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PRODUCTION ENGINEERING MEASURE
FOR METERS, TAUT-BAND SUSPENSION, A-C MOVING IRON VANE
PER SIGNAL CORPS REQUIREMENTS SCS-160

FIRST QUARTERLY PROGRESS REPORT

Covering the Period
May 1, 1963 through July 31, 1963

Signal Corps Contract Number DA 36-039-AMC-01473(E)
Order Number 21048-PF-63-81-81
U.S. Army Signal Equipment Support Agency
Fort Monmouth, New Jersey

ASSEMBLY PRODUCTS INCORPORATED
7100 WILSON MILLS ROAD
CHESTERLAND, OHIO

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OBJECT: To establish the capability and facilities to manufacture ruggedized, taut-band suspension, A-C iron vane panel meters. The taut-band suspension will result in performance characteristics heretofore unattainable in ruggedized panel meters using conventional pivot-and-jewel construction.

Prepared by: R. H. Nichols, Project Engineer

ASSEMBLY PRODUCTS, INC.
CHESTERLAND, OHIO

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ABSTRACT

A preliminary sample has been designed and constructed in order to study various parameters of AC moving-iron vane meters. Initial evaluation of the electrical characteristics of the prototype mechanism showed that the basic design meets the electrical specifications which have been evaluated thus far.

The Data Control Report and the Management Evaluation Report have been accepted by the Contracting Officer.

PURPOSE OF CONTRACT

This contract is for a Production Engineering Measure and General Report in accordance with Steps I and II of Signal Corps Industrial Preparedness Procurement Requirements (SCIPPR) NO. 15, Dated 1 October 1958, for Meters, Taut Band Suspension, A-C, per Specification SCS-160, dated 11 September 1962.

The meters covered by this contract are 2½ inch and 3½ inch meters, 100° scale, 60 CPS with the following ranges:
2 milliamperes, 150 volts, and 5 amperes.

The primary applicable specifications are SCS-160 and MIL-M-10304.

The objects of the contract are (1) to establish the capability to manufacture such meters on a pilot line basis, including actual fabrication of test samples; (2) to obtain preproduction approval of such meters; (3) and to complete a production type run to demonstrate the capability to produce such meters at a rate of fifty units per eight-hour shift.

TECHNICAL REPORT

In order to study the basic parameters of the moving-iron vane type mechanism a preliminary prototype was designed and fabricated. Preliminary drawings for the case and shockmount have been completed and some parts have been fabricated.

The mechanism consists essentially of a cast zinc-alloy main bracket, which was cast in a plaster mold, and supports the coil, dial, fixed vane and taut band suspension parts. The iron vanes were fabricated from grain oriented silicon steel. The moving portion includes an aluminum vane for permanent-magnet eddy-current damping.

Current sensitivity, voltage loss and power loss were measured for the 2 MA, 3½ inch mechanism and all were within the specified limits.

It is anticipated that frequency error, which has not yet been investigated, may be a problem.

PUBLICATIONS, REPORTS, AND CONFERENCES

In addition to the regular monthly reports to the Contracting Officer, the Data Control Plan Report and the Management Evaluation Report were submitted and accepted.

On June 21, 1963, a conference was held at Assembly Products, Inc. with Mr. F. S. Feldheim, Project Engineer for the U. S. Army Electronics Material Agency.

Assembly Products personnel who were present were Mr. R. Petruske, Contract Coordinator; R. Howard, Chief Production Engineer; J. Shaw, Industrial Engineer; and R. Nichols, Project Engineer.

All phases of administration of the contract were discussed.

CONCLUSIONS

As a result of preliminary tests on the first prototype it appears that the basic electrical requirements have been met in the first design. Work may now proceed to determine the requirements of the taut band suspension system and the damping mechanism for a ruggedized moving iron vane mechanism.

It is estimated that eight percent of the total contract has been completed.

PROGRAM FOR NEXT INTERVAL

- (1) Perform basic tests on frequency effect and temperature effect.
- (2) Reduce moment of inertia of movement.
- (3) Evaluation of damping mechanisms.
- (4) Evaluation of calibrating mechanisms.
- (5) Evaluation of ruggedized taut-band suspension.
- (6) Evaluate shock-mounting system and case.

IDENTIFICATION OF KEY TECHNICAL PERSONNEL

George J. Crowdes, director of engineering, designed the basic taut-band suspension used in meters made by Assembly Products. The precision, ruggedness and general reliability of this design have contributed heavily to API's pre-eminence in the taut-band field.

Crowdes also designed API's highly successful continuous reading meter-relay and the new optical meter-relay. The latter could be the greatest stimulus ever devised to promote the use of meter-relays, especially into fields never before visualized for these instruments. Crowdes also was mainly responsible for developing "Super-Calibrated" meters and meter-relays, which require a special machine to print dial divisions corresponding to actual positions of meter movements when current flows through them. A chemical engineering graduate, his experience covers such other fields as plastics and rubber chemistry and electrical engineering.

W. R. Howard, chief production engineer, is an electrical engineering graduate and a member of the I.E.E.E. He recently designed a complete new line of meters, including taut-band suspension models, which is now in production at Assembly Products. Formerly in charge of the specifications department, he is thoroughly familiar with all modern types of meters, and is especially experienced in translating broad specifications into exact manufacturing details. His duties have covered constant improvement and cost reduction of components and assemblies.

Donald J. Runo laboratory manager, has been responsible for environmental and specialized quality control testing, including the design, construction and maintenance of equipment for these purposes. He maintains a calibration check system in accordance with MIL-C-45662A. These duties have covered all types of meters and meter-relays, including taut-band suspension models.

George Hammond, has a special competence for making prototypes of instruments and for determining the best manufacturing procedures from a practical standpoint, as distinguished from the theoretical. He has built the first working models of practically every new instrument produced by Assembly Products for the past 15 years, including the first reliable locking coil meter-relay, the continuous reading meter-relay, the first taut-band meters and meter-relays, and the optical meter-relay. Along with building prototypes, he has supervised such other activities as the tool room, coil wind-

ing and sub-assembly.

All prototypes and preproduction samples for this contract will be built by him or under his direction. He will also coordinate the new designs with Production Engineering to assure smooth transition from prototype stage to pilot run. This work will include checking drawings, methods and tools.

Robert H. Nichols, has been assigned project engineer for this PEM contract and has the responsibility for coordinating all technical areas of the project to their timely completion. He reports directly to the chief production engineer (W. R. Howard).

He is an electrical engineering graduate of Purdue University and a member of the I.E.E.E. His responsibilities include design of special permanent magnet moving-coil meters including non-linear meters using specially shaped magnets, establishing design constants used in the routine design of semi-standard meters, and engineering consultant to the production departments. An important design aid developed by him is a concise format for summarizing meter characteristics which affect response time and overshoot resulting in quick mathematical prediction of meter ballistics for any meter design.

Prior to joining Assembly Products he spent four years in development engineering of industrial control equipment, including two years as project engineer designing a-c electromagnetic devices.

PROJECT SCHEDULE
Meters, Taut-Band Suspension, A-C Moving Iron Vane
Per Signal Corps Requirements SCS-160

PROJECT TASK	1963												1964												1965													
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	
Production Design Engineering																																						
State of the Art Samples																																						
Design and Fabrication of Pilot Line Equipment																																						
Refining Equipment and Solving Production Problems																																						
Preproduction Sample Approval																																						
Pilot Run																																						
Monthly and Quarterly Reports																																						
Final Report and Step II Study																																						

Contract Number DA-36-039-AMC-01473(E)
Order Number 21048-PP-63-81-81

Contractor:
Assembly Products, Inc.

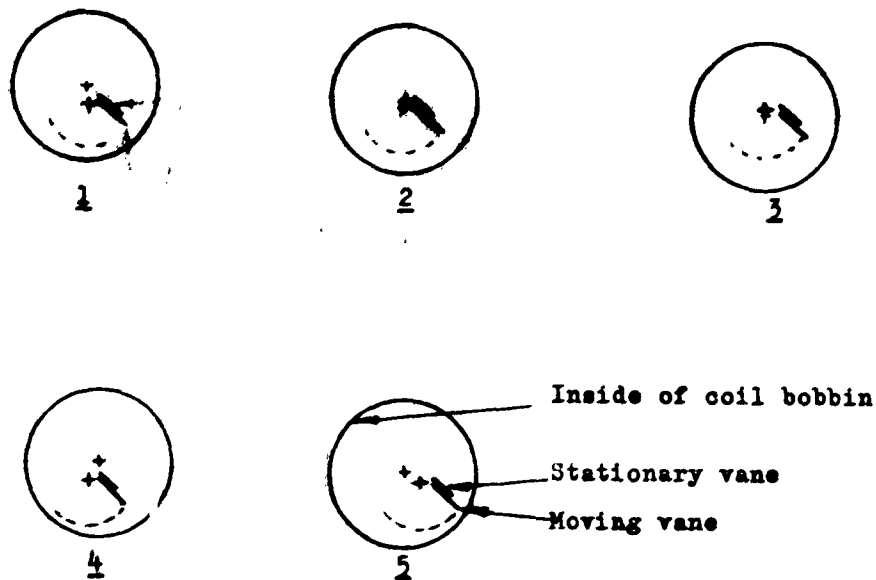


FIGURE I

Coil Positions used to obtain graph in Figure III

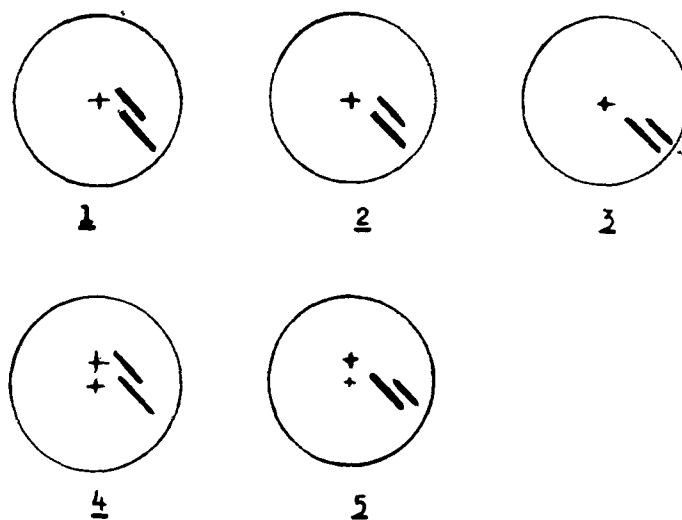
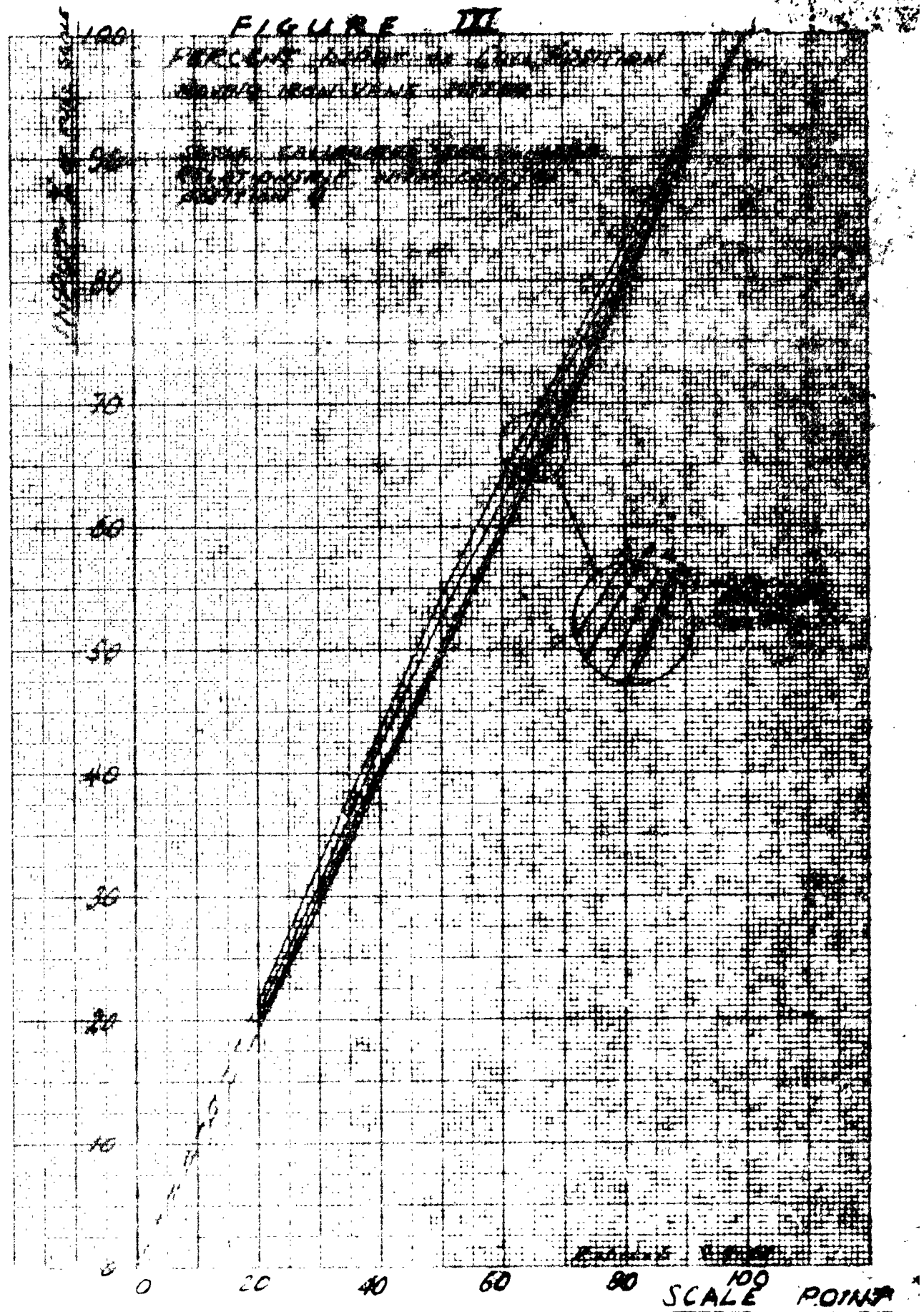


FIGURE II

Positions of stationary iron vane used to obtain graph in Figure IV

38-10-13



K-E 20X20 TO THE INCH 389-10MG
 PER FREI & ESSEN CO. MADE IN U.S.A.

% ERROR
 (+ = INSENSITIVE)

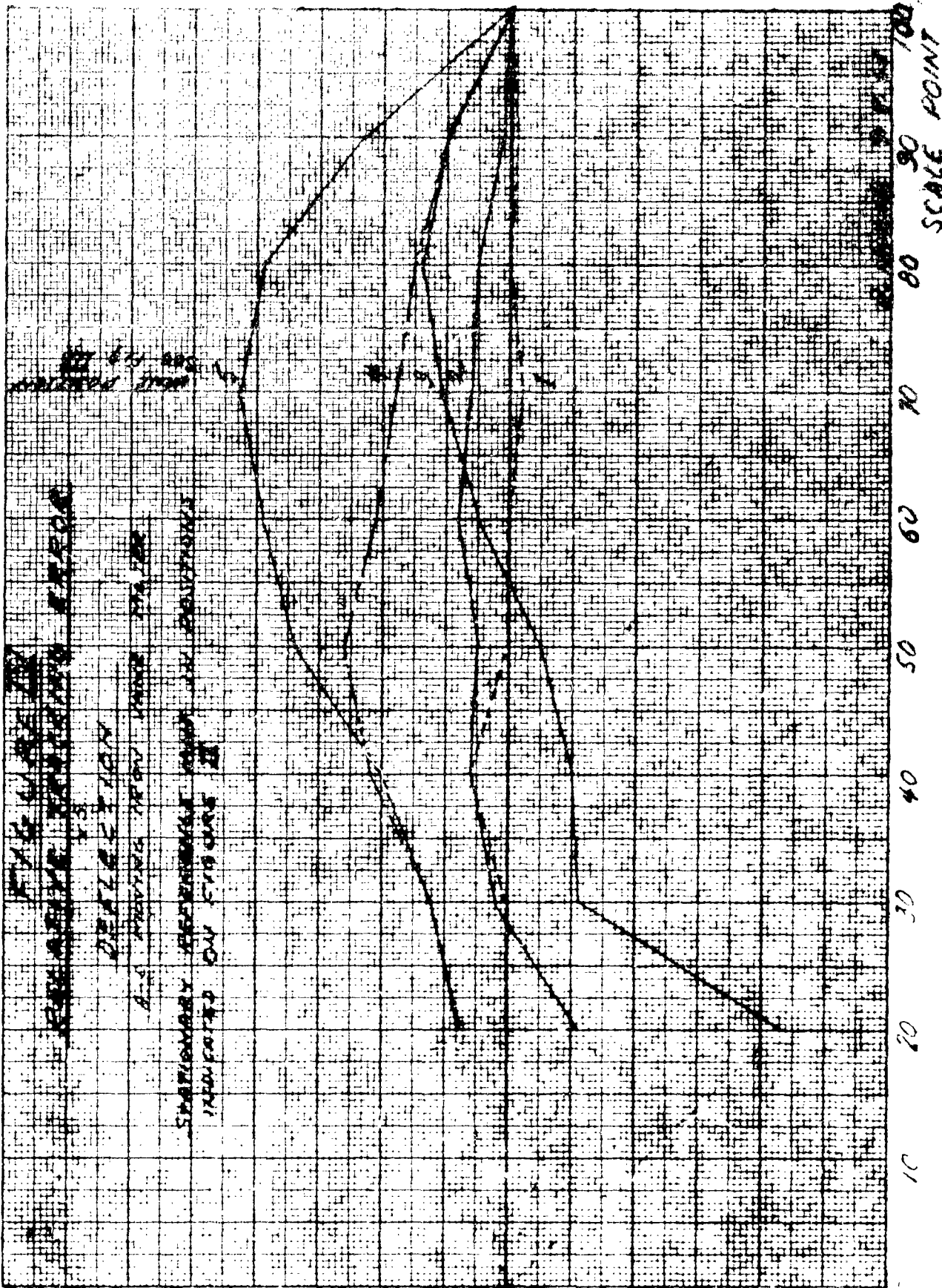


FIGURE 1
 PERCENTAGE ERROR
 DIRECTION
 A-5 MEASURING APPARATUS
 SUBSTANTIALLY IDENTICAL WITH THE
 INSTRUMENTS ON FIGURE 2