



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : G03B 17/18, 17/24, 7/16</p>	<p>A1</p>	<p>(11) International Publication Number: WO 91/02285 (43) International Publication Date: 21 February 1991 (21.02.91)</p>
--	-----------	--

(21) International Application Number: PCT/US90/04241
 (22) International Filing Date: 30 July 1990 (30.07.90)
 (30) Priority data:
 387,469 31 July 1989 (31.07.89) US
 (71) Applicant: EASTMAN KODAK COMPANY [US/US];
 343 State Street, Rochester, NY 14650 (US).
 (72) Inventor: BELL, Cynthia, Sue ; 18 Westover Drive, Webster, NY 14580 (US).
 (74) Agent: DUGAS, Edward; 343 State Street, Rochester, NY 14650-2201 (US).

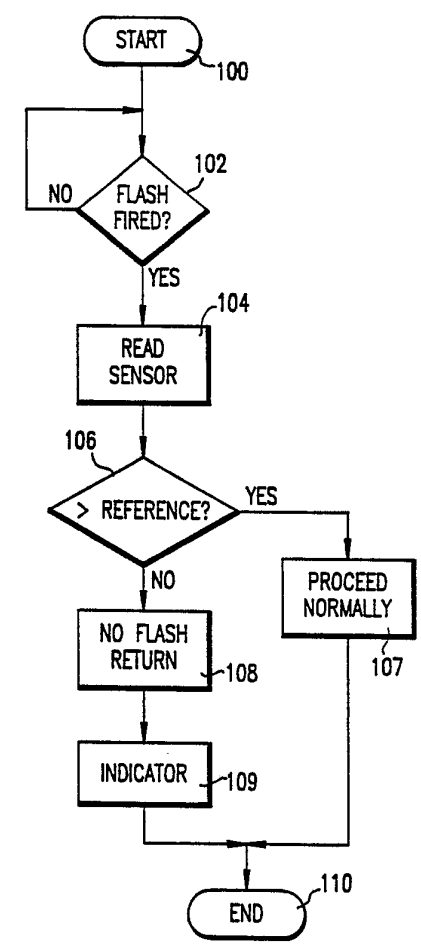
(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent)*, DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).

Published
*With international search report.
 Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: CAMERA WITH FLASH RETURN SENSING

(57) Abstract

A camera includes both film for recording an image and a solid state image sensor. The solid state sensor determines the brightness level after the flash has been fired in order to determine whether enough light has reached the camera for a proper exposure. If insufficient light is returned from the flash, as in a "stadium" shot, the camera indicates either to the operator or to the printer that this problem exists. Appropriate steps may then be taken either by repeating the shot or by adjusting the printing process.



* See back of page

DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MC	Monaco
AU	Australia	FI	Finland	MG	Madagascar
BB	Barbados	FR	France	ML	Mali
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Fasso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GR	Greece	NL	Netherlands
BJ	Benin	HU	Hungary	NO	Norway
BR	Brazil	IT	Italy	PL	Poland
CA	Canada	JP	Japan	RO	Romania
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	LI	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
DE	Germany	LU	Luxembourg	TD	Chad
DK	Denmark			TG	Togo
				US	United States of America

-1-

CAMERA WITH FLASH RETURN SENSINGBACKGROUND OF THE INVENTIONField of the Invention:

The present invention relates to a
5 photographic camera and more particularly to a camera
including both photographic film and a solid state
sensor.

Discussion of the Background

Cameras are known which both record an image
10 on photographic film and also produce an image
electronically. In general, these cameras include not
only traditional optics and film handling mechanisms for
the film but also include a solid state imager to view
the image electronically. The electronic image is used
15 to preview a scene before exposing the film or to
review a shot to ascertain that the composition in the
picture is correct.

U.S. Patent 4,742,369 shows a camera having
both photosensitive film and a solid state imaging
20 element. This camera as well as other prior art
includes basically two separate systems to record the
film image and the electronic image.

A more advanced camera has recently been
described in copending application 288,887 which was
25 filed in the U.S. Patent and Trademark Office on
December 20, 1988. In this device, the electronic and
film recording mechanisms are integrated so as to form
a less expensive and less complicated device. This
camera also has a number of functions which are
30 controlled by the solid state image sensor. Thus,
functions such as exposure control and autofocus can be
accomplished. Furthermore, the image sensed
electronically can also be displayed to the operator.
However, this camera does not provide for the function
35 of determining whether proper illumination has resulted
from the use of a flash and in particular no mechanism .

-2-

is available for taking remedial steps if the flash is insufficient.

SUMMARY OF THE INVENTION

5 It is therefore an object of the present invention to provide a novel camera function which measures the brightness level after a flash has been fired.

10 It is a further object of the invention to provide a method for sampling the brightness level after a flash and determining whether it is sufficiently bright or not and for providing an indication of this.

15 It is a further object of the invention to provide a method for correcting the situation of too little light being returned from a flash.

20 Another object of the present invention is to provide an inexpensive and uncomplicated camera which can determine whether a minimum brightness level has been returned from the flash and which can indicate to the operator or to the printer the fact that insufficient flash return has resulted.

25 Briefly these and other objects of the invention are achieved by providing a solid state image sensor which can be sampled after a flash has occurred to determine the brightness level of the returned flash. This is compared to a reference level and if the brightness is below a minimum, an indication of this may be displayed. The indication may be to the operator or may be indicated on the film so that the
30 printer may overcome the problem.

-3-

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIGURE 1 is a schematic overall view of the camera in which the present invention may be placed;

FIGURE 2 is a schematic of the solid state image sensor used in the present invention;

FIGURE 3 is a schematic of the controller used in the present invention; and

FIGURE 4 is a flow chart indicating the sequence of the operation used in the present invention.

Various other objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the accompanying drawings in which like reference characters designate like or corresponding parts throughout the several views and in particular FIGURE 1 which shows the overall arrangement of a camera in which the present invention may be utilized.

The camera 10 includes optical elements 14 and 16 which are disposed along an axis 18. Incoming light is carried along this axis and reflected by mirror 20 onto a ground glass viewing screen 88. The image on this screen may be viewed through viewfinder 24 which include a prism 26, mirror 30 and eyepiece 28. When a shot is to be taken, the mirror 20 pivots upwardly to a horizontal position so as to expose film 32.

A solid state image sensor 40 is also provided which receives light from beamsplitter 42 which is placed on the optical axis 18. The light is focused onto the sensor by means of lens 44. A

-4-

splitter may be used which transmits about 80% of the light to the film and about 20% to the image sensor 40. The camera includes a number of other parts, which are not shown in the figures for the sake of clarity.

5 Although the present invention is shown in conjunction with a camera having film and a solid state imager, it could also be used for cameras having totally electronic sensors. it can also be used for moving picture cameras of either type.

10 The sensor can be a charge-coupled device (CCD) such as an interline CCD image sensor, number KAI-0280, manufactured by Eastman Kodak Company of Rochester, New York. This type of sensor uses photodiodes as the image sensing elements. However,
15 other types of sensors could be used as well.

FIGURE 2 shows the arrangement of the photodiodes 53 in a matrix on the sensor 40. The photodiodes are connected to a series of vertical shift registers 55. The charge collected on each photodiode
20 is transferred to the corresponding shift register and then transported to a single horizontal shift register 57. An output section 61 converts the charge to a voltage signal. Clock signals are provided to shift the registers at appropriate times.

25 Since the present sensor may be utilized for a number of functions, it is preferable to include an entire matrix as shown in FIGURE 2. However, for the function of the present invention it is only necessary to utilize a single photo diode, a small group of
30 photodiodes or a single column of photodiodes. Thus, if other functions are not necessary, a much smaller sensor array can be utilized. Alternatively, if it is necessary to have the entire matrix due to other functions, it is possible to only sense the desired
35 elements, such as a single vertical column.

-5-

The particular functions which are based on the sensor array are controlled by a system controller 70 shown in FIGURE 3. This controller operates in response to inputs from the camera such as the movement of the shutter release and the completion of the flash. Based on these and other inputs, the various functions to control the exposure and to quench the flash may be accomplished. Likewise, the brightness level of the return light from the flash may also be determined by the controller based on the output of the sensor. When the flash has been fired, the controller senses the firing and indicates to the sensor that this has occurred. The sensor samples the light from the flash that is returned by objects in the scene with the elements of the array. The signals from these elements are compared to a reference signal indicating the minimum brightness level which is acceptable. If the minimum brightness level has been equalled or exceeded, the camera continues to operate in a standard fashion. However, if the signal from the sensor is less than that of the reference signal, indicating that the minimum brightness level has not been reached, a signal is sent to the controller to indicate this. This situation may occur in a "stadium" shot, where the objects in the scene are so far removed that very little of the light from the flash is returned. The controller then orders a special procedure. The specific operation taken may include an indication to the operator so that a second shot can be taken. Another possibility is an indication placed on the film so that when the film is being developed, the printer will detect the problem and compensate for the lack of brightness. It may also be possible to extend the exposure period to compensate for the lack of the flash return.

-6-

This particular sequence of events is shown in FIGURE 4 with the start procedure shown as 100. The determination as to whether the flash has been fired is indicated as step 102. If the flash has not yet been
5 fired the process returns to start and repeats until such a determination is made. When the flash has been fired, an order is sent to the sensor for the appropriate elements to be read (step 104). The signals read are compared in step 106 to a reference
10 value. If the values from the sensor are greater than the reference value, the process proceeds normally as indicated by step 107 and the process continues to the end at step 110. If not, the comparison sends a no flash return signal at step 108 to the controller. In
15 step 109 the controller proceeds to give an indication of the problem to the operator or places an indication on the film for the printer to read. After this process is completed the sequence again reaches the end step 110.

20 As indicated above, the indicator step may be replaced by a more positive action such as extending the exposure time of the shot.

If an indication is given to the operator, he has the option of then repeating the shot with the
25 necessary modifications to the exposure time or other parameters in order to produce a good picture. If an indication is placed on the film, the information is given to the developer so that when the printing operation proceeds, appropriate compensation can be
30 given for the lack of light. Of course, if the decision concerning the return light is quick enough, the exposure time of the camera may automatically be extended in order for sufficient light to reach the film and thus indications to either the operator or
35 printer would then be unnecessary.

-7-

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended
5 claims, the invention may be practiced otherwise than as specifically described herein.

-8-

CLAIMS

1. A method of sensing a flash return in a camera having a sensor array and a flash, comprising the steps of:
- 5 detecting the firing of the flash;
sensing with said sensor array after firing the flash the light from the flash which is returned to the camera;
comparing the sensed light with a
10 predetermined value;
producing a signal indicative of too little light when the sensed light is less than said predetermined value.
2. The method according to Claim 1, further
15 comprising the step of indicating to the operator that too little light has been returned.
3. The method according to Claim 1, further comprising the step of placing an indicator on film that too little light has been returned.
- 20 4. The method according to Claim 1, further comprising the step of controlling the camera to increase the exposure time.
5. The method according to Claim 1, further comprising the steps of producing a signal indicative
25 of sufficient light when the sensed light is greater than or equal to said predetermined value; and proceeding normally when said signal indicative of sufficient light is produced.
6. The method according to Claim 1, wherein
30 the entire array is used to sense the flash return.
7. The method according to Claim 1; wherein only a part of said array is used to sense the flash return.
8. The method according to Claim 1, wherein
35 a single sensor of said array is used to sense the flash return.

-9-

9. A camera having a flash, comprising:
an array of sensors;
means for detecting the firing of the flash;
means for controlling said sensors to sample
5 the light from the flash which is returned to the
camera, said means for controlling operating in
response to the firing of the flash;
means for comparing the sample light with a
predetermined value;
10 said means for comparing producing a signal
in response to the sample light being less than the
predetermined value.
10. The camera according to Claim 9, further
comprising means for indicating to the operator that
15 too little light was returned, said means for
indicating operating in response to said signal.
11. The camera according to Claim 9, further
comprising means for indicating on film that too little
light was returned, said means for indicating operating
20 in response to said signal.
12. The camera according to Claim 9,
further comprising means for controlling the camera to
increase the exposure time in response to said signal.
13. A method of sensing a flash return in a
25 camera having a solid state sensor array, a flash,
photographic film and optical means for forming an
image, comprising the steps of:
firing said flash;
controlling said optical means to form an
30 image on both the photographic film and the sensor
array;
controlling the sensor array to sense light
from the flash which is returned to the camera after
the firing of the flash;
35 comparing the magnitude of the sensed light
with a predetermined value;

-10-

producing a signal indicative of too little return light when the sensed light is less than said predetermined value;

- 5 making an indication on the film in response to said signal that too little light was returned in such a way that is readable by a printer.

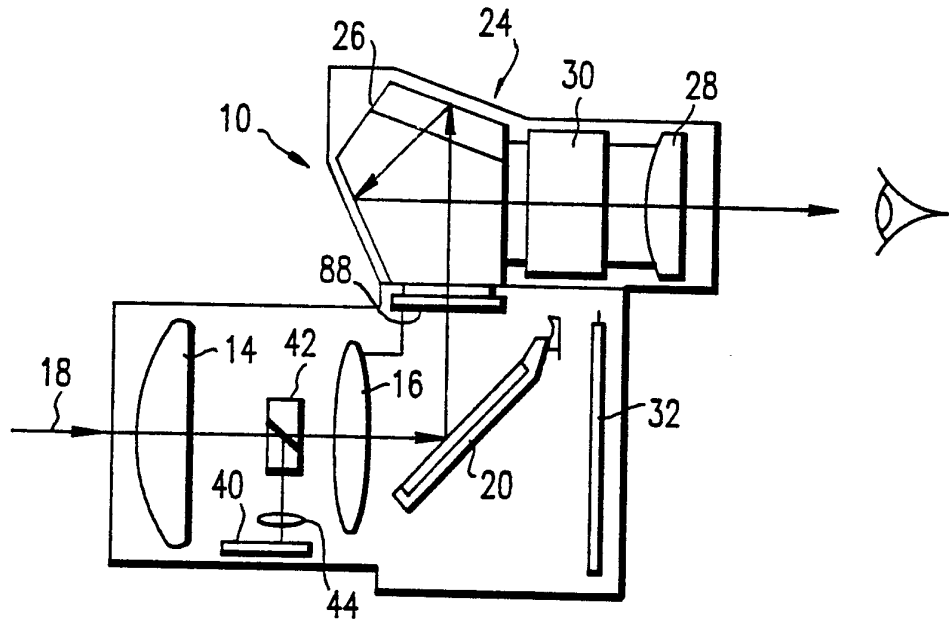


FIG. 1

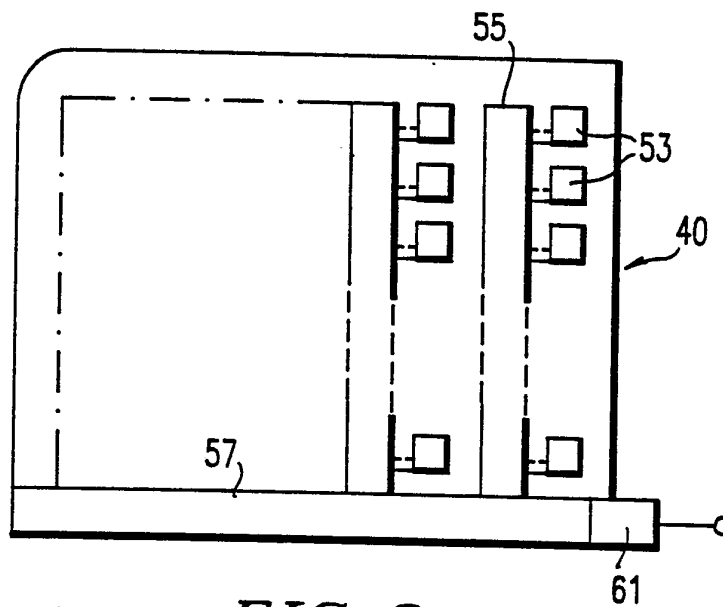


FIG. 2

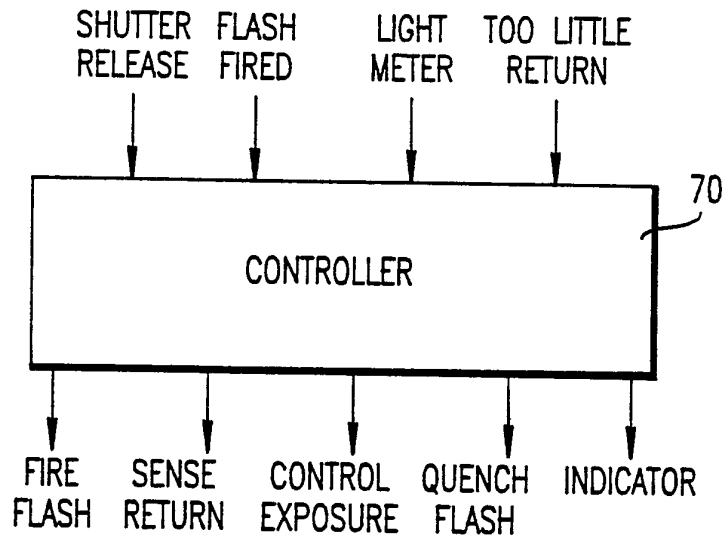


FIG. 3

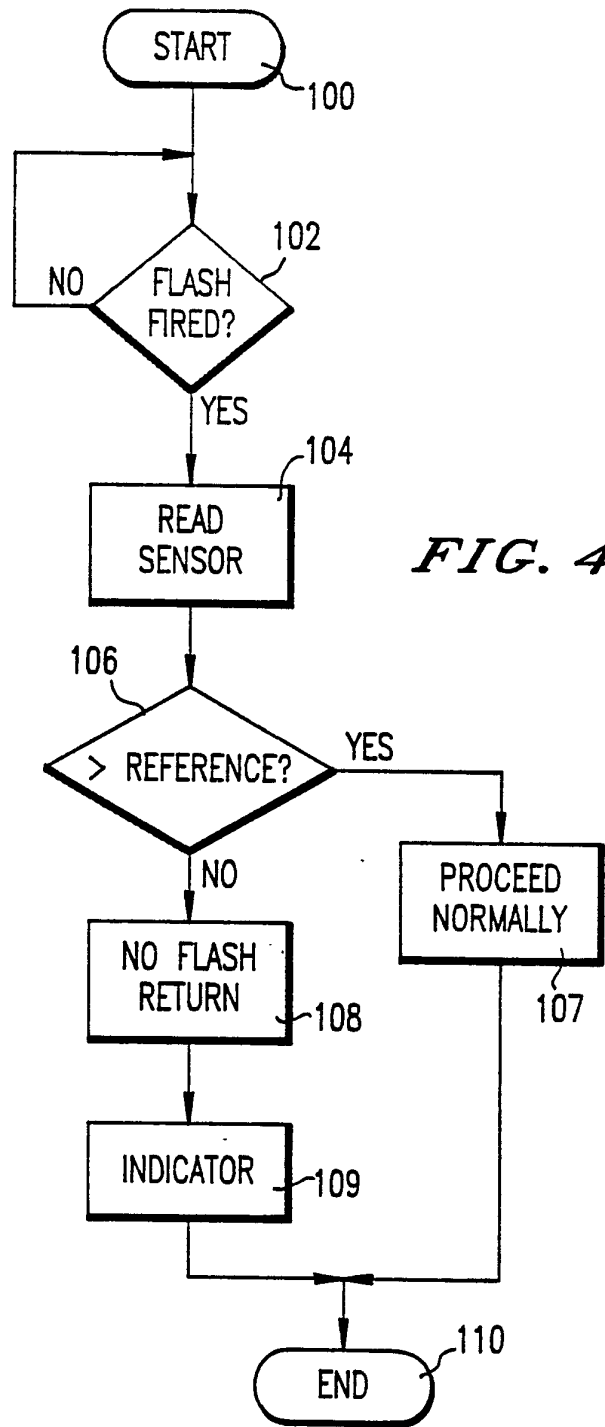
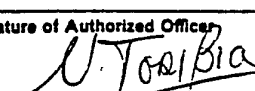


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 90/04241

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		
IPC ⁵ : G 03 B 17/18, 17/24, 7/16		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁵	G 03 B 17/18, 17/20, 17/24, 7/16	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US, A, 4760418 (A. ISHIZAKI) 26 July 1988 see columns 2,3; figures 1,2	1,9
A	--	6
Y	DE, A, 3315379 (OLYMPUS OPTICAL CO.) 3 November 1983 see pages 7,8,12,16,17; figure 2	1,9
A	--	2,5,10
Y	GB, A, 2170320 (CANON K.K.) 30 July 1986 see page 2, figures 1-4	1,9
A	--	2,4,5,10
P,A	WO, A, 89/09946 (EASTMAN KODAK CO.) 19 October 1989 see page 9; figures 1,2	1,3,9,11,13
	--	./.
<p>¹⁰ Special categories of cited documents:</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	
9th January 1991	24. 01. 91	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 Nuria TORIBIO	

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, 4523830 (Y. IIDA) 18 June 1985 see column 7, lines 40-68 --	1,2,5,9,10
A	Patent Abstracts of Japan, volume 8, no. 183 (P-296)(1620), 23 August 1984, & JP, A, 5974535 (NIHON KOUGAKU KOGYO K.K.) 27 April 1984 see the abstract --	1
A	Patent Abstracts of Japan, volume 8, no. 215 (P-305)(1652), 2 October 1984, & JP, A, 59100418 (MINOLTA CAMERA K.K.) 9 June 1984 see the abstract -----	1

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

US 9004241
SA 40227

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 18/01/91. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4760418	26-07-88	JP-A- 62066239	25-03-87
DE-A- 3315379	03-11-83	JP-A- 58190931 US-A- 4518237	08-11-83 21-05-85
GB-A- 2170320	30-07-86	JP-A- 61156238 JP-A- 61156239 JP-A- 61156240 JP-A- 61156241 JP-A- 61156236 US-A- 4717934	15-07-86 15-07-86 15-07-86 15-07-86 15-07-86 05-01-88
WO-A- 8909946	19-10-89	AU-A- 3557489 EP-A- 0338408	03-11-89 25-10-89
US-A- 4523830	18-06-85	JP-A- 58075132	06-05-83