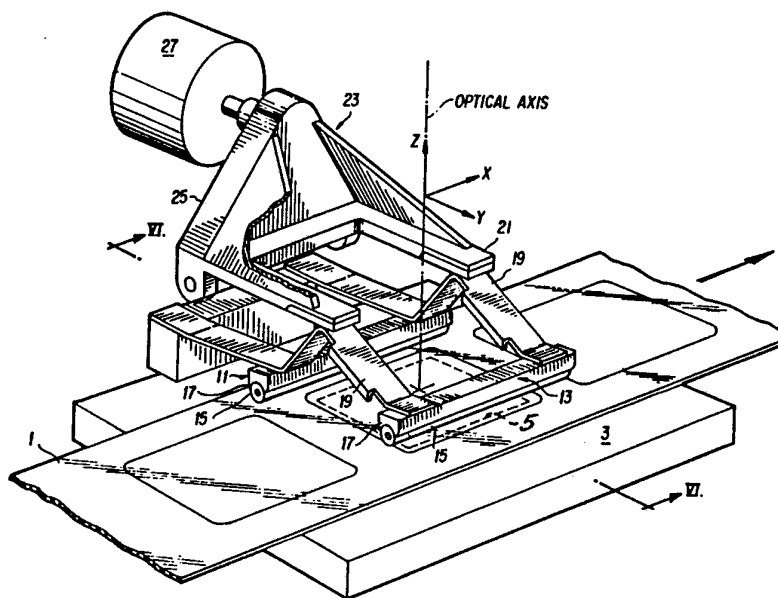




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<p>(21) International Application Number: PCT/US90/06719</p> <p>(22) International Filing Date: 19 November 1990 (19.11.90)</p> <p>(30) Priority data: 442,375 28 November 1989 (28.11.89) US</p> <p>(71) Applicant: EASTMAN KODAK COMPANY [US/US]; 343 State Street, Rochester, NY 14650 (US).</p> <p>(72) Inventors: JADRICH, Bradley, Stephen ; 28 Alecia Drive, Rochester, NY 14626 (US). WAKEFIELD, Edward, Henry ; 74 Buck Hill Road, Rochester, NY 14626 (US).</p> <p>(74) Agent: SCHAPER, Donald, D.; 343 State Street, Roches- ter, NY 14650-2201 (US).</p>		<p>(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), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).</p> <p>Published <i>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.</i></p>

(54) Title: A FILM CLAMP



(57) Abstract

A platen (3) has a flat working surface and an aperture (5). A proximal gripping member (11) is sized, shaped, and positioned to extend along the proximal side of the aperture (5) and to grip a proximal edge of a film (1) between the platen (3) and the proximal gripping member (11). A second gripping member (13) is sized, shaped, and positioned to extend along the distal side of the aperture (5) and to grip a distal edge of the film (1) between the platen (3) and the distal gripping member (13). Arms (19) press the proximal gripping member (11) at least generally perpendicularly toward the platen (3) and press the distal gripping member (13) toward the platen (3) and away from the proximal gripping member (11) in order to pull the film flat and place the film in tension across the aperture.

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A FILM CLAMP

This invention pertains to a film clamp for holding a film extremely flat over an open gate aperture in a platen.

In various types of imaging apparatus, a photographic film must be clamped in a work station while a particular operation is performed on the film. In certain types of apparatus, for example, film scanners, the film must be held extremely flat in order for an image on the film to be recorded properly. One problem in maintaining the film flat is that photographic film has a natural curl due to an emulsion coated on one side of the film.

In a conventional film clamp, as illustrated in Figures 1 and 2, a film 1 is clamped against a platen 3 on all four sides of a rectangular aperture 5 by a vertical force (represented by a plurality of arrows 7). In the use of such a film clamp, the natural curl in the film 1 will be retained, and the film will not be held flat. Further, when all sides of the film 1 are clamped, any thermal variation of the film that occurs while the film is clamped can result in the film's buckling.

It is an object of the present invention to overcome the problems in the prior art described above and to provide a film clamp which will hold film against a platen to a greater degree of flatness than do conventional film clamps.

In accordance with the present invention, there is provided a film clamp comprising: a platen having a flat working surface and an aperture in the flat working surface, the aperture having a first side and a second side; a first gripping member sized, shaped, and positioned to extend along the first side of the aperture and to grip a film between the platen and the first gripping member; a second

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gripping member sized, shaped, and positioned to extend along the second side of the aperture and to grip the film between the platen and the second gripping member; and means for pressing the first gripping member at least generally perpendicularly toward the platen and the second gripping member whereby one edge of the film is held in position by the first gripping member and a second edge of the film is pushed down on the platen and away from the first gripping member.

A film clamp according to the invention comprises a platen having a flat working surface and an aperture in the flat working surface which has a first side and a second side; a first gripping member sized, shaped, and positioned to extend along the first side of the aperture and to grip a film between the platen and the first gripping member; a second gripping member sized, shaped, and positioned to extend along the second side of the aperture and to grip the film between the platen and the second gripping member; first means for pressing the first gripping member at least generally perpendicularly toward the platen; and second means for pressing the second gripping member toward the platen and away from the first gripping member after the first gripping member has gripped the film, whereby first one edge of the film is held in position by the first gripping member and then the second edge of the film is pushed down on the platen and away from the first gripping member by the second gripping member.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a perspective view in free body diagram form used to describe the operation of a conventional film clamp;

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Figure 2 is a cross-sectional view in free body diagram form used to describe the operation of a conventional film clamp;

Figure 3 is a perspective view in free body diagram form used to describe the operation of a film clamp according to the invention;

Figure 4 is a cross-sectional view in free body diagram form used to describe the operation of a film clamp according to the invention;

Figure 5 is a perspective view of an embodiment of a film clamp according to the invention; and

Figure 6A-6C are cross-sectional views on the plane VI-VI in Figure 5. In Figure 6A, the film clamp is in the film advance position. In Figure 6B, the proximal side of the film is clamped. In Figure 6C, both the proximal and the distal sides of the film are clamped, and the film has been tensioned.

Figures 3 and 4 illustrate in free body diagram form how a film clamp according to the invention works. Again, the number 1 represents the film, the number 3 the platen, and the number 5 a rectangular aperture in the platen 3.

In the clamp of the present invention, (a) the gripping member that makes contact with the proximal side of the film 1 presses at least essentially vertically against the film 1, and (b) the gripping member that makes contact with the distal side of the film 1 presses both toward the platen 3 and away from the proximal gripping member as illustrated by an arrow 9 in Figure 4. In the preferred embodiment of the present invention, there are preferably no gripping members on the lateral sides of the aperture 5, that is the sides of aperture 5 which extend between the proximal and distal sides of the film as defined herein. It will

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be apparent, however, that the film clamp of the present invention could operate in a position in which it is rotated 90° from the position in which it is shown in Fig. 5; in this case the gripping members
5 would contact the film adjacent the lateral sides of the films.

Note that, if μ is the coefficient of static friction between the film 1 and the platen surface, the following relationship must be
10 maintained:

$$F_2 \cos \theta < \mu F_1 + \mu F_2 \sin \theta.$$

Failure to meet this condition will result in slippage of the entire film 1 in the y direction when the force F_2 is applied.

15 Figures 5 and 6 show the presently preferred embodiment of the film clamp according to the invention. In this embodiment, there is a proximal gripping member 11 and a distal gripping member 13. Each gripping member 11, 13 comprises a cylinder 15
20 which, in use, makes line contact with the film 1 and a tie bar 17 which mounts the cylinder 15. Each gripping member 11, 13 is mounted on two arms 19. The arms 19 are preferably intrinsically resilient, and they can, for instance, be made of beryllium
25 copper. Alternatively, the arms 19 can be non-resilient but pivotally mounted at their proximal ends and biased away from the platen 3.

Each arm 19 can be pressed toward the platen 3 by a corresponding finger 21 of a bell crank 23. A
30 third finger 25 of the bell crank 23 can be pivoted toward the platen 3 by an actuator 27, which can be a solenoid, an air cylinder, or a similar device. If the arms 19 are resilient, their intrinsic resiliency returns them to the position shown in Figure 6A when
35 the actuator 27 does not bear against the third finger 25. If the arms 19 are not resilient, a

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biasing means of some kind must be attached to the arms 19 to return them to the position shown in Figure 6A when the actuator 27 does not bear against the third finger 25.

5 As best seen in Figure 6A-6C, the arms 19 are preferably sized, shaped, and positioned so that, when the fingers 21 are pivoted toward the platen 3 by the actuator 27, the proximal gripping member 11 contacts the film 1 first, bearing at least
10 essentially vertically against the proximal edge of the film 1 and forcing it toward the platen 3, after which the distal gripping member 13 contacts the film 1, pressing the distal edge of the film 1 both toward the platen 3 and away from the proximal gripping
15 member 11 to place the film in tension.

Of course, it is not essential to the invention that the distal and proximal gripping members be mounted on the same arms. However, the arrangement shown in the drawings has been found to
20 be simple to manufacture and robust in use. Moreover, measurements to date using the device shown in Figures 5 and 6 have shown that the film flatness is held to .0010 inches - .0015 inches over a standard 35 mm image area, in contrast to a flatness
25 of .004 inches - .006 inches over a similar area provided by a conventional four-sided film clamp. Similar improvements in film flatness can be obtained in other sizes of film.

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Claims:

1. A film clamp comprises:
a platen (3) having a flat working surface
and an aperture in said flat working surface, said
5 aperture (5) having a first side and a second side;
a first gripping member (11) sized, shaped,
and positioned to extend along said first side of
said aperture (5) and to grip a film (1) between said
platen (3) and said first gripping member (11);
10 a second gripping member (13) sized, shaped,
and positioned to extend along said second side of
said aperture (5) and to grip the film (1) between
said platen (3) and said second gripping member (13);
and
15 means (19,23,27) for pressing said first
gripping member (11) at least generally
perpendicularly toward said platen (5) and said
second gripping member (13) toward said platen (5)
and away from said first gripping member (11) whereby
20 one edge of the film (1) is held in position by said
first gripping member (11) and a second edge of the
film (1) is pushed down on said platen and away from
said first gripping member.
2. A film clamp as recited in Claim 1
25 wherein said means (19,23,27) presses said first and
second gripping members (11,13) resiliently toward
said platen (3).
3. A film clamp as recited in Claim 2
wherein said means comprises an arm (19) to which
30 each of said first and second gripping members
(11,13) is attached.
4. A film clamp as recited in Claim 3
wherein said arm (19) is made out of beryllium copper.
5. A film clamp as recited in Claim 2
35 wherein said means (19,23,27) comprises two arms

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(19), each of said first and second gripping members (11,13) being attached to both of said two arms (19).

6. A film clamp as recited in Claim 1 wherein said means (19,23,27) comprises an arm to
5 which each of said first and second gripping members (11,13) is attached.

7. A film clamp as recited in Claim 1 wherein said means comprises two arms (19), each of said first and second gripping members (11,13) being
10 attached to both of said two arms (19).

8. A film clamp as recited in Claim 1 wherein said first and second gripping members (11,13) are cylindrical in shape, whereby, in use, said first and second gripping members (11,13) make
15 line contact with the film.

9. A film clamp, as recited in Claim 1, wherein said second gripping member (13) is pressed toward said platen (3) and away from said first gripping member (11) after said first gripping member
20 (11) has gripped the film (1).

10. A film clamp as recited in Claim 1 wherein said means (19,23,27) comprises two arms (19), each of said first and second gripping members (11,13) being attached to both of said two arms (19),
25 and said means further comprises a bell crank (23) for pressing against said two arms (19).

11. A film clamp as recited in Claim 10 wherein said bell crank (23) has two fingers (21), one of which bears against each one of said two arms
30 (19), and another finger (25), and said means further comprises an actuator (27) that bears against said other finger (25).

12. A film clamp as recited in Claim 10 wherein each of said two arms (19) is resilient.

35 13. A film clamp as recited in Claim 12 wherein each of said two arms (19) is made out of beryllium copper.

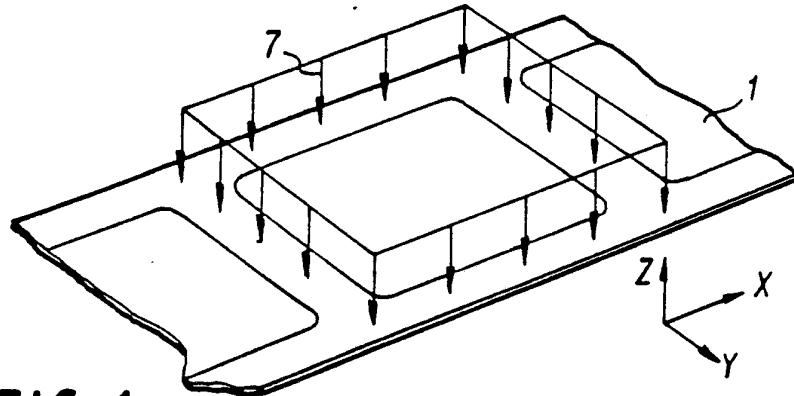


FIG. 1 PRIOR ART

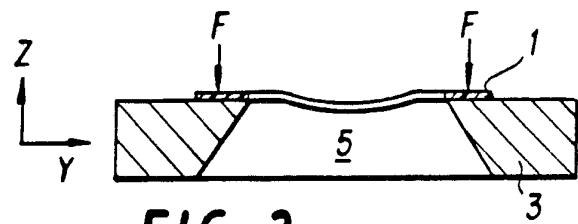


FIG. 2 PRIOR ART

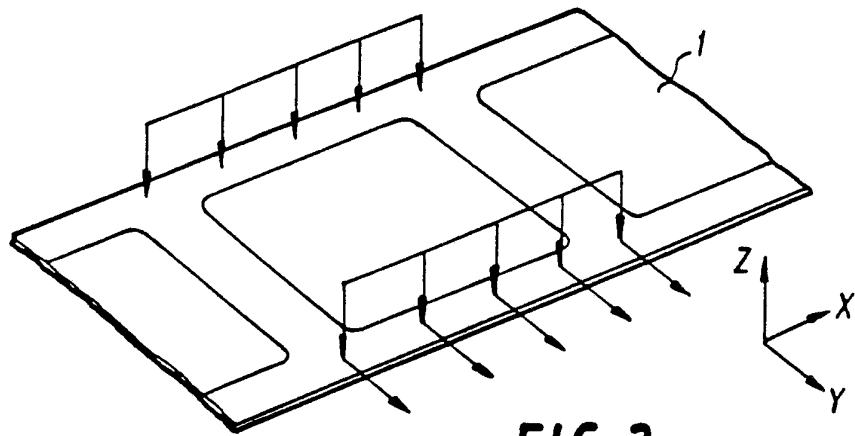


FIG. 3

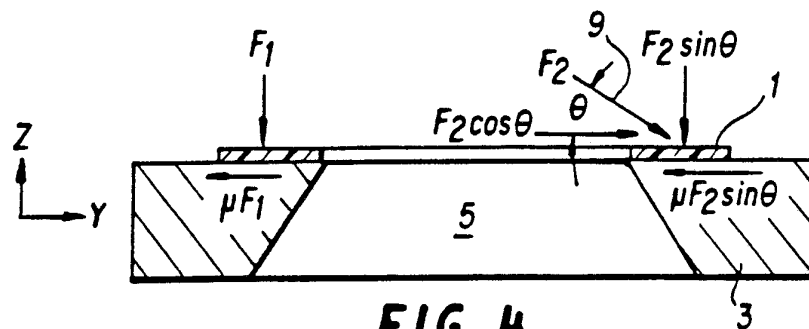


FIG. 4

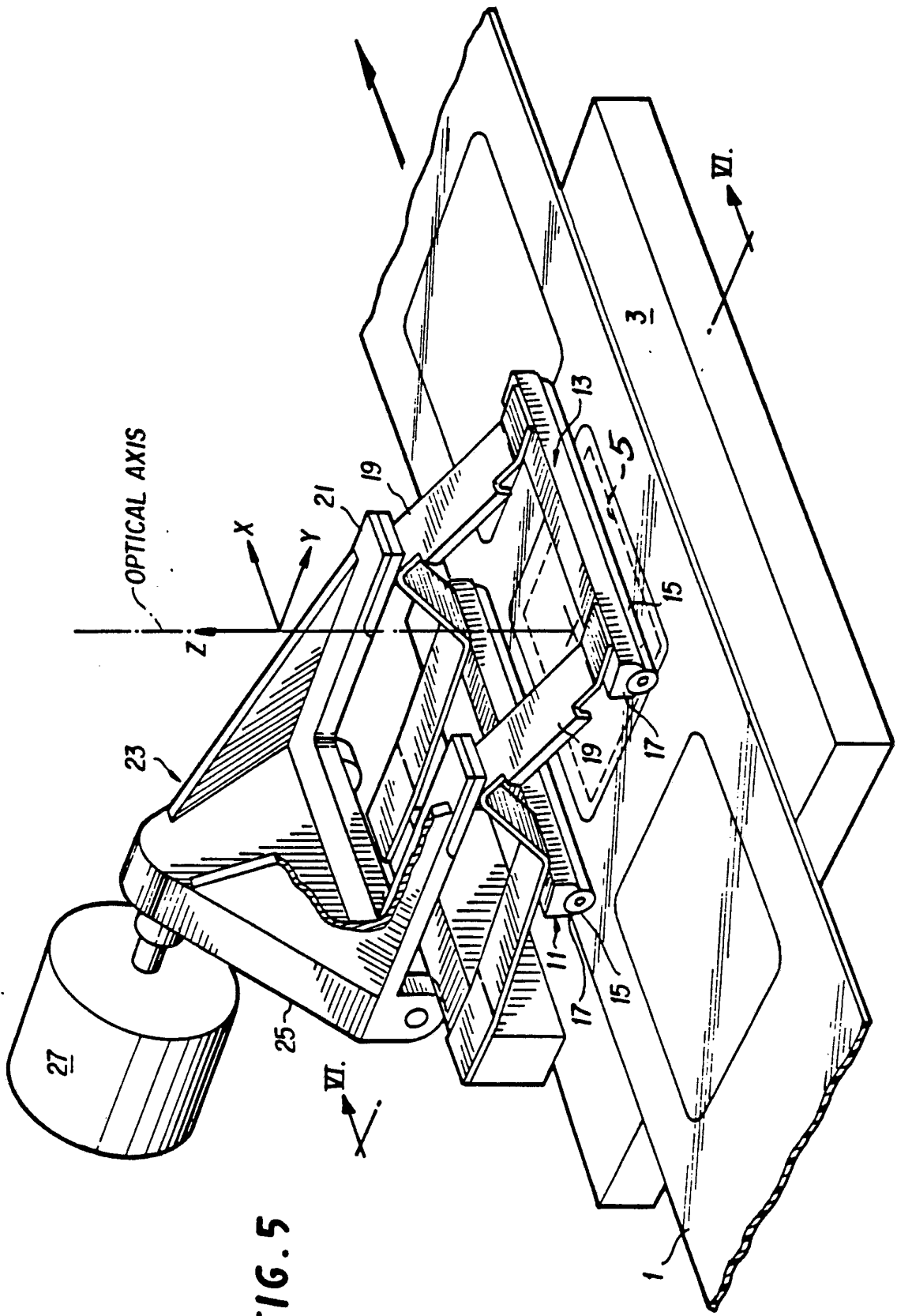
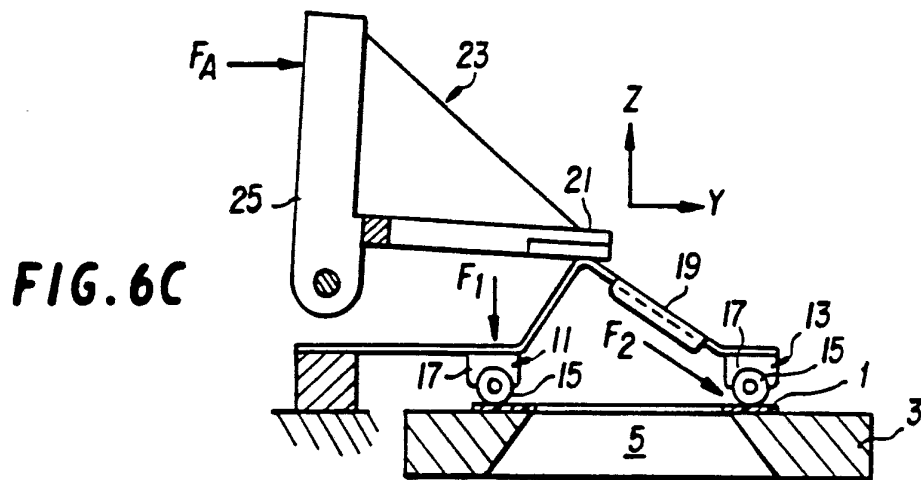
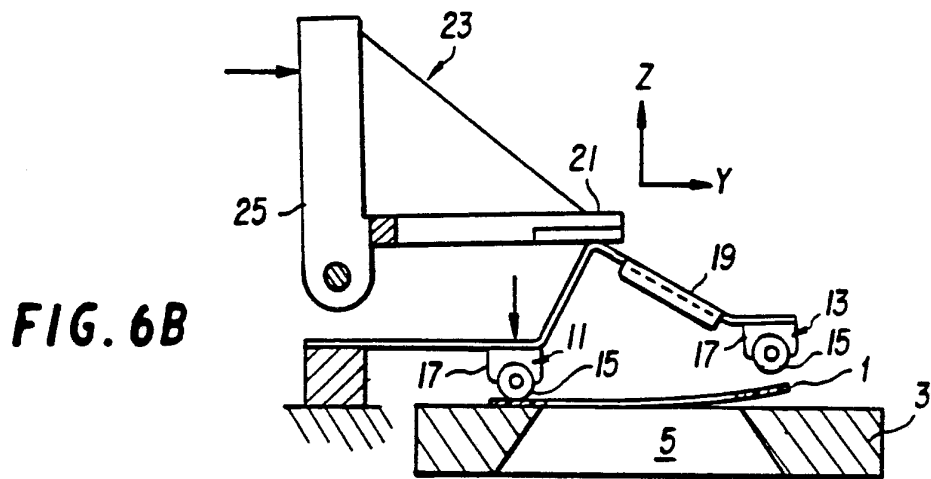
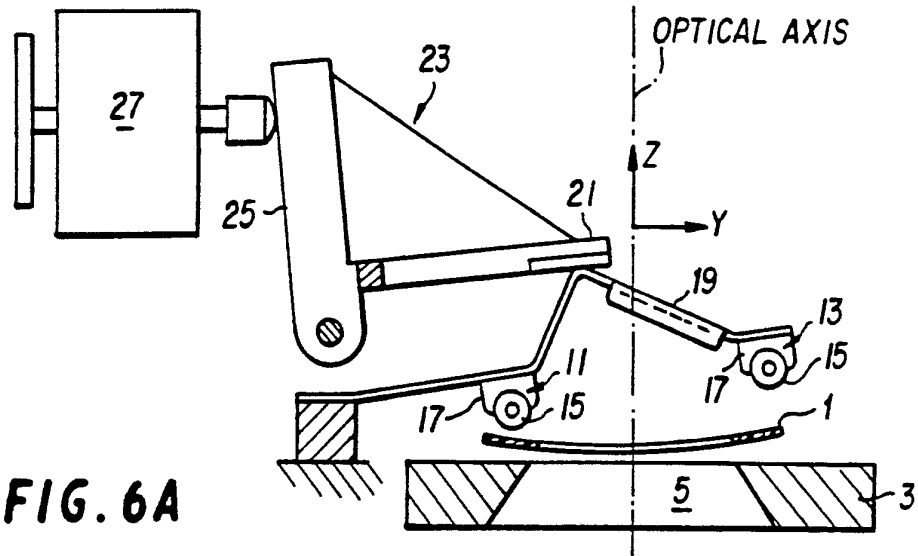


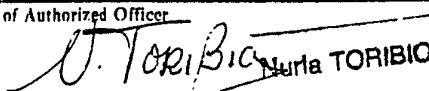
FIG. 5



INTERNATIONAL SEARCH REPORT

PCT/US 90/06719

International Application No

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 Int.Cl. 5 G03B27/62		
II. FIELDS SEARCHED Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	G03B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US,A,2248646 (H. SMALL) 08 July 1941 see pages 1 - 2 see page 3, column 1, lines 1 - 38; figures 1-7 ---	1-3, 5-7, 9
X	CH,A,457140 (CIBA AG) 31 July 1968 see columns 2 - 4; figures 1-5 ---	1-3, 9-11
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US-A-2248646		None	
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