



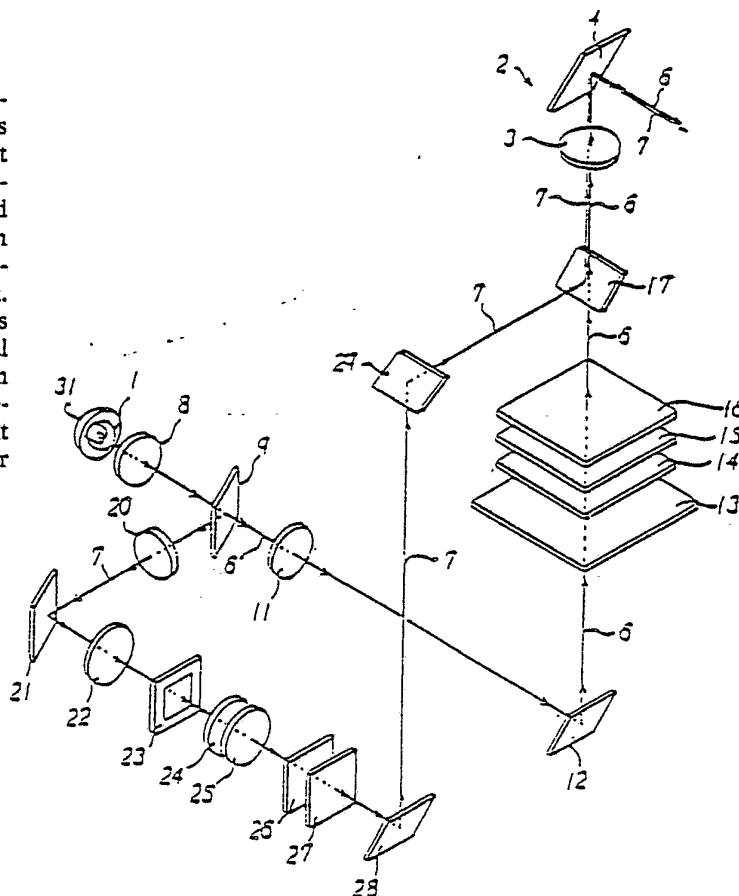
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/SE86/00541 (22) International Filing Date: 26 November 1986 (26.11.86) (31) Priority Application Number: 60/268216 (32) Priority Date: 28 November 1985 (28.11.85) (33) Priority Country: JP (71)(72) Applicants and Inventors: ÖSTBERG, Olof [SE/US]; Department of Industrial Engineering, University of Wisconsin-Madison, 1513 University Avenue, Madis- on, WI 53706 (US). TSUNEHIRO, Takeda [JP/JP]; TAKEO, Iida [JP/JP]; YUKIO, Fukui [JP/JP]; Indus- trial Products Research Institute, 1-1-4, Yatabe Hi- gashi, Tsukuba Science City, Ibaraki 305 (JP).		(74) Agents: HOLMQVIST, Lars, J., H. et al.; Lars Holmqv- ist Patentbyrå AB, P.O. Box 4289, S-203 14 Malmö (SE). (81) Designated States: AT (European patent), BE (Euro- pean patent), CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (Euro- pean patent), IT (European patent), LU (European patent), NL (European patent), NO, SE (European patent). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt</i> <i>of amendments.</i> Date of publication of the revised version of the inter- national search report: 16 July 1987 (16.07.87)

(54) Title: A PROJECTION AND DISPLAY APPARATUS

(57) Abstract

A projection and display apparatus comprising a light source (1) and a projecting means (2) for projecting light beams from the light source towards a screen. The apparatus comprises a first light-path (6) including an overhead printer sheet (16) to be displayed on the screen and a second light-path (7) including a slide projector film (23) to be displayed on the screen. The light beams are selectively directed towards either of the light-paths (6, 7). Liquid crystal shutters (15, 27) are interposed in each light-path and controlled by an electric voltage to selectively prevent or allow the passage of the light beams for selecting either of overhead printer sheet or slide projector film.



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A PROJECTION AND DISPLAY APPARATUS

FIELD OF THE INVENTION

The present invention relates to an image projection and display device that can be used either as an overhead projector or as a slide projector.

5

PRIOR ART

In preparing educational papers and the flexibility related to the presentation of a variety of data to research institutes and educational members, the use of overhead projectors (OHP) have steadily grown. However, the picture and figures of an overhead projector, when projected on a screen, are often distorted. Moreover, it is difficult to transport and control such overhead projection sheets. Thus, 35 mm slide film projectors are still made available in many symposiums and assemblies. A large number of scholars, scientists, and professors desire to gain access to materials prepared by both of these formats so that they can use both materials at the same time. However, simultaneous application of both the overhead projector and 35 mm slide projector involves difficulties.

20 In addition, since the optical path overlaps between the OHP projector and the 35 mm slide projector in certain portions, either of these devices must be moved for example, the OHP device should be removed when using the 35 mm slide projector. This certainly creates a problem from the handling viewpoint.

25

SUMMARY OF THE INVENTION

The object of the present invention is to provide a new device for displaying and projecting images by selectively switching to either of the overhead projector or 35 mm slide projector so that
5 the inherent advantages of both devices can be used.

According to the invention there is provided a projection and display apparatus comprising a light source emitting light beams; and a projecting means for projecting said light beams towards a screen. The apparatus comprises a first light-path including an
10 overhead printer sheet to be displayed on the screen; a second light-path including a slide projector film to be displayed on the screen; directing means for selectively directing said light beams towards either or both of said light-paths; control means for controlling the light beams in said light-paths; and combining means
15 for combining the light-paths for passing the light beams to said projecting means.

Said control means could be liquid crystal shutters interposed in each light-path and controlled by an electric voltage to selectively prevent or allow the passage of the light beams or
20 alternatively mechanical shields to be inserted in the light-path to prevent the passage of the light beams.

Preferably, said directing means comprises a first half-mirror dividing the light beams from the light source into two equal parts each passing through the corresponding light-path.

25 Alternatively, said directing means and control means are said light source being arranged to be directed in two different directions by rotation thereof or offset by displacement thereof to direct the light beams into one of said first or second light-paths and thereby controlling the light beams in the relevant light-path,
30 or a mirror being movable between a retracted position allowing the light beams to pass straight ahead to the first light-path, and an extended position reflecting the light beams to the second light-path.

Said combining means could be a half-mirror, or alternatively a
35 mirror which is movable between a retracted position allowing the light beams from the first light-path to pass to the projecting means and an extended position reflecting the light beams from the

second light-path to the projecting means.

Preferably, said liquid crystal shutters are protected by a transparent heat absorbing sheet. each light-path is provided with imaging elements such as mirrors and lenses in order to project the
5 overhead printer sheet and slide projector film on the screen in equal sizes or magnitudes.

SHORT DESCRIPTION OF THE DRAWINGS

The invention is described in more details below by means of a
10 preferred embodiment of the invention during reference to the drawing, the only figure of which is a schematic, isometric and exploded view of said embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

15 Referring to Fig. 1 the projection and display apparatus according to the invention comprises a light source 1 and a beam-projecting means comprising a lens 3 and a mirror 4. The light source 1 is surrounded by a semispherical mirror 31. To allow selective switching operation to use either the first light-path 6
20 or the second light-path 7 between the light source 1 and the beam-projecting means 2, there is arranged an half-mirror 9 that splits the light path into two parts. The half-mirror 9 is installed at a position immediately before the light source after a condensor lens 8.

25 Thus, the light beams issued by the light source 1 passes along the first light-path 6 and thence through an overhead printer sheet 16, whereas the light beams passing along the second light-path 7 goes through a slide projector film 23 before either of these beams are eventually projected against a screen (not shown) by the
30 beam-projecting means 2.

The first light-path 6 is provided with a Fresnel lens 13, a transparent heat-absorbing sheet 14, a transmission-type liquid crystal shutter 15 which is opened and closed by a voltage applied to the shutter, and said overhead projector sheet 16, said members
35 being preceeded by a lens 11 and a mirror 12. Thence, the light beams pass through a half-mirror 17 and reach said beam-projecting means 2 provided immediately after said half-mirror 17.

Consequently, light beams passing through said first light-path 6 are controlled by said liquid crystal shutter 15 between light source 1 and beam-projecting means 2. Thus, only when said liquid crystal shutter 15 is open, beams from light source 1 can be projected against the screen by the beam-projecting means 2 through overhead projector sheet 16.

Correspondingly, the second light-path 7 is provided with a lens 20, a mirror 21, a lens 22, a slide projector film 23, lenses 24 and 25, a transparent heat-absorbing sheet 26, a transmission-type liquid crystal shutter having identical construction as said liquid crystal shutter 15, and a mirror 28. In addition, the second light-path 7 is provided with a mirror 29 which reflects beams from the mirror 28 towards the half-mirror 17 so that beams reflected by the half-mirror 17 can be transmitted to said beam-projecting means 2. Consequently, the light path between half-mirror 17 can be transmitted to said beam-projecting means 2. As a result, the light path between half-mirror 17 and beam-projecting means 12 is common for the first and second light paths 6 and 7. Those lenses included in the first and second light paths 6 and 7 make up the scale factor of the included image to be almost equal to each other, thus eventually allowing images to be projected against the screen for display to become almost equal in magnitude between both light-paths.

Note that said heat-absorbing sheets 14 and 26, respectively, protect transparent liquid crystal shutters 15 and 27 from heat generated by light source 1.

The projection and display device provided with above-mentioned elements is effectively used both as an overhead projector and a slide film projector. When the device should be used as an overhead projector, the transparent liquid crystal shutter 15 of the first light-path 6 is opened, and the transparent liquid crystal shutter 27 is closed. Thus, light beams from the light source 1 will pass through the first light-path 6, and the image of the overhead projector sheet 16 is projected against the screen by the mirror 4 of beam-projecting means 2. Correspondingly, when the device should be used as a slide projector, the transparent liquid crystal shutter 15 of the first light-path 6 is closed and the transparent liquid

crystal shutter 27 of the second light-path 7 is opened. Thus, light beams from the light source 1 will pass through the second light-path 7 and the image of the slide projector film 23 is reflected by mirrors 28 and 29 and reflects from half-mirror 17 to arrive at beam-projecting means 2 before it is eventually projected against the screen by the mirror 4. Since the scale factor of the optical system for use with the slide projector film is designed to be almost equal to that for use with the overhead projector sheet, it is possible for the present device to project and display the intended image having a magnitude almost equal to each other when projected through either of light-paths 6 and 7.

In addition to the light-path switching means described above, a variety of other means may also be used. For example, there may be arranged mechanical shutter means in the periphery of lenses 11 and 20. Alternatively, the condensor lens 8 may be arranged in a beam-projecting hole prepared in a part of a reflection plate 31 having spherical hollow configuration while said reflection plate totally surrounds the light source 1. The assembly comprising the light source 1, the reflection plate 31 and condensor lens 8 may alternatively be arranged at the position of half-mirror 9 to allow beams to be emitted through either of said light-paths 6 and 7 by rotating the assembly by 90° . A still further embodiment uses a specific mirror in place of half-mirror shown in Fig. 1 in order to optionally select either of said light-paths 6 and 7 by moving said mirror inside or outside of the light beams from condensor lens 8 to allow beams to propagate through either of these light-paths. The display and projecting device according to the present invention is also easily made up by modifying a conventional overhead projector or slide film projector available today.

From the above it is evident that a projection and display apparatus for both overhead printer sheets and slide projector film has been provided. It is clear that the disclosed embodiment may be amended in many details without departing from the scope of the invention. Specifically, it is pointed out that said shutters 15, 27 both may be opened simultaneously to superpose the images of the slide projector film and the overhead printer sheet. The invention is only limited by the appended claims.

C L A I M S

1. A projection and display apparatus comprising
a light source (1, 31, 8) emitting light beams; and
a projecting means (2, 3, 4) for projecting said light beams
towards a screen;
- 5 c h a r a c t e r i z e d by said apparatus comprising
a first light-path (6) including an overhead printer sheet (16)
to be displayed on said screen;
a second light-path (7) including a slide projector film (23)
to be displayed on said screen;
- 10 directing means (9, 17) for selectively directing said light
beams towards either or both of said light-paths;
control means (15, 27) for controlling said light beams in said
light-paths (6, 7); and
combining means for combining said light-paths (6, 7) for
15 passing said light beams to said projecting means (2, 3, 4).
2. The apparatus according to claim 1,
c h a r a c t e r i z e d in that said control means (15, 27) is
liquid crystal shutters interposed in each light-path (6, 7) and
controlled by an electric voltage to selectively prevent or allow
20 the passage of said light beams.
3. The apparatus according to claim 2,
c h a r a c t e r i z e d in that said control means is mechanical
shields to be inserted in said light-path (6, 7) to prevent the
passage of said light beams.
- 25 4. The apparatus according to any of the preceeding claims,
c h a r a c t e r i z e d in that said directing means (9, 17)
comprises a first half-mirror (9) dividing said light beams from
said light source into two equal parts each passing through the
corresponding light-path (6, 7).
- 30 5. The apparatus according to any of claims 1 - 3,
c h a r a c t e r i z e d in that said directing means and control
means are said light source (1) being arranged to be directed in two
different directions by rotation thereof or offset by displacement
thereof to direct said light beams into one of said first or second
35 light-paths and thereby controlling said light beams in the relevant
light-path.

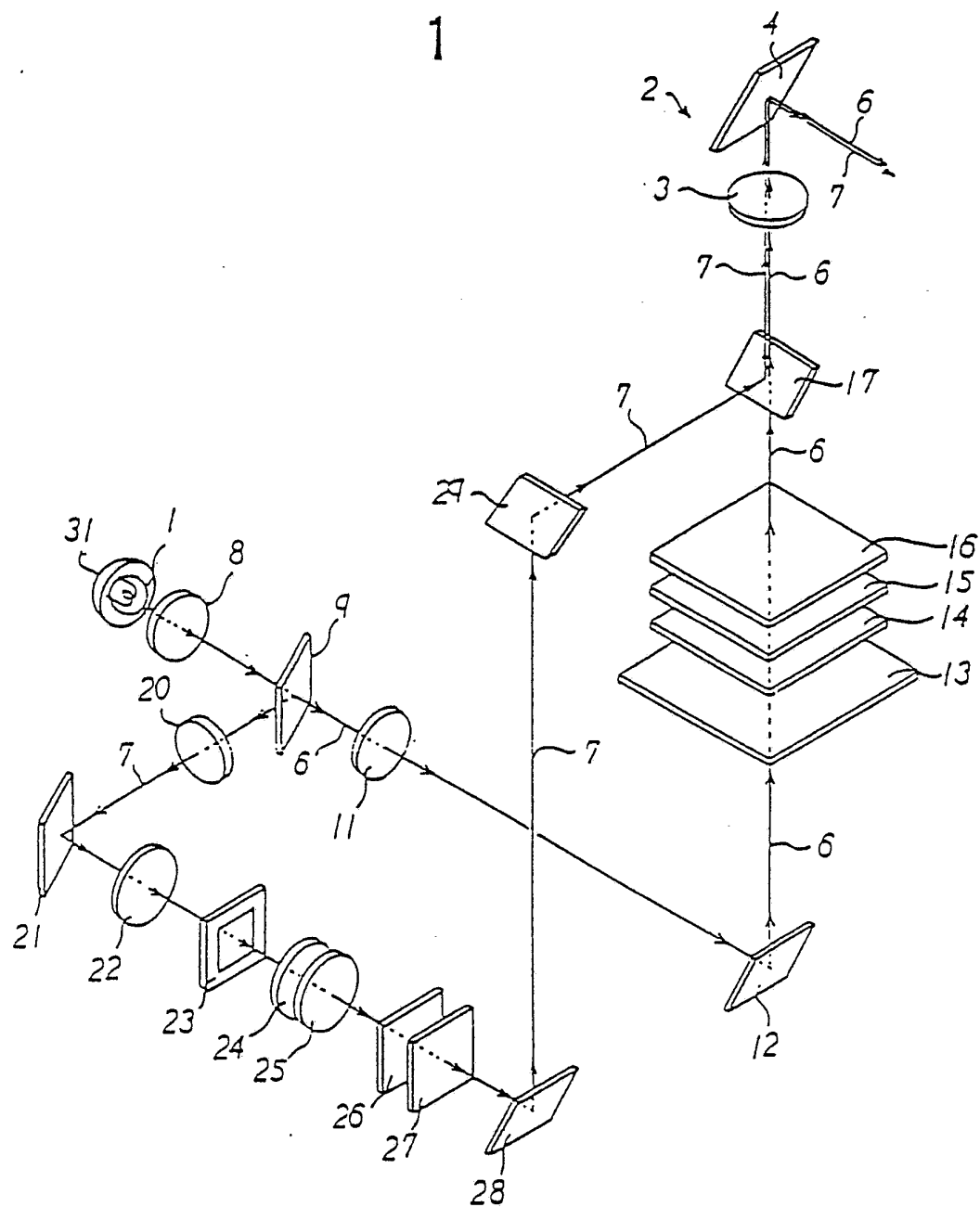
6. The apparatus according to any of claims 1 - 3,
c h a r a c t e r i z e d in that said directing means and control
means are a mirror being movable between a retracted position
allowing said light beams to pass straight ahead to said first
5 light-path, and an extended position reflecting said light beams to
said second light-path.

7. The apparatus according to any of the preceeding claims,
c h a r a c t e r i z e d in that said combining means is a
half-mirror (17).

10 8. The apparatus according to any of claims 1 - 7,
c h a r a c t e r i z e d in that said combining means is a mirror
being movable between a retracted position allowing said light beams
from said first light-path to pass to said projecting means and an
extended position reflecting said light beams from said second
15 light-path to said projecting means.

9. The apparatus according to claim 2,
c h a r a c t e r i z e d in that said liquid crystal shutters (15,
27) are protected by a transparent heat absorbing sheet (14, 26).

10. The apparatus according to any of the preceeding claims,
20 c h a r a c t e r i z e d in that each light-path is provided with
imaging elements such as mirrors and lenses for projecting said
overhead printer sheet and said slide projector film on said screen
in equal sizes.



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00541

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
G 03 B 21/00 4		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC 4	G 03 B 21/00, /08, /132, /134, /14, /26, /28, 27/28, /58-/62	
US C1	353:20, 34, 37, 44, 50, 51, 63, 64, .../...	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US, A, 4 033 685 (KEIICHI UNO ET AL) 5 July 1977	
A	Patent Abstract of Japan abstract of JP 60-41032 (CANON KK) 4 March 1985	
<p>¹⁰ Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
1987-06-12		16 JUN 1987
International Searching Authority		Signature of Authorized Officer
Swedish Patent Office		Björn Kallstenius

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II Fields Searched (cont).

US CI 353:66, 68, 73, 78, 82, 83, 88, 89,
90, 97, 98, 99, 121, 122, 77

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers _____, because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.