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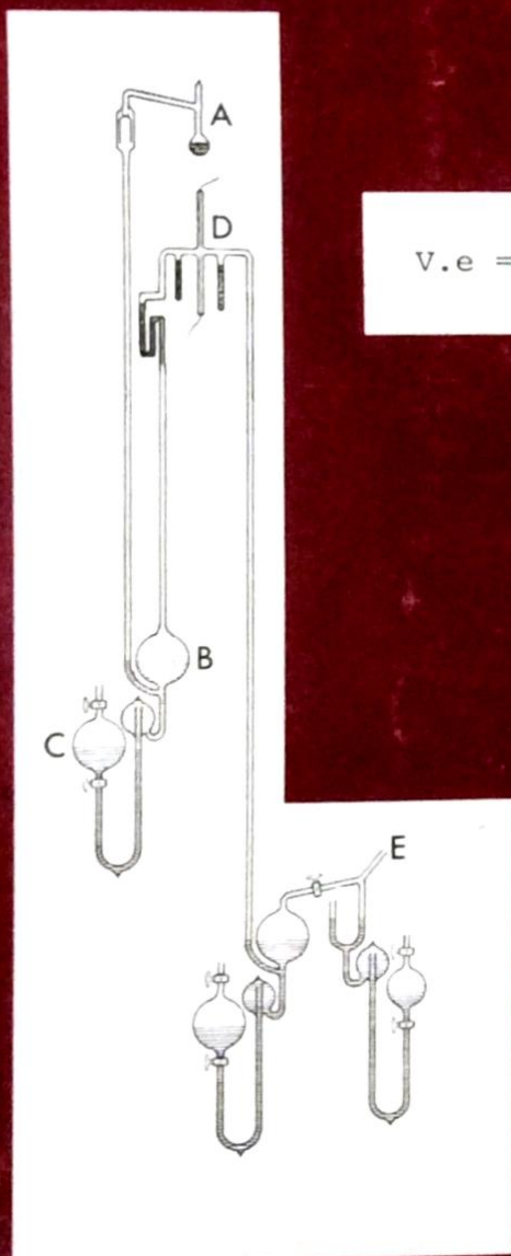
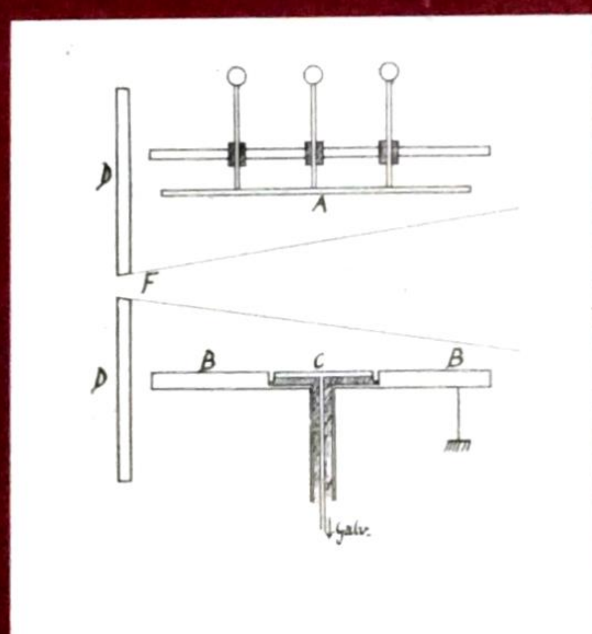


$$V.e = \frac{h.c}{\lambda}$$



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AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE
23rd ANNUAL MEETING

August 9–13 1981
Sheraton-Boston Hotel, Boston, Massachusetts

CALENDAR OF EVENTS

SCIENTIFIC PROGRAM

Sunday, 9 August 1981

All day	Council and Committee Activities—Times and locations posted at Registration desk	
11:00–7:30	Registration	Constitution Foyer
1:15–3:15	Professional Symposium I "Organizing and Running a Private Practice Medical Physics Group"	Republic Ballroom
3:15–3:30	Break	
3:30–5:30	Professional Symposium II "Health Planning and the Physicist"	Republic Ballroom
3:30–5:30	Children's Cancer Study Group Workshop "Potential Physics Problems and Protocol Performance"	Independence Room
5:30–6:30	Authors place papers for exhibit in Exhibition Hall	
6:30–8:30	Ice-Breaker Party	Grand Ballroom

Monday, 10 August 1981

8:00–4:00	Registration	Constitution Foyer
8:15–10:30	President's Symposium "Emerging Imaging Modalities for the Eighties" E Dale Trout Memorial Lecture—Professor Jack Boag	Grand Ballroom
10:30–11:00	Formal Opening of Exhibits—View Commercial Exhibits, Exhibited Papers, and Scientific Exhibits	Exhibition Hall
11:00–12:20	Scientific Sessions	
	A. Computed Tomography: Methods	Republic Ballroom
	B. Dosimetry	Independence Room
	C. Nuclear Medicine Posters	Constitution Room
12:20–1:45	Lunch (visit Cafe in Exhibition Hall)	
1:45–3:05	Scientific Sessions	
	D. Ultrasound	Republic Ballroom
	E. Diagnostic Instrumentation and Methods	Independence Room
	F. Radiation Therapy Posters I	Constitution Room
3:05–3:30	Break—Refreshments in Exhibit Area	
3:30–4:50	Scientific Sessions	
	G. Diagnostic Radiology Posters	Constitution Room

1:30 **Introduction**
1:35 **YI. Investigation of Physical Characteristics of Scattered Radiation and Performance of Antiscatter Grids**—H-P Chan* and K. Doi
1:48 **YI2. Twelve-Pinhole Radionuclide Tomography**—B. H. Hasegawa,* D. L. Kirch, and P. P. Steele
2:01 **YI3. Improved Applicator-Load Coupling in Microwave-Induced Hyperthermia**—R. E. Goodman,* G. H. Nussbaum, and A. A. Bruce
2:14 **YI4. Thermal Energy Deposition from a Single-loop RF Whole-Body Applicator**—R. D. Zwicker* and E. S. Sternick
2:27 **YI5. The MASTERSCAN System: A Microcomputer-Based Intelligent Controller for Radiation Therapy Beam Scanning Devices**—G. W. Sherouse,* F. J. Bova, and L. T. Fitzgerald
2:40 **YI6. Phosphorus Activation Neutron Dosimetry for an 18 MV Linear Accelerator**—J. R. Bading,* L. Zeitz, and J. S. Laughlin
2:53 **YI7. Correlation of Ultrasound Velocity and Attenuation with Breast Pathology**—R. A. Belgam,* A. L. Scherzinger, T. V. Oughton, and P. L. Carson
3:06 **YI8.** Reserved for the winner of the Peter W. Neurath Young Investigator Symposium, New England Chapter
3:25 **Presentation of Prizes**

Thursday, 13 August 1981

Continuing Education Courses (8:00–9:00)

CE10. Heavy Charged Particles in Radiotherapy (Republic Ballroom)—
A. Physics and Dosimetry—Alfred R. Smith, University of Mexico
B. Treatment Planning—George T. Y. Chen, Lawrence Berkeley Laboratory
CE11. The Psychology of Learning and Teaching Medical Physics (Commonwealth Room)—Perry Sprawls, Emory University School of Medicine. This course is presented in cooperation with the Committee on the Training of Radiologists.
CE12. Computers in Nuclear Medicine (Constitution Room)—Robert E. Zimmerman, Harvard Medical School
CE13. The New AAPM Protocol for the Dosimetry of High-Energy X-rays and Electrons Task Group 21, Radiation Therapy Committee (Independence Room)—R. J. Schulz

R. Dose Calculations and Treatment Planning (Independence Room)—*Chairman:* Donald J. Dawson, Ontario Cancer Foundation; *Associate Chairman:* Kenneth A. Wright, Massachusetts Institute of Technology

9:10 **R1. Clinical Evaluation of an Electron Beam Algorithm**—K. R. Hogstrom,* M. D. Mills, J. H. Cundiff, and P. R. Almond
9:23 **R2. Analytical Calculations of Scattered Dose for Wedged Fields**—L. H. Brown* and G. K. Svensson
9:36 **R3. Reconsideration of the Batho (power-law) Equation for Inhomogeneity Corrections in Dose Calculations**—J. W. Wong* and R. M. Henkelman
9:49 **R4. Dosimetric Consequences of Lung Density Variations in Carcinoma of Lung**—G. D. Fullerton,* A. L. Boyer, J. Mira, and E. C. Mok
10:02 **R5. Optimization of Treatment Plans Using OTD and NTD Index**—P. K. Kartha,* A. Pagnamenta, A. Chung-Bin, and F. R. Hendrickson
10:15 **R6. Performance Evaluation of the Modulex Treatment Planning System for Radiotherapy External Photon Beam Dose Computations**—W. B. Harms,* J. A. Purdy, S. C. Prasad, and Y. Y. Liu

Presented by Title:
R7. withdrawn

R8. The Net Fractional Depth Dose (NFD): Concept, Physical Properties, and Computational Advantages—Jan van de Geijn and Cheng PoCheng
R9. Product Representation of Teletherapy Dose Distributions—D. Jette, A. Pagnamenta, S. Jayaraman, L. H. Lanzl, and M. Rozenfeld
R10. Scatter Dose to the Fetus from Fields Far Away from the Abdominal Region—D. Bhaduri and S. K. Agarwal
R11. CAT Scan Flat Insert for Radiation Therapy Planning—A. Devata and H. Palmer
R12. Rapidly Retrievable/Quality Assured Treatment Planning Data—A. L. Boyer, E. C. Mok, and M. S. Mendiondo
R13. Multiple Scattering Model for Electron Teletherapy Dosimetry—D. Jette, A. Psgnamenta, S. Jayaraman, L. H. Lanzl, and M. Rozenfeld
R14. Treatment Planning for Head and Neck Tumors—J. M. Payl

S. Hyperthermia (Constitution Room)—*Chairman:* Gilbert Nussbaum, Mallinckrodt Institute of Radiology; *Associate Chairman:* Bruce Curran, Tufts-New England Medical Center

9:10 **S1. Microwave Radiometry in Dielectric Phantoms**—J. Shaeffer, A. M. El-Mahdi, and T. E. Schultheiss*
9:23 **S2. Microwave Hyperthermia: Effects of Thermal Conduction and Blood Flow on Heating Patterns**—T. S. Sandhu
9:36 **S3. Deep Heating Characteristics of the Magnetrode System**—B. R. Paliwal,* A. L. Wiley, C. Sibata, C. Filamor, P. Turner, F. Gibbs, and Y. K. Chan
9:49 **S4. Design and Thermometry of Moving-Coil RF Transducers for Hyperthermia**—I. A. Lerch, P. Antich,* and S. Kohn
10:02 **S5. Effect of Hyperthermia on Cellular Repair of DNA Damage Caused by Ionizing Radiation**—F. Krasin* and E. S. Sternick

T. General Medical Physics (Republic Ballroom)—*Chairman:* John S. Laughlin, Memorial Sloan-Kettering Cancer Center; *Associate Chairman:* Goran Svensson, Harvard Medical School

9:10 **T1. Algorithms for Biomedical Image Analysis**—J. F. Brenner
9:23 **T2. Transferring Digital Images from Ultrasonic Scanners to a Radiologic Computer System**—M. J. Flynn,* J. S. Newman, and R. M. Mares
9:36 **T3. Effect of Fat Content in Determination of Bone Mineral Density by Coherent to Compton Scattering**—S. Ling, A. Karellas,* J. Whiting, D. Craven, and M. Greenfield
9:49 **T4. An Instrument for Measuring Air Ion Concentration**—J. R. Cameron, J. R. Vetter, and D. W. Boys*
10:02 **T5. Attenuation of Primary, Scatter, and Leakage Radiation in Concrete and Steel for 18 Mv X-Rays**—F. G. Abrath,* J. Bello, and J. A. Purdy
10:15 **T6. Some Comments on the BEIR III Report**—D. E. Herbert, Jr.

Presented by Title:
T7. The Use of Moiré Topographs for the Detection of Orthopedic Defects in Children of Age Group Four to Seven Years—Syed Arif Kamal and Mohsen M. El-Sayyad
T8. FDA Radionuclides in Foods Program and Experience with T.M.I. and the Chinese Fallout of 1976—E. J. Baratta
T9. Temperature and Humidity Effects Upon Spirometer Systems—R. Liberace and S. Aronow

THE USE OF MOIRÉ TOPOGRAPHS FOR THE DETECTION OF ORTHOPEDIC DEFECTS IN CHILDREN OF AGE GROUP FOUR TO SEVEN YEARS

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ABSTRACT

Orthopedic problems cannot always be detected by inspection and physical examination only. Therefore moire topography was used. Front, rear and side views were taken through a specially constructed screen and subjects were four to seven years old children. The symmetric and asymmetric patterns of body contours were studied. Study of these contours revealed valuable information for the physicians. It is suggested that moiré topography should be an essential part of pre-school physical examination.

INTRODUCTION

Moiré topography is a simple optical method to provide three dimensional information. When an object is illuminated by a spot light source through a screen, moire fringes can be observed or photographed from a position above or below the light source. The fringes represent the information in a similar way the contour lines are used on topographical maps to describe the surface of earth. They can be generated, for example, by a screen of evenly spaced opaque lines and its shadow cast on the object being analyzed. A permanent record of the fringe pattern can be obtained by photography.

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Back deformity most often develops in adolescence. Unfortunately so, because generally speaking, this is a disease free period and the resulting complacency regarding medical problems can lead to missed diagnosis. Furthermore, many youngesters do not get routine physical examinations. Even when they do have an examination, their spines are not checked properly.

Many authors[5] agree that back deformities start sometime between the age of 5 and 10 years. The onset of spinal curvature is usually before age 5 and seldom occurs after age 10. We screen the children between the ages of 4 and 7 years. This has the following advantages:

(i) The onset of back deformity can be detected early and suitable correction can be applied.

(ii) It will allow sufficient time for the follow up.

In the treatment of back deformity it is important that the deformity is detected in the early stages. If there is a technique to detect the back deformity at an early stage the physiotherapeutic treatment would be much more easy and effective. Unfortunately the physical examination does not indicate minor deformities and the roentgenograms cannot be taken very often because of the built up of X-ray dose in the body. Therefore there is a need for a technique which is safe, reliable, fast and easy to interpret.

The moiré technique has been applied in various screening and medical projects[4]. There has been an increasing interest to use it in scoliosis and other back deformity screening of school children[1,2] and physiotherapeutic clinical evaluation of spinal curvatures.

This paper describes the method and the experimental moiré equipment used in a school screening pilot project. The results obtained from the pilot project are discussed.

DESIGN CONSIDERATIONS

Our design objective for the contourograph was to permit accurate photographic measurements of the projected moire fringes on the children's bodies. In addition to generating and photographing accurate fringe patterns, the optimal instrument should assure reproducible control of child positioning. The instrument should be simple to operate, be light weight and completely portable. Limited space in physiotherapeutic clinic necessiated that the overall design be such that the instrument could be set up in a relatively small area. The challenge was to achieve all these goals, while minimizing the cost to the clinician.

After reviewing all the current systems for moiré fringe production, we decided that the shadow type offered the greatest accuracy with the least complexity. A shadow type system involves a grid screen made of fishing line of nylon dyed black (approximately 0.5 mm diameter), a light source (quartz studio light 1000 watt), and a camera arranged in a geometric relationship as governed by Takasaki's equation

$$h_n = nL/(w/d - n)$$

where

L is the distance from the camera to the screen.

w is the distance from the light source to the camera.

d is the pitch of the screen.

n is the fringe number.

This equation gives the distance from the screen to the projected shadow planes behind the screen. The fringe interval is a function of the geometry. The geometry was selected to produce a fringe interval of 5 mm with a 10 % accuracy through a 100 mm depth of field. The parameters we chose were:

Distance from the camera to the screen (L) = 175 cm.

Distance from the light source to the camera (w) = 73 cm.

Pitch of the screen (d) = 2 mm.

We selected the photographic equipment based on the two areas of application that the instrument would address, mass screening for scoliosis and follow-up treatment of scoliosis patients. For physical therapy follow-up evaluation it would be necessary to use a polaroid type camera which would yield an immediate image for evaluation of the contour patterns. We determined that a 4" x 5" format would provide adequate magnification for direct scaling and measurement. For mass screening, we decided that a 35 mm camera would allow recording a large number of subjects. The film could be processed in bulk at a later date and the data evaluated by trained therapist using projection or magnification equipment.

PILOT SCREENING PROGRAM

A pilot screening program of children aged 4-7 years was conducted with the cooperation of Indiana University Health Center. As each child came he was provided with a number. Same number was also attached to the screen so that it appeared in the photograph. A forward bending test was then carried out on the child by one of the authors (MME) and the results recorded. The child then went behind the screen (Fig. 1) to be photographed. Each child was made to stand erect with feet together, buttocks placed close to the screen and with shoulders parallel to it. After being photographed each child dressed and left the area. There were certain cases in which the child was not properly positioned with respect to the screen. These cases were detected by comparing the number of fringes between the midline and the tip of each scapula. Unequal number of fringes for the left and right scapulae indicate a certain degree of non-parallelism of the scapulae and the screen. The asymmetry of the moiré pattern was assessed independently by each of the authors and a decision reached without knowing the results of the forward bending test. The authors then compared their results and discussed the photos over which there was disagreement. All curves of more than 5° were regarded as positive. The family doctors of children with positive results were informed through the Health Unit and recommendations made as to the future care of their patients.

RESULTS

The total number of children who attended the screening test was 23 (12 boys and 11 girls). The contour lines, which represent a set of vertical planes parallel to the screen, were plotted at the computed distances between the moiré fringes and the screen (Table 1). It should be noted, however, that the moire photograph is affected by distortions caused by its central perspective geometry, which accounts for some of the discrepancies. These distortions increase with the distance from the principal point of the photograph (intersection of the instrument's horizontal and vertical coordinate axes) and with the surface depth.

Any screening technique must avoid a high incidence of false positive and false negative results. Too many false positives and false negatives would make the system unreliable. In this study an attempt was made to eliminate these conditions.

In general the moiré technique was convenient to use and the interpretation of moiré topographs is a relatively simple matter and could be performed by physical therapist.

SUMMARY

Moiré topography, a simple technique for three-dimensional quantification, was used to provide interference fringe photographs of the human back with sufficient accuracy to be used for detecting children with asymmetry and to be used in the evaluation of therapeutic treatment. To make it a good absolute measuring system requires careful consideration of the sensing limitations of moire and the technical complexity involved in overcoming them.

REFERENCES

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3. S. Hoppenfeld, Physical Examination of the Spine and Extremities, Appleton Century-Crofts, 1976, New York.

4. D. Meadows, W. Johnson and J. Allen, Generation of surface contours by moire patterns, Appl. Opt. 9(1970) 942-947.

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8. S. Willner, Moiré topography for the diagnosis and documentation of scoliosis, Acta. Orthop. Scand, 50(1979)295-302.

TABLE 1: DISTANCES FROM BODY TO SCREEN AND FRINGE INTERVAL

Fringe no.	Distance from body to screen (mm)	Fringe interval (mm)
1	34.2	
		5.0
2	39.2	
		5.0
3	44.3	
		5.1
4	49.3	
		5.1
5	54.4	
		5.1
6	59.5	
		5.1
7	64.6	
		5.2
8	69.8	
		5.2
9	75.0	
		5.2
10	80.2	
		5.3
11	85.5	
		5.3
12	90.8	
		5.3
13	96.1	
		5.4
14	101.5	
		5.4
15	106.9	
		5.4
16	112.3	
		5.5
17	117.8	
		5.5
18	123.3	
		5.5
19	128.8	
		5.6
20	134.3	
		5.7
21	139.9	
		5.7
22	145.6	
		5.7
23	151.2	

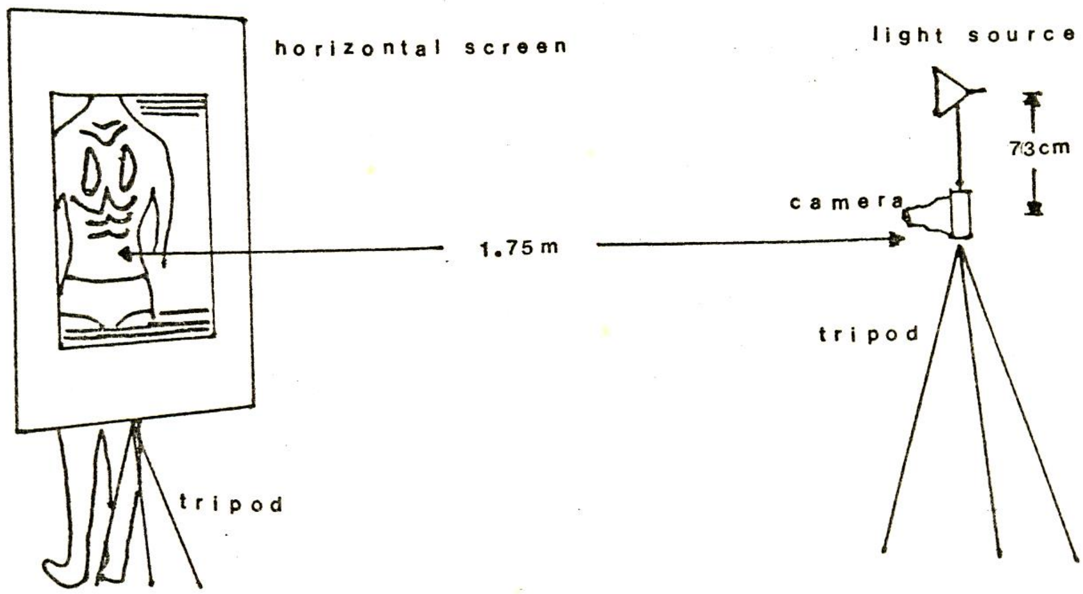

FIGURE 1: Arrangement of Equipment

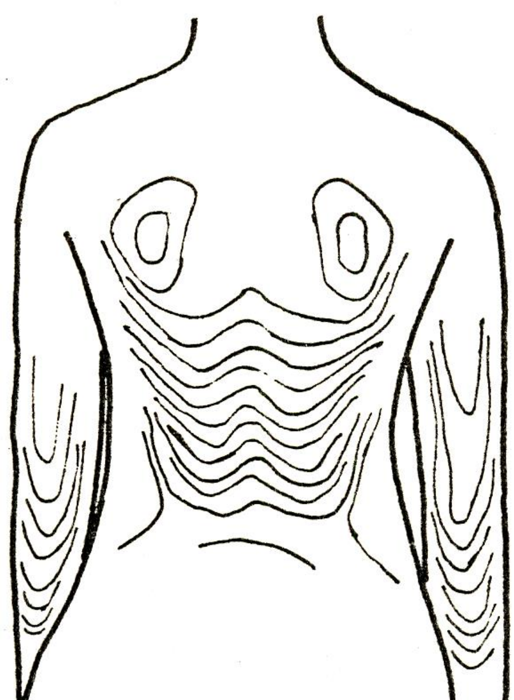

FIGURE 2: Moiré Pattern of a Normal Spine

FIGURE 3: Moiré topographs of front and back of a seven year old boy with negative bending test.

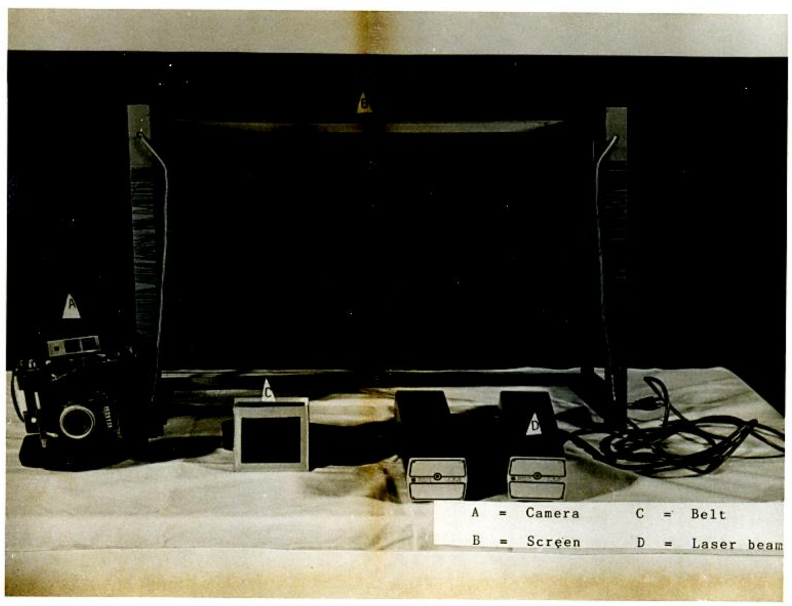

FIGURE 4: Equipment used in the study.