

United States Patent

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[54] **COMBINED VIEWFINDER-RANGEFINDER**
12 Claims, 7 Drawing Figs.

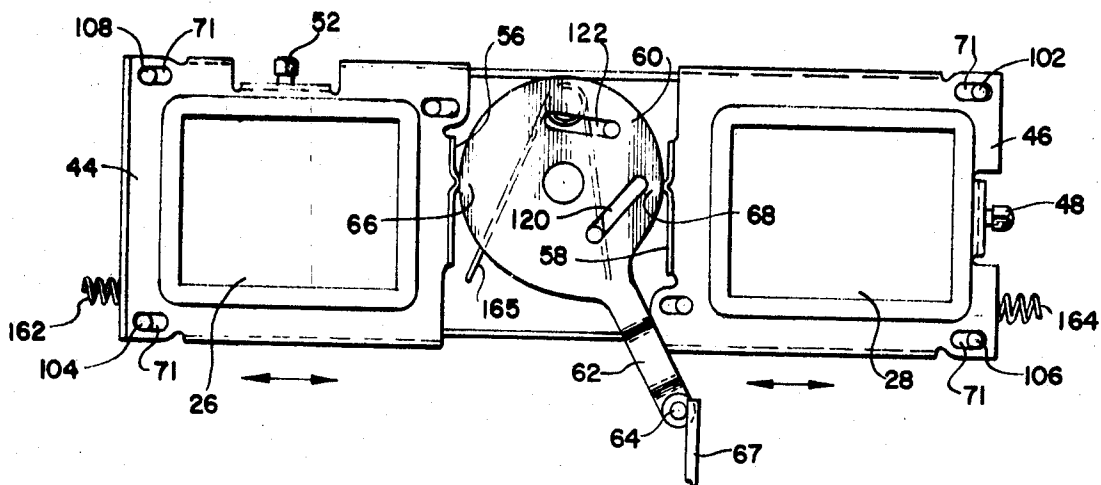
[52] U.S. Cl. 95/44,
356/8, 356/16

[51] Int. Cl. G03b 3/00

[50] Field of Search 95/44 (C);
356/8, 16

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ABSTRACT: A full-field viewfinder-rangefinder of the coincident type for a photographic camera is disclosed. A single cam is operable to cause coincidence of a pair of superposed images at predetermined focus settings of the camera. The cam also adjusts framing elements in the device so the frame size is related to the camera's field and also to correct parallax.



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3,581,644

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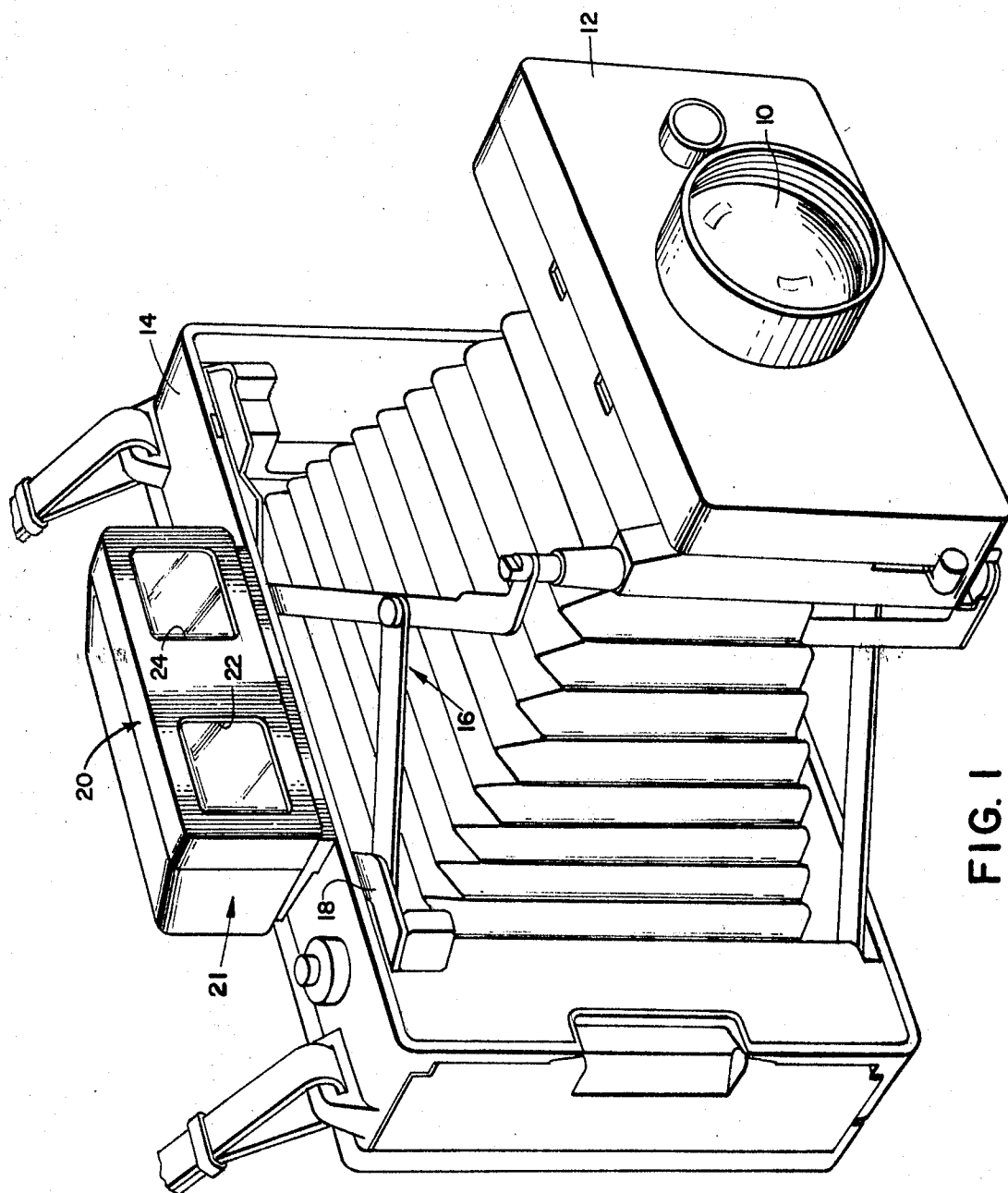
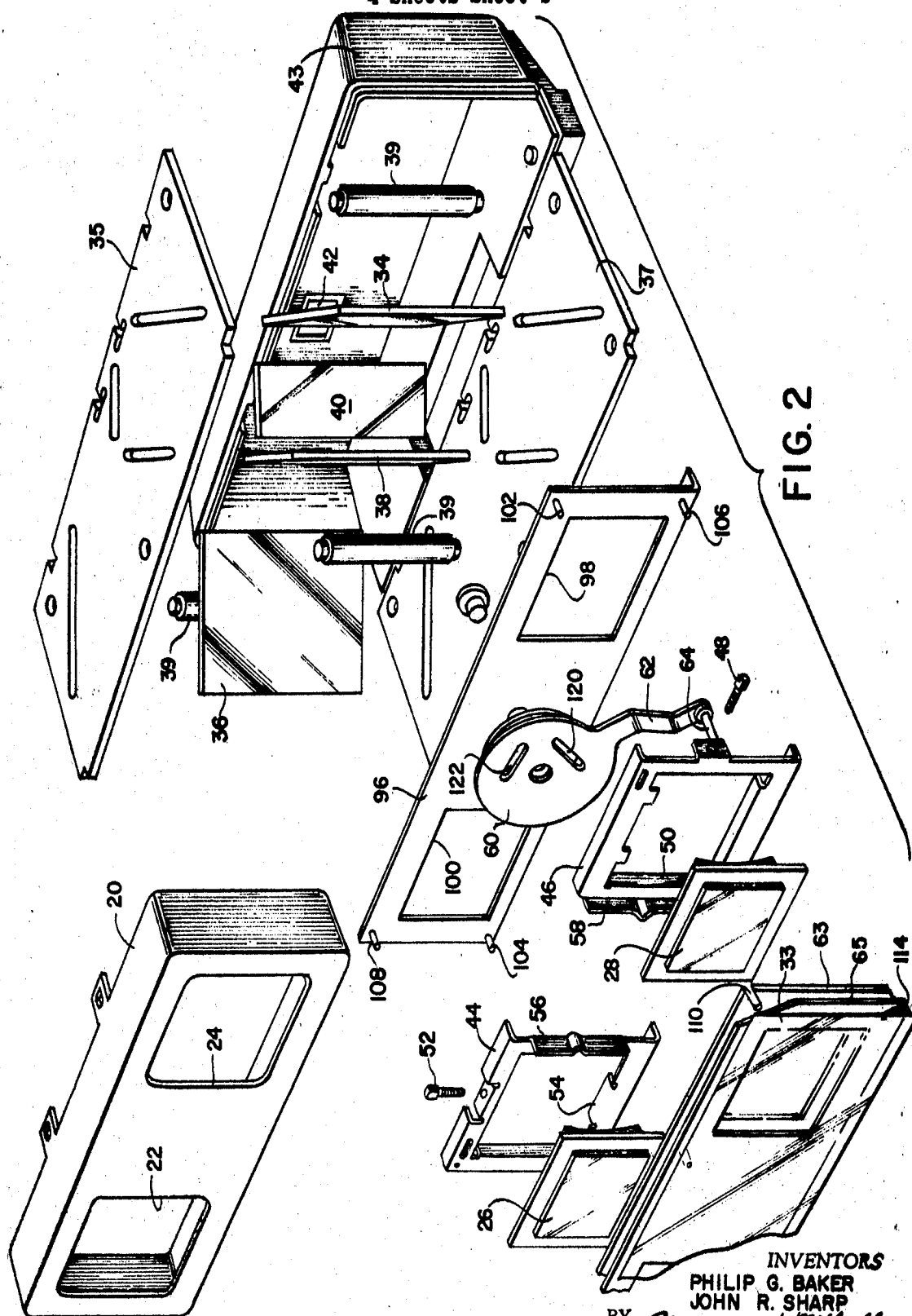


FIG. 1

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4 Sheets-Sheet 2



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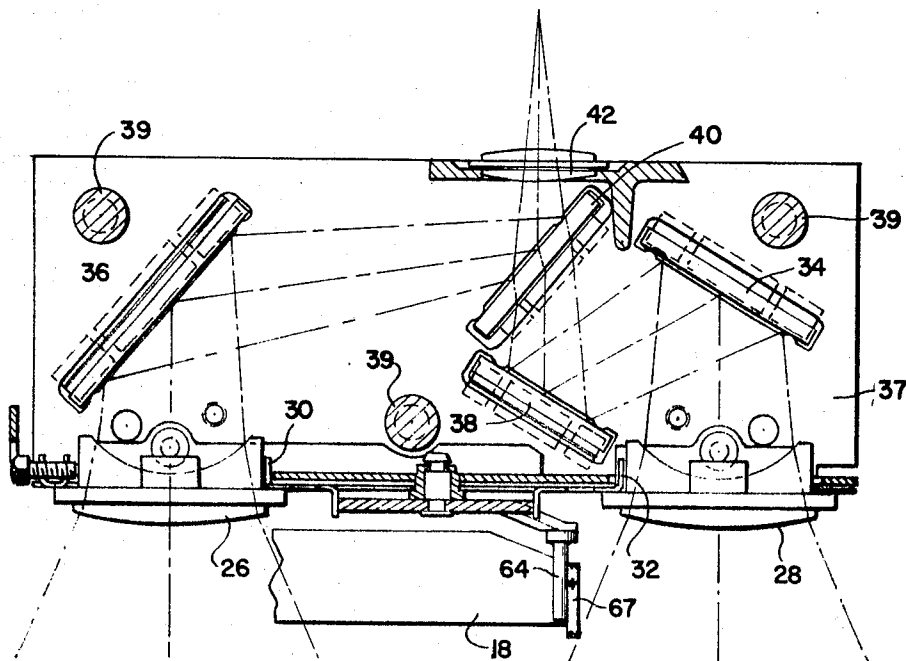


FIG. 3

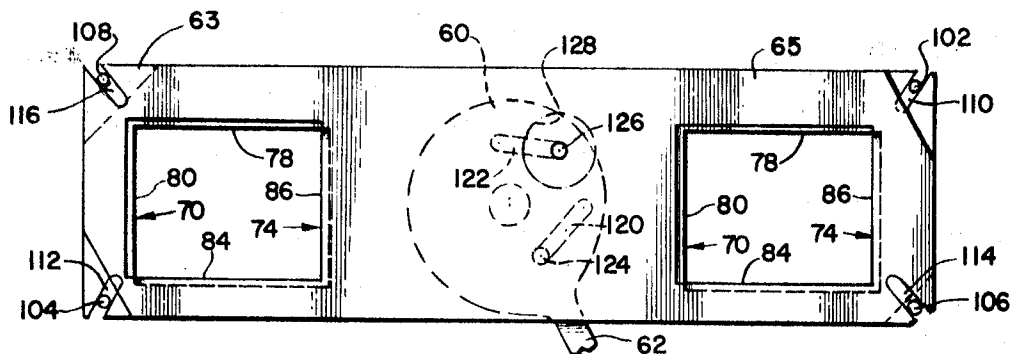


FIG. 6

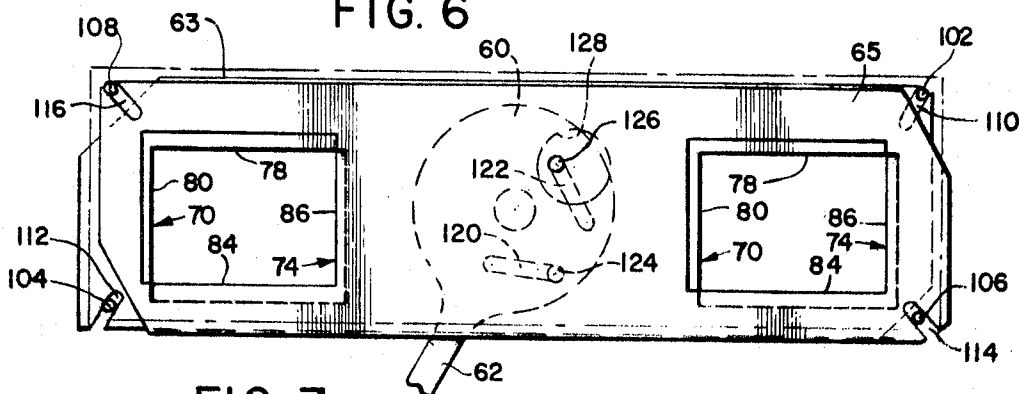
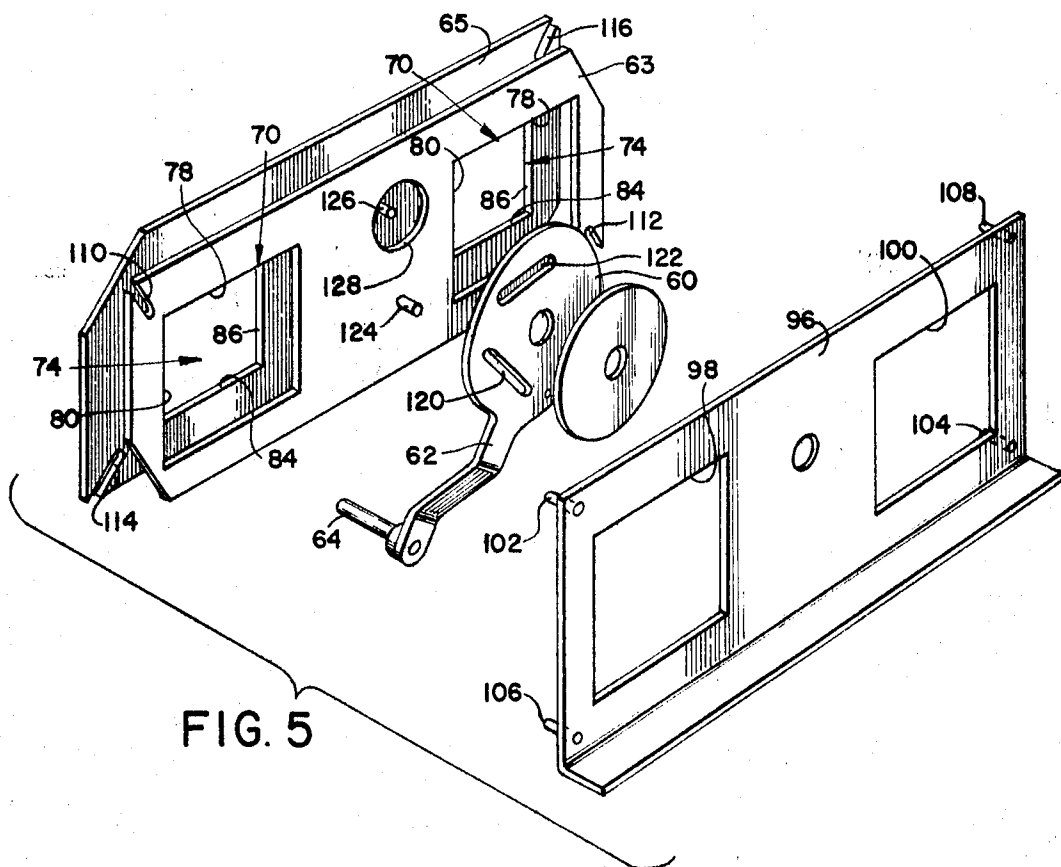
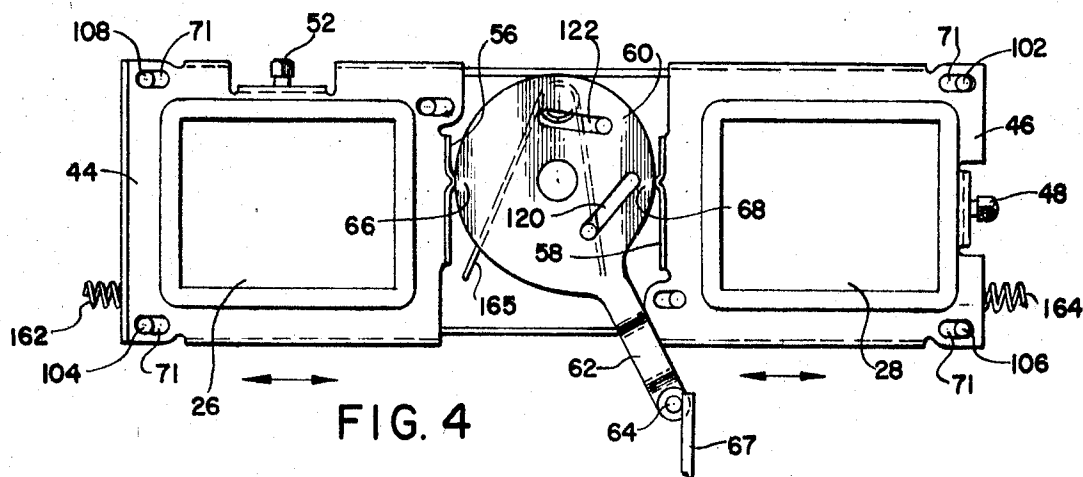


FIG. 7

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COMBINED VIEWFINDER-RANGEFINDER

BACKGROUND AND SUMMARY OF THE INVENTION

Many of the viewfinder-rangefinders in use today, especially of the coincident type, are quite complicated mechanisms with a multiple of parts which require great exactness in assembly. Both of these factors add greatly to the expense of such devices, and it is one of the principal aims of this invention to provide a viewfinder-rangefinder with all the accuracy of these expensive devices which is much simpler in both construction and assembly.

The light rays from the scene to be photographed enter the viewfinder-rangefinder, as is customary, through a pair of spaced windows and are directed through two optical paths to a common viewfinder lens where viewed through the eye of the photographer. In the preferred embodiment of the invention, the entire image scene from each window is utilized, an arrangement commonly referred to as a full-field viewfinder-rangefinder in contrast to those where a mask only allows the center portion of one of the scene images to pass to the viewfinder lens. Since the scene is viewed from two spaced apart windows, objects not "in focus" will be seen as two images superimposed over one another but slightly out of coincidence as viewed through the viewfinder lens. To make the two images of an object coincide, one or both sets of rays forming the images must be deflected. To accomplish this in the present invention, a lens is positioned directly behind each window, the lenses being movable simultaneously and in opposite directions. This is accomplished by spring biasing the lenses, each in a frame, against a rotatable vertical focusing cam located between the two lenses. The frames carry cam followers and the cam surface is such that the rotation of the cam will cause the desired movement. Mechanical linkage may be provided between the focusing means of a photographic camera and the cam rotating elements so that when the camera lens is focused on a particular object, the image of that object will coincide as seen through the viewfinder lens. The use of a single cam directly linked to the focusing means greatly simplifies the focusing mechanism and assures a high degree of accuracy. Since it is a relatively simple matter to keep the followers in biased contact with the cam surface, no lost motion can occur which is often present in other mechanical linkages. Provision is also made in the present invention for indicating to the viewer the changes in field coverage of the picture-taking lens for different focusing distances. This is accomplished by certain frame means which are adjustable and are positioned over the spaced windows of the optical system. These same framing means also correct for problems of parallax which arise due to the position of the windows slightly above the taking lens. Thus without correction, one viewing an object through the windows, especially at a close distance, might for example, see more space above the object than is actually covered in the field of view of the taking lens. To correct this situation, the aforementioned framing means are provided over each window which include a pair of masks, each movable relative to one another and each framing one side of the scene and either the top or bottom respectively. The movement of the frames is uniquely controlled by the focusing cam described above by means of a pair of slots in the face of the cam having followers riding therein, the followers being mechanically connected to the framing means for translating the movement of the cam thereto with reference to the two optical paths of the rangefinder system.

Accordingly, it is an object of this invention to provide an improved coincident type full-field viewfinder-rangefinder for a photographic camera or the like wherein a single focusing cam is operable to cause coincidence of a pair of images of the scene at predetermined focus settings.

It is another object of this invention to provide framing means for properly framing the field of view of the viewfinder-rangefinder in accordance with the field of view of the picture-taking lens of said camera, said framing means being mechanically adjustable by said single focusing cam.

A further object of this invention is to provide an improved viewfinder-rangefinder wherein adjustment of said framing means also corrects for problems of parallax between said picture-taking lens and the scene-imaging elements of said viewfinder-rangefinder.

Other objects of the present invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure and the scope of the application of which will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a photographic camera having a viewfinder-rangefinder thereon embodying the present invention;

FIG. 2 is an exploded perspective view of the optical system as well as the focusing and framing means of the invention;

FIG. 3 is a top plan view of the optical system of the invention;

FIG. 4 is a front elevation of the image-deflecting means of the invention including the focusing cam;

FIG. 5 is an exploded perspective view of the framing means which are shown in driving connection with said focusing cam; and

FIGS. 6 and 7 are representations of the framing means in different framing positions.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawing, there is shown a photographic camera having the usual objective lens 10, mounted on lens board 12 for axial movement with respect to the film plane of the camera, contained within camera body 14. Lazy tong erecting system 16 and focusing bar 18 are provided for effecting focusing movement of lens 10 by manual movement of bar 18 in a direction transverse to the direction of focusing movement. This type of erecting and focusing system is described in much greater detail in U.S. Pat. No. 3,185,060, issued May 25, 1965 to Robert S. Borghesani. The front portion 20 of housing 21 has a pair of windows 22 and 24 which are spaced apart a distance which is referred to as a "base distance" in terms of triangulation principles upon which the rangefinder operates. For increased accuracy, this distance should be extended as far as possible in accordance, however, with practical space considerations. Light rays from the scene to be photographed enter the housing through these spaced windows, and both sets of rays are directed to the eye of the user by the various optical elements about to be described and are seen as two distinct superimposed scene images in a common field.

Turning now to FIGS. 2 and 3, the individual elements which comprise the optical system of the viewfinder-rangefinder are shown schematically but substantially as they are actually positioned within housing 21. Negative lenses 26 and 28 are each positioned directly behind windows 22 and 24, respectively. The lenses each serve to direct an image of the scene toward a pair of reflecting means or mirrors 34 and 36 positioned behind said lenses. The plan view of FIG. 3 is especially helpful in tracing the light rays forming the scene image as they are affected by the optical system. The image reflected off mirror 34 is directed to another mirror 38, which in turn directs the image through dichroic element 40 to positive eye lens 42. The dichroic element 40 is generally a partially silvered element which allows the light rays from mirror 38 to pass through the eye lens. The light rays which are reflected off mirror 36 to the back of element 40 are reflected off the silvered portions thereof also to the eye lens 42 mounted in the rear portion 43 of housing 21. Each negative lens 26 and 28 together with positive eye lens 42 form the elements of the usual reversed Galilean viewfinder system. The user looking through this optical system will observe two complete images

of the scene, the images of the various objects except those at the distance the system is focused at being slightly out of coincidence due to the spacing of the windows 22 and 24. Behind the windows a clear plastic element 33 is positioned, as shown in FIG. 2, to prevent any foreign matter from entering the housing 21. It should be obvious that a mask may be placed, for example, between mirror 36 and dichroic element 40 which will serve to allow only the central portion of the scene, which enters in the form of light rays through window 22 to reach eye lens 42. However, since this invention is directed to a full-field viewfinder-rangefinder, no such mask is utilized, and two images of the entire scene are seen by the user. A pair of plates 35 and 37 spaced apart by spacer elements 39 serve to hold the fixed mirrors 34, 36 and 38, dichroic element 40 between them.

For purposes of ranging or focusing with this type of viewfinder-rangefinder, it is customary to deflect one or both of the images so that the particular object one wishes to focus upon appears as only a single image to the user. Of course, there actually are still two images; however, when the images coincide exactly with one another, they appear as one. Referring to FIGS. 2 and 4, there is shown an illustration of the deflecting means of the present invention which include the pair of lenses 26 and 28. Each lens is mounted in its lens frame 44 and 46 and provision is made to adjust the lenses in the individual frames so that they may be properly aligned relative to one another. As shown in FIG. 2, one of the lenses 26 is adjustable horizontally by means of set screw 48 which urges the lens against spring portion 50, while another set screw 52 provides for vertical adjustment of lens 28 urging it against spring portion 54. Thus, the lenses may be originally adjusted relative to one another, and if they become misaligned during use, they may easily be adjusted within their frames. On each lens frame 44 and 46, there is provided a follower portion 56 and 58 which may be formed integrally therewith. The follower portions are urged into contact with focusing cam 60, as shown in FIG. 4, by means of springs 162 and 164 or equivalent biasing means. Vertical cam 60, as shown, is rotatable about a horizontal axis and its periphery include a pair of identical lobe portions 66 and 68 which are engaged by follower portions 56 and 58 on lens frame means 44 and 46. Cam 60 has an arm 62 extending therefrom by means of which it may be rotated about its axis. The arm 62 includes a cam driving portion 64 which extends through an appropriate opening in housing 21 and is biased by spring 165 so it is always in contact with element 67 on focus bar 18 for movement therewith. As the cam 60 is rotated first in one direction and then in another, the lenses 26 and 28 in their frames will slide back and forth simultaneously and in opposite directions. The movement is guided by four pins which engage slots 71 in the frames as shown in FIG. 4.

FIG. 5 of the drawing shows the pair of framing means 63 and 65 as they are positioned behind the pair of windows 22 and 24, also shown in FIG. 2. Each framing means has a pair of openings therein; for example, framing means 63 has two openings 70, and framing means 65 has a pair of openings 74 therein as shown in FIG. 5. Two sides of each opening are actually used to frame the scene as viewed through the device, i.e., top framing portions 78 and left side framing portions 80 of openings 70 and bottom and right side framing portions 84 and 86 respectively, of openings 74. The two framing means 63 and 65 are mounted in the housing on vertical plate member 96 also having a pair of larger openings therein 98 and 100 through which the scene images may pass. The plate member 96 has four pins 102, 104, 106 and 108 extending from each corner. These are the pins that engage the slots 71 in the frames 44 and 46 as shown in FIG. 5. Two of the pins 102 and 104 extend into slots 110 and 112 on diagonally opposite corners of framing means 63. The other two pins 106 and 108 extend into slots 114 and 116 on framing means 65. To prevent interference with the pins the corners opposite the slots on framing means 63 and 65 are cut away as shown in FIG. 5. For providing movement of the framing means in

response to the rotation of cam 60, a pair of slots 120 and 122 are formed in the radial face of said cam. A follower pin 124 extends from framing means 63 into driving engagement with slot 120 and another follower pin 126 on framing means 65 extends into driving engagement with slot 122 in cam 60. A clearance opening 128 is provided in framing means 63 for pin 126 to pass through. It should be apparent that the driving force for moving the framing means is derived from the rotation of cam 60, but the direction of movement is determined by the orientation of the slots 110, 112, 114, and 116. Thus, for each position of the cam 60, the field of view of the lens is determined, and the position of the framing means necessary to frame the same scene as viewed through the eye lens can likewise be determined and the slots oriented accordingly.

FIGS. 6 and 7 show the framing means and their orientation when the camera lens is focused, for example, at infinity, in FIG. 6 and at 4 feet in FIG. 7. In FIG. 6, the two framing means 63 and 65 are aligned and the openings are framed by the top and left side framing portions 78 and 80 of openings 70 and by the bottom and right side framing portions 84 and 86 of openings 74. In FIG. 7, the cam 60 has been rotated clockwise and the framing means have been displaced relative to one another in response to the driving force applied to follower pins 124 and 126 by slots 120 and 122. Both the framing means 63 and 65 have been displaced substantially downward in the direction of the slots 110, 112, and 114, 116, respectively and the field of view has been adjusted to coincide with what is actually being projected onto the film plane of the camera by lens 10. As an example, the side and bottom portions may move inward thirty-thousandths of an inch while the top portion may move downward sixty-thousandths of an inch. The steeper angle of slots 110 and 112 account for the greater movement of the top portion which is necessary for parallax correction.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. A photographic viewfinder-rangefinder comprising:

a plurality of optical elements positioned with respect to the light rays from a scene to be viewed so as to present a pair of images of the scene to be viewed to the eye of the user, the pair of images being superimposed and the coincidence of the images being affected by the respective orientations of the optical elements with respect to the light rays from said scene, said series of optical elements including a pair of laterally movable lenses which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the separation of said lenses; and

means for moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single rotatable cam located between said pair of lenses, said cam's axis being generally aligned to said lenses' axes, the rotation of said cam resulting in equal lateral movement of each of said lenses.

2. A photographic viewfinder-rangefinder comprising:

a housing enclosing the elements of said viewfinder-rangefinder therein;

a pair of spaced windows in said housing through which light rays from the scene to be viewed may enter;

a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, the pair of images being superimposed and the coincidence of the images being affected by the lateral spacing of said windows, said series of optical elements including a pair of laterally movable lenses, one disposed opposite each said window, which serve to deflect the light rays forming the two scene images, the

amount of deflection depending upon the lateral separation of said lenses; and

means for laterally moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single cam located between said pair of lenses, said cam's axis being generally aligned to said lenses' axes, the movement of said cam resulting in equal movement of each of said lenses.

3. A photographic viewfinder-rangefinder comprising:

a housing enclosing the elements of said viewfinder-rangefinder therein;

a pair of laterally spaced windows in said housing through which light rays from the scene to be viewed may enter;

a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the separation of said lenses, the pair of images being superimposed and the coincidence of the images being affected by the lateral spacing of said lenses; and

means for moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single cam located between said pair of lenses, said cam's axis being generally aligned to said lenses' axes, the movement of said cam resulting in equal movement of each of said lenses.

4. A photographic viewfinder-rangefinder comprising:

a casing enclosing the elements of said viewfinder-rangefinder therein;

a pair of laterally spaced windows in said casing through which light rays from the scene to be viewed may enter;

a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the changing path which the light rays take according to the position of each lens the pair of images being superimposed and the coincidence of the images being affected by the lateral spacing of said lenses; and each of said lenses being mounted in a frame, the frame each having a cam follower portion thereon;

means for moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single cam located between said pair of lenses, said cam's axis being generally aligned to said lenses' axes, the follower portion of each lens frame being in constant contact with said cam and the movement of said cam resulting in equal movement of each of said lenses.

5. A photographic viewfinder-rangefinder comprising:

a casing enclosing the elements of said viewfinder-rangefinder therein;

a pair of laterally spaced windows in said casing through which light rays from the scene to be viewed may enter;

a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the changing path which the light rays take according to the lateral position of each lens, the pair of images being superimposed and the coincidence of the images being affected by the lateral spacing of said lenses; and each of

said lenses being mounted in a frame, each said frame having a cam follower portion thereon;

means for moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide said means comprising a single rotatable cam positioned between said pair of lenses, said cam's axis being generally aligned with said lenses' axes, the follower portion of each lens frame being in constant contact with the peripheral surface of said cam, the portions of said peripheral cam surface contacting said follower portions being identical so that upon rotation of said cam each lens mounted in its frame will be moved equal amounts thus requiring a small increment of movement of each lens individually to cause the image of certain objects as viewed through the viewfinder-rangefinder to coincide.

6. A photographic viewfinder-rangefinder comprising:

a plurality of optical elements positioned with respect to the light rays from a scene to be viewed so as to present a pair of images of the scene to be viewed to the eye of the user, the pair of images being superimposed and the coincidence of the images being affected by the respective orientations of the optical elements with respect to the light rays forming said scene images, said series of optical elements including a pair of laterally movable lenses which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the path which the light rays take according to the lateral spacing between said lenses; and

means for moving each of said lenses between lateral positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single cam located between said pair of lenses, the movement of said cam resulting in equal movement of each of said lenses;

framing means for framing the scene image as viewed by the user, said framing means having portions engageable with said cam and being driven thereby so that they frame a predetermined field of view at each position of said cam.

7. A photographic viewfinder-rangefinder comprising:

a housing enclosing the elements of said viewfinder-rangefinder therein;

a pair of laterally spaced windows in said housing through which light rays from the scene to be viewed may enter;

a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a pair of laterally movable lenses which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the path which the light rays take according to the lateral spacing between said lenses, the pair of images being superimposed and the coincidence of the images being affected by the spacing of said lenses;

means for moving each of said lenses between lateral positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single cam located between said pair of lenses, the movement of said cam resulting in equal lateral movement of each of said lenses; and

framing means for framing the scene image as viewed by the user, said framing means having portions engageable with said cam and being driven thereby so that they frame a predetermined field of view at each position of said cam.

8. A photographic viewfinder-rangefinder comprising:

a casing enclosing the elements of said viewfinder-rangefinder therein;

a pair of laterally spaced windows in said casing through which light rays from the scene to be viewed may enter;

a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the

eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the changing path which the light rays take according to the position of each lens, the pair of images being superimposed and the coincidence of the images being affected by the spacing of said lenses;

means for moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide, said means comprising a single cam located between said pair of lenses, the movement of said cam resulting in equal movement of each of said lenses; and

framing means for framing the scene image as viewed by the user, said framing means having portions engageable with said cam and being driven thereby so that they frame a predetermined field of view at each position of said cam.

9. A photographic viewfinder-rangefinder comprising:

- a casing enclosing the elements of said viewfinder-rangefinder therein::
- a pair of laterally spaced windows in said casing through which light rays from the scene to be viewed may enter;
- a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the changing path which the light rays take according to the position of each lens, the pair of images being superimposed and the coincidence of the images being affected by the spacing of said lenses; and each of said lenses being mounted in a frame, the frame each having a cam follower portion thereon;
- means for laterally moving each of said lenses between positions wherein the images of certain objects as viewed through the rangefinder-viewfinder coincide said means comprising a single cam located between said pair of lenses, the follower portion of each lens frame being in constant contact with said cam and resulting in equal movement of each of said lenses; and
- framing means for framing the scene image as viewed by the user, said framing means having portions engageable with said cam and being driven thereby so that they frame a predetermined field of view at each position of said cam.

10. A photographic viewfinder-rangefinder comprising:

- a casing enclosing the elements of said viewfinder-rangefinder therein;
- a pair of laterally spaced windows in said casing through which light rays from the scene to be viewed may enter;
- a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the changing path which the light rays take according to the position of each lens, the pair of images being superimposed and the coincidence of the images being affected

by the spacing of said lenses; and each of said lenses being mounted in a frame, the frames each having a cam follower portion thereon;

means for moving each of said lenses between positions wherein the images of certain objects as viewed through the viewfinder-rangefinder coincide said means comprising a single cam located between said pair of lenses, the follower portion of each lens frame being in constant contact with the peripheral surface of said cam and resulting in equal movement of each of said lenses, said cam also having at least one slot formed in a radial surface thereof; and

framing means for framing the scene image as viewed by the user, said framing means having at least one cam slot engaging follower portion whereby the rotation of said cam is translated into movement of said framing means so that they frame a predetermined field of view at each position of said cam.

11. A photographic viewfinder-rangefinder comprising:

- a casing enclosing the elements of said viewfinder-rangefinder therein;
- a pair of laterally spaced windows in said casing through which light rays from the scene to be viewed may enter;
- a series of optical elements positioned with respect to each of said windows to present an image of the scene which enters as light rays through each of said windows to the eye of the user, said series of optical elements including a laterally movable lens mounted over each window which serve to deflect the light rays forming the two scene images, the amount of deflection depending upon the changing path which the light rays take according to the lateral position of each lens, the pair of images being superimposed and the coincidence of the images being affected by the spacing of said lenses; and each of said lenses being mounted in a frame, the frames each having a cam follower portion thereon;
- means for moving each of said lenses between lateral positions wherein the images of certain objects as viewed through the viewfinder-rangefinder coincide said means comprising a single cam located between said pair of lenses, the follower portion of each lens frame being in constant contact with the peripheral surface of said cam and resulting in equal movement of each of said lenses, said cam also having a pair of slots formed in a radial surface thereof; and
- framing means for framing the scene image as viewed by the user through the pair of windows in the viewfinder-rangefinder casing, said framing means including a pair of relatively movable superposed plates positioned behind said pair of windows, each plate having an opening positioned behind said pair of windows, said plate openings together framing the scene image as viewed by the user, said plates each having a follower portion engaging one of said slots in the radial surface of said cam whereby the rotation of said cam is translated into movement of each of said superposed plates in a manner to change the size of the framed opening formed by the openings in the pair of superposed plates, whereby the framing means frame a predetermined field of view at each position of said cam.

12. The photographic viewfinder-rangefinder as defined in claim 11 wherein the scene image is four sided and each plate opening frames two sides of the scene image.