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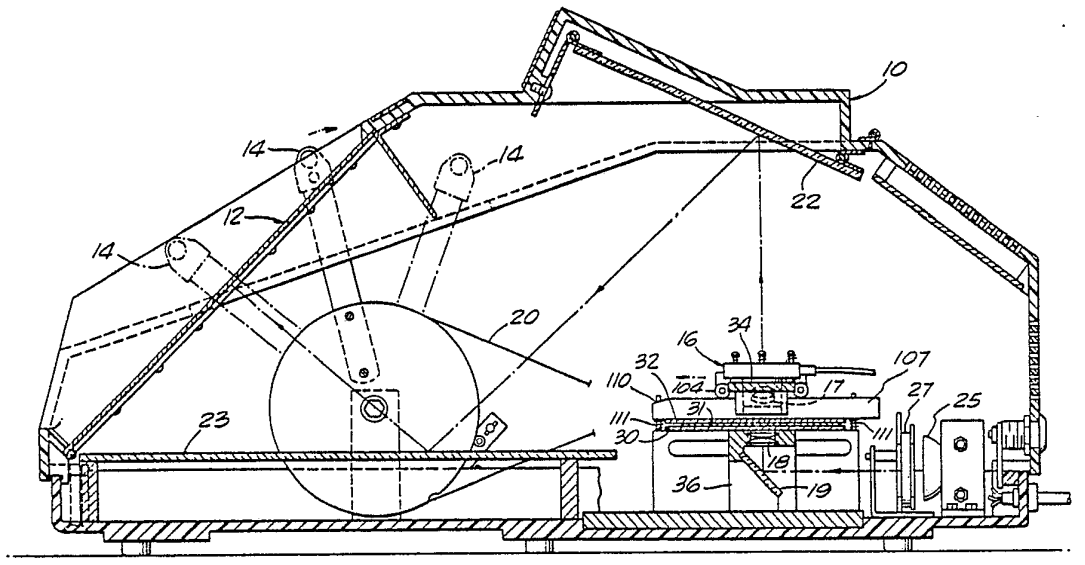

(57) Abstract

An optical film reader for projecting and enlarging microcopy information recorded in rollfiche format on rolls of photographic film or the like which provides a film transport mechanism enabling rapid manual scanning of the enclosed rollfiche strip (31) in both directions, with instantaneous reversal of the scanning direction without backlash in the film drive. A low glare, high contrast viewing screen (12) is mounted at 45° to the vertical and placed low at the front of the unit perpendicular to the viewer's line of sight. Movable projection optics (16) are provided for scanning of rollfiche microcopy which is wider than that projectable on a fixed sized screen at one given time at a given magnification ratio; the movable projection optics allow projection of the microcopy data or eye-readable index area of the rollfiche by means of a single scanning lever (14).

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OPTICAL ROLLFICHE READER

BACKGROUND OF THE INVENTION

The present invention relates to an optical film reader for reading information contained on film strips and more particularly to a manually operated optical film reader for projecting and enlarging microcopy information recorded in rollfiche format on rolls of photographic film.

In recent years, the rapid increase in the production of written information has resulted in the concomitant problem of efficient information storage and retrieval. In order to reduce the physical volume of documents and other printed material that must be stored and made available for rapid retrieval and inspection, microfilm techniques in which documents, data and other printed material are photographed in a reduced size have become common. Microfilm containing such information allows for a convenience in storage and transportation as many thousands of printed pages can be contained on a single roll of film. Another attendant advantage of such microfilm techniques is that enlarged prints can be made from the film, or the film can be viewed by projection on a screen or viewer.

In addition to roll microfilm recording of information, microfiche, a sheet of microfilm approximately 4 inches by 6 inches is also used to record microcopy. A single microfiche can contain many pages of microcopy and has an advantage over conventional roll microfilm in that recorded

information can be readily indexed with respect to a two cordinate system: along the margins of the fiche or microfilm sheet. Thus, information can be rapidly located upon reference to the particular address or horizontal and vertical coordinates of the information when the sheet is placed in a microfiche projection device and viewed.

In order for the information recorded on microfilm or microfiche to be viewed, or enlarged prints obtained, the film or fiche must be projected in a viewer or reader. A major disadvantage or prior art viewers and projectors is that they have been expensive, bulky and often complicated to operate. Prior art viewers and readers have required the operator to handle the film or microfiche subjecting it to dust, moisture, scratching of the film and other hazards of mishandling such as misfiling or theft. Another disadvantage of microfilm and microfiche systems found in the prior art is that multiple rolls of microfilm or many individual sheets of microfiche are required to store large quantities of information.

SUMMARY OF THE INVENTION

The present invention relates generally to apparatus for the optical projection and viewing of information contained on photographic film. More particularly, the invention relates to apparatus for the optical projection and viewing of information recorded in rollfiche format on rolls of photographic film or the like.

The advantages of the rollfiche reader of the present invention over that found in the prior art is that: it enables rapid manual scanning

of the rollfiche strip in both directions to locate the desired information with instantaneous reversal of the scan direction without backlash in the film drive; it provides a low glare, high contrast viewing screen mounted at 45° to the vertical and placed low at the front of the unit perpendicular to viewer's line of sight; it allows for the scanning of data on rollfiche which is wider than that projectable on a fixed sized screen at one given time at a given magnification ratio; it allows projection of the eye-readable or index area of the film by simply shifting a lever, and it eliminates operator handling of the rollfiche thereby insuring the integrity of the rollfiche and the data contained thereon.

The rollfiche reader of the present invention is comprised of three basic systems; the rollfiche movable projection optics; the rollfiche film transport and rollfiche reader housing assembly.

The movable projection optics provides for vertical scanning of the data area of the rollfiche which is wider than that projectable on a fixed size screen at one given time at a given magnification ratio while the film remains stationary.

The movable optics system possesses a major advantage over that of prior art fiche readers in that during the vertical scan of the fiche, the film and projection lamp remain stationary allowing the unit to be more compact than in conventional readers.

The rollfiche film transport mechanism provides for manually driving a roll of rollfiche film in both directions at either a high speed or low speed by means of a single hand crank. The mechanism is designed to allow instantaneous reversal of the

film drive while eliminating all backlash in the film and thereby eliminate breakage to the film caused by sudden reversals in film direction by the operator. Additionally, the film transport mechanism employs a fast scan/slow scan mode to allow rapid location of a particular address or index along the roll and then slow scan of individual microcopy.

A unique feature of the instant invention is the housing assembly and its attendant optics which allow the viewing screen to be mounted at 45^{o} to the vertical and placed low in the front of the unit. Prior art microfiche readers possess vertical viewing screens making sustained viewing tiring to the operator and contribute to the bulkiness of the apparatus.

OBJECT OF THE INVENTION

It is an object of the invention to provide a novel apparatus for the projection and viewing of microcopy information recorded on rolls of photographic film and the like.

Another object of the invention is to provide a rollfiche reader with a viewing screen mounted at 45^{o} to the vertical and placed low at the front of the reader such that the viewing screen is perpendicular to the operator's line of sight when looking down at the unit.

Another object of the invention is to provide a rollfiche reader in which the optical projection system is movable along a direction perpendicular to the direction of film travel.

Another object of the invention is to provide a rollfiche reader which possesses projection

optics capable of scanning data on rollfiche film which is wider than that projectable on a fixed sized screen at one given time at a given magnification ratio.

It is still another object of the invention to provide a rollfiche reader in which vertical scanning of the data and eye-readable area of the rollfiche may be scanned by means of a single lever.

It is still a further object of the invention to provide a rollfiche reader in which the roll of readable film may be manually driven in either direction at selected rates of speed.

It is a further object of the invention to provide a rollfiche reader with a film transport mechanism that is instantly reversible and without backlash in the film drive thereby eliminating breakage of the film due to sudden stoppage or reversal of the film drive by the operator.

It is still another object to provide a manually operated rollfiche reader of the type described in the proceeding paragraphs which is compact in size and is highly reliable and efficient yet inexpensive to fabricate and maintain.

In summary, these and other objects of the invention will appear in the following description and appended claims and will be more clearly understood when read with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an oblique view of the exterior housing and viewing screen of the preferred embodiment of the invention;

FIG. 2 is a side elevational view of the

apparatus of the invention taken along lines 2-2 of Fig. 1 illustrating the movement of the optic projection system and the optic path through the system;

FIG. 3 is a plan view of the invention taken along lines 3-3 of Fig. 2 illustrating the movable projection optics, film transport mechanism and trapezoidal projection mirror;

FIG. 4 is a front elevational view of the invention taken along lines 4-4 of Fig. 3 illustrating the movable projection optics and film transport mechanism;

FIG. 5 is a fragmentary plan view taken along lines 5-5 of Fig. 4 further illustrating the movable projection optics;

FIG. 6 is a fragmentary front elevational view taken along lines 6-6 of Fig. 5 further illustrating details of the movable projection optics and film transport mechanisms;

FIG. 7 is a fragmentary side elevational view taken along lines 7-7 of Fig. 6 illustrating the movable projection optics in the read position such that the data section of the rollfiche is projected onto the viewing screen;

FIG. 8 is a fragmentary side elevational view similar to Fig. 7 illustrating the movable projection optics in the fast scan drive position in which the glass platen film guides are canted open to prevent wear to film surfaces;

FIG. 9 is a fragmentary plan view taken along lines 9-9 of Fig. 4 illustrating the slow scan/fast scan rollfiche film drive mechanism in slow scan position;

FIG. 10 is a fragmentary plan view similar

to Fig. 9 but illustrating the slow scan/fast scan rollfiche drive mechanisms in fast scan position;

FIG. 11 is a schematic side elevational view of the movable projection optics of the invention illustrating the optical paths of projected microcopy when the projection optics are moved across the rollfiche perpendicular to the direction of film travel; and

FIG. 12 is a fragmentary front perspective view of the rollfiche transport system illustrating the film drive film tensioning one way clutch mechanisms of the film transport system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Figs. 1-4 of the drawings, one form of the apparatus is shown as comprising several operative associated subassemblies or subsystems which cooperate to enable the scanning of photographic microcopy on rollfiche and projection of the enlarged image onto a viewing screen.

As shown in Fig. 1, the rollfiche reader of the present invention consists of a housing assembly 10 which contains a viewing screen 12 mounted at 45° to the vertical and placed at the front of the unit. Mounted on the right side of housing assembly 10 is the film drive crank 13 for scanning the rollfiche in either direction along the length of the film roll and the focus control knob 15 for focusing the projected microcopy on the viewing screen 12. Located on housing 10 to the left of the viewing screen 12 is the vertical film scan and slow scan/fast scan shift lever 14 which enables vertical scanning of the rollfiche perpendicular to

the direction of film travel and shifting of the film drive gearing from high speed scan to low speed scan.

Referring to Fig. 2, the vertical film scan and slow scan/fast scan shift lever 14 operates the movable carriages 16 containing the projection optics 17 and 18 and 45° mirror 19 by means of a cable connection 20. By moving lever 14, the movable projection optics can be made to scan the width of the rollfiche film, perpendicular to the direction of film travel, thereby causing the recorded microcopy to be projected onto the viewing screen 12 by projection of the microcopy image first onto a front surfaced mirror 22 which reflects the image onto a second trapezoidal front surfaced mirror 23 which reflects the projected image onto the viewing screen 12.

A unique feature of the present invention over that found in the prior art is that the viewing screen 12 is mounted at 45° to the vertical and placed low at the front of the reader. This configuration puts the viewing screen 12 at an ideal position, being close to the observer at an angle perpendicular to the line of sight when looking down at the unit. To enhance the contrast of the projected image, screen 12 is constructed of a "venetian blind" like material. These tightly spaced venetian blinds included in the screen material allow only those light rays substantially perpendicular to the screen to pass through. Stray light from outside and inside the unit that is not perpendicular to the screen surface is blocked. Thus, the potential problem of glare created by mirror 23, due to light entering through screen 12 and being reflected back up onto screen 12 and

also into the viewer's eyes is eliminated by use of the "venetian blind" screen material.

Referring to Figs. 2 and 11, projection light is provided by a miniature tungsten-halogen lamp or the like with an integrally mounted dichroic reflector 25. An infra-red filter 27 is interposed in the light path to preclude heat damage to the film. Mirror 19 directs the projected light through condenser lenses 18 contained in the movable projection optics assembly 16 and through glass platen 30, the film 31, and glass platen 32. A focusable projection lens 17 images the microcopy contained on film 31. Front surface mirrors 22 and 23 reflect and enlarge the projected microcopy image onto screen 12 where it is viewed.

An important feature of the instant invention is the movable projection optics assembly 16 as illustrated in Figs. 3-6. Assembly 16 allows the operator to scan the rollfiche film 31 perpendicular to the direction of film travel without moving the film by moving scan lever 14. As shown in Figs. 5-8, the projection lens 17, condenser lens 18 and mirror are all arranged to move together on two mechanically interconnected carriages 34 and 36. The upper carriage assembly 34 carries projection lens 17, the projection lens focus eccentric 35, the adjustable boss 37 for the high speed/slow speed scan gear change mechanism, the six guide rollers 38 which guide the upper assembly along the upper carriage tracks 40, and the connecting clamp 41 to the film scan lever control cable 20.

As shown more clearly in Figs. 9 and 10, the lower carriage assembly 36 carries the condenser lenses 18, the mirror 19 and clamp 42

connecting the lower carriage to cable 45.

Movement of the upper and lower carriage assemblies are controlled by the scan lever 14 which is interconnected to the upper carriage assembly 34 by means of cable 20. Thus, the operator can scan the width of the rollfiche 31 by moving the scan lever 14 in either direction causing individual microcopy contained thereon to be projected onto the viewing screen 12.

As more clearly seen in Figs. 5, 6, and 9, the lower carriage assembly 36 is mechanically interconnected to the upper carriage assembly 34 by means of a clamp 42 on closed loop cable 45 so that the projection lens is always centered on the condenser lens 18 and the upper and lower carriage assemblies 34 and 36 are kept in syncronization by calbes 20 and 45 running on pulleys 47, 54 and 49, 53 pinned to opposite ends of transfer shafts 50 and 51. To assure that the projection lens 17 contained in the upper carriage assembly 34 is always in exact synchronization with the condenser lens 18 and mirror 19 carried by the lower carriage, assembly 36 independent of the amount of heavy use and possible slippage of the cables 20 and 45 on the pulleys 47, 54 and 49, 53 an automatic alignment mechanism consisting of stop screws 55 and 56 is provided.

As shown in Figs. 5, 9 and 10, either end of the travel of the upper and lower carriages 34 and 36 is limited by adjustable stop screws 55 and 56. If the lower carriage assembly 36 is out of synchronization in the forward direction, it will come against stop screw 56 before the upper carriage 34 reaches its forward limit. Further forward movement of the vertical scanning lever 14

moves only the upper carriage assembly 34 until it reaches its forward limit and the two carriage assemblies 34 and 36 are in exact synchronization. Likewise, if the lower carriage assembly 36 is out of synchronization in the rearward direction, stop screw 55 arrests its movement and the upper carriage 34 is brought into alignment by continued movement of the vertical scan lever 14 toward its rearward limit.

Referring particularly to Figs. 3 and 4 of the drawings, the novel film transport means of the invention is disclosed for driving a roll of film in either direction by means of a single hand crank 13. A unique feature of the drive mechanism is its ability to reverse direction instantly without backlash or slippage of the film. As will be discussed later in greater detail, Figs. 3, 9 and 10 show how the drive force is transmitted from the hand crank 13 to the drive roller 71.

Referring to Fig. 4, the basic film transport system employs a pair of drive rollers 71 and a pair of pinch rollers 73 on the right and left side of the projection optics. These rollers keep the film 31 under positive control as it is being driven between the glass platens 30 and 32 and minimizes the backlash in the system.

The rollfiche film 31 feeds off supply/take up roller 78, over a brake roller 79 around a pressure roller 80 and pinch roller 73. The pressure roller 80 is connected to lever arms 98 which is pivoted about shaft 101 and biased by springs 103 thereby causing the film 31 to be held against the pinch roller 73 and feed positively against rubber drive roller 71. The rubber drive roller propels the film 31 through the movable pro-

jection optics assembly and between two glass platens 30 and 32 which guide and maintain the roll-fiche within the depth of field of the projection optics when the film is scanned or read across its width. The film 31 then passes over a corresponding left hand drive roller 71, pinch roller 73, pressure roller 80, brake roller 79, and accumulates on supply/take up roller 78. These elements on the left hand side of the unit are duplicates of those on the right hand side and perform the same functions when the film drive direction is reversed.

The two rubber drive rollers 71 are connected by a toothed drive belt 82. Accordingly, both drive rollers 71 are driven directly, and are synchronized. The result is that the film 31 is positively transported through the projection optics and between glass platens 30 and 32 so that it always remains tight as shown in Fig. 6 of the drawings.

As illustrated in Fig. 4 and more particularly in Fig. 12 of the drawings, the supply/take up rolls 78 are driven by O-ring belts 84 from the drive roller shafts 70. The pulleys 85 and 86 for these belts are sized so that the supply/take up rollers 78 are driven at a slightly faster rate than the drive rollers 71. In addition, pulleys 86 on the supply/take up rollers 78 each contain a one-way clutch 87 as shown in Fig. 12 so that the O-ring belts 84 effectively drive only when a given roll 78 is being used as a takeup roll. Since the takeup roll 78 cannot be driven any faster than the film 31 is fed through the drive rollers 71, the O-ring belt 84 slips. In the process of slipping, it maintains a positive tension on the film

so that no slack in the film 31 is allowed to develop. This tension also serves to keep the film tight in between the drive rollers 71. The one-way clutches 87 are necessary as the O-ring belts 84 are designed to drive the supply/take up rolls 78 faster than the film is actually used. The one-way clutches 87 prevent the supply roller 78 from being driven too fast and creating slack in the film 31 as it travels through the transport mechanism.

Referring to Figs. 3, 4 and 12, the film 31 as it is transported to a corresponding take-up roll 78 on the other side of the apparatus is prevented from overrunning or developing slack by the brake rollers 79 and brake bands 89. The brake rollers 79 are connected to lever arms 88 which act on brake bands 89 in frictional contact with brake drums 91. The brake drums 91 are connected to the shaft 94 of each film supply/take up roller 78. The brake bands 89 are designed to prevent overrun of a film supply roller 78 when the system is operated in the high speed mode and suddenly brought to a halt. The levers 88 holding the brake rollers 79 are biased by springs 96. If there is any slack in the film 31, the levers 88 move outward in response, tightening the brake bands 89 on the brake drums 91 preventing overrun by the supply roller 78 and act as snubbers to absorb shock induced by uneven cranking or quick reversal in drive direction. In addition, the brake drums 91 are attached by one-way clutches 99 to the film roller shafts 94. The one-way clutches 99 are constructed such that the brake bands 89 are only effective when the film roll 78 is used as a supply roll. In this way, any slack in the film due to

supply run overrun will bring the film supply roll 78 to a quick halt. The corresponding take-up roller 78 will not be affected due to the operation of the one-way clutch 99 which allows it to move as long as there is any movement of the film.

Referring to Fig. 3, the drive force for the film transport mechanism is provided by a hand crank 13, however, in alternate embodiments of the invention, electrical motors and the like may be used to supply power to the system. Power is transmitted from crank 13 to the right hand drive roller 71 by means of beveled gears 58 and 59, through two U-joints 63 and 64 to the splined drive shaft 61.

As shown in detail in Figs. 9 and 10 of the drawings, the drive force is transmitted from drive shaft 61 to the right hand roller shaft 70 and roller 71 through a set of slow scan/fast scan step gears 73, 74, 75 and 76 which are selectively meshed for either a low speed or a high speed scan mode.

With the movable optics in the read position as shown in Fig. 9, such that microcopy is projected onto the viewing screen, step gears 73 and 74 are engaged allowing the operator to slowly scan along the length of the rollfiche by rotating hand crank 13. To engage the high speed scan mode, the vertical scan lever 14 is moved to the extreme (detent) position toward the operator as shown in Fig. 2. The movement of lever 14 to the high speed scan mode position causes the movable projection optics 16 to move to the edge of the rollfiche film nearest the operator. As further shown in Fig. 8 at this position, two of the four glass platen pressure rollers 104, carrying the upper optics carriage assembly 34 and bearing on the glass platen pressure rails 107,

ride down inclines 110 on the front of pressure rails 107 and cause the glass platen pressure rails 107 and a portion of the upper carriage assembly 16 to pivot. The combination of the displacements of the four glass platen pressure rollers 104 eliminate all downward pressure on the glass platen rails 107, which are biased in the upward position by springs 111. The rails 107 move upward and the glass platens 30 and 32 open. The springs 111 which bias the rails 107 are of equal force, but, the rear edge of the glass platen opens to a greater degree than the front edge, as the front edge is somewhat restrained by the two glass platen pressure rollers 104 on the incline 110 of the glass platen pressure rails 107. This unequal amount of glass platen lift is designed to retain the front edge of the rollfiche film in a position so that the "eye readable" or large indexing type which is commonly displayed on the margin of the film is held in close control vertically and thus within the depth of focus of the projection lens so that it can be viewed during the high speed scan mode. The opening of the glass platens 30 and 32 in the high speed mode prevents wear to the film surface and dirt and dust buildup.

As illustrated by Fig. 9, also when the vertical scan lever 14 is moved into the high speed scan mode position, in addition to the glass platens 30 and 32 opening as described above, a gear ratio change of 9:1 is accomplished to enable scanning of film at a high rate of speed. The gear change from slow speed scan to high speed scan is affected by movement of the upper and lower optics carriage assemblies 34 and 36 forward to the extreme front of the unit as shown in Fig. 8. In

this position as illustrated in Fig. 10, an adjustable boss 37 mounted on the underside of the upper carriage assembly 34 engages the spring biased gear shift lever 120 causing it to rotate about pivot 121. The other end of shift lever 120 contains a yoke which pushes the drive gears 73 and 75 splined to the drive shaft 61 along the shaft, meshing drive gear 75 with gear 76 pinned to the right hand roller shaft 70 and thereby shifts the film drive into the high speed scan mode. Moving the carriage from the "eye readable" area of the film to the data area of the film allows the biasing spring 125 to return the gear shift lever 120 to the slow scan position which engages the low speed gears 73 and 74.

From the foregoing description, it is believed that it will be appreciated that the heretofore outlined objects of the invention will be attained, and that the apparatus embodying the described features provides inherent advantages in the projection and reading of microcopy recorded on photographic film.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of the disclosed invention, and hence, it is not wished to be restricted to the specific forms shown or uses mentioned except to the extent indicated in the appended claims.

WHAT I CLAIM IS:

1. An apparatus for the viewing of microcopy recorded on rolls of photographic rollfiche film or the like comprising:

means for optically projecting and enlarging microcopy information recorded on photographic rollfiche film or the like;

screen means for viewing the enlarged projected microcopy image;

film transport means for moving said photographic film rolls in either direction past said projection means;

means for optically scanning said microcopy in a direction perpendicular to the direction of film travel on said film transport means; and

housing means for enclosing said apparatus and containing said viewing screen.

2. The combination as defined in claim 1 in which:

said optical microcopy projection means includes a light source means, lens means for imaging said microcopy and mirror means to reflect and enlarge said microcopy image onto the viewing means.

3. The combination as defined in claim 1 in which:

said screen means is mounted at 45^{o} to the vertical and placed low in the front of the apparatus such that said screen is perpendicular to the operator's line of sign when looking down at said screen; and

said screen possessing means for allowing only light rays substantially perpendicular to said screen to pass through, such that stray light from inside or outside said apparatus that is not perpendicular to the screen surface is not transmitted.

4. The combination as defined in claim 1 in which:

said film transport means includes manually operable means for driving said rollfiche film from supply/take up means in either direction at selected rates of speed, film tensioning means to allow instantaneous reversal of the film drive direction while eliminating all backlash in the film; and

brake means to engage said supply/take up rollers when slack in the film is encountered such that overrun of the supply is prevented.

5. The combination defined in claim 1 in which:

said optical scanning means includes lever controlled movable optics, and said lever controlling means for selectively changing the film transport drive speed.

6. An apparatus for the viewing of microcopy recorded on rolls of photographic rollfiche film or the like comprising:

means for optically projecting and enlarging microcopy information recorded on photographic rollfiche film or the like;

a viewing screen on which said enlarged microcopy is projected, possessing means to allow

only light rays substantially perpendicular to the screen to pass through;

means to transport said rollfiche film past said projection optics keeping said film under continuous tension so as to allow instantaneous reversal of said film without backlash;

gear means for selectively changing the rate of speed at which said film is driven past said projection optics;

means for causing said projection optics to move across said rollfiche roll in a direction perpendicular to the direction of film travel so that it allows scanning of data on said rollfiche roll which is wider than that projectable on a fixed sized screen at one given time at a given magnification ratio; and

housing means for enclosing said apparatus, containing said viewing screen, and instrument controls.

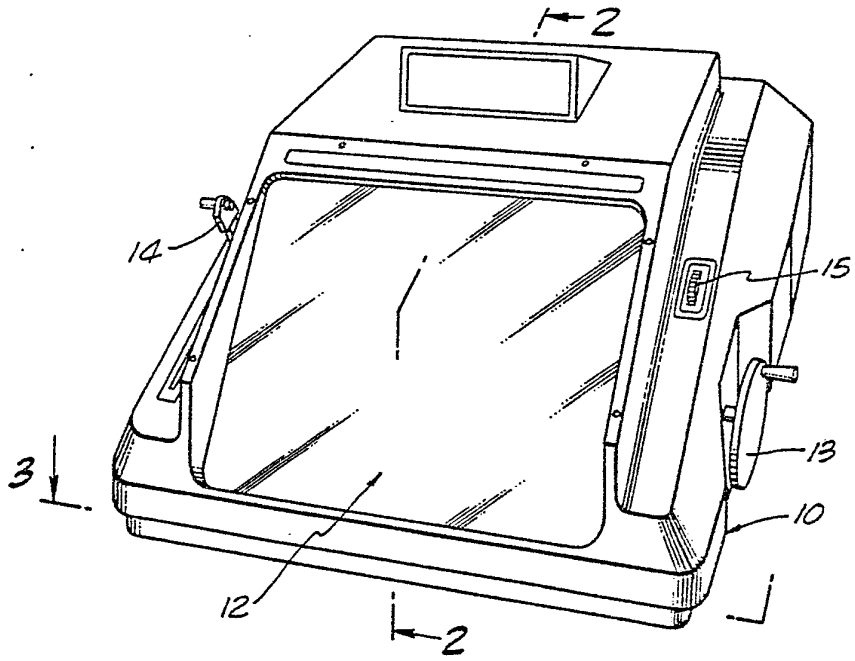


FIG. 1.

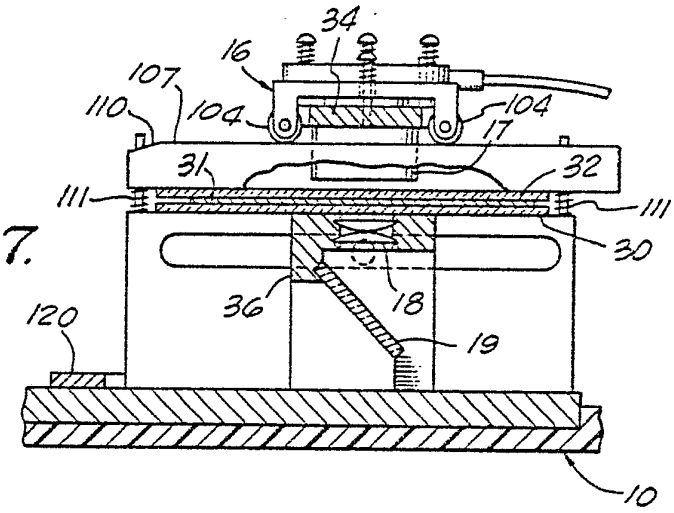


FIG. 7.

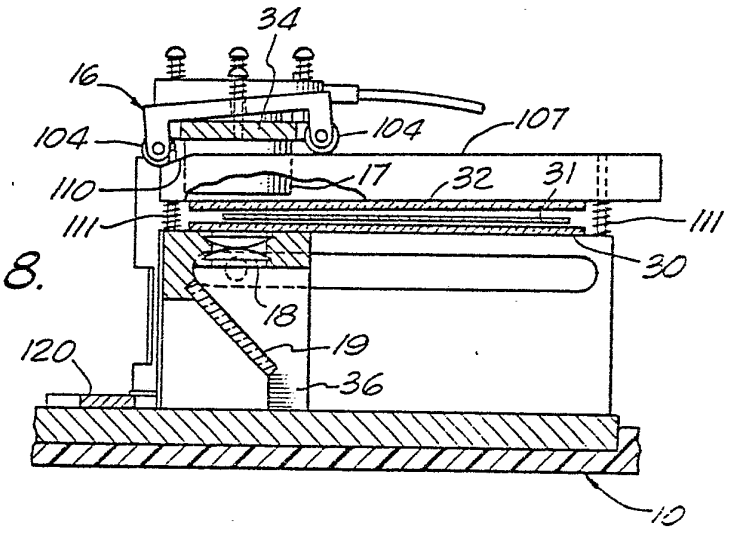


FIG. 8.

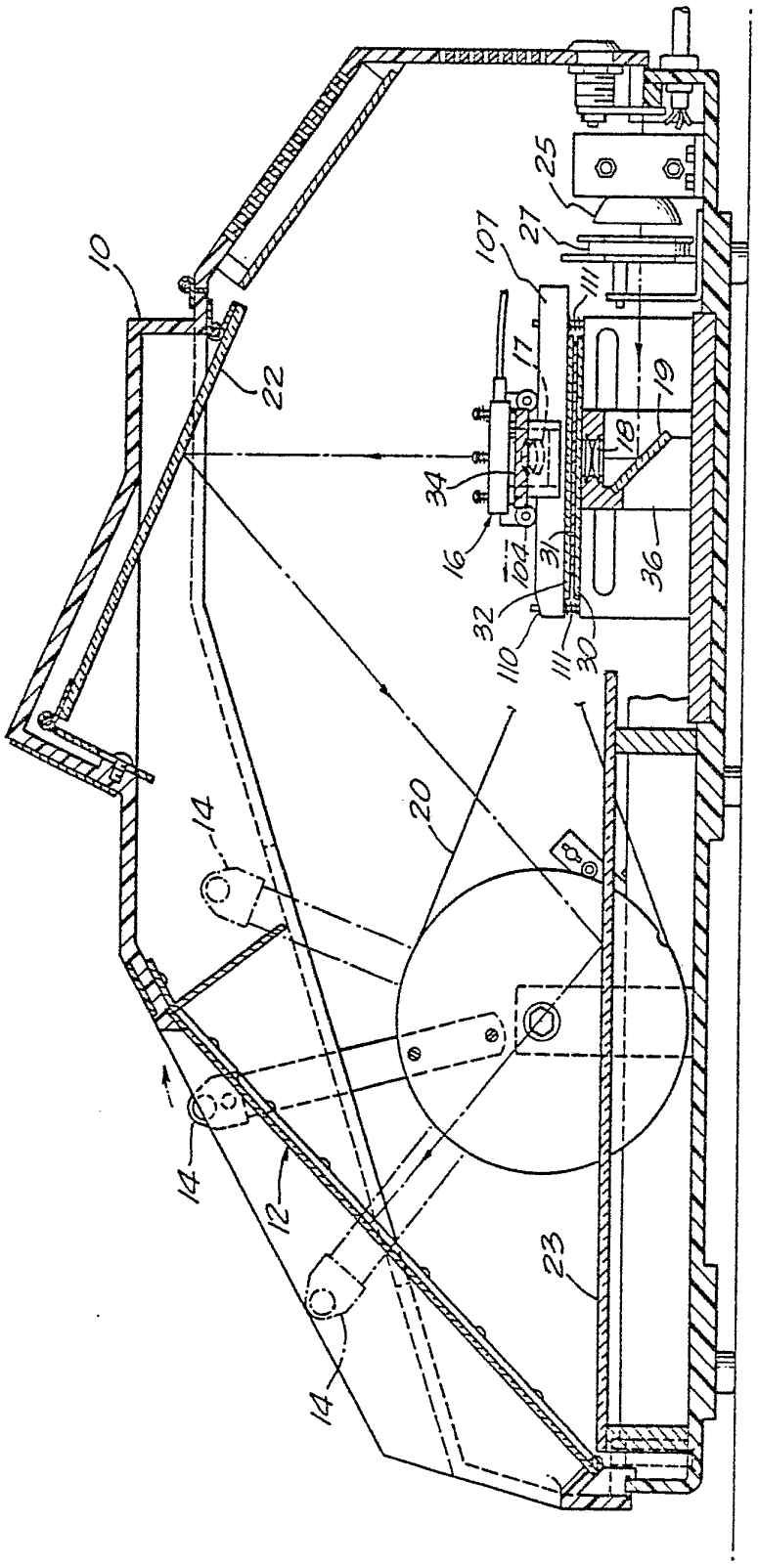


FIG. 2.

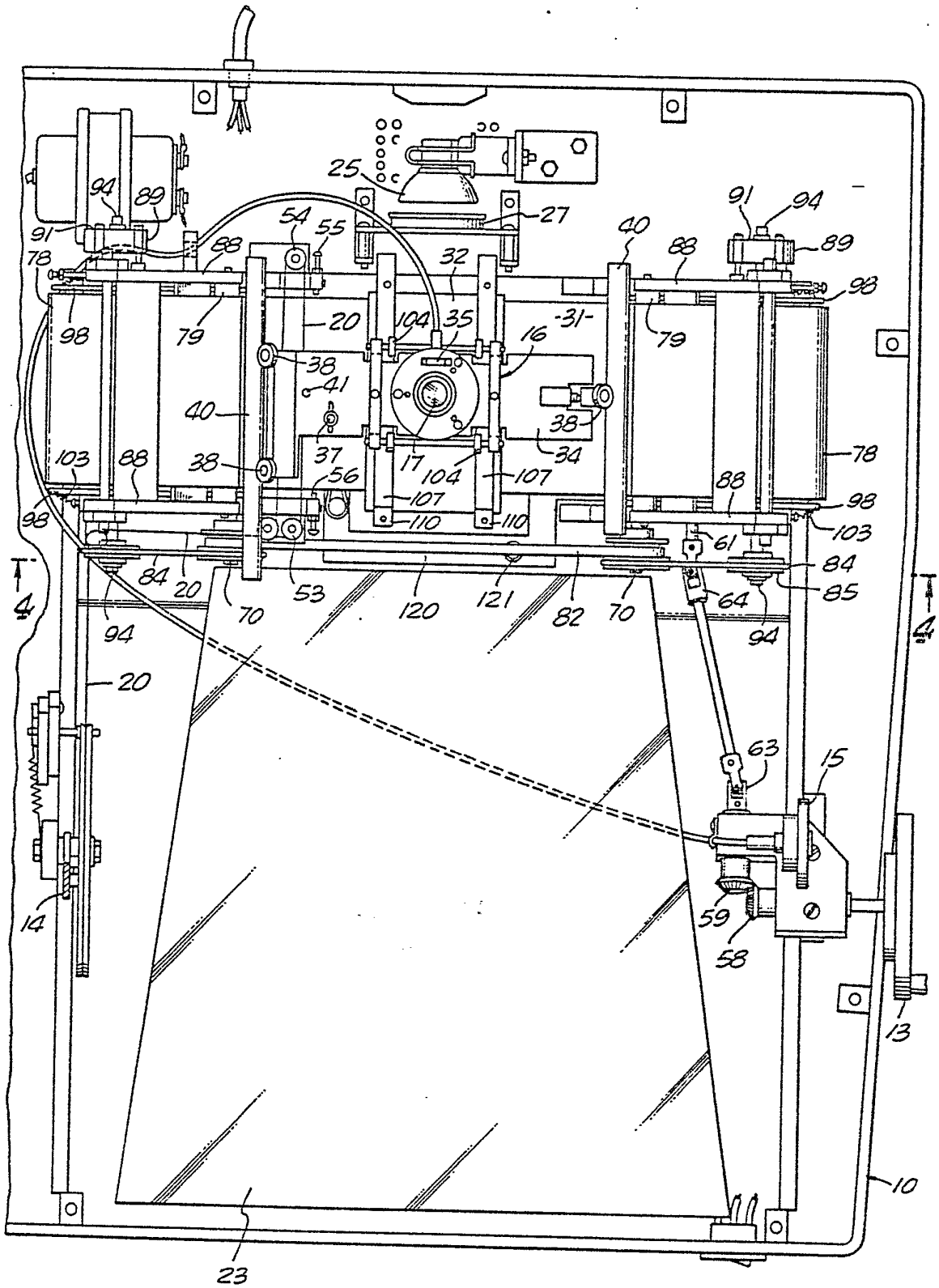
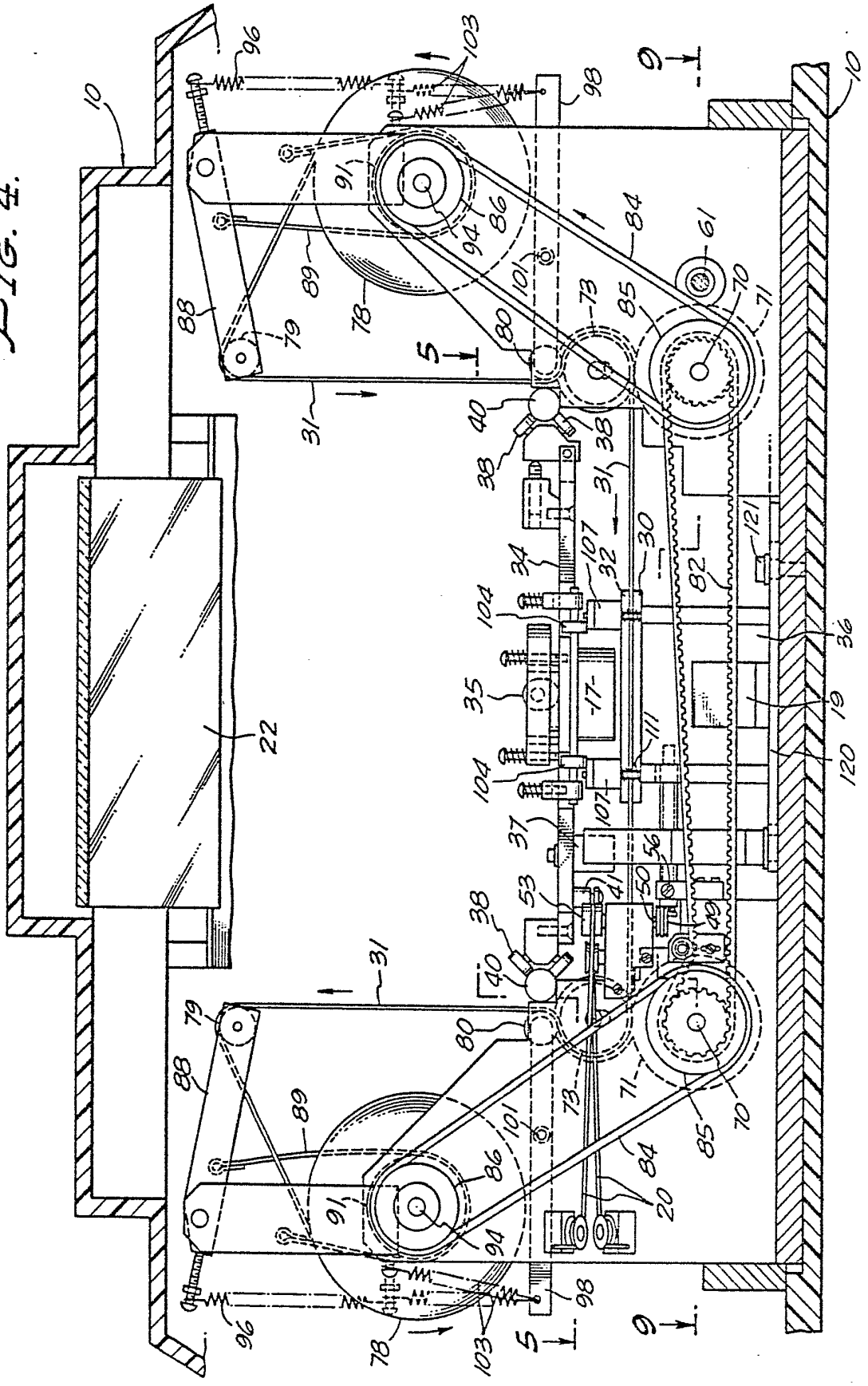


FIG. 3.

FIG. 4.



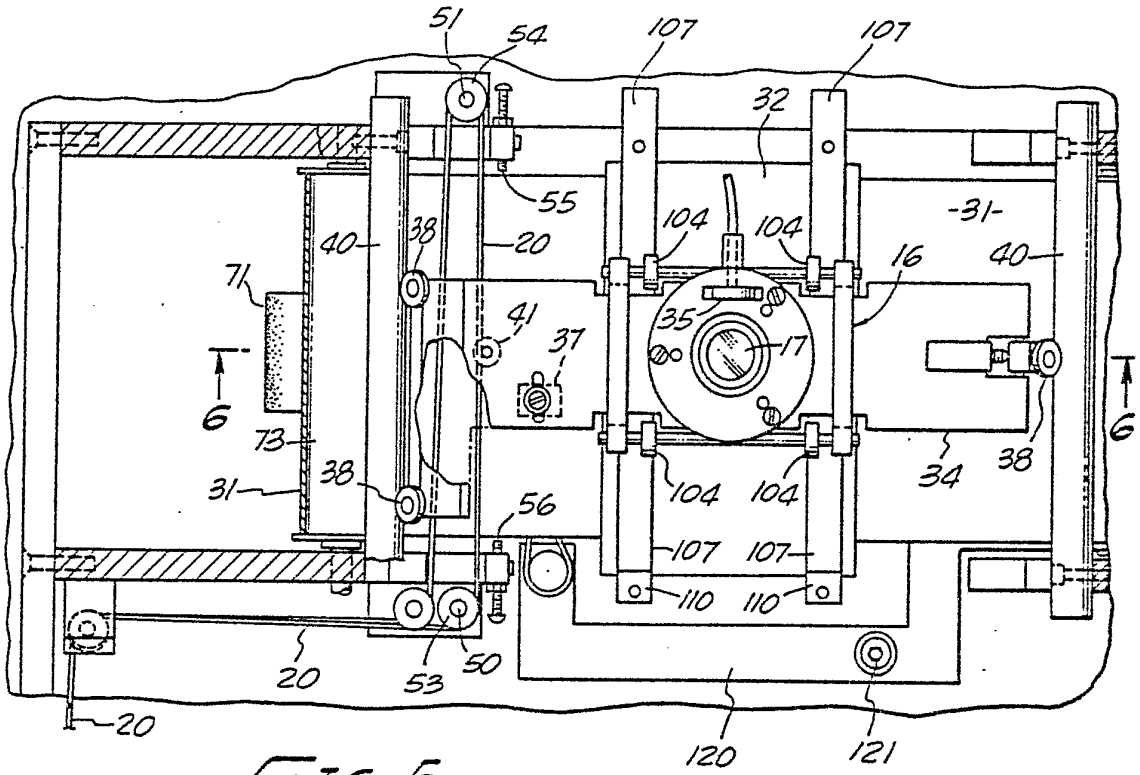


FIG. 5.

FIG. 6.

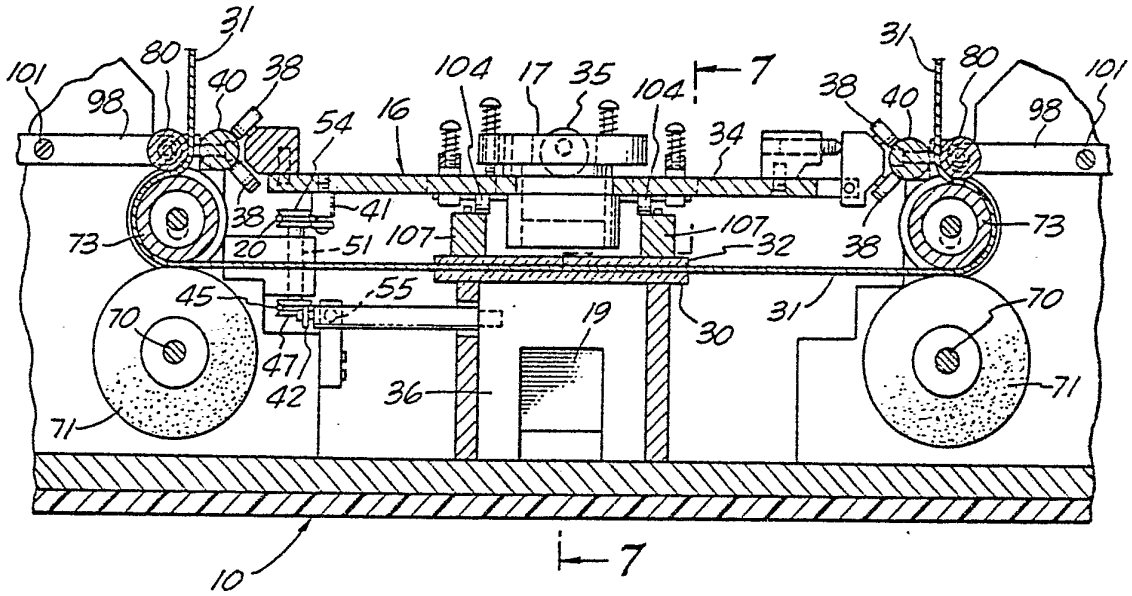


FIG. 9.

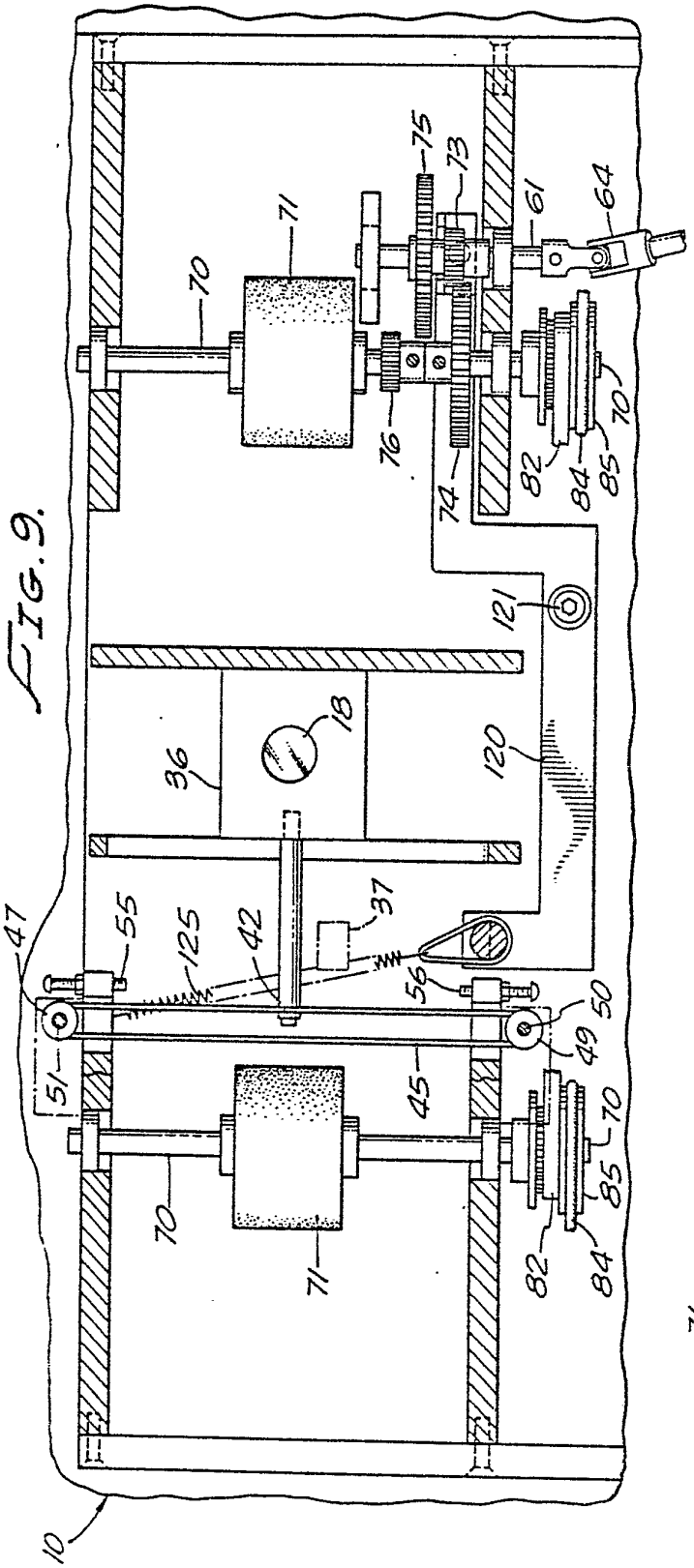


FIG. 10.

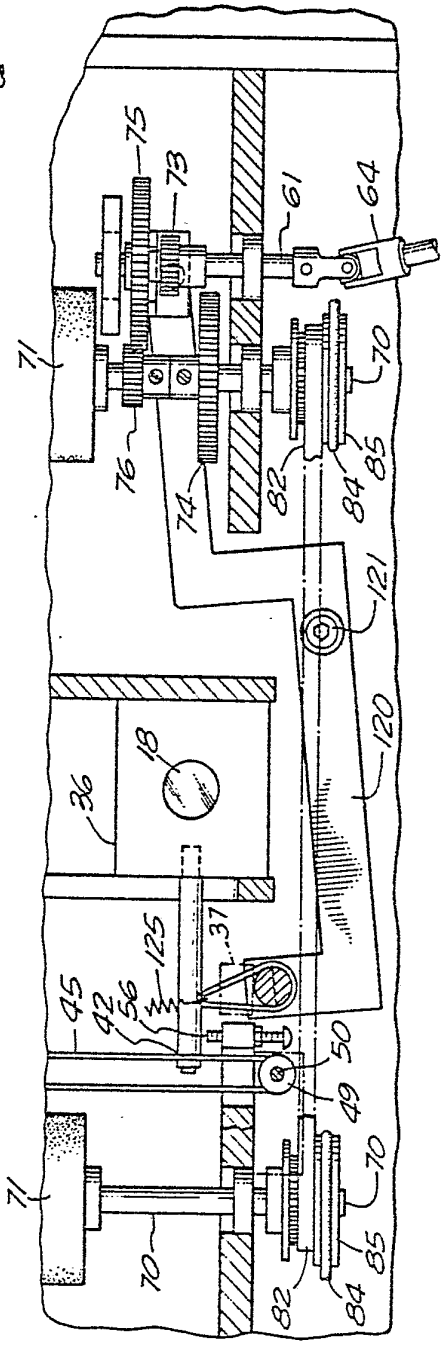
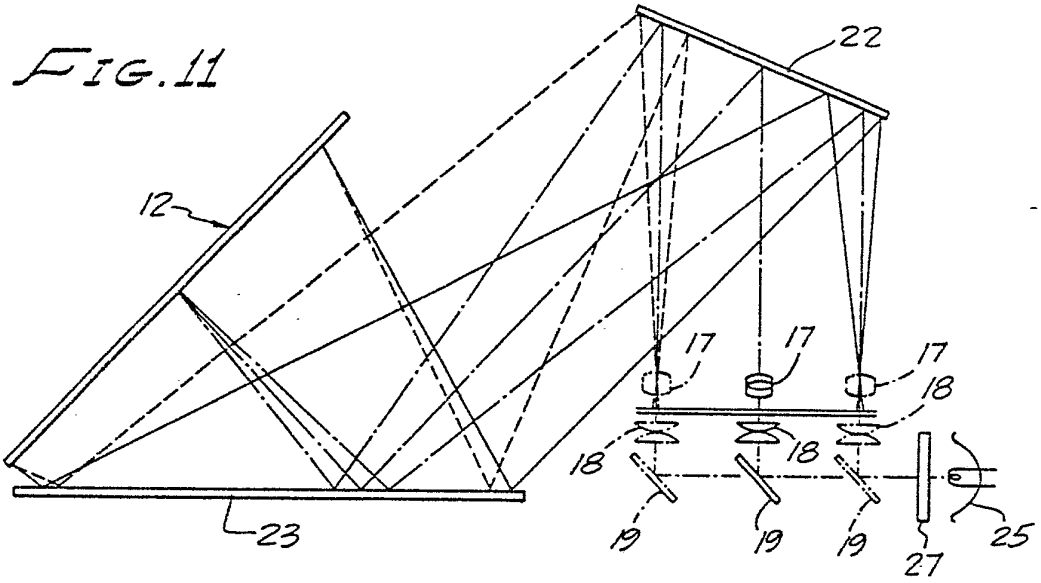


FIG. 11



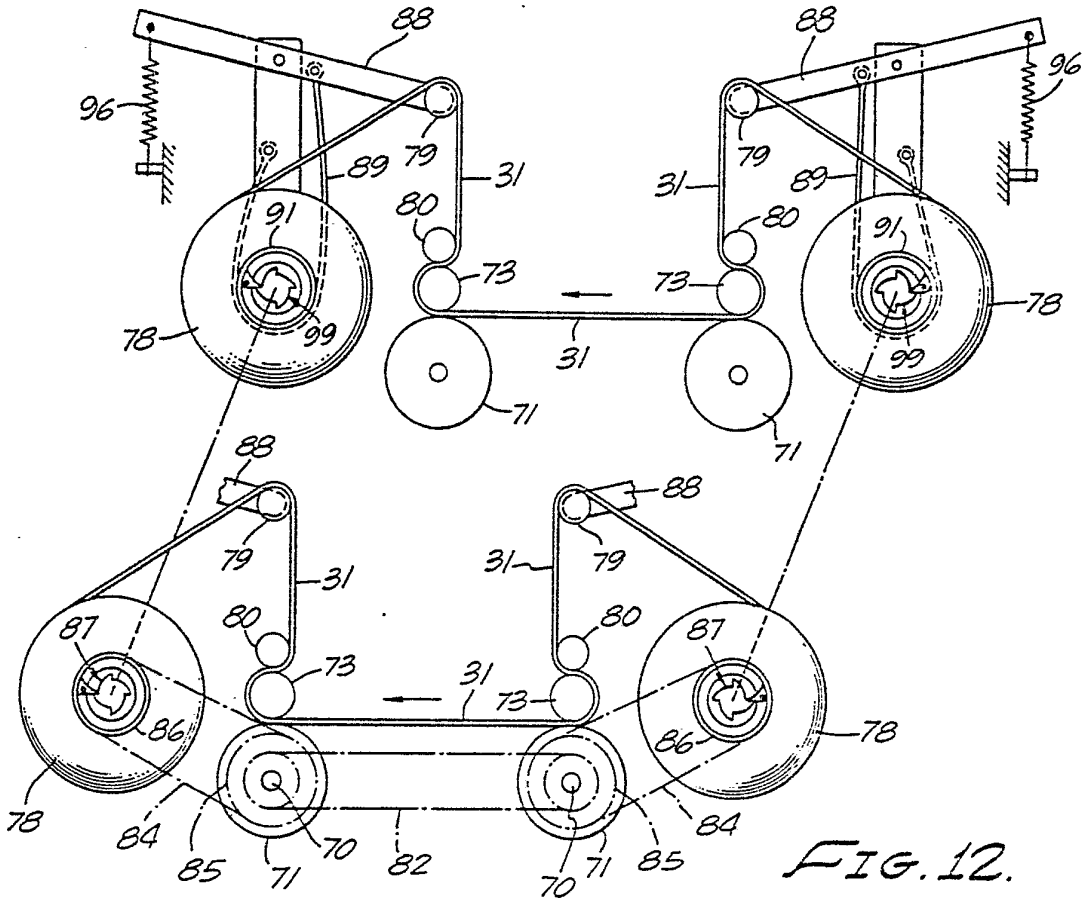


FIG. 12.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US81/00525

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

I.P.C.[3] G03B 23/12
U.S. CL. 353/26R

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
US	Class 353, Subs 26R.A. 25R, 101 Class 242 Sub 75.42

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	US, A 2,130,562 Published 20 September 1938 Pratt	1,2,5
X	US, A 4,126,387 Published 21 November 1978, Broome et al.	3
X	US, A 3,445,075 Published 20 May 1969, Siegemund	4
X	US A 3,741,645 Published 26 June 1973 Hollwedel et al	6

* Special categories of cited documents: [15]

"A" document defining the general state of the art

"E" earlier document but published on or after the international filing date

"L" document cited for special reason other than those referred to in the other categories

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or 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

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
17 July 1981	06 AUG 1981
International Searching Authority [1]	**Signature of Authorized Officer [20]**
ISA/US	Harry N. Haroian

Form PCT/ISA/210 (second sheet) (October 1977)