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(54) **DUAL CAMERA MOUNT FOR STEREO IMAGING**

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(57) **ABSTRACT**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 40 days.

An apparatus and method for holding two cameras on a single mount for stereo graphic imaging with controls for: (a) the synchronous convergence of the optical line of focus of both cameras at a single point at a desired distance; (b) the adjustment of the position of the image focal plane in one camera with respect to the image focal plane in the other camera such that the two cameras are correctly focused on the same image; (c) the adjustment of the spacing between the two cameras such as to mimic the average distance between human eyes; and (d) adjustment of the two cameras such that the two cameras, while being converged, rotate around the same image (nodal) point.

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(52) **U.S. Cl.** **396/329**; 396/333

(58) **Field of Search** 396/329, 428, 396/325, 324, 323, 334

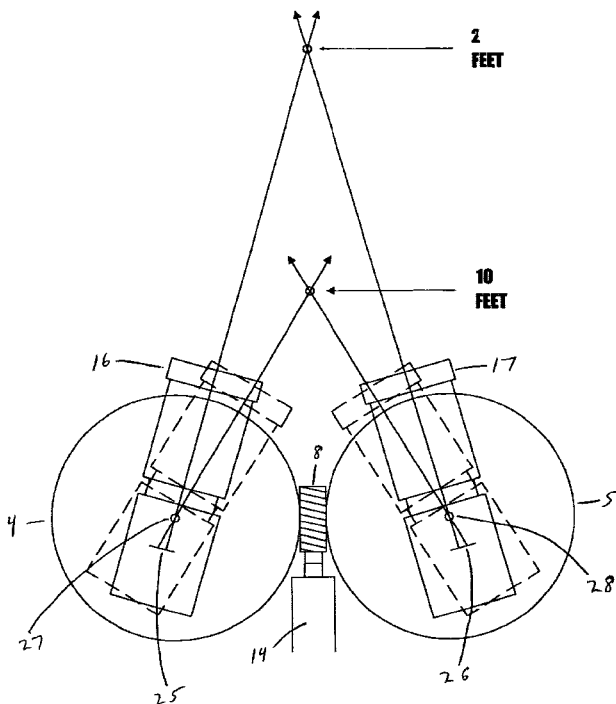
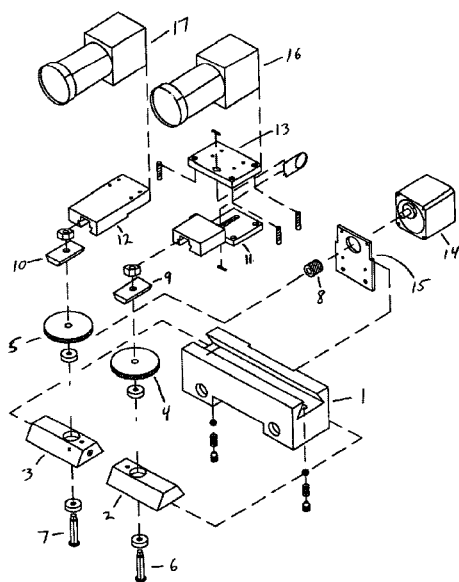
The primary benefits of the present invention are a compact mechanical configuration, simple and precise control of the optical convergence of two cameras, simple and precise alignment of the image plane in one camera with respect to the image plane in the second camera, simple adjustment of the distance between the cameras to mimic the distance between human eyes, and simple adjustment of the image (nodal) point around which the cameras are rotated for convergence.

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2 Claims, 6 Drawing Sheets



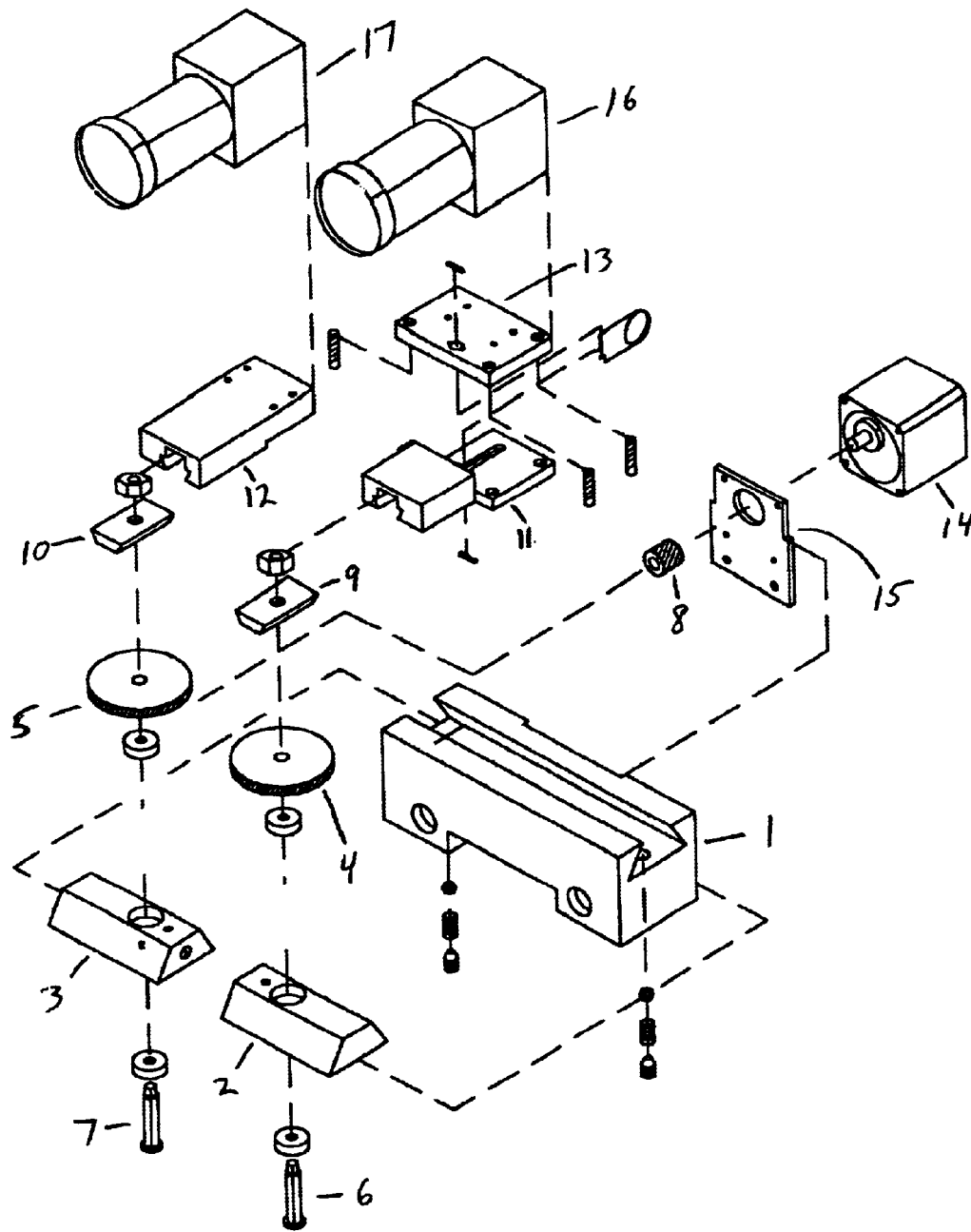


FIG. 1

DUAL CAMERA MOUNT FOR STEREO IMAGING

CROSS-REFERENCE TO RELATED APPLICATIONS

Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

REFERENCE TO A MICROFICHE APPENDIX

Not Applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to a certain apparatus whereby a mount for two cameras for use in stereo imaging has controls for the convergence of the two cameras, adjustment of the position of the image plane in one camera with respect to the image plane in the other camera such that the two cameras are correctly focused on the same image, adjustment of the spacing between the two cameras such as to mimic the average distance between human eyes, and adjustment of the two cameras such that the two cameras, while being converged, rotate around the same image (nodal) point.

The primary benefits of the present invention are a compact mechanical configuration, simple and precise control of the optical convergence of two cameras, simple and precise alignment of the image plane in one camera with respect to the image plane in the second camera, simple adjustment of the distance between the cameras to mimic the distance between human eyes, and simple adjustment of the image (nodal) point around which the cameras are rotated for convergence.

2. Description of the Background Art

A wide variety of camera mounts have been known and used since the beginning of the film and television industries. Almost all of these are designed for a single camera and two dimensional photography. A small number of camera mounts that hold two cameras simultaneously have been made for making three dimensional photographs, motion picture films and television shows, commonly referred to as "stereo graphic" or "3D" imaging. At least one such camera mount known to Applicant has a very coarse, manual adjustment of the convergence of the two camera's optical systems, but it is poorly designed and very difficult to use. To applicant's knowledge, no dual camera mount, of the design disclosed herein, has contained all of the following elements: (a) a convenient and accurate convergence adjustment mechanism; (b) the ability to precision adjust, in any dimension, the position of the image planes between the two cameras such that they were located at the same image focal plane and received the same image; (c) the ability to adjust the spacing between the two cameras such as to mimic the average distance between human eyes; and (d) the ability to adjust the two cameras such that the two cameras, while being converged, rotate around the same image (nodal) point.

BRIEF SUMMARY OF THE INVENTION

The present invention consists of a mount for two cameras that provides a combination of precision convergence con-

trol and precision alignment of the image planes of two cameras for stereo graphic imaging. More particularly, it is an apparatus for precise control of the convergent focusing of two cameras and the fine adjustment of the position of the image plane in one camera with respect to the image plane in the other camera. This apparatus significantly improves the ability to make stereo graphic images by making the adjustment of camera convergence and the alignment of the image focal planes precise and simple.

One object of the invention is to combine into a single mount for two cameras a simple and precise control of the optical convergence of the two cameras.

Another object of the invention is to combine into a single mount for two cameras simple and precise alignment of the image focal plane in one camera with respect to the image focal plane in the second camera.

Another object of the invention is to combine into a single mount for two cameras simple means for adjustment of the distance between the two cameras to mimic the distance between human eyes.

Another object of the invention is to combine into a single mount for two cameras simple means for adjustment of the image (nodal) point around which two cameras are rotated for convergence.

Further objects and advantages of the invention will be brought out in the following portions of the specification, wherein the detailed description is for the purpose of fully disclosing preferred embodiments of the invention without placing limitations thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood by reference to the following drawings which are for illustrative purposes only:

FIG. 1 shows an exploded, isometric view of a complete, two camera mount with integral worm gear convergence control with electric motor drive, precision image focal plane adjustment mechanism, and two example cameras;

FIG. 2 shows a front view of a complete, two camera mount with integral worm gear convergence control with electric motor drive, precision image focal plane adjustment mechanism, and two example cameras;

FIG. 3 shows a top view of a complete, two camera mount with integral worm gear convergence control with electric motor drive, precision image focal plane adjustment mechanism, and two example cameras;

FIG. 4 shows a side view of a complete, two camera mount with integral worm gear convergence control with electric motor drive, precision image focal plane adjustment mechanism, and two example cameras.

FIG. 5 shows an explosive close up isometric view of the precision image focal plane adjustment mechanism in the dual camera mount, and an example camera.

FIG. 6 shows simplified, conceptual, top down view of the dual camera mount demonstrating the precision convergence mechanism.

DETAILED DESCRIPTION OF THE INVENTION

Referring more specifically to the drawings, for illustrative purposes the invention is embodied in the apparatus generally shown in FIG. 1 through FIG. 6. It will be appreciated that the apparatus may vary as to configuration and as to details of the parts, and that the method may vary

E. Summary

The present invention can be varied in many details of the mechanical design so as to accommodate different cameras, lens assemblies, electric motors (or manual drive) for the worm rotation, as well as to permit operation within specific environments, physical space requirements, and attachment of the subject two camera mount to different tripods, gibs, and other types of camera supports.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention, but merely as providing illustrations of the presently preferred embodiments of this invention.

What is claimed is:

1. An apparatus for mounting two cameras for stereo graphic imaging with the capability to control the convergence of said two cameras, the capability to adjust the position of the image focal plane in one of said cameras with respect to the image focal plane in the other said camera, such that the two said cameras are correctly focused on the same image, the capability to adjust the spacing between the two cameras such as to mimic the average distance between human eyes, and the capability to adjust the two cameras such that the two cameras, while being converged, rotate around the same image (nodal) point, comprising:

- (a) two gears, friction discs, or pulleys with a feature on the top surface for mounting a camera (collectively "gear"), each said gear mounted on a separate shaft and bearing assembly, the rotation of each said gear synchronized to the rotation of the other said gear, said gears able to rotate in either direction; and
- (b) a gear, friction disc, or pulley mounted on a separate shaft and bearing assembly capable of simultaneously driving the synchronized rotation of the said gears ("gear driver"); and
- (c) means for rotating said gear driver to cause the synchronized rotation of said gears in either direction, thereby enabling the convergence of said cameras to be adjusted; and
- (d) a non-adjustable mounting for one of said cameras affixed to one of the said gears such that when one of said cameras is attached to said non-adjustable mounting, said camera remains in a fixed position with respect to said gear, and
- (e) an adjustable mounting for the other said camera affixed to the other said gear comprised of two brackets held together by three adjustable screws and a spring located centrally among, said adjustable screws, said adjustable screws applying force opposite to said spring such as to keep said two brackets separated, but permitting the pitch, roll and distance between said two brackets to be adjusted by changing the relative length of said adjustable screws to each other; and
- (f) means for turning said adjustable screws in said adjustable mounting such as to alter the pitch, roll and distance between said two brackets, thereby enabling the image focal plane of said camera mounted to said adjustable mounting to be aligned with the image focal plane of the other said camera mounted on the other said non-adjustable mounting; and
- (g) two adjustable dovetail slides onto which said gears are mounted such as to permit the adjustment of the distance between the center of rotation of each said gear, thereby enabling the effective center to center distance between said cameras to be increased or decreased; and
- (h) means for moving said adjustable dovetail slides onto which said gears are mounted as to permit the effective

center to center distance between said cameras to be increased or decreased; and

- (i) two adjustable dovetail slides mounted on top of said gears such as to permit the adjustment of the forward or backward position (along the optical line of sight) of each said camera, thereby enabling the image (nodal) point of each said camera to be individually adjusted along its respective optical line of sight; and
 - (j) means for moving said adjustable dovetail slides on top of which said gears are mounted as to permit the adjustment of the forward or backward position (along the optical line of sight) of each said camera, thereby enabling the image "nodal" point of each said camera to be individually adjusted along its respective optical line of sight.
2. A method of using an apparatus for mounting two cameras for stereo graphic imaging with the capability to control the convergence of said two cameras, adjust the position of the image focal plane on one of said cameras relative to the image focal plane in the other said camera, adjust the spacing between the two said cameras to mimic the average distance between human eyes, and adjust the two said cameras such that the two said cameras, while being converged, rotate around the same image (nodal) point, comprising the steps of:
- (a) controlling the convergence of said two cameras by providing:
 - (i) two gears, function discs, or pulleys with a feature on the top surface for mounting a camera (collectively "gear"), each said gear mounted on a separate shaft and bearing assembly, the rotation of each said gear synchronized to the rotation of the other said gear, said gears able to rotate in either direction; and
 - (ii) a gear, rotation disc, or pulley mounted on a separated shaft and bearing assembly capable of simultaneously driving the synchronized rotation of said gears ("gear driver"); and
 - (iii) a means for rotating said gear driver to cause the synchronized rotation of said gears in either direction, thereby enabling the convergence of said cameras to be adjusted; and
 - (b) adjusting the position of the image focal plane of one of said cameras relative to the image focal plane in the other said camera by providing:
 - (i) a non-adjustable mounting for one of said cameras, said non-adjustable mounting affixed to said gear such that when one of said cameras is attached to said non-adjustable mounting, said camera remains in a fixed position with respect to said gear; and
 - (ii) an adjustable mounting for the other said camera affixed to the other said gear comprised of two brackets held together at three points by adjustable screws, pins, rods or ties (collectively "screws") with a spring located in the middle of said adjustable screws applying force opposite to said adjustable screws such as to keep said two brackets separated, but permitting the pitch, roll and distance between said two brackets to be adjusted by turning said adjustable screws; and
 - (iii) a means for adjusting said adjustable screws in said adjustable mounting such as to alter the pitch, roll and distance between said two brackets, thereby