.

[0003] The solutions currently used require to arrange the color changer after the focusing unit, with considerable bulk in construction and with great difficulties in providing the intended color ranges. Moreover, in the solutions of the prior art it is not possible to easily adjust the spread of the resulting light beam, thus having projectors which are very bulky and difficult to handle.

[0004] The aim of the present invention is to eliminate the above-described drawbacks, by providing a projector particularly for projecting images in variable dimensions and in infinite colors which allows to obtain, with structurally simple means, an infinite range of colors, allowing to combine in the various shades the three complementary colors, i.e., cyan, magenta and yellow.

[0005] Within the scope of this aim, an object of the present invention is to provide a projector which allows to vary at will the dimensions of the resulting image and to provide said variation continuously and simply.

[0006] Another object of the present invention is to provide a projector which is particularly versatile and capable of combining the possibility of obtaining an infinite color range and of modifying the dimensions of the image and of combining their shape at will.

[0007] Another object of the present invention is to provide a projector, particularly for projecting images in variable dimensions and infinite colors, which thanks to its particular constructive characteristics is capable of giving the greatest assurances of reliability and safety in use.

[0008] These and other objects which will become better apparent hereinafter are achieved by a projector particularly for projecting images in variable dimensions and infinite colors, according to the present invention, which comprises, on a light beam emitted by a light source, a color changer, characterized in that said color changer is interposed between said light source and an image focusing unit.

[0009] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment of a projector particularly for projecting images in variable dimensions and infinite colors, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a schematic perspective view of the projector according to the present invention;

Figure 2 is an optical diagram of the projector with focusing of the focal plane of an iris diaphragm;

Figure 3 is an optical diagram with focusing of the focal plane of masks or gobos;

Figure 4 is a perspective view of the shape of one of the sectors in a complementary color;

Figures 5, 6 and 7 are successive views of the two opposite sectors in a complementary color in different mutual positions in order to vary the coloring of the light beam;

Figure 8 is a schematic perspective view of the color changer;

Figure 9 is a view of the focusing lens assembly;

Figure 10 is a schematic view of the gobos or masks;

Figure 11 is a perspective view of the unit for the continuous variation of the focal length of the projector or zoom.

[0010] With reference to the above figures, the projector particularly for projecting images in variable dimensions and infinite colors, generally designated by the reference numeral 1, comprises a light source 2, constituted by a high-power discharge lamp which emits an unfocused light beam 3.

[0011] Downstream of the source 2 there is provided a color changer, generally designated by the reference numeral 4, which is constituted by a mechanical system with six motors, two for each complementary color (cyan, magenta and yellow), and there is also provided a dimmer designated by the reference numeral 5; with this arrangement, an unfocused beam of light is projected onto the color changer.

[0012] The color changer 4 has, for each complementary color, two sectors 10 which are arranged symmetrically with respect to each other and are provided with a central body 11 which can engage a rotation pivot 12.

[0013] A toothed sector 13 is connected to the central body 11 and meshes with the gear 14 of a corresponding actuation motor.

[0014] On the opposite side of the toothed sector 13 with respect to the pivot 12 there is provided a glass plate 15 of the type capable of withstanding high temperatures and on which a portion is provided which is colored in a complementary color and in practice forms a dichroic film which is laser-etched so as to have a contour having a particular pattern.

[0015] In greater detail, the colored portions 16 have a continuous covering layer 16a which has, on its edge directed toward the other sector, comb-shaped protrusions 16b.

[0016] The sectors 10 can be interposed along the light beam 3 so as to produce a coloring which depends on the arrangement of the sector in the light beam.

[0017] The comb-shaped protrusions of the two sectors are shaped complementarily, so that when the two sectors are completely mutually superimposed the light beam is completely colored, while the gradual spacing of the sectors causes the light beam, which is unfocused, to produce a coloring whose intensity decreases

gradually as the sectors move apart, until they are mutually separated and therefore not interposed on the light beam.

[0018] It is evident that the proportional parallel insertion of the dichroic filters of two sectors in the same color changes the color of the beam of light from white to saturated in the three different color components.

[0019] The overlap of the various sectors related to the different color components in practice allows to obtain infinite colors.

[0020] Moreover, the presence of the dimmer allows to adjust the luminous output at will.

[0021] The dimmer is provided by means of sectors which are shaped exactly like the above described sectors regarding the color changer, the only difference being that the two complementary sectors are constituted by sheet-like elements made of metal plate or the like which are optically black, so that it is possible to achieve a continuous variation in light intensity.

[0022] The color changer is interposed between the light source and a focusing unit, generally designated by the reference numeral 21.

[0023] An iris diaphragm and a rotating unit are arranged between the color changer and the focusing unit; the rotating unit is provided with a first gobo 23 and a second gobo 24, one for fixed images and one for rotating images, which can be selectively interposed on the light beam; correspondingly, the focusing unit 21 has a first doublet 22 which arranges itself so as to correspond with the iris diaphragm 20, and a second achromatic doublet 25 for focusing the gobos or masks 23 and 24.

[0024] The iris diaphragm is motorized, and its internal laminas assume different diameters; when one of the contours (gobos) fitted on the wheels 23 and 24 is inserted on the optical plane, the iris diaphragm opens and the projected images is the projection of the contour of the gobo inserted in the light beam with the wheels 23 or 24.

[0025] The lenses 22 and 25 are supported by a rotating disk 26 which can be actuated automatically in combination with the movement of the rotating assembly; moreover, the disk 26 can have a lens-free passage to obtain maximum luminous output, achieving particular effects.

[0026] The rotating disk 26 can be actuated manually in order to obtain any combination of effects.

[0027] Downstream of the image focusing unit it is possible to provide a prism wheel 28 which can support rotating and fixed prisms and is also provided with a through opening in order to provide its functional disconnection.

[0028] Downstream of the optional rotating prism wheel there is provided a focal length variation unit, generally designated by the reference numeral 30, into which the images focused by the unit 21 are input. The zoom 30 comprises a first lens set 31 and a second lens set 32 in which the first set 31 has two double-convex lenses and the second unit has a double-concave lens.

[0029] The sets 31 and 32 are slidingly mounted on a guide which is designated by the reference numeral 40.

[0030] The first set is connected to a first belt 41 which is actuated by a first variation motor 42 of the step type, while the second set 31 is connected to a second belt 43 which is connected to a second variation motor 44 of the step type.

[0031] The mutually independent actuation of the motors 42 and 44 causes, by means of the translatory motion of the corresponding belts 41 and 43, the sliding of the units 31 and 32 on the guiding bar 40, thus allowing to provide a zoom with a projection angle between 7 and 69 degrees.

[0032] The simultaneous use of the color changer and of the focusing unit interposed between the color changer and the focal length variation device allows to obtain a particular luminous effect which combines the continuous variation of an infinite range of colors with the possibility to continuously vary the dimensions of the images and their focusing.

[0033] Another important aspect of the present invention is constituted by the fact that the projector has very small dimensions, thanks to the particularly sophisticated embodiment of the assembly.

[0034] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

[0035] All the details may further be replaced with other technically equivalent elements.

[0036] In practice, the materials employed, as well as the contingent shapes and dimensions, may be any according to requirements.

[0037] The disclosures in Italian Patent Application No. MI2000A001132 from which this application claims priority are incorporated herein by reference.

[0038] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A projector particularly for projecting images in variable dimensions and infinite colors, comprising, on a light beam emitted by a light source, a color changer, **characterized in that** said color changer is interposed between said light source and an image focusing unit.
2. The projector according to claim 1, **characterized in that** said color changer, for each complementary color, comprises two sectors which have portions colored in a complementary color which can be inserted, through motor means, in said light beam,

said colored portions of said two sectors being shaped complementarily in order to color the light beam according to the mutual position of said sectors.

3. The projector according to claim 1, **characterized in that** said color changer comprises a mechanical system with six motors, two for each complementary color.

4. The projector according to claim 2, **characterized in that** it comprises a dimmer arranged so as to correspond to said color changer.

5. The projector according to claim 2, **characterized in that** each one of said sectors has a central body which can engage a rotation pivot, a toothed sector being connected to said central body and meshing with a gear actuated by the corresponding motor, a glass plate which is resistant to high temperatures being provided on the opposite side of said toothed sector relative to said pivot, said glass plate bearing said colored portions.

6. The projector according to claim 2, **characterized in that** said colored portions are constituted by a dichroic film which is laser-etched so as to have a preset contour.

7. The projector according to claim 2, **characterized in that** said colored portions have a continuous covering layer which has, on the edge directed toward the other sector, comb-like protrusions which are mutually complementarily shaped.

8. The projector according to claim 4, **characterized in that** said dimmer is substantially equal in shape to the sectors used for each complementary color, the sectors of said dimmer being obtained by means of optically black sheet-like elements.

9. A projector, comprising a light beam emitted by a light source, **characterized in that** it comprises, downstream of a focusing unit, a unit for varying the focal length of said projector.

10. The projector according to claim 9, comprising, on the light beam emitted by said light source, a color changer, **characterized in that** said color changer comprises, for each complementary color, two sectors which have portions which are colored in a complementary color and can be inserted, through motor means, in a light beam, said colored portions of said two sectors being shaped complementarily in order to color the light beam according to the mutual position of said sectors, a focal length variation unit being provided downstream of said color changer.

11. The projector according to claim 10, **characterized in that** it comprises, between said color changer and the focusing unit, an iris diaphragm and a rotating assembly which bears a first gobo and a second gobo which can be selectively interposed on the light beam generated by said light source.

12. The projector according to claim 11, **characterized in that** said focusing unit comprises a first doublet for focusing said iris diaphragm and a second achromatic doublet for focusing said first and second gobos.

13. The projector according to claim 9, **characterized in that** the focusing unit has a lens-free passage in order to provide maximum luminous intensity.

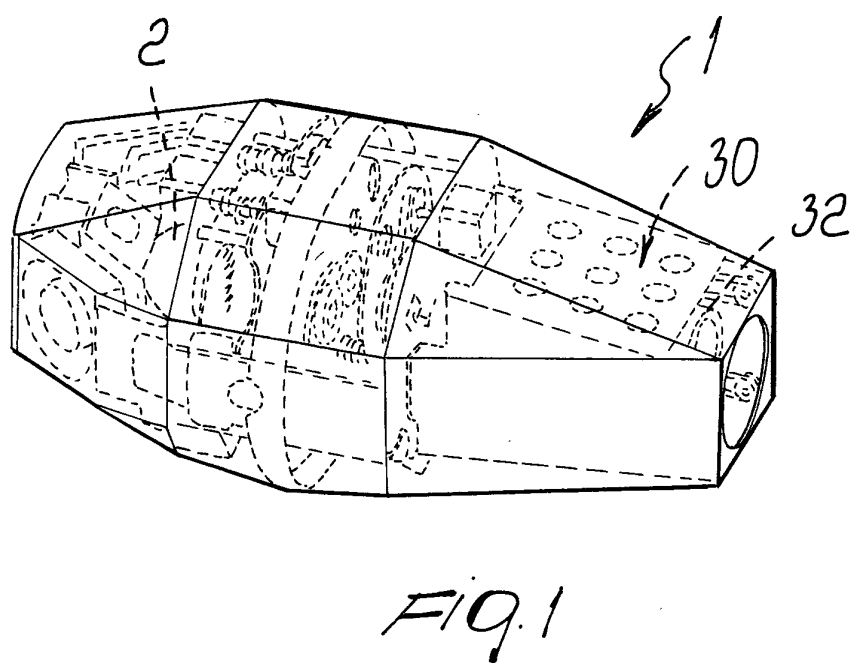
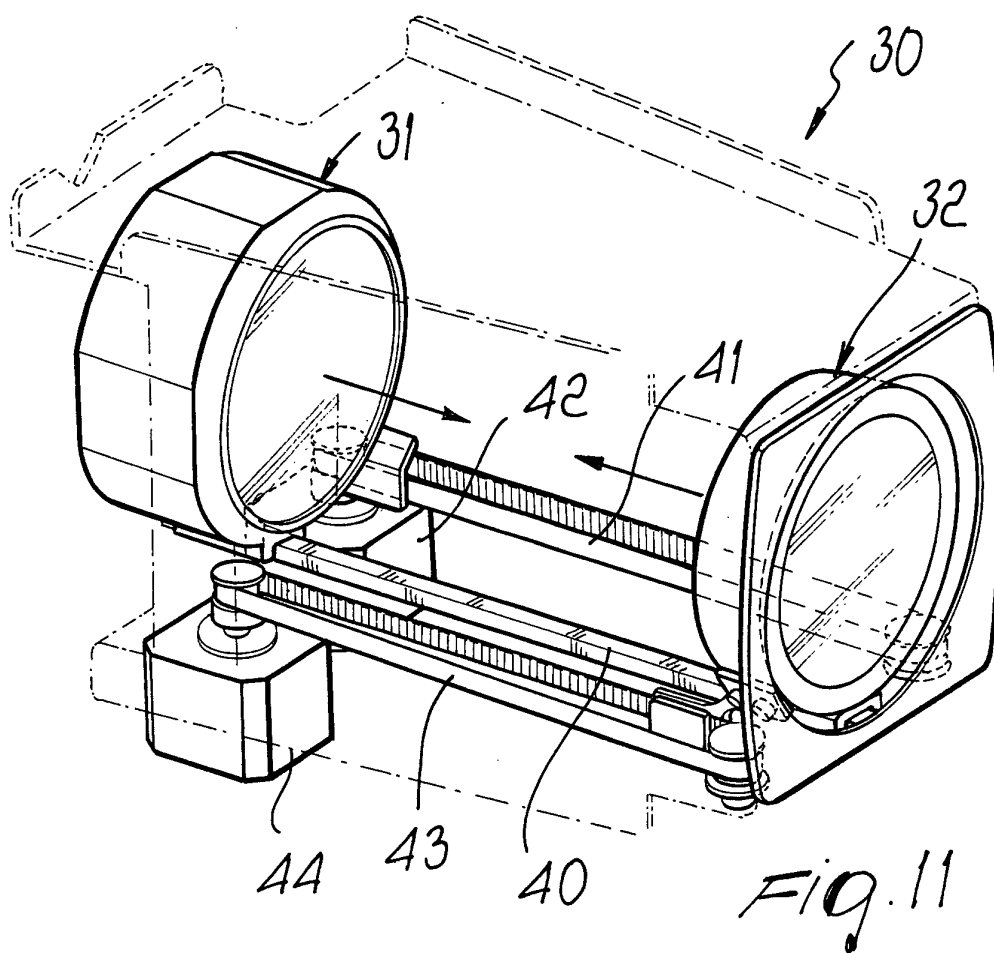
14. The projector according to claim 9, **characterized in that** it comprises, between said focusing unit and said unit for varying the focal length, a wheel with rotating prisms.

15. The projector according to claim 11, **characterized in that** it comprises automatic means for actuating said focusing unit according to the position of said rotating assembly.

16. The projector according to claim 9, **characterized in that** said focusing unit is actuated manually.

17. The projector according to claim 9, **characterized in that** said unit for varying the focal length variation device comprises a first lens set and a second lens set, said first set having two double-convex lenses and said second set having a double-concave lens, said first and second sets being able to slide with respect to each other.

18. The projector according to claim 17, **characterized in that** it comprises a sliding guide which supports said first and second sets, said first set being connected to a first belt which is actuated by a first variation motor of the step type, said second set being connected to a second belt which is connected to a second variation motor of the step type, said variation motors being actuatable independently.



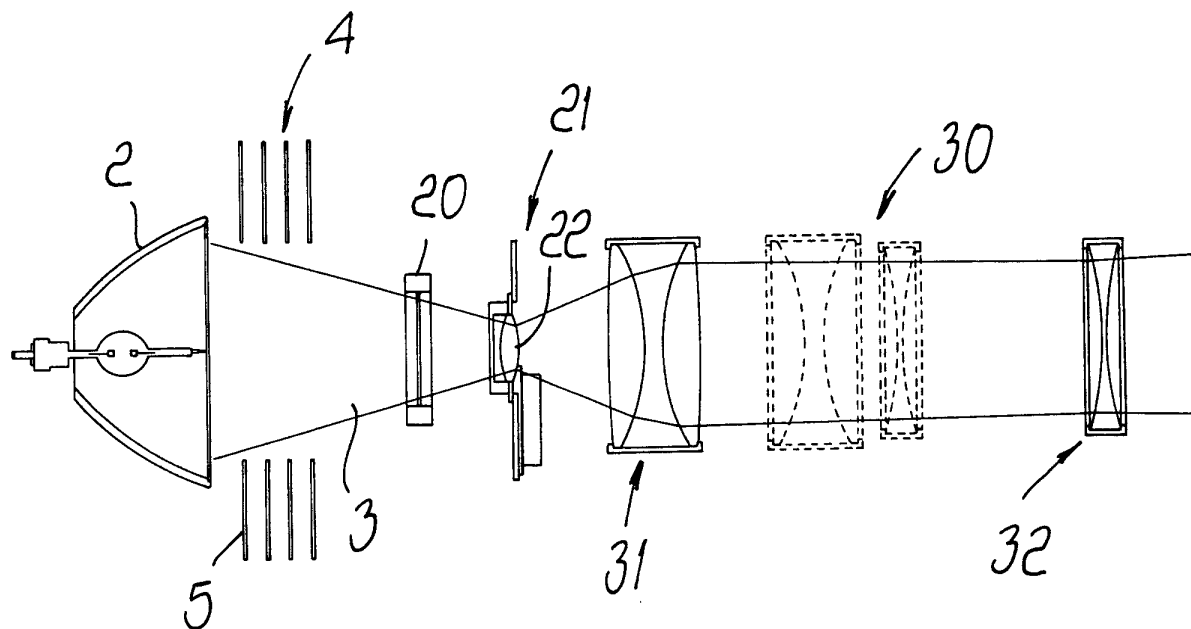


Fig. 2

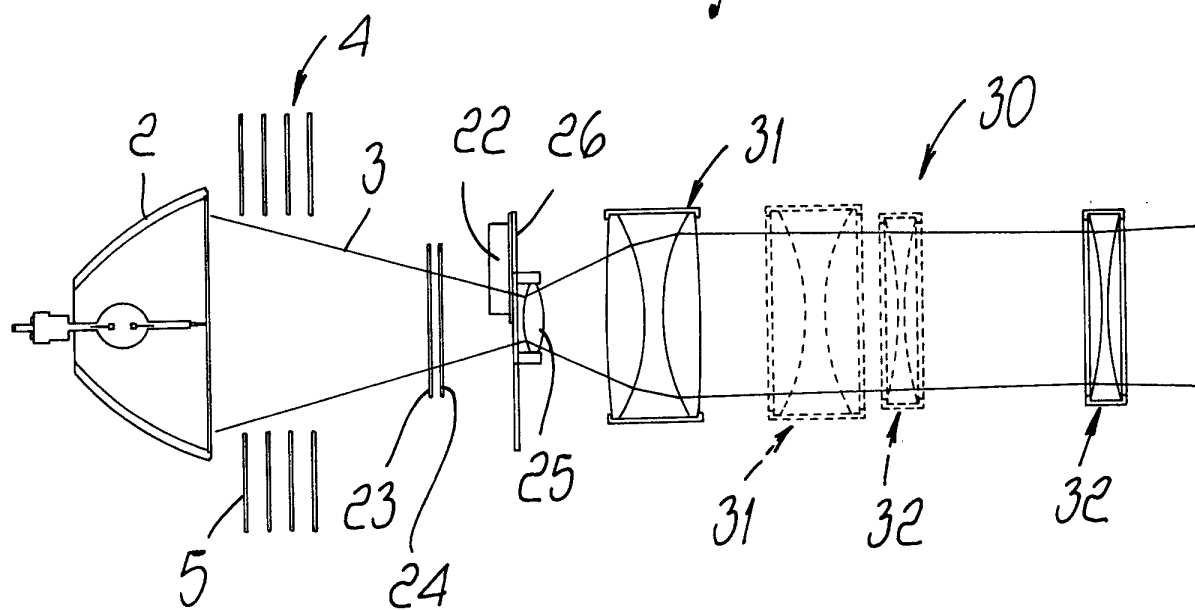
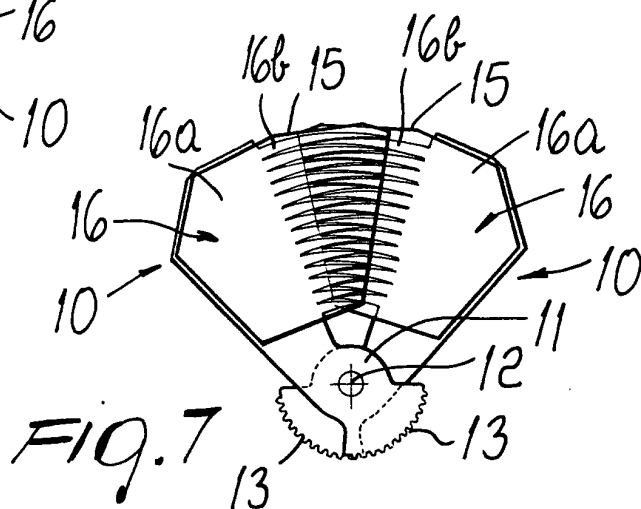
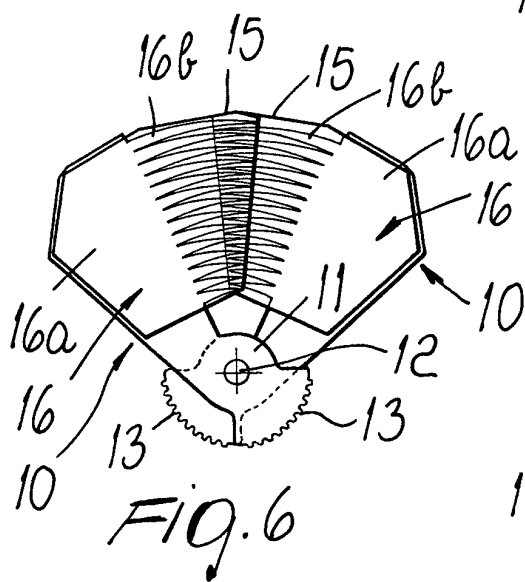
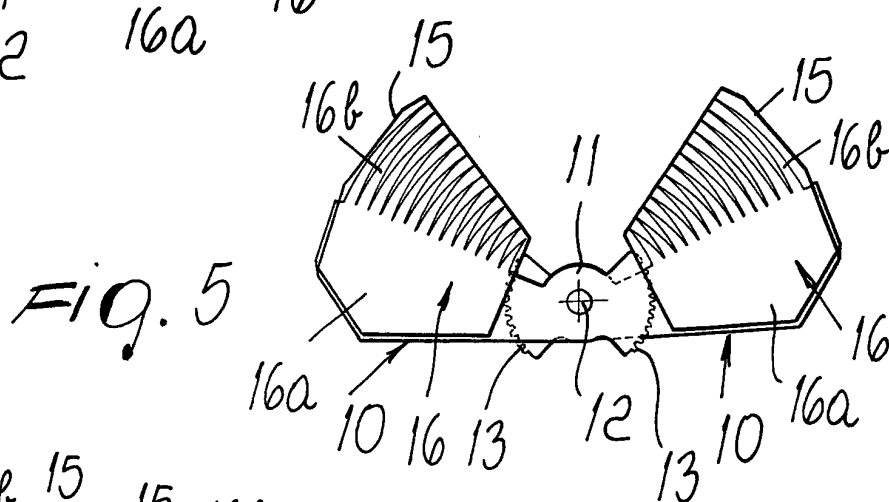
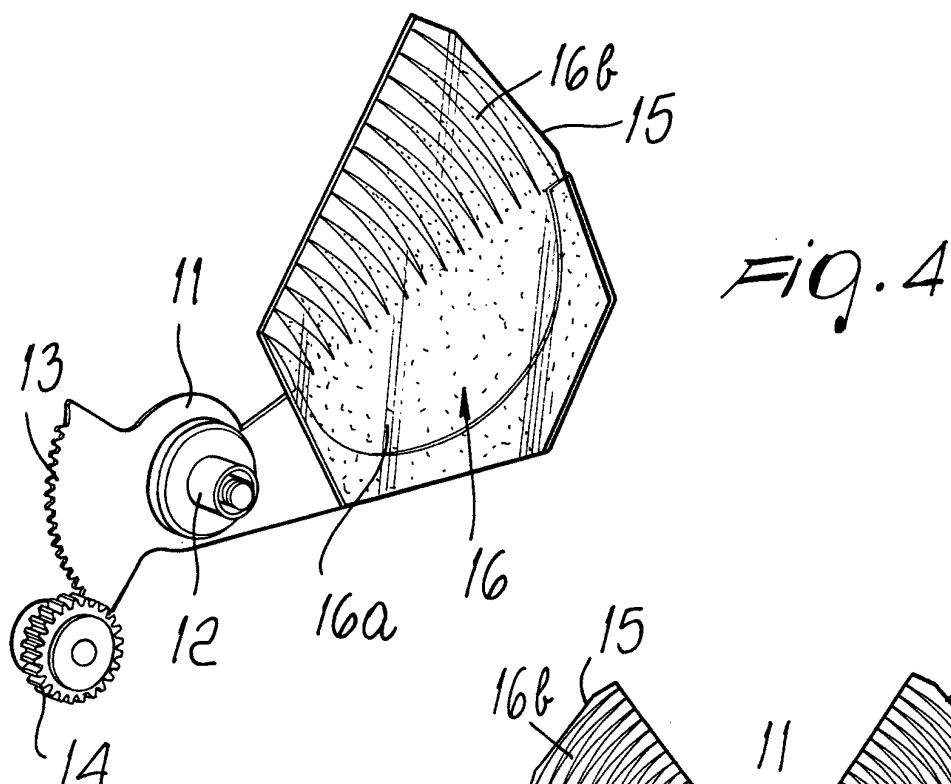
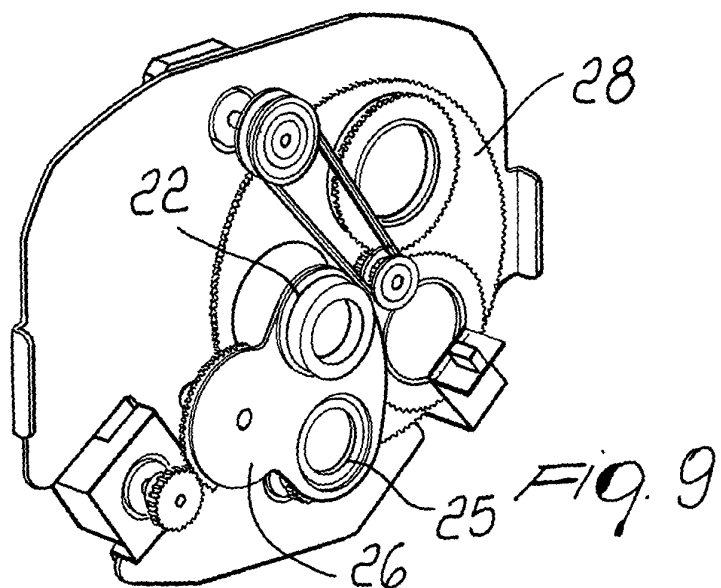
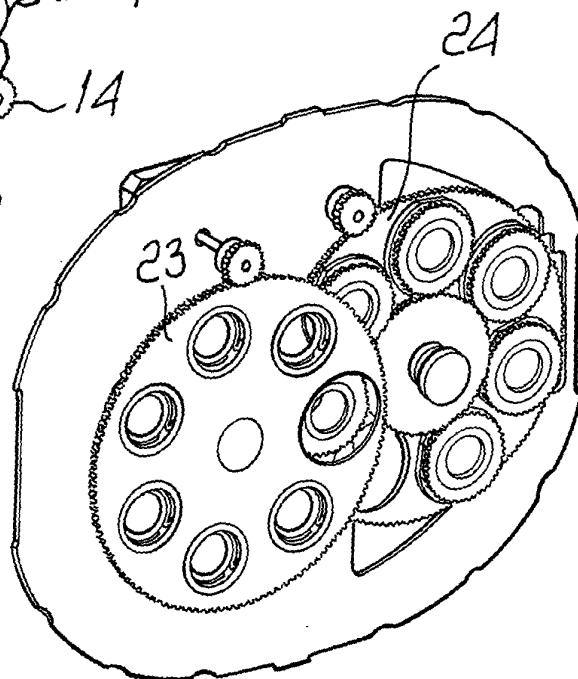
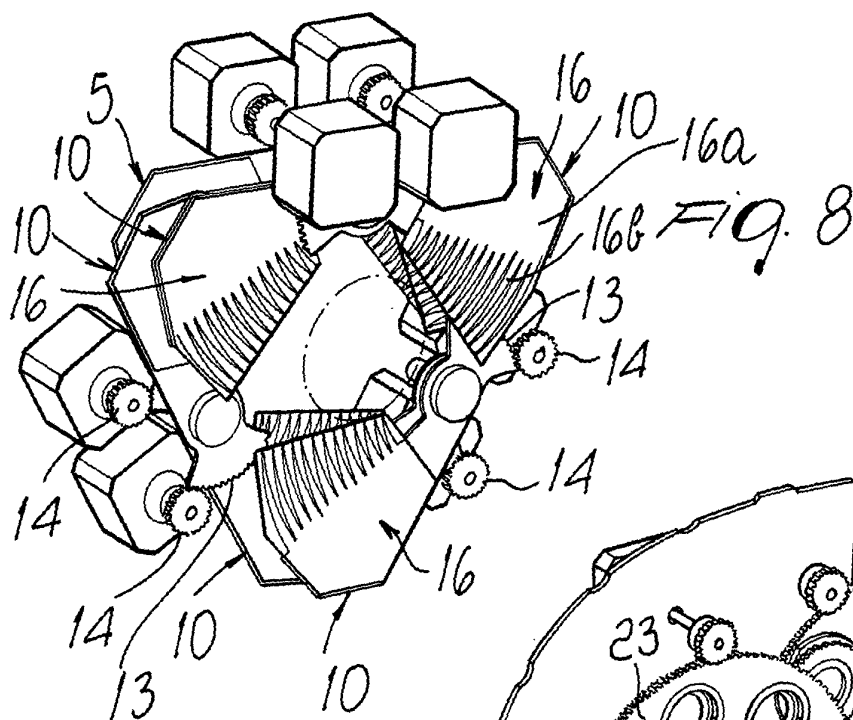


Fig. 3







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 9304

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.7)
X	EP 0 415 164 A (VARI LITE INC) 6 March 1991 (1991-03-06) * column 5, line 45 - column 6, line 1 * * figure 1 *	1	F21S8/00 F21W131/406 F21V9/10
X	US 5 622 426 A (FRY ROBERT A ET AL) 22 April 1997 (1997-04-22) * column 2, line 43 - column 3, line 16 * * figures 2,3 *	1	
X	EP 0 828 111 A (ALTMANN) 11 March 1998 (1998-03-11) * column 4, line 7 - line 25 * * figure 1 *	9	
X	GB 2 310 035 A (WATTS STEPHEN ERNEST ;FLEETWOOD ALAN (GB)) 13 August 1997 (1997-08-13) * page 3, line 11 - line 22 * * figure 1 *	1	
Y		2,4,6-8	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
X	EP 0 352 754 A (MORPHEUS LIGHTS, INC.) 31 January 1990 (1990-01-31) * column 4, line 42 - column 5, line 54 * * column 7, line 14 - column 8, line 20 * * figures 4-7 *	1,9,17, 18	F21P F21V F21S
Y		10,14	
X	US 5 795 058 A (OWEN KEITH JAMES) 18 August 1998 (1998-08-18) * column 2, line 3 - line 7 * * column 2, line 22 - line 23 * * column 3, line 24 - line 37 * * figures 1A-1C,3 *	1,9,17, 18	
Y A		6 2	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 August 2001	Examiner De Mas, A
CATEGORY OF CITED DOCUMENTS		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	
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			

EPO FORM 1503 03.02 (P04C01)



European Patent
Office

Application Number
EP 00 11 9304

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 11 9304

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.7)	
Y	DE 195 23 351 A (FEDDERSEN CLAUSEN OLIVER ;WELM KLAUS DIPL ING FH (DE)) 2 January 1997 (1997-01-02) * column 2, line 58 - column 6, line 13 * * figures 1-9 *	2,4,8,10		
A	----	1,9		
Y	GB 629 266 A (SKEVES) 6 October 1949 (1949-10-06) * page 3, line 82 - page 4, line 13 * * figures 2,4-7 *	7		
A	----	1,2,5		
Y	US 5 934 794 A (HUTTON) 10 August 1999 (1999-08-10) * column 2, line 27 - column 4, line 21 * * column 5, line 11 - line 24 * * figures 1-3,8 *	14		
A	----	9-13,15,16		
A	US 5 053 934 A (KREBS) 1 October 1991 (1991-10-01) * figures 1,2 * * column 5, line 24 - line 57 *	1,2,4,8		TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	WO 97 05423 A (WYNNE WILLSON GOTTELIER LTD.) 13 February 1997 (1997-02-13) * page 17, line 7 - page 19, line 1 * * figures 8-11 *	1,2,5		
A	WO 99 67569 A (ELECTRONIC THEATRE CONTROLS) 29 December 1999 (1999-12-29) * page 7, line 10 - page 8, line 14 * * page 9, line 9 - line 21 * * figures 1-5 *	9,17,18		
The present search report has been drawn up for all claims				
Place of search THE HAGUE		Date of completion of the search 16 August 2001	Examiner De Mas, A	
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				

EPO FORM 1503 03/02 (P04001)



European Patent
Office

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number
EP 00 11 9304

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-8

Projector comprising a color changer interposed between light source and image focusing unit.

2. Claims: 9-18

Projector comprising a unit for varying the focal length of said projector located downstream of a focusing unit.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 11 9304

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-08-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0415164 A	06-03-1991	US 5031078 A JP 3116602 A	09-07-1991 17-05-1991
US 5622426 A	22-04-1997	US 5626416 A US 5816690 A	06-05-1997 06-10-1998
EP 828111 A	11-03-1998	DE 19643220 C	12-02-1998
GB 2310035 A	13-08-1997	NONE	
EP 352754 A	31-01-1990	US 5029992 A AU 623160 B AU 3893589 A JP 2160301 A	09-07-1991 07-05-1992 01-02-1990 20-06-1990
US 5795058 A	18-08-1998	AU 4724593 A CA 2142619 A EP 0655144 A WO 9404951 A	15-03-1994 03-03-1994 31-05-1995 03-03-1994
DE 19523351 A	02-01-1997	DE 19549485 A	23-10-1997
GB 629266 A	15-09-1949	NONE	
US 5934794 A	10-08-1999	AU 9387898 A WO 9917052 A	23-04-1999 08-04-1999
US 5053934 A	01-10-1991	NONE	
WO 9705423 A	13-02-1997	AT 185616 T AU 715871 B AU 6622896 A CA 2227788 A DE 69604673 D DE 69604673 T EP 0840873 A US 6102554 A	15-10-1999 10-02-2000 26-02-1997 13-02-1997 18-11-1999 08-06-2000 13-05-1998 15-08-2000
WO 9967569 A	29-12-1999	US 6092914 A EP 1097341 A	25-07-2000 09-05-2001

EPO FORM P0489

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82