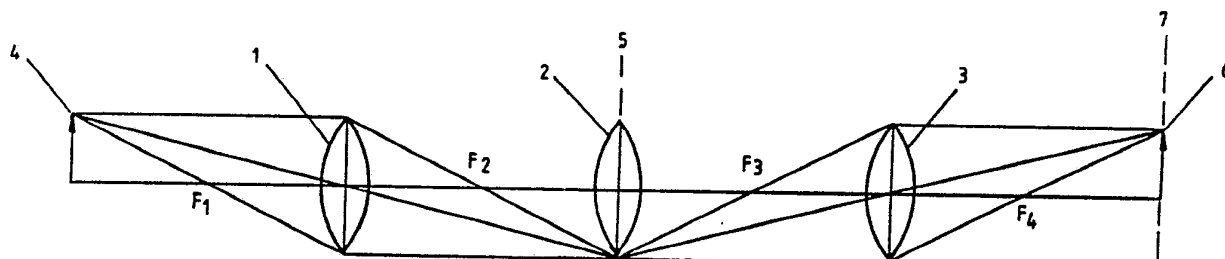


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: A REPROGRAPHIC LENS SYSTEM AND A REPROGRAPHIC CAMERA COMPRISING SUCH A SYSTEM



(57) Abstract

A symmetrical lens system for a copy camera comprising a three part system consisting of a first zoom lens (1), a field lens (2) which can include aperture, stop, filter and other optical elements, like illumination head and a transparent original, and a second zoom lens (3). The field lens (2) is arranged to project the aperture of the first zoom lens (1) upon the aperture of the second zoom lens (3). The lens system will preferably be of use for copy cameras.

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A Reprographic Lens System and a Reprographic Camera
Comprising such a System.

The invention relates to a reprographic lens system consisting of first, second and third subsystems symmetrically aligned about the optical centre of the system, the first subsystem comprising a first zoom
5 lens, the second subsystem a field lens and the third subsystem comprising a second zoom lens.

The construction of lens systems for reprographic cameras indispensably requires that the lens system is symmetrical about its optical centre. This
10 requirement makes it difficult to provide lens systems with variable focal length for that purpose and it has therefore been necessary to make use of different lens systems for obtaining different reproduction ratios.

The object of the present invention is to provide a symmetrical lens system with variable focal
15 length, said lens system being realized on the basis of prior art sectional systems.

This is obtained according to the invention in that the field lens is arranged to reproduce the outlet
20 aperture of the first zoom lens in the inlet aperture of the second zoom lens. Further embodiments of the lens system are stated in claims 2 and 3.

The invention also relates to a reprographic camera of the type in which the object plane and image
25 plane are at the same level and in which the path of beams is broken by two reflecting surfaces, e.g. mirrors or prisms. The camera is characterized in that it includes a lens system of the above mentioned type.

The invention will now be explained in more
30 detail with reference to the drawings, in which

Fig. 1 schematically illustrates an embodiment of a lens system according to the invention,

Figs 2a and 2b illustrate the lens system provided with further elements, and

Fig. 3 illustrates an embodiment of a reprographic camera according to the invention.

Fig. 1 is a schematical view of a lens system according to the invention. The lens system consists of three main elements 1, 2 and 3. Said elements may consist of a number of sections which for the sake of clearness are not shown.

Element 1 produces a real image of the object 4 in a plane 5 coinciding with the plane of symmetry of lens element 2, and element 3 produces a real image 6 of the object 4 in a plane 7.

Lens element 2, the field lens, is formed so that it reproduces the outlet aperture of lens element 1 in the inlet aperture of lens element 3. This provides for obtaining a maximum transfer of light energy from lens element 1 to lens element 3.

According to the present invention lens elements 1 and 3 are formed as elements with variable focal length, so-called zoom lenses. For use in this arrangement they must be designed so that their outlet apertures are in a fixed plane, irrespective of the instantaneous adjustment of the focal length. However, this is no limitation in practice.

In the practical structure of the lens system according to the invention lens systems 1 and 3 are generally identical.

Fig. 2a illustrates how a light source 10, a filter 11 and a transparent original 12 may be inserted instead of lens system 2. It is thus possible to reproduce the transparent original under reproduction circumstances determined by lens system 3. This gives a simple solution to the problems involved in respect of the reproduction of diapositives and similar transparent originals.

As illustrated in Fig. 2b, lens element 2 may also include a diaphragm 14, filters 15, shutters 16

or other members that are desired to be inserted into path of beams.

Fig. 3 shows diagrammatically a reprographic camera according to the present invention, the lens system of which is constructed as explained above. The camera includes an apparatus housing 20 carrying an object plane 21 and an image plane 22. Object plane 21 and image plane 22 are separated by a wall 23 impermeable to light and accommodating lens system 24. Mirrors 25, 26 are arranged to break the path of beams and are stationary in relation to object plane 21, image plane 22 and lens system 24. The light sources 27, 28 illuminate the object plane with a pre-determined light distribution. This design of the camera provides for obtaining considerable operational advantages, the object plane and the image plane being at the same horizontal plane and located at a comfortable working height contrary to the prior art reprographic cameras, that are difficult to operate, particularly on the image plane. This camera may incidentally be equipped with known automatics for illumination, focusing and so on.

The use of the above specified lens system makes it possible to obtain a large range of reproduction ratios without the necessity of using movable mirrors, thereby substantially simplifying the structure and control of the camera. When constructing the camera the path of beams may be broken by other optical elements than mirrors, e.g. prisms.

The described lens system may of course be used in a conventional reprographic camera as well.

P A T E N T C L A I M S

1. A reprographic lens system consisting of first, second and third subsystems symmetrically aligned about the optical centre of the system, the first subsystem (1) comprising a first zoom lens, the second subsystem (2) a field lens and the third subsystem (3) comprising a second zoom lens, characterized in that the field lens (2) is arranged to reproduce the outlet aperture of the first zoom lens (1) in the inlet aperture of the second zoom lens (2).
2. A lens system as claimed in claim 1, characterized in that the field lens (2) includes a diagram (14), shutters (16), filters (15) and/or other optical elements (10, 12) to be inserted into the path of beams.
3. A reprographic lens system as claimed in claim 2, characterized in that said other optical elements include an illuminating unit (10) for transparent originals (12).
4. A reprographic camera of the type in which the object plane and the image plane are at the same level and the path of beams is broken by two reflecting surfaces, e.g. mirrors or prisms, characterized in that the mirrors are stationary and that the camera has a lens system of the type specified in claim 1.
5. A camera as claimed in claim 4, characterized in that the second section may be replaced by a light source (27, 28) and a holder (21) for a transparent original.

AMENDED CLAIMS

[received by the International Bureau on 6 July 1989 (06.07.89)
original claim 3 amended ; other claims unchanged (1 page)]

1. A reprographic lens system consisting of first, second and third subsystems symmetrically aligned about the optical centre of the system, the first subsystem (1) comprising a first zoom lens, the
5 second subsystem (2) a field lens and the third subsystem (3) comprising a second zoom lens, characterized in that the field lens (2) is arranged to reproduce the outlet aperture of the first zoom lens (1) in the inlet aperture of the second zoom lens (2).

10 2. A lens system as claimed in claim 1, characterized in that the field lens (2) includes a diagram (14), shutters (16), filters (15) and/or other optical elements (10, 12) to be inserted into the path of beams.

15 3. A reprographic lens system as claimed in claim 2, characterized in that said field lens (2) is substituted by an illuminating unit (10) for transparent originals (12).

20 4. A reprographic camera of the type in which the object plane and the image plane are at the same level and the path of beams is broken by two reflecting surfaces, e.g. mirrors or prisms, characterized in that the mirrors are stationary and that the camera has a lens system of the type specified in claim 1.

25 5. A camera as claimed in claim 4, characterized in that the second section may be replaced by a light source (27, 28) and a holder (21) for a transparent original.

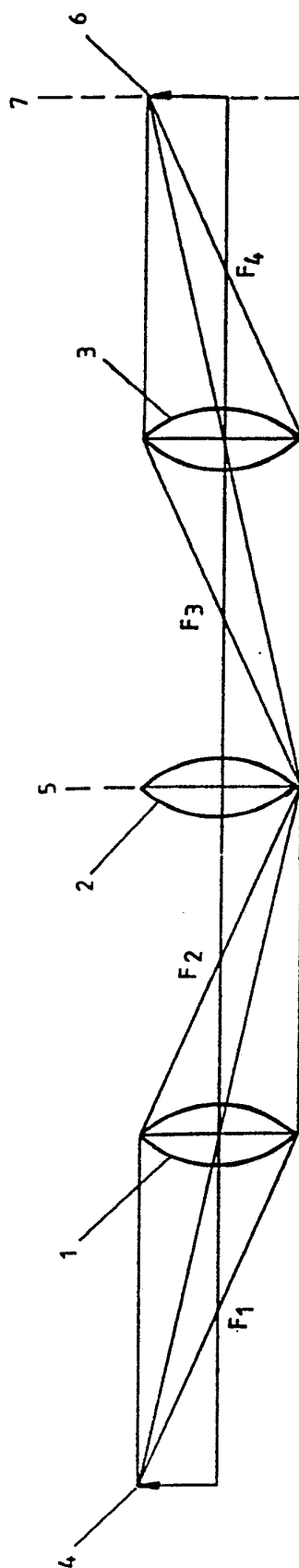


Fig.1

2/3

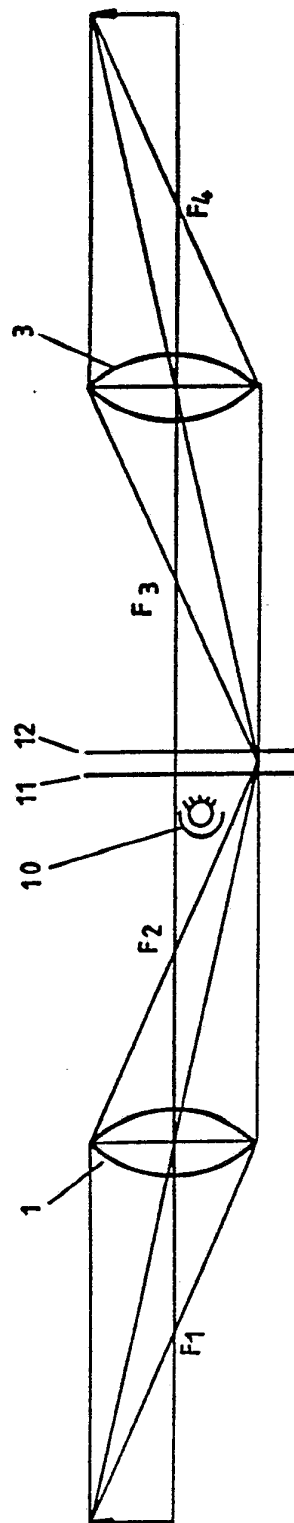


Fig. 2a

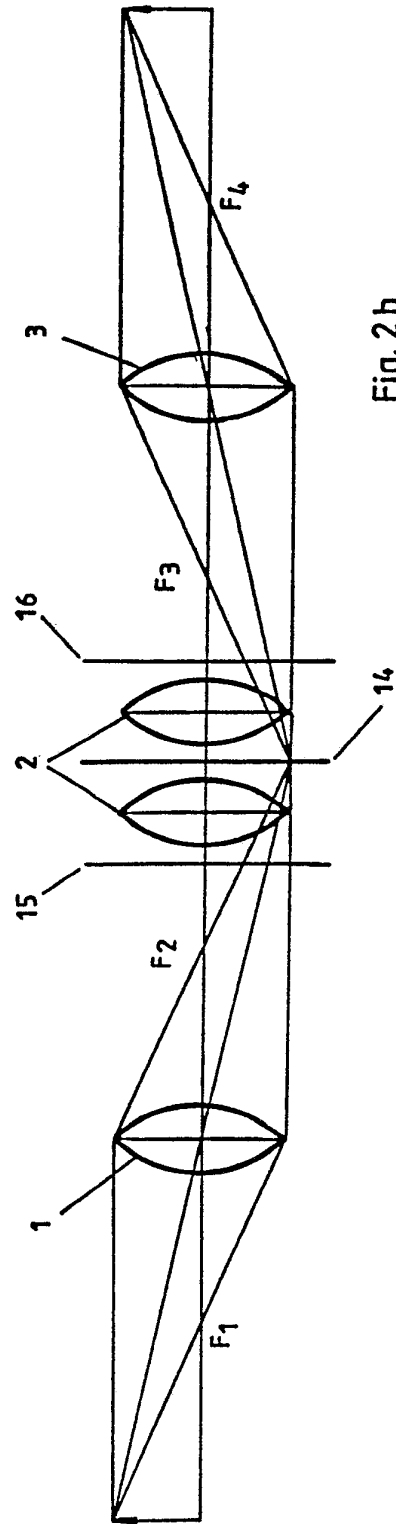


Fig. 2b

3/3

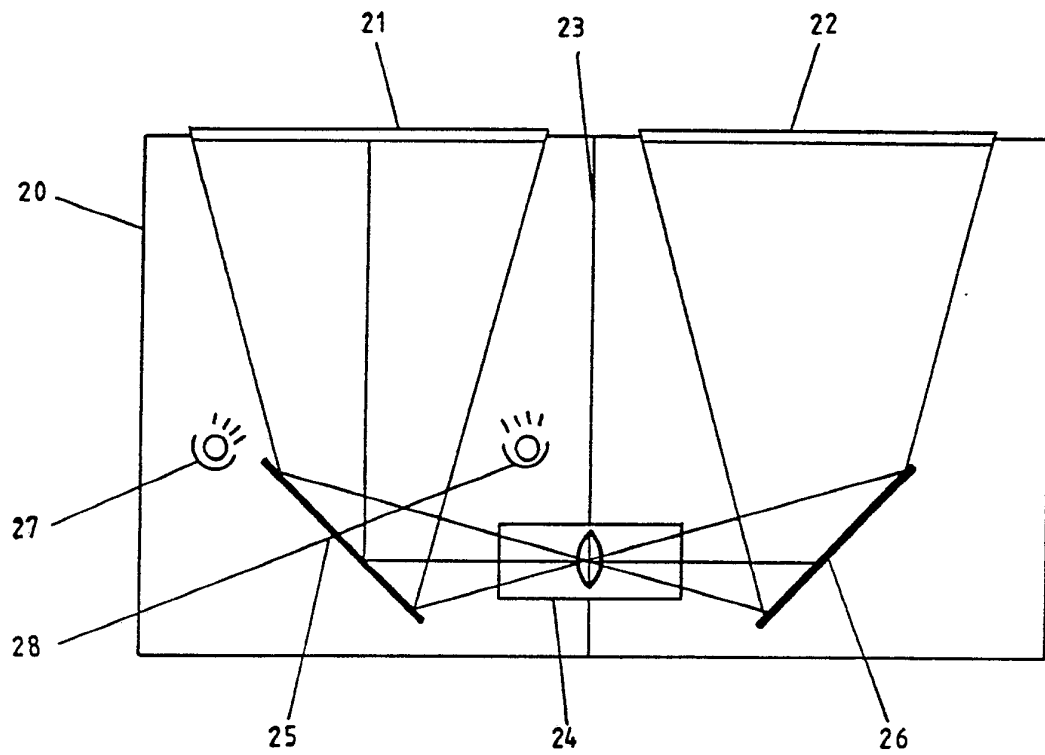
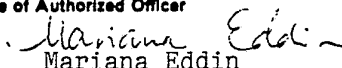


Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK89/00028

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 ⁴		
G 03 B 27/32, G 02 B 13/24		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC 4	G 02 B; G 03 B	
US C1	352; 355	
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
Y	US, A, 3 428 398 (R.E. GOTTSCHALK) 18 February 1969 Fig. 1 & NL, 6607562	1-5
Y	US, A, 3 584 950 (R.W. GRUNDLACH) 15 June 1971 Fig. 3, 4	1,2
Y	US, A, 2 391 430 (J.J. MACEK) 25 December 1945 Fig. 3	3
Y	US, A, 3 045 539 (G.J. DUPRE) 24 July 1962 Fig. 3	4-5
A	US, A, 3 592 542 (H. KÄUFER ET AL) 13 July 1971 Fig. 1 lenses 6, 7 and column 5, lines 22-29 .../...	1
¹⁰ Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "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 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "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. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1989-05-12	1989-05-22	
International Searching Authority	Signature of Authorized Officer	
Swedish Patent Office	 Mariana Eddin	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 1 783 998 (H. CHRÉTIEN) 9 December 1930 Fig. 1	1
A	US, A, 4 264 199 (M.R. KUEHNLE) 28 April 1981 Fig 1	4,5
A	DE, A1, 3 218 514 (CANON K.K) 25 November 1982	1, 4

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

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:

Claims 1-3: Reprographic lens system
 Claims 4-5: Reprographic camera

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.