this in obtaining a more pleasing, a more "idealized" portrait. Obtaining this distortion is difficult when modeling the portrait by hand, but is easily obtained with the new methods. The sculptor's action is like that of the photographer when photographing a tall building and he cannot get vertical lines vertical and parallel on the film plane of his view camera; he simply tilts the back of his camera. Similarly the sculptor, by tilting the film plane of his motion picture camera, can distort his contour pictures so that the top portion or the bottom portion of his portrait become larger or smaller. All points between the top and bottom will be changed in perfect mathematical proportions. This correct mathematical change is important, as thereby the pictures retain the best possible likeness, which the carver can transfer to the carved-out portrait.

The most complicated task of the sculptor—successfully idealizing a sculptured portrait and yet retaining the best possible likeness—can now be done by a simple tilting of the film plane of the camera.

Obviously the more the sculptor idealizes a portrait, the more the likeness suffers. Nature mysteriously, yet accurately records man's inner nature in his face; this is difficult for us mortals to read correctly.

In industry these methods should be taken into consideration in the reproduction of three-dimensional objects which have surfaces that are irregular, difficult to measure, and difficult to machine, such as streamlined surfaces on planes, boats and automobiles.

*Stereoscopic Medical Photography**

JULIUS HALSMAN, *Chief, Photography Division, Armed Forces Institute of Pathology Washington 25, D. C.*

PHOTOGRAPHY, now in its second century, has progressed from the status of a curiosity to a highly respected and necessary scientific tool. This tool, when used in combination with stereoscopic principles and photogrammetrical interpretation, has become as precise as a micrometer or transit in its ability to supply spatial information.

It would be unnecessary to explain to this Society the advantages to be gained by the use of stereograms over the more commonly used two-dimensional processes. It will suffice to say that stereoscopic photographs depict structures which otherwise could not be illustrated, give a clearer concept of shape, comparative size, perspective, and depth, and reveal detail normally obscured in a two-dimensional photograph. In point of fact, many small structures can be more clearly visualized in a stereogram than under magnification or with the unaided eye.

While the value of stereoscopic photography is only beginning to be ap-

* This is one of the papers included in the Report of the Reporter, U.S.A., Commission V, International Society of Photogrammetry.

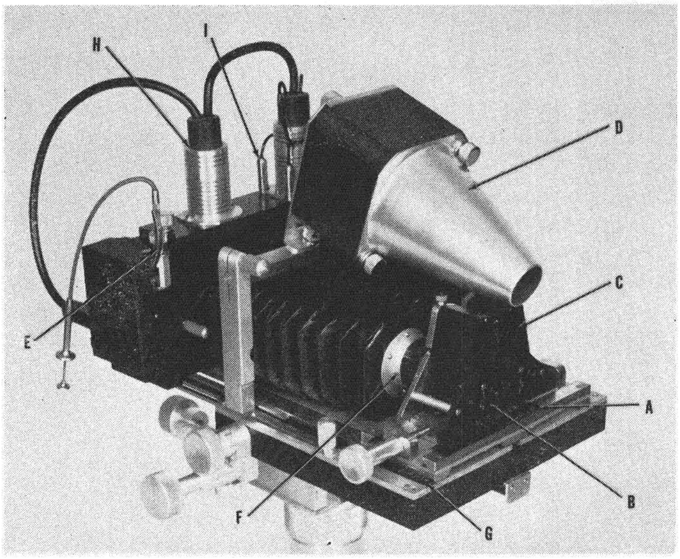

FIG. 1. Oblique view of Donaldson Stereo Camera showing: A. Scale for adjustment of interocular distances for parallax control. B. Scale adjustment to control depth effect. C. Matched rhomboid prisms. D. Cone of stroboscopic lamp. E. Cocking mechanism. F. Matched lenses. G. Magnification scales. H. Focusing lamps. I. Field lights for framing subject.

preciated in the field of medicine, its adoption is being accelerated by the availability of simplified photographic and viewing equipment.

Some of the projects under-way at the Armed Forces Institute of Pathology, which utilize stereoscopic photography, are as follows: Studies of the vascular system in situ or in gross specimens to show dimensional changes under the influence of drugs or gases; studies designed to demonstrate and measure the changes in bone structure under stress caused by weight, muscular pull, posture

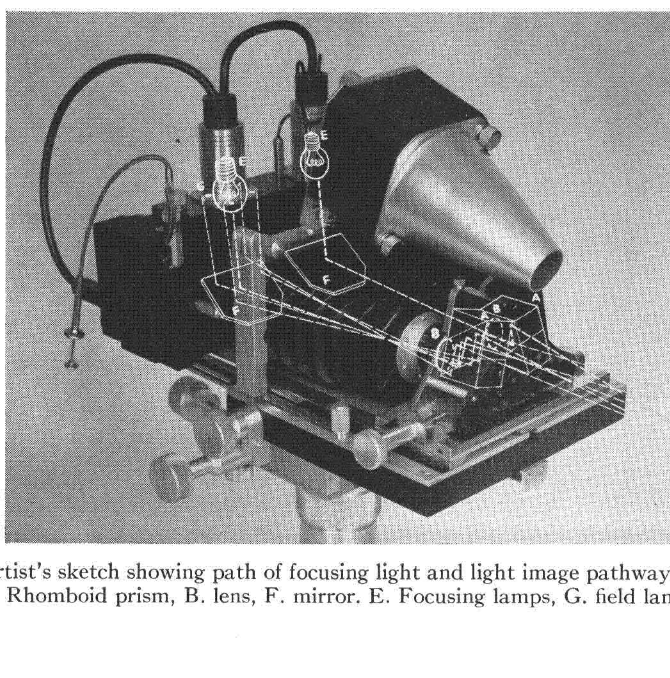

FIG. 2. Artist's sketch showing path of focusing light and light image pathways through: A. Rhomboid prism, B. lens, F. mirror. E. Focusing lamps, G. field lamps.

and disease; and studies of the changes in length and diameter of muscle fibers in an effort to determine whether a traumatic lesion of muscle was caused by direct injury to the muscle or indirectly by nerve injury.

The stereoscopic camera which is used for clinical and gross specimen studies at the Armed Forces Institute of Pathology is the Donaldson Camera, now being manufactured by the Perkin-Elmer Corporation. This camera features the utilization of independent variable inter-lens separation and parallax adjustments which eliminate distortion (Figure 1). Two rhomboidal prisms are mounted in front of each of the matched lenses in such a manner that the distances between both the upper and lower reflecting surfaces of the prisms are

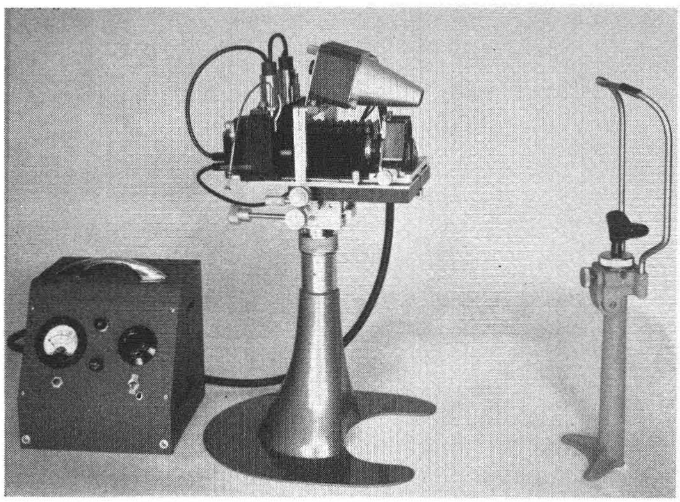

FIG. 3. Photograph showing power source, camera and chin rest, as used for ophthalmic photography.

variable. Separation of the upper surface increases or decreases the effective inter-lens distance, permitting control of depth effect. The separation of the lower prism surface determines the horizontal position of the images at the focal plane. This allows parallax correction by translation instead of the more common convergence and is responsible for the absence of the usual wedge-shaped distortion, or keystone effect.

All scales on the camera (Figure 1-A, B, G), bellows, extension, interlens, distance and parallax correction are calibrated and set according to magnification, and the camera is focused by projecting the images of two vertical filaments originating at "*H*" located in the roof of the double reflex housing down to two reflex mirrors that also perform as shutters reflecting this light through the lens-prism combination onto the subject. By moving the camera in or out by a special control, these two images are vertically aligned end-to-end and the camera is then in focus. The projected images of four point source light bulbs (Figure 1) are arranged in a rectangle and exactly define the photographic area directly on the subject.

A built-in "strobe" light (Figure 1-D) activated from a separate power source is variable and also scaled by means of magnification tables. This lamp is so positioned that it is automaticaly centered on the subject when the magnification scales are set.

It is to the advantage of the photographic novice that operation of the camera

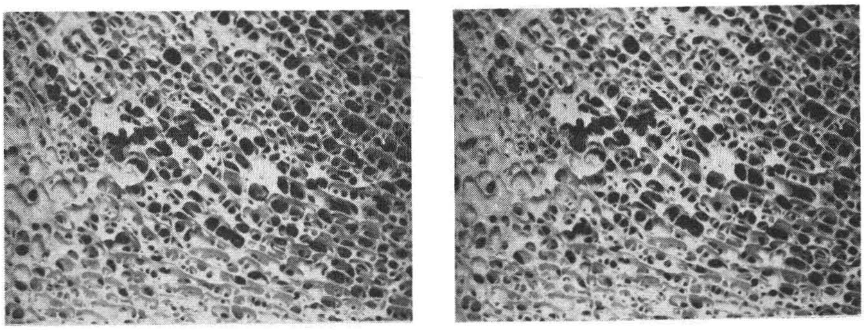

FIG. 4a. Femur. 2×.

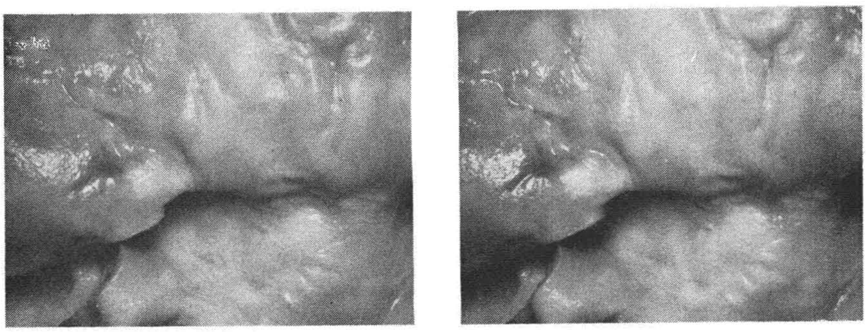

FIG. 4b. Arteriosclerosis aorta. 2×.

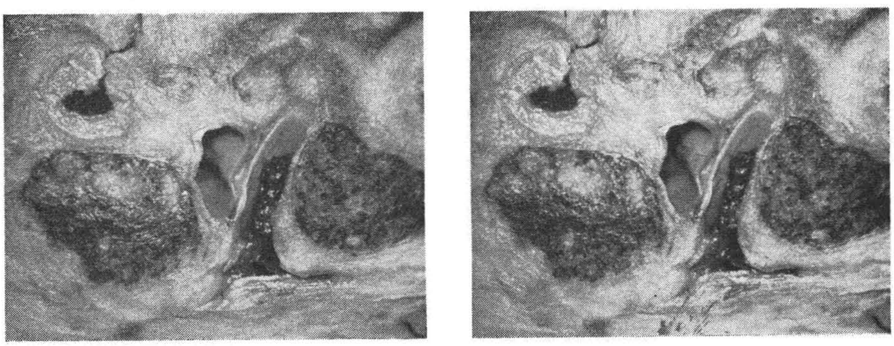

FIG. 4c. Carcinoma, lung. 2×.

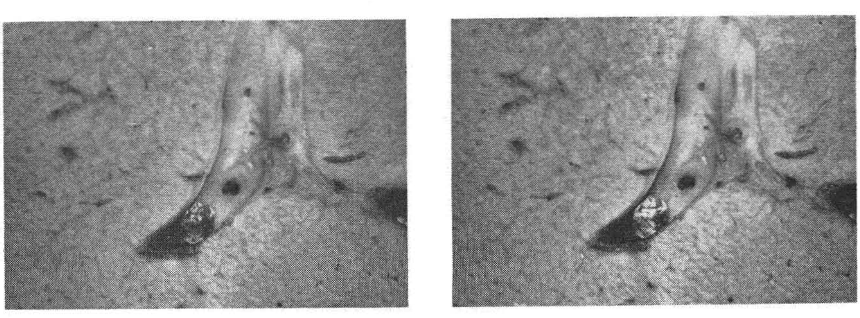

FIG. 4d. Normal Liver. 2×.

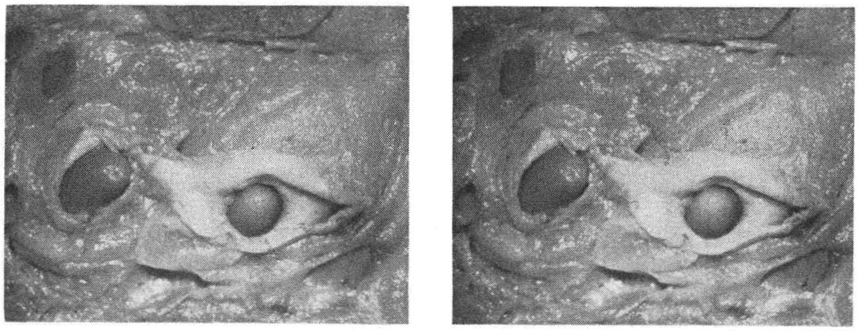

FIG. 4e. Normal Kidney. 2×.

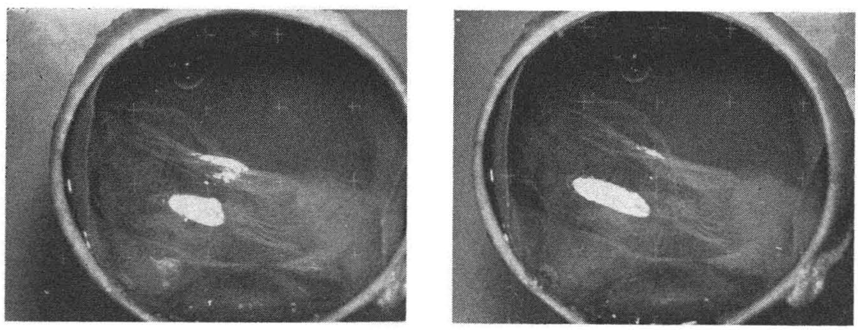

FIG. 4f. Detached degenerated vitreous. 2×.

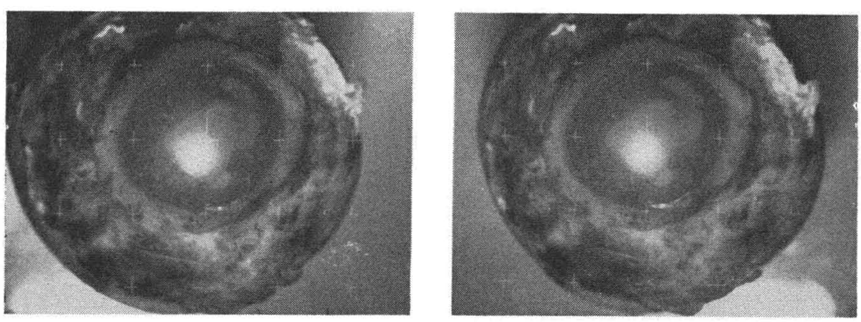

FIG. 4g. Band scar, cornea. 2×.

is such that no technical skill is necessary: focusing is accomplished by alignment of two filament images; magnification, diaphragm, prism and light output, by scale; framing, by visual observation of light boundaries on the subject. To the professional photographer, the following data may be of interest: Film (color), daylight; picture size per frame of each stereo pair, 24×30 mm. The lens is an 80-mm. *f*/45 Leitz Micro-summar. The shutter is incorporated in the mirror mechanism and has an effective speed of 1/50 second. The electronic flash unit utilizes a variable scaled power source in conjunction with a General Electric flash tube FT 218, and is capable of supplying a light ouput of 200 joules. The lens diaphragm is kept at *f*/18. Adjustments can be made to use different effective inter-lens distances with a stereo-projector or stereo-viewer. Depth effect can also be kept constant or changed for exaggerated hyper-stereoscopic effects.

The features of this camera are such as to require the minimum of attention from the photographer and allow him to devote most of his time to his subject.

BIBLIOGRAPHY

Donaldson, D. C., "Camera for Stereoscopic Photography of Anterior Segment." *Arch. Ophth.*, 43: 1083–1087, 1950.

Donaldson, D. C., "A Stereo-camera for Medical Photography." *Medical & Biological Illustration*, 5: 209–216, 1955.

Linssen, E. F., "Stereo Photography in Practice," London, Fountain Press, 1952.

Morgan, W. D., and Lester, H. M., "Stereo Realist Manual," New York, Morgan & Lester, 1954.

A New Stereoscopic Camera for Extreme Close-ups. *Instrument News*, Perkin-Elmer Corp., Norwalk, Connecticut, p. 6, Vol. 6, No. 3.

*Macrophotogrammetry with the Donaldson Stereo-Camera**

GOMER T. MCNEIL, *President, Photogrammetry, Inc., Silver Spring, Maryland*

INTRODUCTION

THE Donaldson Stereo-Camera[1] is being utilized primarily in the fields of ophthalmology and pathology for qualitative analyses. The purpose of this report is to demonstrate and to determine the quantitative capabilities of a camera designed specifically for the interpretation of stereoscopic photographs of the eye and of gross specimens.

The only Donaldson Stereo-Camera conveniently available for metrical analysis was located at the Armed Forces Institute of Pathology, Washington, D. C. which undoubtedly is one of the most modern and well equipped laboratories of its kind in the world. The responsible officials of the Institute encouraged the metrical analysis of the Donaldson Stereo-Camera. A request was made to the Institute for a one day loan of the camera for the purpose of making an elaborate calibration. The loan was not approved for the very legitimate reason that the camera must remain in a continual stand-by condition for emergencies and other unscheduled demands.

Inasmuch as the camera could not be removed from the Institute, it was decided to conduct the analysis in a more simplified manner so that technicians not versed in the science of photogrammetry can duplicate the following procedure.

CAMERA CALIBRATION

Prepare a glass plate grid of transparent lines on a black background. The interval between lines is 5 millimeters. Place the grid, with emulsion side up, on a trans-illuminator (Figure 1).

The scale indicator on the side of the camera is set opposite the index 1 (ratio of image size to object size). The angular orientation of the camera is adjusted and locked when the optical axes are perpendicular (or nearly so)

* This is one of the papers included in the Report of the Reporter for U.S.A. Commission V of the International Society of Photogrammetry.