July 8, 1969 W. G. ENGEL 3,454,328

LIGHT VALVE ASSEMBLY FOR MOTION PICTURE FILM PRINTER

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Fig. 1

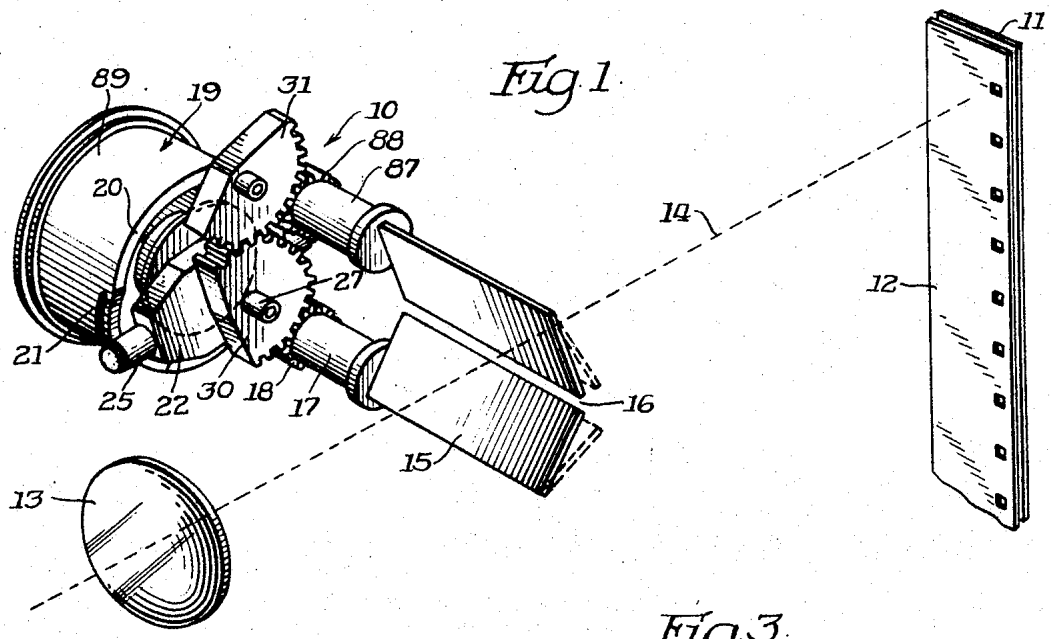


Fig. 3

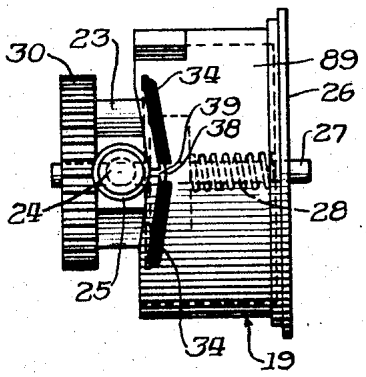


Fig. 2

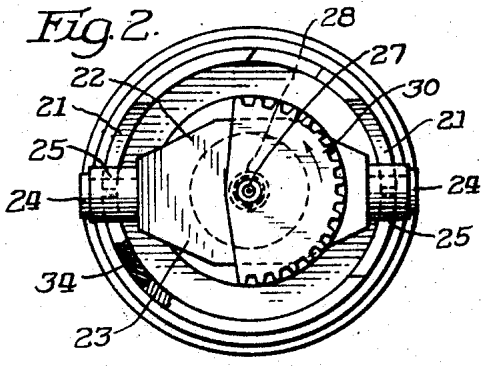


Fig. 4

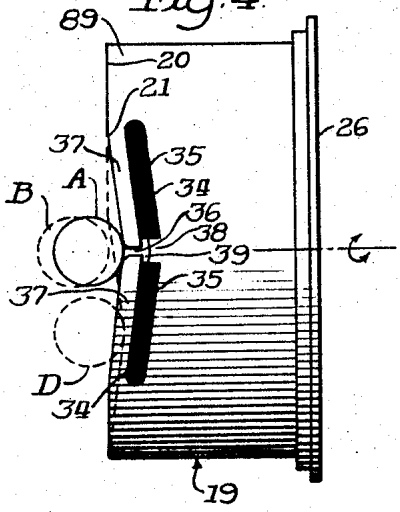
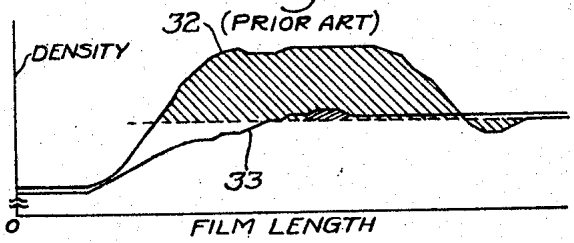


Fig. 5



Inventor:
Willi G. Engel.

By Barry E. Clark
John E. Peele Jr.
Attys

United States Patent Office

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LIGHT VALVE ASSEMBLY FOR MOTION PICTURE FILM PRINTER

Willi G. Engel, Evanston, Ill., assignor to Bell & Howell Company, Chicago, Ill., a corporation of Illinois

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U.S. Cl. 350—271 3 Claims

ABSTRACT OF THE DISCLOSURE

The adjusted position of the vanes of a light shutter are controlled by the angular condition of a roller which is displaceable into locked condition against a bearing defined by the edge of a cup from which the roller is extendable. The cup is adjustable to adjust the position of roller locking means in the bearing. Resiliently padded springs in the cup prevent vane flutter due to bounce upon engagement of the roller with the bearing and the locking means.

The present invention relates to photographic printers. Particularly the invention relates to light valve apparatus for film printers. Specifically, the invention relates to control means for light vanes of a light valve apparatus of a motion picture film printer and the like.

The employment of light vanes or shutters in film printing, to adjustably control the cross-sectional area of light from a source to the end that therefrom resulting intensity and/or color composition of printing light is adjusted to compensate for varying lighting conditions under which themes being printed were originally exposed, is well known in the art. One heretofore known mechanism for controlling vanes of the class described comprises a cup which is rotated through a synchronizing mechanism in response to desired changes in light intensity. The cup has an edge fashioned with a pair of diametrically disposed V-shaped recesses the angular positions of which are synchronized with vane spacing. To releasably adjust and lock the vanes in adjusted positions a roller assembly comprising diametrically opposed rollers is guided into nadirs of the angles of said recesses by being forcibly drawn against the edge of the cup. The roller assembly is operably connected to an assembly of the vanes and as it is motivated toward the nadirs in which its rollers become releasably locked, it adjusts the vanes.

The kinetic energy generated by the force with which the roller assemblies of prior printers are drawn into their operating positions cause them to "bounce" against their respective cup edges. That phenomenon produces undesirable effects in a film being printed because of variations in the light volume passed from between the shutters as they vibrate in response to roller assembly bounce.

It is an object of the present invention to provide improved light valve means in a film printer and the like for adjusting the volume of printing light.

It is a further object of the present invention that said light valve means comprise a pair of cooperatively arranged vanes and an improved control mechanism therefor.

It is another object of the present invention that said control mechanism include a cup-like member having an edge fashioned with V-shaped recess means into which a vane controlling roller assembly is forcefully drawn to adjust the vanes by edge motivation of said roller assembly and cushioning means for absorbing the impact of the roller assembly with said cup-like member.

An additional object of the invention is that said cushioning means be of impact absorbing fabrication and

arranged in the walls of said cup-like member adjacent the edge thereof whereby the roller assembly is precluded from bouncing as it is forcefully drawn into the recess means.

The foregoing and other objects, features and advantages of the present invention will become more apparent upon consideration of the following description and appended claims, when considered in conjunction with the accompanying drawings wherein the same reference character or numeral refers to like or corresponding parts throughout the several views.

On the drawings:

FIG. 1 is a schematic view in perspective of a light valve assembly for a film printer and embodying the present invention.

FIG. 2 is an end view of the cup-like member and roller assembly of the light valve assembly, portions of the latter having been omitted, and portions being broken away for the purpose of illustration.

FIG. 3 is an elevational view looking toward the right of FIG. 2.

FIG. 4 is an enlarged view schematically illustrating the relationship of the cup-like member and roller assembly during vane adjustment.

FIG. 5 is a graphic comparison of the density vs. film length curves representing the paths of a pair of vanes actuated by a prior art vane control mechanism and my improved vane control mechanism.

Referring now more particularly to the drawings, in FIG. 1 a photographic printer generally designated **10** is employed for continuously exposing raw film stock **11** by means of light rays passing through a printed processed film **12** having segments depicting scenes which may have been exposed under varying lighting conditions. To the end that related scenes when printed will appear as having been exposed in natural relationship rather than disjointedly, known means are provided for variably obscuring the cross-sectional area of the beam with light valve mechanisms. With these mechanisms, the brightness of the beam is varied.

Although the invention is described as it relates to a single light beam, a printer capable of printing color is understood to have a light valve assembly associated with each chromatic beam into which a beam of white light is split. Each light valve assembly varies its beam before that chromatic beam is recombined into a white beam having compensated chromatic values, by which film **11** is exposed through the film **12**. Inasmuch as illustrating a plurality of light valve assemblies adds nothing to the understanding of the invention, they have been omitted from the drawings.

The beam affected by the light valve apparatus shown in FIG. 1 is passed along an optical axis **14** through a conventional relay lens **13**. The beam then passes through an adjustable vane slot **16** toward the film strips **11** and **12**. The slot **16** is defined by a pair of conventional adjustable light vanes or shutters **15** and **85** which are adapted to vary the cross-sectional area of a beam passing about the axis **14**. Each of the vanes **15** and **85** is secured along an outer edge on an axis pin (not shown) which is journalled in a respective of suitably mounted cylinders **17** and **87**. A pair of pinions **18** and **88** are constrained for rotation on the axis pins of the vanes **15** and **85** for control thereof in a manner hereinafter to be described.

A cup-like member which may be referred to as a solenoid cup **19** is defined by a wall **89** of cylindrical configuration. At its vane proximate end said wall comprises a bearing defined by rim or edge **20** which is fashioned with a pair of diametrically opposed broad V-shaped recesses **21** and adapted for bearing support of a roller assembly generally designated **22**.

The roller assembly **22** comprises a medial body **23** disposed normally to the axis about which the solenoid cup is generated. From the opposite ends of said roller assembly body **23** there projects outwardly a pair of diametrically aligned pins **24** which extend over diametrically opposite portions of the edge **20**. A pair of rollers **25** are rotatably arranged on the pins **24**, respectively. The roller assembly body **23** is adapted for rocking about a fixed axis of rotation provided by a shaft **27** with which said body is constrained for movement. Said shaft projects through the opposite end **26** of the cup in which said shaft not only is journalled but also is reciprocative longitudinally thereof to move the roller assembly **22** toward and away from the edge **20**, that is, to the right and left relative to FIG. 3 and thereby comprises means for moving roller **25** into and out of engagement with edge **20**. Reciprocation of the shaft **27** to the right may be achieved by a solenoid (not shown) which operates said shaft and is capable of exerting 40 pounds of pull against the roller assembly to condition it into engagement with the edge **20**. A coiled spring **28** is positioned between the cup **19** and roller assembly **22** in surrounding relationship with shaft **27**. Spring **28** normally urges the shaft **27** and rollers **25** to the left in FIG. 3 so that the rollers are out of engagement with rim or edge **20**.

Rotational movement of the assembly **22** causes adjustment of the vanes **15** and **85**. For that purpose, a gear sector **30** which is constrained for rotation with the shaft **27** meshes with the pinion **18** to drive its associated vane **15**, as illustrated in FIG. 1. The gear sector **30** also operably meshes with a suitably supported gear sector **31** for driving the other of the pinions **88** to rock its associated vane **85**. Accordingly, as the gear sector **30** moves counterclockwise from the position shown in FIG. 1, the vanes will move toward the dotted line position shown in FIG. 1 and slot **16** will enlarge. Contrariwise, upon opposite rotation of the gear sector **30** said vanes will move to narrow said slot.

By heretofore known light responsive means (not shown), when adjustment of the vanes is required, the roller assembly **22** will be disengaged from the edge **20** by outward extension of shaft **27**. Simultaneously, the cup **19**, the angular position of which is synchronized to provide vane adjustments required, will be rotated about the axis defined by shaft **27** to set the nadirs of the angles formed by the recesses **21** in a position such that when the rollers **25** are engaged against edge **21** in such nadirs the vanes will have become arranged to allow passage of only the disired volume of light through the slot **16**.

In FIG. 4, the relative positions of the solenoid cup **19** and the roller assembly **22** during vane adjustment is illustrated diagrammatically. The operative position of the roller assembly immediately prior to release or disengagement from edge **20** for adjustment is shown in solid lines and designated A. By reason of the proportioning of the parts, the roller assembly is locked in the recesses **21** when disposed in the A position. When the requirement for adjustment arises the roller assembly is extended from cup **19** by heretofore known means and assumes the dotted line B position. Simultaneously, by heretofore known means the cup **19** is rotated to the cup position shown in dotted lines in FIG. 4. The latter cup position is synchronized to produce desired vane conditioning. Thereafter, by heretofore known means which include a solenoid to which reference was previously made herein, the shaft **27** is drawn inwardly to engage the roller assembly with the edge **20** of the adjusted cup at diametrically opposed positions designated C which are then removed from the nadirs of the angles of the recesses **21** because of the prior rotation of said cup. The inward force with which the roller assembly is drawn causes it to rotate about the axis of shaft **27** and thereby slide the rollers **22** into the nadirs of angles of the recesses **21** to

the dotted line position designated D in FIG. 4 as the roller assembly is cammed by the sloping sides of the recesses **21** which define means for displacing rollers **25** along edge **20**. As the roller assembly rotates to the D position, the vanes become adjusted, the roller assembly being locked in adjusted position when said rollers become seated in said nadirs.

The cup **19** is rotatable in both directions of rotation depending upon light volume requirements. Consequently, the roller assembly **22** is adapted to rotate in opposite angular directions depending upon the relative positions of recesses **21**. Accordingly, the vanes are automatically adjustable to either enlarge or reduce the light passing slot **16**.

The force with which the roller assembly is drawn against the edge **20** to adjust the vanes is of a magnitude sufficient to cause said roller assembly to "bounce" if a prior solenoid cup is employed in printer **10**. The vane path, in such event, would be as illustrated graphically at **32** in FIG. 5 through a graph based on a film density vs. film length curve. Ensuing light volume variations could cause undesirable apparent variation of intensity values in the film **11**. By employing the present improvement, the "bounce" evident with prior constructions as seen in the cross-hatched area under curve **32**, is eliminated and vane adjustment will be in a substantially straight or uniform path as graphically illustrated at **33** in FIG. 5.

For effectuating the improved result, a shock absorbing mechanism is provided. It comprises a plurality of elastomer pads **34** which are arranged in the walls **89** of the cup inwardly from the edge **20**. In the present embodiment, each pad **34** is engaged in a slot **35** which is formed adjacent and parallel the edge of each leg of each V configuration defining a recess **21**. Accordingly, the slots **35** are associated in pairs, one thereof for each recess **21**. Shock absorption is augmented by parting the wall **89** inwardly from edge **21** at the nadirs of the angles forming each recess to connect each associated pair of slots **35** through a neck space **36**. Such arrangement generates a pair of resilient fingers **37** which define each of the recesses **21** and serve to retain associated elastomer pads **34**. To additionally facilitate retention of the said pads, the adjacent ends of each pair of slots **35** are restricted by an integral wall section or boss **38** as illustrated in FIGS. 3 and 4. However, the bosses **38** do not entirely separate associated slots, the adjoining ends of which communicate through narrows **39** which are communicatively connected to the neck space **36**.

As many substitutions or changes could be made in the above-described construction and as many apparently widely different embodiments of the invention within the scope of the claims could be constructed without departing from the scope and spirit thereof, it is intended that all matter contained in the accompanying specification shall be interpreted as being illustrative and not in a limiting sense.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A device of the type having a light valve including adjustable vane means defining a variably dimensioned light passing slot for controlling the cross-sectional area of a beam of light to which a stream of film is to be exposed, and comprising:

an elongated bearing mounted for adjustment to control the dimensions of said slot;

a roller arranged for movement between an extended condition in which said roller is spaced from said bearing during adjustment therof and an engaged condition in which said roller is displaceable along said bearing;

locking means fashioned for limiting displacement of said roller along said bearing when in engaged condition; coupling means connected to said vane means

for adjusting the dimension of said slot as said roller is displaced;

means for moving the roller into and out of engagement with said bearing;

means for displacing said roller along said bearing, when in engaged condition; and

resilient means for absorbing shock generated when said roller is moved into engagement with and displaced along said bearing toward said locking means.

2. A device according to claim **1** characterized by a cup having an edge comprising said bearing, said edge having a pair of opposed recesses defining said locking means, said recesses being proportioned to prevent angular displacement of said roller to secure said vane means in adjusted positions, the resilient means arranged in the wall of the cup and extending longitudinally of said edge.

3. A devive according to claim **2** characterized in that

a plurality of spring-like fingers are fashioned in said cup, said cup having a plurality of slots which together with said edge define said fingers, the resilient means comprised of pad-like structures held in said slots for absorbing force of impact of said roller against said bearing.

References Cited

UNITED STATES PATENTS

2,204,864 6/1940 Michaelsen ---------- 352—208

RONALD L. WIBERT, *Primary Examiner.*

ORVILLE B. CHEW II, *Assistant Examiner.*

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