Patent Summary Sheet

# ABSTRACT

Primary Examiner Alan A. Mathews Attorney, Agent, or Firm John E. Wagner 57 A viewfinder, particularly useful in a camera, is lensleSS but which provides a useful reticle to aid the user to properly frame the desired Scene.

A camera body includes a view finder front wall opening.

Surrounding the front wall opening, on its interior Surface is a concave mirror with its focus on a reticle.

The reticle on an internal Surface of the camera body is located at the interior face of the eyepiece opening region of the viewfinder.

Incoming light at the front opening illuminates the reticle and its image is reflected by the concave mirror Surface to the user's eye.

In one embodiment, the front opening of the camera is a Single opening larger than the rear or eyepiece opening, and in another embodiment, the front opening constitutes a Series of Small holes in the front wall of the camera with the Surface between the holes reflectorized and acting as the concave mirror.

In another embodiment also adapted particularly for Zoom lens cameras, a reticle mask is included within the camera body and is adjustable with the Zoom position of the taking lens to change the Size of the reticle.

This feature includes a pair of movable L-shaped masks, each including an L-shaped reticle and which combine to produce a variable Size rectangular reticle.

27 Claims, 9 Drawing Sheets

U.S. Patent

U.S. Patent

U.S. Patent

Sheet 3 of 9

U.S. Patent

Sheet 4 of 9

Sheet 5 of 9

w P

Xa.

ss so

( W f )

Sheet 6 of 9

Sheet 7 of 9

s

Sheet 8 of 9

Sheet 9 of 9

RS s S Š S.

This is a continuation-in-part application of U.S. patent application Ser.

No.

08/859,868 filed May 21, 1997, now abandoned, which is a non provisional application based upon provisional application Ser.

No.

# BACKGROUND OF THE INVENTION

Viewfinders find many uses and are of particular impor tance in cameras to aid the photographer in framing the Subject.

And the most accurate and capable viewfinders, found in S70-300 point-and-shoot cameras, are too expensive for current S9-S15 single-use cameras.

In the very least expensive cameras of the Single-use camera type, an optical viewfinder is dispensed with, providing only a hole through the camera which provides virtually no accu racy in aiming the camera.

In order to provide accurate framing, Viewfinders have been used which require the use of a minimum of two lenses, to which reflective optical coatings are added (the Albada viewfinder).

A number of viewfinders have been devised.

Summary of existing low cost viewfinders:

Small hole in rear wall of camera.

Acceptable for only the least expensive cameras.

Comments: Small hole near eye acts as a pin-hole lens.

Pros: Image of scene and front frame sharp.

No motion parallax between frame and scene.

Cons: Adds cost of lenses and assembly.

Lenses collect dirt, finger prints and scratches.

Image is minified making it harder to see Edges of frame are out of focus.

Comments: Created by adding reflective coatings to reverse Galilean viewfinder lenses.

Pros: Bright rectangular frame is imaged in the scene.

No motion parallax between frame and scene.

Lenses collect dirt, finger prints and scratches.

Image is minified making it harder to see.

2, so named because it makes use of one positive and one negative lens, as Galileo used in the first telescope.

The Albada viewfinder as illustrated in FIG.

reflective coating to the concave Surface of the negative lens to act as a magnifying mirror.

Also a frame or reticle is formed on the interior Surface of the positive lens, usually by metal deposition.

In each of these types of prior art cameras which are represented in the accompanying drawings, FIGS.

and typical images Seen therein are represented by FIGS.

Many cameras, including low cost point and shoot cam eras provide Zoom capability.

For Such applications, a reticle is even more important to accurately frame the photograph.

In the photo finishing business, a cropping aid is used which consists of a pair of planar right angled notched sheets which are movable to define a variable size exposure rect angle.

In certain complex lens type ViewfinderS Similar planar masking devices have been used.

This type of adjustment has not, heretofore, been applied to a lensleSS Viewfinder.

# BRIEF DESCRIPTION OF THE INVENTION

The Subject of this invention relates to a lensleSS optical viewfinder and camera with a lensless viewfinder which is not only low in cost but provides a reticle which is visible through the Viewfinder when the photographer frames the portion of the Scene which will appear in the processed picture.

The user then can obtain properly framed photoS as when using much more expensive cameras.

This is achieved in the preferred embodiment by employ ing two aligned openings in the camera case in the front and rear walls of the opaque hollow camera body.

The inner Surface of the front opening in the camera body is surrounded by a concave mirror Surface RC.

The viewfinder of this invention optionally eliminates the need for any refractive material Such as lenses or transparent windows in the viewfinder opening.

In the case of a Zoom lens camera, the Same basic lensleSS viewfinder is formed in the camera body with its front opening and concave mirror.

The reticle, however, is formed in two parts, on diagonally opposite corners of the rear opening, described below.

Within the camera body in the viewfinder optical path are a pair of L-shaped sliding masks which define a variable

These plates are coupled to the Zoom adjustment mechanism to change their spacing and thus to change the size of the reticle opening to correspond to the field of view of the camera lens.

By comparison with the prior viewfinders discussed

lensless variable focal length viewfinder

Pros: Bright rectangular frame is imaged in the scene.

No lenses used or associated cost.

No motion parallax between frame and scene.

Image of scene remains full size as in the most expensive SLRs.

Costs approximates that of using no viewfinder.

Quality suitable for more expensive cameras as well.

Cons: --- Pros: Bright rectangular frame is imaged in the scene.

No lenses used or associated cost.

No motion parallax between frame and scene.

Image of scene remains full size as in the most expensive SLRs.

Costs approximates that of using no viewfinder.

Quality suitable for more expensive cameras as well.

Provides a wider field of view of the scene than the reticle, to aid composition.

Edges of holes creates some diffraction.

Accommodates a range of reticle sizes, required by Zoom cameras.

Pros: camera provides accurate frame lines, of a size matching that of the Zoom lens, without cost of multi element Zooming viewfinder lenses.

Cons: eye relief is slightly reduced for wide-angle position.

This viewfinder is not limited to cameras but may be used in other applications, as well.

The Single use camera is a prime candidate for its application because of its low cost, ease of incorporation in those products and the fact that it provides a reticle image in the field of view of the user's eye without the use of any refractive elements and without any image minification.

# BRIEF DESCRIPTION OF THE DRAWINGS

This invention may be more clearly understood with the following detailed description and by reference to the draw ings in which:

1 is a transverse Sectional view through a prior art lensleSS Viewfinder having a large opening at the front of a camera and a Small eyepiece opening at the rear and a user's eye with the field of view of the viewfinder FOV(v?)

and the field of view of the user's eye in the vertical plane defined by limit lines;

with typical Soft-focus indistinct frame lines,

2 is a transverse Sectional view through a conven tional prior art reverse-Galilean Viewfinder illustrating the light path and fields of view of the viewfinder and of the user's eye similar to FIG.

3 is a view similar to FIG.

1 of the prior art Albada

3 with Superimposed sharply focused reticle;

4 is a lateral croSS Sectional view through a camera incorporating my invention including the fields of View of the viewfinder and the user's eye and the light paths of incident light and the reflected light path from the reticle to the concave mirror, and the reflected reticle image to the users eye in dashed lines,

5 is an interior perspective view of the preferred

7 is a partial perspective view similar to FIG.

alternate embodiment of my invention;

7A shows the unminified view of the Scene, with Sharply focused reticle and slight localized attenuation of the Scene due to the radial Struts,

8 is an interior perspective view similar to FIG.

9 is a partial perspective view similar to FIGS.

10 is a partial perspective similar to FIGS.

11 is a lateral cross-sectional view taken slightly off center to clearly show reflected light passing through a perimeter opening through a camera of the embodiment of FIG.

10 and with a user wearing glasses;

12 is a perspective view of a camera with the viewfinder of my invention partly broken away for clarity; FIG.

13 is a horizontal sectional view of a camera with Zoom capability which also employs my lensleSS Viewfinder invention with corresponding changeable reticle size;

14 is simplified exploded front elevational view of

15 is a reduced size top plan view of a camera of this invention in the wide angle lens and Viewfinder position; FIG.

16 is a fragmentary front elevational view of the changeable aperture feature of my lensleSS Viewfinder on the camera of FIG.

13 when in a wide angle configuration;

17 is a reduced size top plan view of a camera of this invention in the normal focal-length lens and Viewfinder position;

18 is a fragmentary front elevational view of the changeable aperture feature of my lensleSS Viewfinder on the camera of FIG.

13 when in a normal focal-length configu ration;

19 is a reduced size top plan view of a camera of this invention in the telephoto lens and viewfinder position; and FIG.

20 is a fragmentary front elevational view of the changeable aperture feature of my lensleSS Viewfinder on the camera of FIG.

13 when in a telephoto configuration.

# DETAILED DESCRIPTION OF THE INVENTION

4, 5–7, 8-9, is my basic viewfinder, which uses no lenses, but which forms a bright image of a reticle at the distance of the Scene to be photographed.

4 with solid line ray traceSTL, and reflected light RL which forms the image of the reticle RT are shown as dashed lines.

My proposed viewfinder uses reflective optics which can be molded as part of the front and rear walls, FW and RW respectively, of the camera body CB FIGS.

as it is defined, both in the Vertical plane.

), achieving the same results as more complex and expensive lens viewfinders.

There is no directly exposed transparent Surface which may become Soiled or Scratched, and no Subassembly opera tions for the Viewfinder are required in manufacturing.

A concave generally Spherical Surface, is molded on a protrusion on the interior face of the front camera wall FW.

The concave surface is preferably flashed with alumi num or other metallizing material to make it a highly reflective Surface RC.

It should be noted that minification of an image, in prior art viewfinders, is not a user advantage, but done for engineering reasons, to be able to use Small viewfinder lenses and maintain the field of view which matches that of the camera taking lens.

A one-to-one, or full size, image, before my invention has usually been implemented in only the Single lens refleX cameras, using a complex and expen Sive lens and prism System or in the least expensive Single use cameras which have not provided sharply focussed frame lenses.

A variation of the Albada viewfinder could be made in which the front and back glass or plastic elements were curved meniscus elements which had no refractive power; however, this would save no cost over the traditional Albada design.

My proposed lensleSS Viewfinder does not result in mini fication; however, provides a Sharply imaged frame of reference.

nothing, except reflective metallizing; however it creates a rectangular frame which appears to be Superimposed on the Scene.

A precise Smooth Surface produced in the injec tion molding process of the opaque camera body may provide sufficient reflectivity to provide a usable reticle image without metallizing.

The result of this embodiment is illustrated in FIG.

Any form of image capture means, film or electronic Storage is usable with this invention.

To minimize obscuration of the reflected image of reticle RT and supports RS, they are molded radial to the optical axis.

The reticle is so thin and out of focus as to be un-noticeable.

When this invention is applied to a more complex camera Such as one which provides various aspect ratioS or Zoom operation, there is a need to change the reticle Size to provide a matching field of View through the Viewfinder, again, without the use of lenses.

The design of taking lens assemblies, shutter mechanisms and film advances for cam eras are well known and will be Selected in accordance with well known design principles in the photographic industry therefore are not illustrated here.

4-6 is, however, replaced by an adjustable or movable reticle which changes in size with changes in focal length of the lens assembly ZL.

The reticle of this embodiment is, preferably, formed from two relatively movable masks, designated for convenience based upon their relative location in the embodiment of FIGS.

The two masks BLM and TRM are each notched to define a variable size rectan gular opening when Superimposed and moved in diagonally opposing directions of the double ended arrow in FIG.

13, 16, 18 and 20 on a rotating disc RD to move the two masks BLM and TRM Simultaneously in opposite directions to open or close the reticle formed by the visible reticle surfaces BLR and TRR.

Movement of the actuator pins LAP and RAP is accom plished Since they are connected to a regulating disc RD which is rotatably mounted for rotation within a recessed cylindrical cavity in the rear wall RW of the camera body CB.

The regulating disc RD is coupled to the lens mecha nism by any one of a number of gear or linkage mechanisms.

Suffice it to say, the masks BLM and TRM are both coupled to the Zoom adjustment of lens assembly ZL for coordinated movement therewith.

Further, the overall position of the mask mechanism can be collectively shifted to compensate for parallax errors when close focusing, and differentially shifted to accommodate various aspect ratioS.

In these figures, the masks BLM and TRM are shown as secured for sliding movement under tabs Twhich preferably are molded integrally as a part of the rear wall RW of the camera body CB.

The above described embodiments of the present inven tion are merely descriptive of its principles and are not to be considered limiting.

# CLAIM

a viewfinder opening in Said front wall; an eyepiece opening in Said rear wall; Said front wall viewfinder opening and Said rear wall eyepiece opening generally defining the field of view of the viewfinder;

a reticle defining means within Said hollow body facing

A viewfinder in accordance with claim 1 wherein Said reticle defining means is a metallized coating on Said rear wall.

A viewfinder in accordance with claim 1 wherein said concave mirror is a metallized coating on Said front wall.

A viewfinder in accordance with claim 1 wherein said concave mirror is a thin Strip generally Surrounding Said front opening and Spaced from the rest of the front wall by a Series of Struts with perimeter openings therebetween, whereby portions of a scene in front of the viewfinder outside of Said concave mirror may be viewed by a user through the perimeter openings in the area of the Struts outside of Said eyepiece opening and Said viewfinder front opening in Said front wall.

an opaque camera body defining a front wall and a rear wall and enclosing taking lens means facing in a direction, Shutter and film advance means therein;

Said opaque camera body defining an eyepiece opening in

Said front viewfinder opening and Said rear wall eyepiece opening defining the field of view of the viewfinder;

means within Said opaque camera body facing Said front wall viewfinder opening between Said eyepiece open ing and viewfinder opening outside of the Viewfinder field of view defining a reticle;

A lensleSS Viewfinder camera in accordance with claim 6 wherein Said reflecting means comprises a concave mirror at least partially Surrounding Said viewfinder opening of Said camera body.

A lensleSS Viewfinder camera in accordance with claim 6 wherein Said reflecting means comprises a metallized coating on the inner Side of Said front wall of Said camera body.

A lensleSS Viewfinder camera in accordance with claim 6 wherein Said viewfinder opening in Said front wall com prises a number of Small holes.

A lensless viewfinder camera in accordance with claim 9 wherein Said camera body SpaceS Said front wall close enough to a user's eye So that said discrete openings are out of focus to a user, and together the discrete openings present the appearance of a single viewfinder opening when a user is viewing a Subject through the viewfinder.

A lensleSS Viewfinder camera in accordance with claim 6 wherein Said means defining a reticle comprises a metallized portion of Said camera body Surrounding Said eyepiece opening.

A lensleSS Viewfinder camera in accordance with claim 12 wherein Said reticle image reflecting means com prises a generally rectangular frame portion of Said camera body to define a Substantially continuous rectangle around Said viewfinder opening, and

Support means Spacing Said rectangular frame from the

A lensleSS Viewfinder camera in accordance with claim 13 wherein Said Support means comprises a Series of Struts integral with Said camera body.

subject within the field of view comprising:

means for capturing an image by Said taking lens assem

including, a first opening in Said camera body on the same Side

A camera in accordance with claim 15 wherein said reflective means comprises a concave mirror focussed on Said reticle.

a camera body having a front and rear face; an adjustable focal length lens assembly on the front of

defined by Said camera body and includes: a first opening in Said camera body on the front face

means defining a reticle for Said viewfinder, Said reticle defining means comprising at least two relatively movable members including reticle defin ing Surfaces within Said camera body and having

The combination in accordance with claim 21 includ ing means for coupling Said reticle defining means to Said adjustable focal length lens assembly for changing of reticle Size related to changes in the focal length of adjustable focal length lens assembly.

The combination in accordance with claim 21 wherein Said relatively movable reticle defining members are two in number and each of Said members includes two adjacent perpendicular edges of a rectangular reticle and one corner thereof and said members together define the third and fourth diagonally opposite corners of Said reticle.

The combination in accordance with claim 23 wherein Said movable Surfaces include a reflecting reticle on a contrasting background.

means defining a reticle for Said viewfinder, and reflective means for reflecting an image of Said reticle

the improvement therein Said reticle defining means

The combination in accordance with claim 26 wherein Said Support means comprise a plurality of Struts which connect the camera body to Said reflective means at Spaced locations around the periphery of Said reflective means.