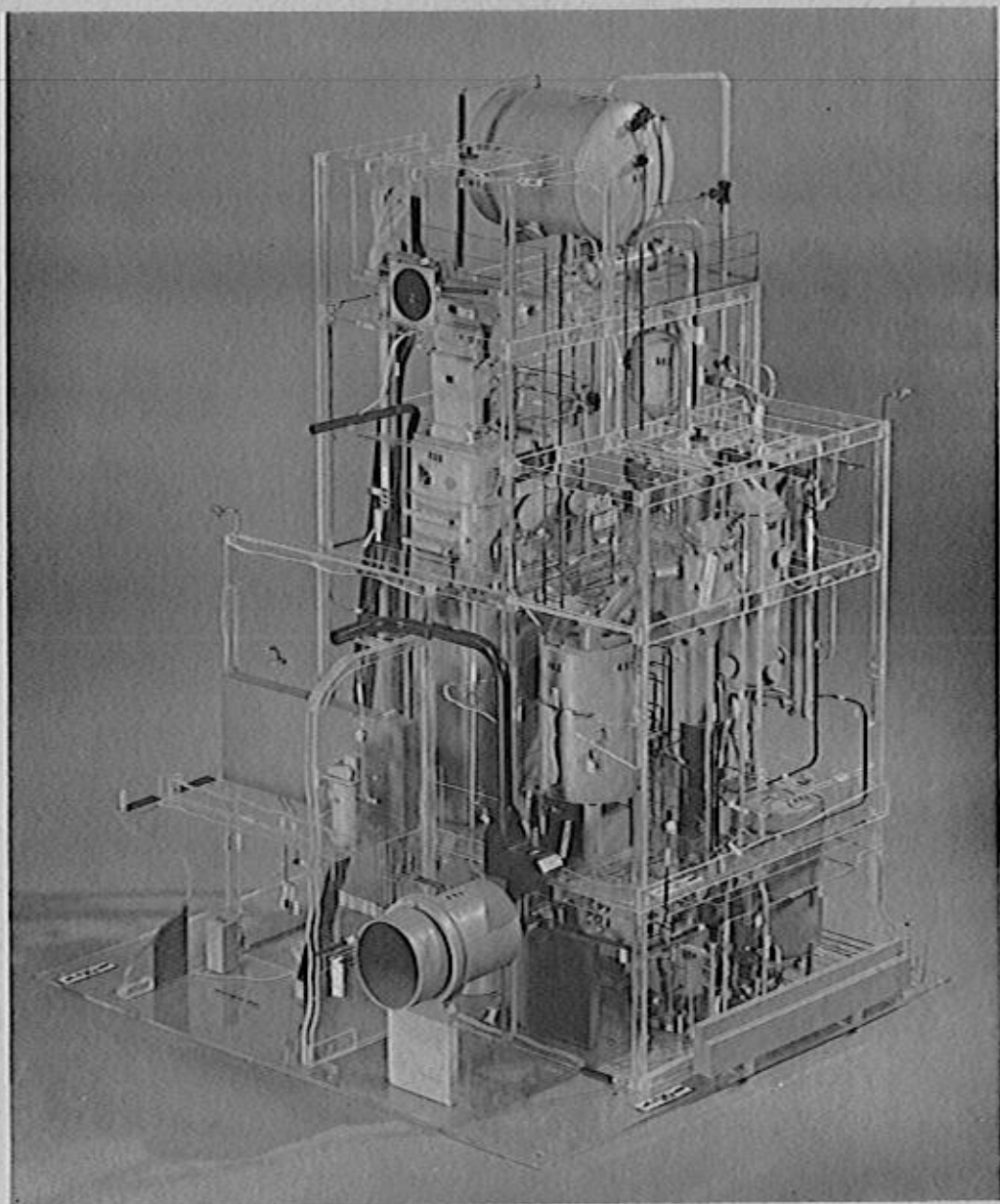


THE JOURNAL OF

ENGINEERING GRAPHICS



VOL. 24, NO. 2

MAY, 1960

SERIES NO. 71

PUBLISHED BY THE DIVISION OF ENGINEERING GRAPHICS
OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Outstanding Books for Engineering Courses

DESCRIPTIVE GEOMETRY

—A Pictorial Approach

HOWARD BARTLETT HOWE
Rensselaer Polytechnic Institute

A CLEAR-CUT PRESENTATION of descriptive geometry, combining the pictorial approach with the direct approach. This popular textbook stimulates student capacity to perceive and visualize; facilitates mastery of principles; and insures a broad coverage of the subject.

The ability to sketch space pictures is gradually built up by progressing from simple fundamentals to more complicated combinations. Special emphasis is placed on vectors and their use in finding stresses in planar and non-coplanar structures, as well as for the representation of moments. Throughout, theories are applied to the solution of practical problems. All projects are complete with drawings and explanations. "Well-written... covers the subject in a very satisfactory manner." — C.H. SPRINGER, University of Illinois. 328 illus.; 332 pp. \$4.75

BASIC ENGINEERING DRAWING

WILLIAM WIRT TURNER, University of Notre Dame;
CARSON P. BUCK, Syracuse University; and
HUGH P. ACKERT, University of Notre Dame

A ONE-VOLUME INTRODUCTION to the basic principles of engineering drawing, descriptive geometry, and machine drawing. Designed for courses integrating these subjects, it is at the same time flexible enough to be used by instructors who cover only one of these fields.

The presentation of all three phases of engineering drawing assumes no previous knowledge of the subject. Chapters devoted to machine drawing detail the application of drawing theory and practice, in keeping with the recommendations of the American Standards Association. The treatment of pictorial drawing is comprehensive and contains many innovations. "Well-organized, well-illustrated, well-written." W. A. WOLFE, University of British Columbia. 563 illus., 26 tables; 669 pp. \$6

SLIDE RULE PROBLEMS —With Operational Instructions

PHILIP J. POTTER, EDWARD O. JONES, Jr.,
and FLOYD S. SMITH
—all of Auburn University

INVALUABLE FOR COURSES in the use of the slide rule, this book provides a wealth of problems for student solution. The number of problems included is sufficient to eliminate any need for repetition for several terms. Nine short text sections on slide-rule operation—with numerous examples—precede the problems. A section on dimensional analysis is included. The book groups all problems in the same order in which the techniques are explained in the sections.

"Fulfills the aims of the authors in a most excellent way... should be a fine text and workbook in courses which devote time specifically to the slide rule." — J. B. WIGGINS, University of Southern California. Instructor's Manual available. 119 illus. 191 pp. \$3

PROBLEMS FOR DESCRIPTIVE GEOMETRY

Also by HOWARD BARTLETT HOWE

THIS PRACTICAL WORKBOOK contains a wide selection of theoretical and applied problems drawn from engineering situations. A valuable supplement to the author's outstanding textbook, it employs the pictorial approach to arouse student interest, and to give a firmer, quicker grasp of the fundamentals.

Liberal use of sketches helps the student see and record space relationships in preparation for orthographic renderings. As an aid to solving problems, it shows how to express space conceptions and the process of analysis in rough sketches. Theoretical problems are presented in layouts to be completed on the same sheet; more elaborate application problems enable students to exercise their judgment and use theory. Includes 77 layout and illustration sheets, 9½ x 11, and 7 sheets of practice paper. \$3.75

INTEGRATED PROBLEMS IN ENGINEERING DRAWING AND DESCRIPTIVE GEOMETRY

WILLIAM WIRT TURNER

THIS CLASS-TESTED SET of worksheets is intended for use in courses integrating engineering drawing with descriptive geometry. From the outset, simple orthographic projection is regarded from the viewpoint of descriptive geometry. Basic theory is presented first, followed by the various phases of drawing in their natural sequence.

Relates theory and application as closely as possible, and maintains a constant review by continually introducing principles already covered into later problems. Each work sheet contains clear instructions indicating exactly what is to be done and gives references to outside reading. Includes 83 sheets of problem layouts, 8½ x 11, and 16 sheets of practice and tracing paper. Instructor's Manual available. \$4.50

HANDBOOK OF GRAPHIC PRESENTATION

CALVIN F. SCHMID, University of Washington

A DETAILED WORKING MANUAL for all concerned with the clear presentation and interpretation of statistical data by means of charts and graphs. Showing how complicated data can be put into easily intelligible form, this book analyzes in detail each basic type of chart, indicating its advantages and disadvantages in presenting different kinds of data. Gives step-by-step directions for laying out charts, with pointers on how to avoid difficulties in construction.

Handbook includes the first detailed discussion of three-dimensionals plus scores of examples from a wide variety of fields. Techniques described can be applied to countless situations in engineering, science, industry, etc. "Reliable and helpful... the most successful effort of this kind." — The Journal of the American Statistical Association. 203 illus., 7 tables; 316 pp. \$6.50



Kuhlmann
**Drafting Machine
and Table**

- New, compact column construction for standing or sitting.
- Height adjustment easily controlled by pedal brake.
- Perfectly balanced; effortless, infinitely variable adjustments.

Send for illustrated literature.

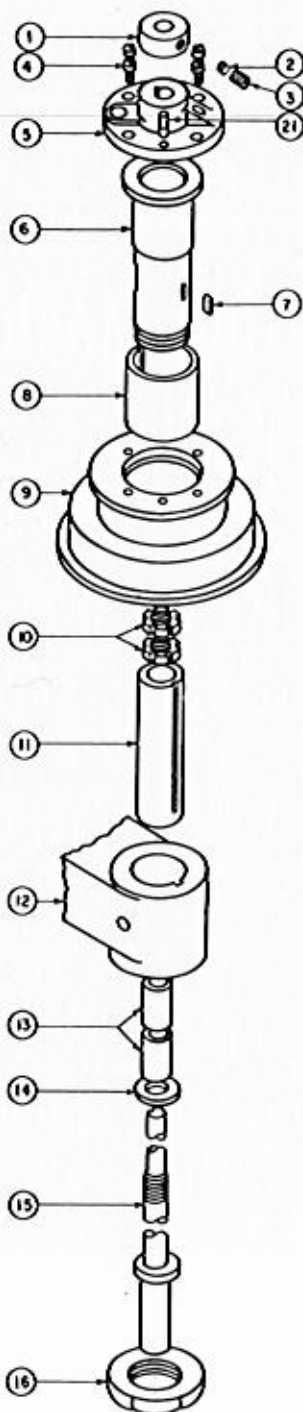
UNITECH CORPORATION 50 Colfax Ave., Clifton, N. J.

A complete line for draftsmen

EUGENE G. PARÉ

State College of Washington

ENGINEERING DRAWING



"Engineering Drawing by Paré is in my opinion an example of an excellently written book with ample coverage in a difficult technical field. . . The illustrations are excellent. The appendices are full of essential stuff."

Review in February 1960 issue of
Graphic Science

"It is magnificently illustrated and printed but this care would be wasted if the content were not comprehensive and detailed. There must always be a sensible selection of topics and an effective order of presentation which I believe Paré has achieved with this book. I am especially happy to see a section on simplified drafting. The book of problems which is keyed to it is sensibly and effectively conceived."

Douglas P. Adams, Massachusetts
Institute of Technology

1959, 500 pp., \$6.50

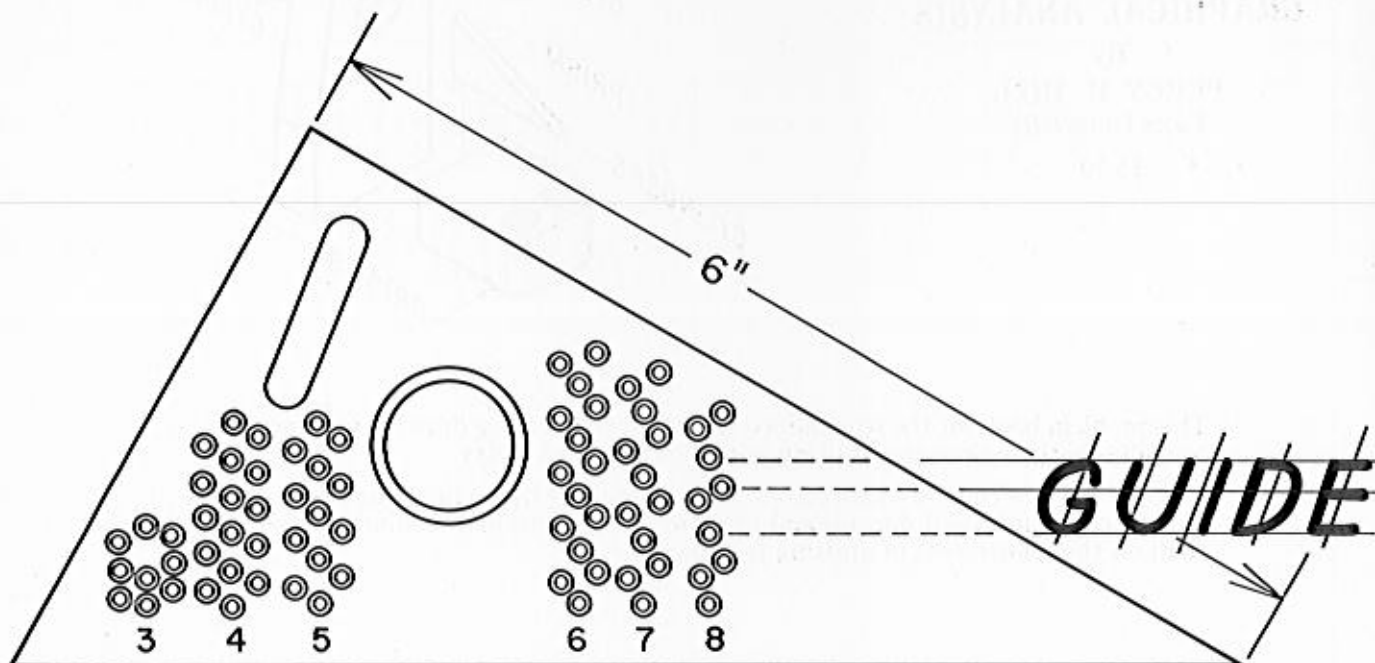
Engineering Drawing Problems

EDWARD V. MOCHEL, University of Virginia

1959, \$4.50

HOLT, RINEHART and WINSTON, INC. 383 Madison Avenue, New York 17

BRADDOCK LETTERING ANGLES



Style "A"

- 5°-60
- 6°-60
- 7°-60
- 8°-60
- 9°-60
- 4°-45
- 5°-45
- 6°-45
- 7°-45
- 8°-45
- 6°-45 Brd.-Rowe
- 8°-45 Style "C"

These combination lettering guides and triangles make it easy and simple to draw accurately spaced guide lines for lettering uniformly spaced parallel lines and systematic dimensioning.

Style "B"

- 5°-60
- 6°-60
- 7°-60
- 8°-60
- 9°-60
- 4°-45
- 5°-45
- 6°-45
- 7°-45
- 8°-45
- 6°-45 Brd.-Rowe
- Lettering Device

CLEAR - TRANSPARENT - FLAT - NON-INFLAMMABLE - DIMENSIONALLY STABLE
 FOR FRESHMAN ENGINEERING STUDENTS and PROFESSIONAL DRAFTSMEN & DESIGNERS

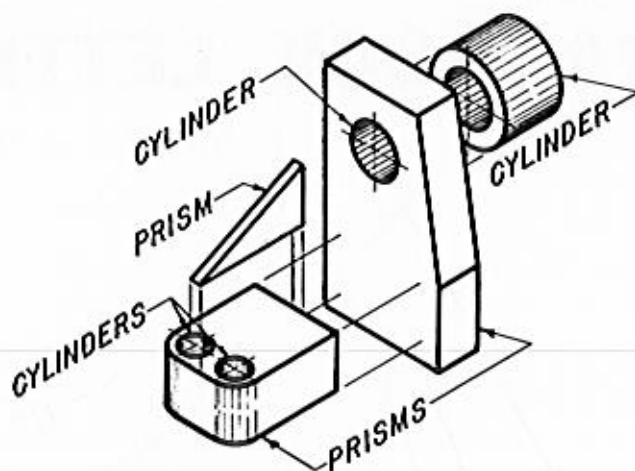
BRADDOCK INSTRUMENT COMPANY

PITTSBURGH 18, PA.

PROBLEMS IN GRAPHICAL ANALYSIS

By
PERCY H. HILL
Tufts University

\$5.50

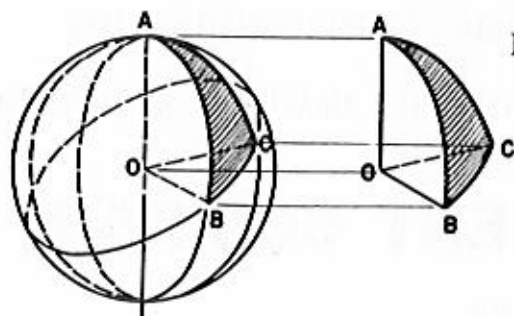


This problem book for the streamlined freshman engineering drawing program combines both engineering drawing and descriptive geometry.

It is designed for courses where emphasis is on teaching the engineering student how to communicate 3-dimensional ideas in a 2-dimensional medium, rather than on the refinements of drafting technique.

Three New Approaches Introduced

- Integration of drawing, descriptive geometry, and graphics into a smooth-flowing sequence, one supplementing the other.
- Traditional machine elements are treated somewhat lightly. Instead, there are more problems which are involved in allied fields of engineering.
- An attempt has been made, through carefully chosen problems, to require of the student an element of creative thinking in problem solution. Many problems have no set answer, thus leaving room for the student to show his individuality.



INSTRUCTOR'S MANUAL AND SOLUTIONS
now available.

McGRAW-HILL BOOK COMPANY, Inc.
330 West 42nd Street New York 36, N. Y.



**DOLGORUKOV
DETROIT**

*The Mark of Drawing Instruments that are
Better Engineered and Better Made—
MUCH Better.*

REGISTERED 1959 BY D. M.F. CO.

New

DRAFTSMAN'S STRAIGHT EDGES

Price List Effective April 1, 1959

The new Draftsman's Straight Edges have been developed by Dolgorukov Manufacturing Co. to eliminate the disadvantages of the use of steel straight edges on a drawing board. The new Draftsman's Straight Edges are machined from the best available cast acrylic sheet material having optically flat surfaces, with the use of specially designed machines to provide for the best precision obtainable with such material. They are light to move on the drawing board and to carry around, are fully transparent, will not soil or mar a drawing, and do not present danger in falling off the board. Their working edges need not be oil-stoned before use, which often is a necessary precaution with draftsmen's steel straight edges which usually are not hardened. These straight edges are not "plastic molded" or "plastic extruded" items and do not distort the image underneath.

These edges are made in two thicknesses, the edges of No. P5700 series being 1/8" thick and the edges of No. P5800 series being 3/16" thick.

All straight edges have one beveled working edge and one square working edge. Both working edges have chamfer of approximately .010" to reduce origination of minute cracks having a tendency to grow, as well as liability of the edges to nicking. Such chamfer also enables the user to produce cleaner drawings.

All straight edges have rounded corners and such corners, as well as the end edges, are chamfered for approximately .030" to reduce breakage of the corners and chipping of the end edges. The width of the straight edges varies with their lengths and has been selected for each size edge to ensure the best performance. Each straight edge is individually packaged in a transparent plastic case designed for continued use.

The following prices are f. o. b. Detroit and are subject to change without notice.

P5700 SERIES — 1/8" THICK

Length	Catalog No.	Price—Clear	Price—Green
18"	P5700-18	\$1.90	\$2.25
24"	P5700-24	2.75	3.25
30"	P5700-30	3.60	4.25
36"	P5700-36	4.90	5.50
40"	P5700-40	6.15	6.75
42"	P5700-42	7.15	7.50

P5800 SERIES — 3/16" THICK

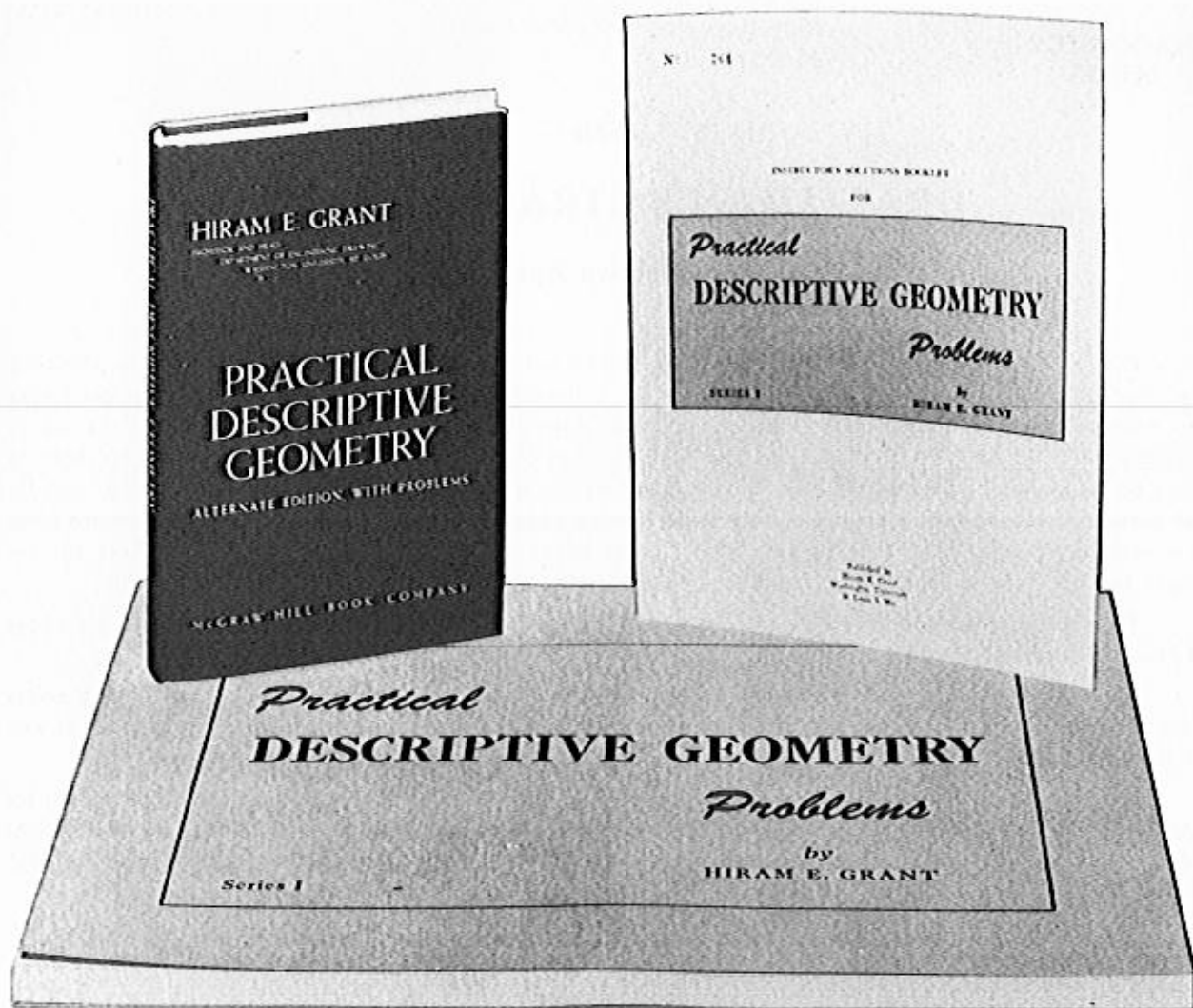
18"	P5800-18	\$2.60	\$2.90
24"	P5800-24	3.35	3.85
30"	P5800-30	4.75	5.25
36"	P5800-36	5.90	7.25
40"	P5800-40	6.85	8.75
42"	P5800-42	7.50	9.25
44"	P5800-44	8.25	10.00
46"	P5800-46	8.75	10.75



DOLGORUKOV MANUFACTURING CO. • 407 FISHER BLDG. • DETROIT 2, MICH.

REGISTERED PROFESSIONAL ENGINEERS. DESIGNERS AND MANUFACTURERS OF ENGINEERING AND DRAWING EQUIPMENT





Practical
DESCRIPTIVE GEOMETRY
Problems

with ANSWER BOOKLET for Staff
 by HIRAM E. GRANT
 Washington University, St. Louis, Mo.

- new practical applications of descriptive geometry
- 183 practical problems with student appeal
- for easier problem solution, two page sizes: 9x12 and 12x18
- copies of author's quizzes sent to schools

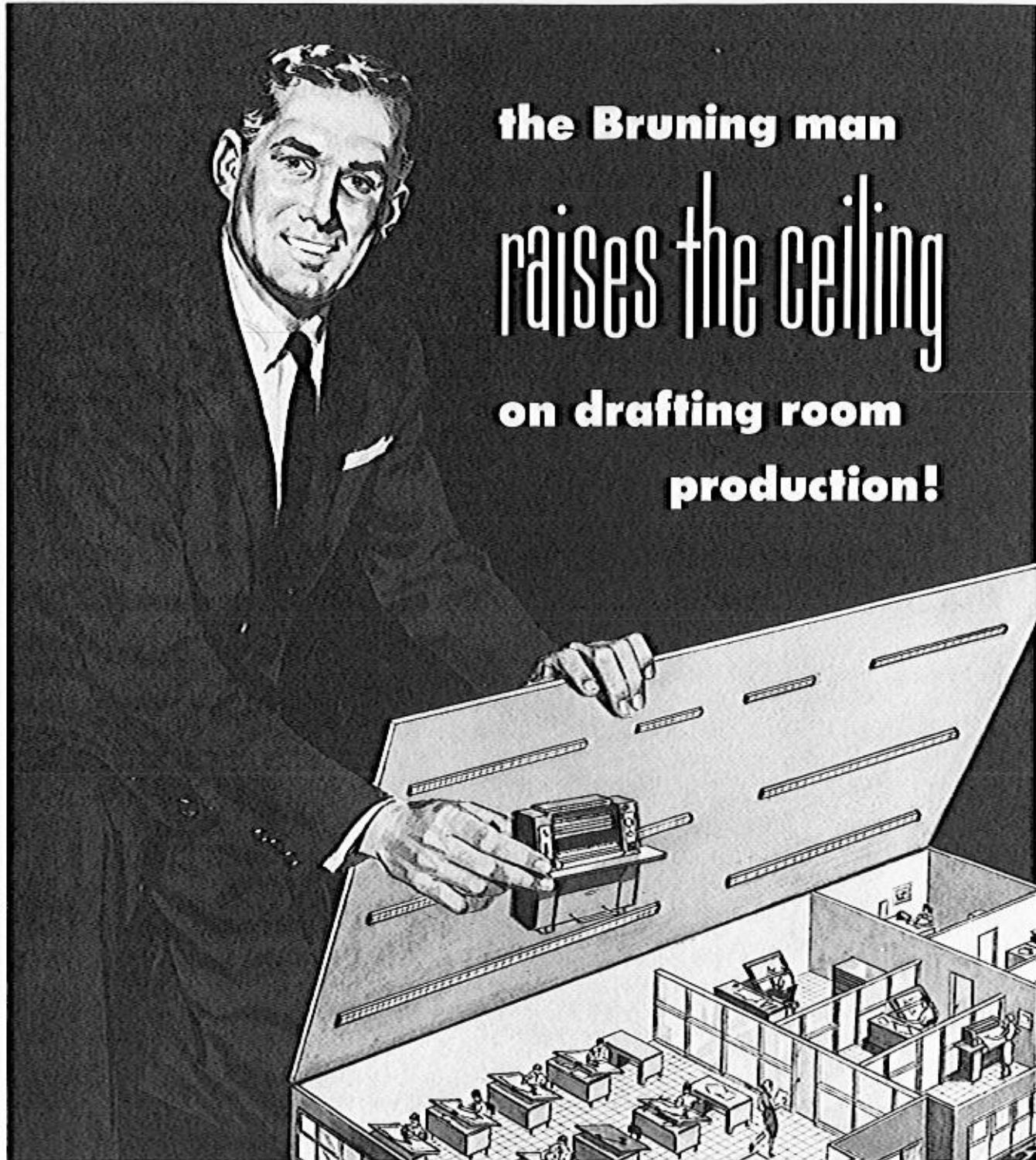
Send for your copy today . . .

HIRAM E. GRANT

Department of Engineering Drawing
 Washington University
 St. Louis 5, Missouri

This new set of 289 printed problems in descriptive geometry, with accompanying text and instructor's answer booklet, offers a wide selection.

A variety of courses may be designed from this problems book designed both to create student interest and to enrich your course. The book features new practical applications of descriptive geometry with complete coverage of fundamentals. In addition to partially laid out problems which enable students to solve twice as many, PRACTICAL DESCRIPTIVE GEOMETRY PROBLEMS includes a number of problems to be set up completely by the student. With this set of printed problems, you may use the regular edition of the author's PRACTICAL DESCRIPTIVE GEOMETRY.



the Bruning man
raises the ceiling
on drafting room
production!

Now! you can increase drafting room production dramatically — without the high cost for expansion or additional personnel! You can do it with the products and help offered *only* by your Bruning Man!

He gives you the widest selection of the most advanced products on the market to save you time and money . . . modern Auto-Shift drafting tables that enable 50% more productive use of space . . . all-new Neoglide drafters that speed drafting up to 40% . . . versatile intermediates that slash time of re-working drawings up to 90% . . . the brand new

Copyflex 675 reproduction machine that offers more operating conveniences and advancements than any other machine on the market.

Your Bruning Man gives you the service, supply, and quality products offered only by a company with over 60 years' experience as researcher, manufacturer, and supplier. He provides you a single, dependable source for everything you need; simplifies ordering and stocking, saves you time and money. His sales-service branches and plants are near you to assure you the product or help you need when you need it!

Charles Bruning Company, Inc.
1800 Central Rd., Mt. Prospect, Ill.

BRUNING

Call your Bruning Man, today. He's located in principal cities of the United States and Canada.



NEW from PRENTICE-HALL

FUNDAMENTALS OF ENGINEERING GRAPHICS

by Myron G. Mochel, Clarkson College of Technology

FUNDAMENTALS OF ENGINEERING GRAPHICS offers a comprehensive course for engineering and science students. It illustrates methods for solving problems and presenting significant information graphically, based upon principles of mathematics and orthographic projection. Text material is arranged in its order of usefulness and in coordination with the concurrent courses of mathematics and physics. Part I, GRAPHICAL DEVICES, offers graphical methods for presenting data, and for making measurements and calculations. Part II, SPATIAL ANALYSIS AND PROBLEM SOLVING, deals with the relationship of points, lines and planes in space. Part III, COMMUNICATION OF IDEAS, considers graphical methods for communicating three-dimensional information. Part IV, GRAPHICAL SOLUTION OF MATHEMATICAL PROBLEMS, considers mathematical problems most readily solvable by graphical means.

In addition, this new book:

- uses complete concrete projects to explain theory and methods of applying theory, thus establishing continuity
- concentrates on essential theory leading to graphical demonstration of applications
- utilizes a psychological approach emphasizing unity and relatedness, rather than isolated topics
- encourages students to develop freehand work, although techniques in themselves are considered a by-product
- is exceptionally well-illustrated
- has been successfully class tested for the last three years

FUNDAMENTALS OF ENGINEERING GRAPHICS

TABLE OF CONTENTS

Part I Graphical Devices

- 1 Graphs
- 2 Functional Scales
- 3 The Vernier

Part II Spatial Analysis and Synthesis

- 4 Orthographic Theory—Principal Projections
- 5 Orthographic Theory—Auxiliary Projections
- 6 Orthographic Theory—Elaboration of Fundamentals
- 7 Orthographic Problems—A Manufacturing Plant
- 8 Orthographic Problems—Centerlines and Outlines
- 9 Orthographic Problems—A Tripod

Part III Communication of Ideas

- 10 Freehand Orthographic Representation
- 11 Freehand Isometric Representation
- 12 Freehand Oblique Representation
- 13 An Engineering Design Problem—A Speed Changer
- 14 Freehand Design Problem—An Instrument Support

Part IV Graphical Solution of Mathematical Problems

- 15 Nomography
- 16 Empirical Equations
- 17 Graphical Differentiation
- 18 Graphical Integration

1960. Approximately 400 pages. Text Price \$8.50.
To receive approval copies, write: Box 903

PRENTICE-HALL, INC.

Englewood Cliffs, N. J.

FILL RULING PENS FAST WITH ONE HAND!

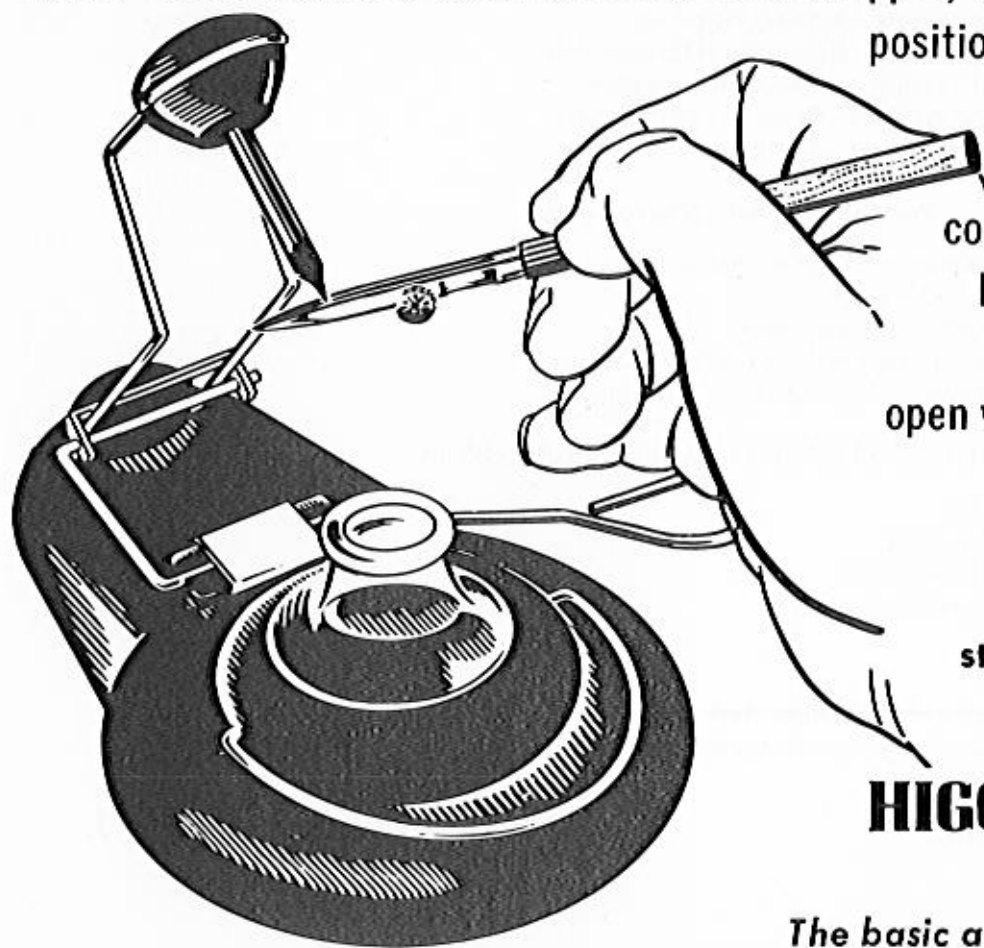
with new HIGGINS INK-A-MATIC drawing ink dispenser

Just a slight movement of your hand, and HIGGINS new drawing ink dispenser fills ruling pens automatically — faster, easier, than ever before! **SPEEDS UP INK TRACING BY 32%**. Ink bottle sits securely on non-skid rubber base. Gentlest touch on lever lifts stopper, brings pen filler into

position. No mess, no waste.

Pen filler may be rotated for most convenient filling angle.

Lever may be clamped down so bottle stays open when you use dip pen.



Now at
art and
stationery
stores



HIGGINS INK CO., INC.
Brooklyn, New York

The basic art medium since 1880.

CONTENTS

Honors Course in Engineering Graphics	
S. M. Slaby.	12
Program of the Annual Meeting of the Engineering Graphics Division of the American Society for Engineering Education	14
Nomography: Do You Practice What You Teach?	
Chet Foster.	15
Previous Drawing Experience of Engineering Students	
Robert P. Borri.	16
I Need Help - or Are We Getting the Most Out of Our Nomenclature?	
R. H. Hammond.	18
Creative Expression in Engineering	
R. L. Ritter, E. A. Lemke, and R. J. Panlener.	19

JOURNAL OF ENGINEERING GRAPHICS published by the **DIVISION OF ENGINEERING GRAPHICS
OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION**

Editor: Wayne L. Shick, 210 Transportation Building, University of Illinois, Urbana, Illinois

Advertising Manager: A. P. McDonald, Rice Institute, Houston 1, Texas

Circulation Manager: Edward M. Griswold, The Cooper Union, Cooper Square, New York 3, N. Y.

Published February, May, November, Annual Subscription: \$1.25, Single Copy: \$.45

ROLLA

Those who paid for a picture of the Rolla meeting and have not received one should write Professor Christianson. He also has copies of papers by Hunter, Schilling and Hendry.

JOINT SESSION

Our division and several others are co-sponsoring the session of June 20, 1960, 9:30 A. M. on "The Technical Institute in America." This will be one of the major events of this annual meeting of ASEE.

N S F

The University of Detroit is conducting another N S F Conference, "Graphics in Scientific Engineering," July 11-12, 1960.

ABOUT OUR COVER

By courtesy of Procter and Gamble Co., we show one of several models used in design and construction of production facilities. Mr. E. L. Dewey described this important work on the program of our annual meeting, 1959.

HONORS COURSE IN ENGINEERING GRAPHICS

By S. M. Slaby
Princeton University

The present trend towards a greater scientific orientation in engineering education places a greater responsibility on engineering educators to foresee and provide for the needs of future engineers. In line with this thinking an advanced course in Engineering Graphics was designed for freshman engineering students whose experience in graphics prior to coming to Princeton was of such a character as to potentially qualify them for advanced work in Engineering Graphics. The concept of an advanced Engineering Graphics course also in principle fits in with the policy of "advanced placement" of qualified students coming to Princeton University and also with the "Honors Course" policy which has been in effect for underclassmen courses.

In order to give the reader a general idea of the advanced placement procedure as carried out at Princeton the following is quoted from a general letter from the Board of Advisors of Princeton University to principals, headmasters, and guidance officers of high schools and preparatory schools:

1. A student who has done well in college level work in secondary school and who has been granted advanced placement may be enrolled in advanced courses in Princeton in the subjects in which he shows achievement.
2. Such a student is given credit toward fulfilling the distribution requirements and the proficiency requirement in mathematics or language.
3. A student granted advanced placement may, in his upperclass years, reduce the number of his elective courses in order to enroll in graduate courses or seminars, or to undertake independent work of greater scope.
4. A student who has gained advanced placement in three or more subjects may graduate in three years or less, without additional course or other requirements, and may be permitted to assume regular status as a sophomore in his first year of residence or as a junior in his second year of residence.

Under the Honors Course system a student may elect courses that are presented on a higher level than the regular course, provided he has the necessary qualifications. For example, the regular freshman mathematics course presents the classical material dealing with differential and integral calculus while the comparative honors freshman mathematics course presents the material more from a philosophical point of view leaving the applications and manipulations of differentiation and integration largely to the responsibility of the student. Therefore, under Princeton's system it is possible for the superior and well-prepared student to choose two avenues in his education, one leading to advanced placement and the other leading to the Honors courses.

The Honors Course in Engineering Graphics was presented as an experimental course for the first time during the fall term of 1959-60. In this course an

attempt has been made to present Engineering Graphics more from the "science" point of view rather than from the "tool" point of view in keeping with the current philosophy of "engineering science". By doing this, the basic subject matter in Engineering Graphics is elevated above the "normal" level.

A qualifying test was given to approximately 40 students who volunteered to take the test. In order to take the test a student must have had one or more years of drawing experience in high school or in industry (summer work, etc.). The 15 students who earned the highest scores on this test were admitted to the Honors Course. There were three problems in the qualifying test which covered in general the areas of visualization, dimensioning, sectioning, and spatial relations (by means of a descriptive geometry problem). Of the 40 students who took this test only 4 attempted a solution to the descriptive geometry problem and of these 4 only one solved the problem correctly.

The Honors Course covered four major areas:

- I. Fundamentals of Graphic Communication
- II. Graphics Analysis of Space Geometry
- III. Graphics of Vector Geometry
- IV. Graphical Mathematics

Each area is discussed below. The total class time spent on the course was 14 weeks with three 2 hour sessions per week for a total of 84 class hours for the term.

I. Fundamentals of Graphic Communication

Since the qualifying test indicated that all students who were chosen to participate in the Honors Course had attained a reasonable level of comprehension and ability in graphic communication through previous work, this area of the course was limited to 3-2/3 weeks (22 class hours). Since students came from many schools where emphasis on topics varied, the following topics were covered to bring them to a similar level of attainment: theory of orthographic projection, principles of dimensioning, sections and basic conventions, theory of pictorial representation, graphical synthesis, and relative planar motion involving displacements only (project type problem dealing with the kinematics of a retractable tailwheel of an airplane).

II. Graphic Analysis of Space Geometry

In this section of the course an introduction to the elements of projective geometry was presented covering such topics as elements at infinity, the cross-ratio theorem, pencil of lines, and map nets. A speaker from the Civil Engineering Department presented some material on photogrammetry which was related to the work the students were doing with map nets. The speaker had a stimulating effect on the class and seemed to give more meaning to the work of the students since they were able to see a real use of the graphical theory as presented by an expert in the field of photogrammetry.

The introduction of the material dealing with projective geometry permitted a smooth transition from the communication concepts of graphics to the concepts involved in spatial graphic analysis. The material covered

under "space geometry" also included classical descriptive geometry (using the "direct" method with mutually perpendicular projection planes) and also a number of problems dealing with the principles of perspective projection (one point and two point). Some of the material presented in this part of the course was referenced to mathematical methods to emphasize the relationship between the physical and symbolical handling of space concepts.

Since auxiliary projection was not handled under "Fundamentals of Graphic Communication" it was presented at the end of the section devoted to "Graphics Analysis of Space Geometry" as a special problem project which involved double auxiliary projection and complete dimensioning of a complex machine component. It was felt that introducing auxiliary projection at this stage was more logical than trying to do it before the students were familiar with the principles of descriptive geometry.

The total amount of time spent on this section of the course was 6-1/3 weeks.

III. Graphics of Vector Geometry

The concept of the "vector" is basically a graphical one which may be described mathematically and manipulated either with graphical or mathematical techniques. It has been my impression that many students do not have a real grasp of the vector concept, in spite of coming into contact with this concept in high school and college physics. Therefore, the presentation of the vector concept prepares the students for future work with vectors in various courses, such as mechanics, dynamics, and electronics.

Most of the problems dealing with vectors in this section of the course were three-dimensional space vectors and involved force systems of the following types:

- (a) Nonparallel - Concurrent
- (b) Parallel - Coplanar
- (c) Parallel - Noncoplanar
- (d) General - Noncoplanar - Nonconcurrent - Nonparallel

The concept of the "couple" was stressed as well as the funicular polygon and Varignon's theorem. In addition, relative motion problems involving displacement and time were analysed and solved. During the presentation of vector concepts reference was made to equations describing the various force systems through the use of the "vector notation" approach. The purpose was to emphasize the compatibility of the graphical and mathematical analysis of vector systems.

IV. Graphical Mathematics

Since one of the origins of mathematics is the geometry of the ancients, and since Engineering Graphics also has its roots in this geometry, it is logical and desirable that an Honors course in Engineering Graphics contain a section dealing with the relation of Engineering Graphics to mathematics.

The general topics dealt with in this section of the Honors course were as follows:

- (a) Graphical scale and scale modulus including scale equations.
- (b) Plotting of data and curve rectification.
- (c) Parallel line and "Z" nomographs.
- (d) Graphs from engineering data.

(e) Graphical differentiation.

(f) Graphical integration.

It was my impression that many students in the Honors course appreciated the graphical explanation of differentiation and integration, especially when the fundamentals were illustrated, and when first and second derivatives of given functions were developed and plotted one above the other showing the relationships between the derivative curves and the curve of the original function.

The last week of the Honors course was devoted to a special project which involved the application of the principles learned under "Graphical Mathematics". This project involved the graphic integration of the static pressures over the surface of an airfoil. The project was concerned with the determination of the lift characteristics of an airfoil when it is subjected to various angles of attack relative to an airstream. Arrangements were made with the Aeronautical Engineering Department for the Honors class to visit a model wind tunnel laboratory where the airfoil used in the wind tunnel was the one with which the class was concerned. This airfoil has a series of orifices on its upper and lower surfaces which are connected to tubes leading to a multiple manometer. The airfoil was tested for various angles of attack and for each angle of attack a photograph was taken of the multiple manometer readings so that a permanent record of this experimental data would be available to the students. (Static pressures were recorded in inches of alcohol).

Each student received a photograph showing the data for a particular angle of attack and plotted his raw data using the ordinate as inches of alcohol (fluid used in the manometer) and the abscissa as the orifice spacing on the upper and lower surfaces. Using the method of graphical integration each student then determined the area enclosed by his particular curve. The area determined in this manner then had to be converted into pounds of lift per foot of wing span for the given airfoil for each angle of attack.

When each student determined the lift value for his particular angle of attack these values were listed on the blackboard and recorded by all the students. Each student then made a graph plotting the lift values and the angles of attack to show the characteristic lift curve of the given airfoil. Thus, individual student results were combined into a class result (the characteristic lift curve).

The total time spent on "Graphical Mathematics", including the special project, was two weeks. It is planned that in the future additional projects will be designed to involve all departments. The only restricting factor here will be the time available for these additional projects.

V. Conclusions

Student reaction to this course was most gratifying. Student morale was continually high; interest never seemed to be lacking, and pride in their work and their status as Honor students in Engineering Graphics was constantly apparent. The special projects were especially stimulating since the students were able to see the value of graphical theory and thinking applied to engineering analysis.

My observations and experience with the experimental Honors Course in Engineering Graphics indicate

that the course was highly successful from every viewpoint. Graphical thought as a total concept was successfully introduced, and graphical techniques were tied together with mathematical techniques, and each assumed its proper perspective. A course of this type will always be in a state of growth and development and will perhaps never be totally fixed in scope or content as long as engineering science continues to develop.

A course of this type permits the expansion of Engineering Graphics as a science of analysis and

is not limited to being only another tool of the engineer. An attempt has been made through the Honors Course to orient the thinking of students of graphics towards a total concept of Engineering Graphics.

Graphical thought processes can be as powerful as mathematical thought processes. Every effort should be made towards the further enlargement of the field of Engineering Graphics into its rightful position as a total concept.

ENGINEERING GRAPHICS DIVISION OF ASEE - ANNUAL MEETING

Purdue University - Lafayette, Indiana

June 20-24, 1960

- PROGRAM -

Monday--June 20

9:30 A. M.

Co-sponsor a conference of the Technical Institute Division

Subject: The National Survey of Technical Institute Education

6:30 P. M. --Executive Committee Dinner - Meeting
Presiding: A. Jorgensen, University of Pennsylvania

Tuesday--June 21

12:00 Noon--Luncheon and Business Meeting

Presiding: A. Jorgensen, University of Pennsylvania

2:00 P. M. --Conference

Presiding: M. McNeary, University of Maine

1. A Fully Integrated Course in Engineering Graphics or a First Course in Engineering--Myron G. Mochel, Clarkson College of Technology
2. Graphics for Non-Engineers--Edmund E. Ingalls Albion College
3. The Role of Descriptive Geometry in Teaching Basic Scientific Principles to Engineering Students--Mary F. Blade, The Cooper Union
4. Internal Views--F. G. Higbee, State University of Iowa

6:00 P. M. --Annual Dinner

Presiding: A. Jorgensen, University of Pennsylvania

Tuesday--June 21 (Continued)

1. Presentation of Awards:

- a. Nomography Award, by John Bryant, Editor General Motors Engineering Journal
- b. Distinguished Service Award, by I. L. Hill, Illinois Institute of Technology

2. Hieroglyphics of the Sky--P. E. Stanley, Purdue University

Wednesday--June 22

12:00 Noon--Co-sponsor a Luncheon Conference of the Engineering Economy Division

Thursday--June 23

2:00 P. M. --Conference

Presiding: I. Wladaver, New York University

1. A New Drawing System--Wayne L. Shick, University of Illinois.
2. Standards for Engineering Drawings, Associated Lists and Specifications, Department of Defense--James H. Mars, Bureau of Naval Weapons, Department of the Navy.
3. Evaluation of National Science Foundation Summer Institutes and Conferences for Engineering Graphics.

Panel:

A. S. Levens, University of California
J. S. Rising, Iowa State College
F. M. Woodworth, University of Detroit

NOMOGRAPHY: DO YOU PRACTICE WHAT YOU TEACH?

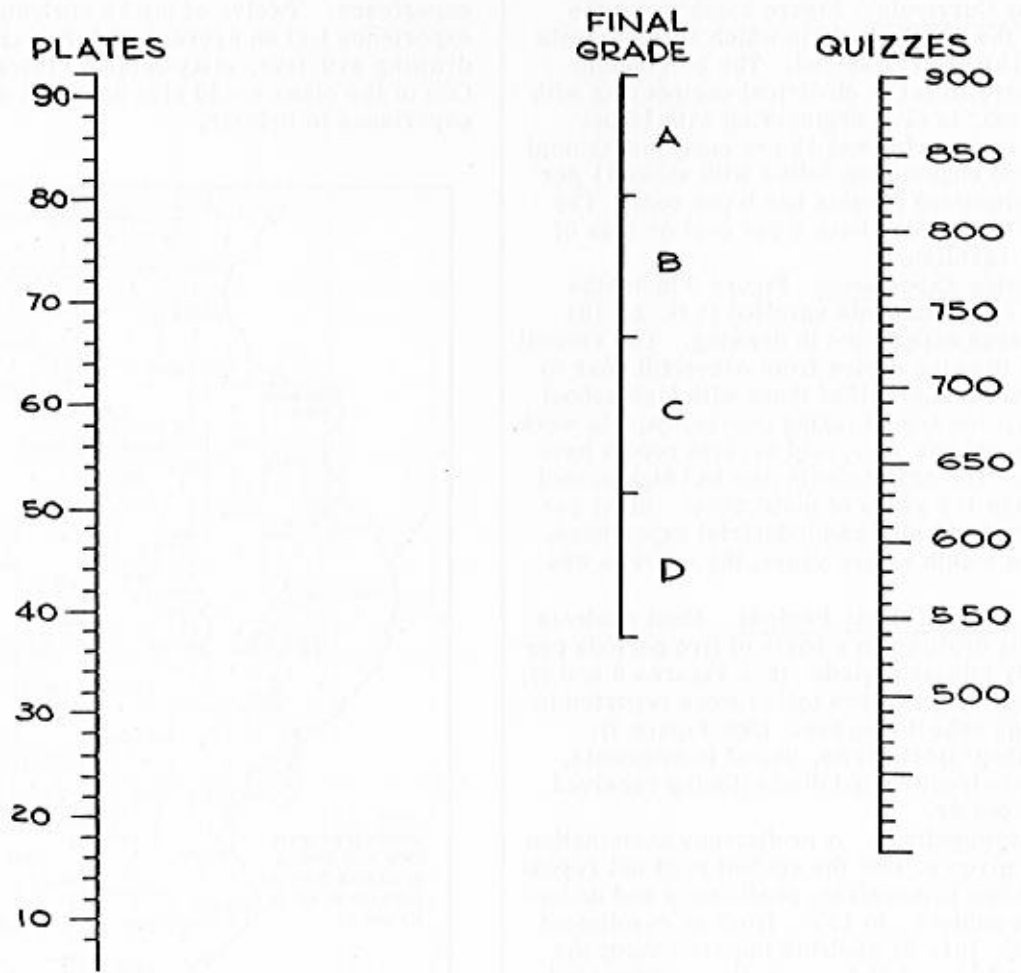
By Chet Foster

Michigan College of Mining and Technology

A nomogram for calculating final grades can be a valuable time saver at term end.

The accompanying nomogram was used to convert 23 numerical plate grades and 9 numerical quiz grades to a final letter grade. The plates were graded on a scale of zero to 4: A = 4, B = 3, C = 2, D = 1, and F = 0, and the quizzes on a 100 point basis. Averaging and conversions were eliminated by using totals only. It is believed that student interest in nomograms was stimulated when they saw an application of nomography on a subject dear to their hearts.

Plates count for 1/2 and quizzes for 1/2 of the final grade; no final exam is given. The Final Grade scale is not located midway between the Plate and Quiz scales because of the different scale moduli. The Final Grade scale was graduated by using the lower limits on the plate and quiz scales for each grade: 78 and 829 for an A, 57 and 765 for a B, etc. A total of 900 quiz points requires only 57 points on plates for an A.



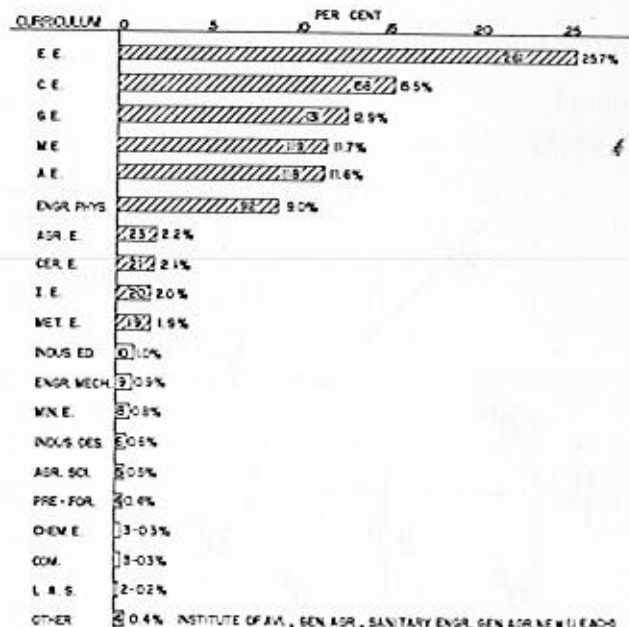


FIGURE 2 A COMPARISON OF THE ENROLLMENTS IN VARIOUS CURRICULA OF THE 1016 STUDENTS ENROLLED IN G. E. 101.

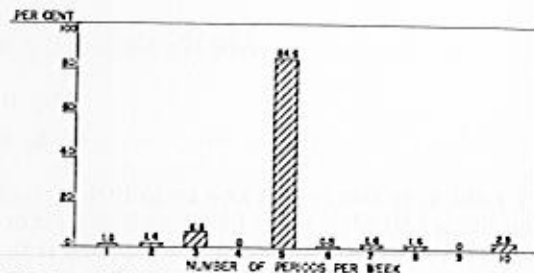


FIGURE 5 COMPARISON OF THE NUMBER OF DRAFTING PERIODS PER WEEK AS REPORTED BY 208 STUDENTS ENROLLED IN G. E. 101.

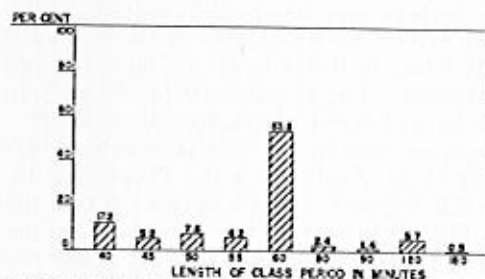


FIGURE 6 COMPARISON OF LENGTH OF HIGH SCHOOL DRAFTING PERIODS AS REPORTED BY 20 STUDENTS ENROLLED IN G. E. 101.

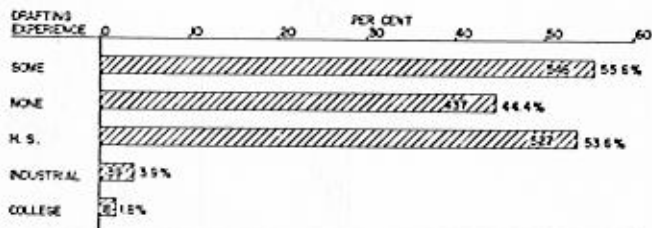


FIGURE 3 PREVIOUS DRAFTING EXPERIENCE OF 963 STUDENTS ENROLLED IN G. E. 101.

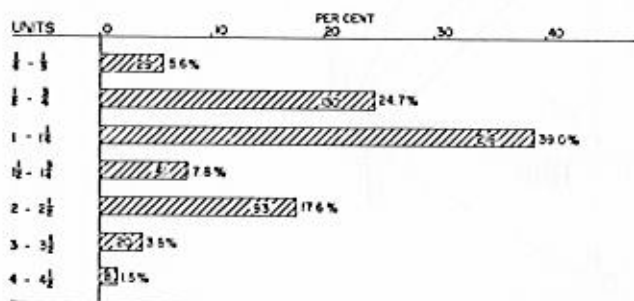


FIGURE 4 THE NUMBER OF HIGH SCHOOL UNITS (YEARS) OF DRAFTING TAKEN BY 546 STUDENTS ENROLLED IN G. E. 101.

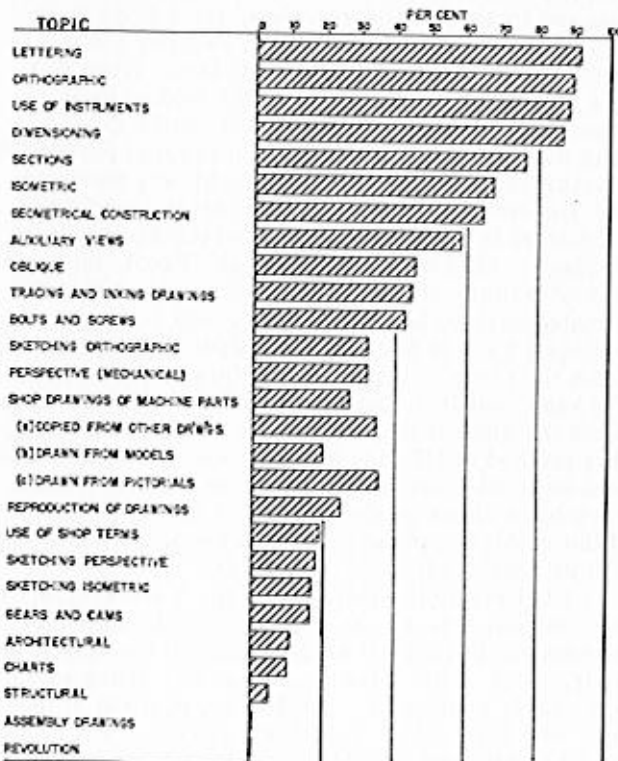


FIGURE 7 CONTENT OF HIGH SCHOOL DRAWING COURSES AS REPORTED BY 206 STUDENTS ENROLLED IN G. E. 101.

I NEED HELP

or

Are We Getting the Most Out of Our Nomenclature?

By R. H. Hammond

U. S. Military Academy

As I read over the recent new texts in the graphics field, one thing bothered me. I then checked other texts, and yes, there it was again. I suppose it is a rather small point that bothers me, but it is the small points that sometimes help a student to understand a problem.

The point that bothers me is the labeling of the folding line (or reference line or reference plane). Illustrations in many texts are labeled similarly to Fig. 1. The letters may be at opposite ends of the line, but they are on the same side of the line as in Fig. 1. This I feel is likely to give a false impression to the student. For instance; depth as seen in the Top view is measured perpendicular to the H-plane; or depth as seen in the Side view is measured perpendicular to the P-plane; or the Front view is bordered by the F-plane. Now I have been told that the H (as in Fig. 1) is on the H-plane, the F on the F-plane, etc. Of what benefit is this bit of information? If the student knows enough to construct the Top view, he also knows that it is on the H-plane.

I believe that the labeling should be done as in Fig. 2. There doesn't seem to be much difference between Fig. 1 and Fig. 2. However, I feel that there is a big difference. In Fig. 2 the lines are labeled correctly as to what they represent. When you are looking at the Top view, the folding lines represent the Edge views of the F-plane and the 1-plane. The F and 1 indicate that fact. When you are looking at the Front view, the folding lines represent the edge views of the H- and P-planes. It is a fact that depth is always measured perpendicular to the F-plane. This is graphically shown in the Top and Side views. It is a fact the height (or elevation) is always measured perpendicular to the H-plane. This fact is shown in the Front, Side, and first Auxiliary views. This method shows that the dimension to be laid off in the second auxiliary (oblique) view is actually the perpendicular distance from the plane of the first auxiliary to the point. We know that fact, but do all of the students? Thus when the student is constructing views and is using this method of labeling he immediately has information as to what dimension to use in the constructed view (or a check on the dimension that he did use). If the reference plane system is used, the same idea can be employed, as in Fig. 3.

I believe in the method of Fig. 2 and Fig. 3. I believe that it is a help to the student in his understanding of the spatial arrangement of the views. However, most of the texts do not use it. Those who do are rarely consistent. Am I in the position of the man who said, while watching a parade, "Everybody is out of step but my Johnny"? Is this too insignificant to worry about and to teach? I don't think so, but I would appreciate hearing your comments.

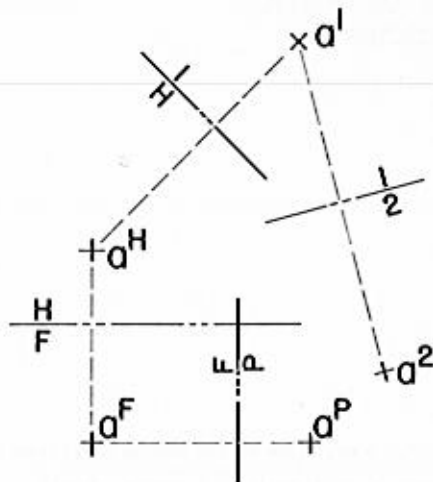


Fig. 1

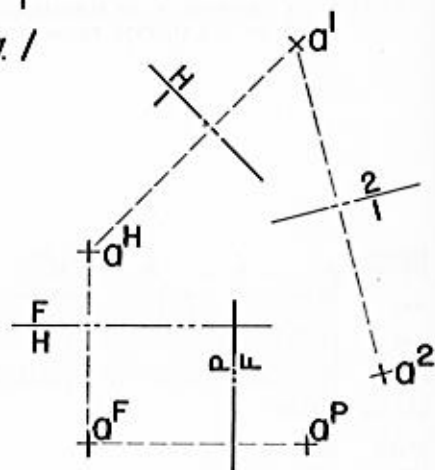


Fig. 2

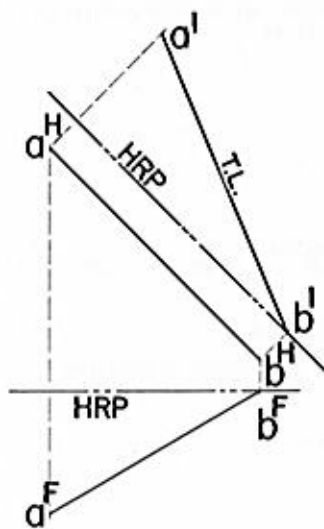


Fig. 3

CREATIVE EXPRESSION IN ENGINEERING

By R. L. Ritter, E. A. Lemke, and R. J. Panlener

Marquette University

Engineering drawing has not been deleted at Marquette University, but we have experienced the "squeeze" as have many others. Our first and only semester of Engineering Geometry is required of all students enrolled in the Mechanical, Electrical and Civil Engineering degree granting programs. Our Electrical sequences offer no further graphics training throughout the four year curriculum. However, students in our Mechanical engineering curriculum will experience additional graphics training required to satisfactorily complete future design sequences. In addition, Mechanical engineering students may now increase their drawing background through electives in Advanced Engineering Drawing and Tool Design.

The Civil engineering program has been reorganized and includes a required second semester freshmen graphics program in Civil Engineering Drawing specifically designed to offer additional training in the interpretation and preparation of Architectural and Structural standards and conventions.

The Creative Expression course is now a requirement for all second semester freshmen electing the Mechanical and Electrical curricula. These new sequences have been carefully labeled Creative Expression and are quite opposed in philosophy to courses in Creative Thinking now a fad on many Engineering and Business Administration campuses.

Classroom experiences with the principles of brainstorming and other problem-solving techniques have given evidence that a full semester is too much time to delegate to material of this nature. Students deplore additional and often repetitious assignments involving these techniques.

Our decision to initiate a series of Creative Expressions was derived after a careful evaluation of objectives and a thorough study of Frank Barron's work at the University of California.¹ Barron, as a part of the Institute of Personality Assessment and Research, had been involved in a seven year study to determine behavior patterns of creative people. Although the study has not produced concrete evidence to show a high positive correlation between behavior patterns relative to creative and non-creative groups, amazing results show this correlation to exist to a degree between creative artists and groups rated as creative by their colleagues. This latter group included mathematicians, engineers, anthropologists, physicians, and writers.

The results of Frank Barron's and a similar study² gave us courage to approach the development of Creative Expression through a utilization of the artist with his facilities, history and environmental factors as a foundation for the sequence of class instruction.

Throughout these units, therefore, an endeavor has been made to provide the media for stimulating

occurrences of creative responses and investigation. At the present time there exists no purpose to an attempt at classification relative to the creative and non-creative personnel among the participants.

Psychological studies to date have offered slight evidence to support a correlation between existing standard test performance and any creative potential. However, additional studies growing from our selected areas of creative expression may someday prove fruitful in this respect.

This endeavor to classify, therefore, has not been attempted as an immediate finale to the exercises provided. Instead, a real objective has been the immediate development of enthusiastic instructor-student relationship to provide a unique rapport suitable for the promotion of effective creative processes. Although not completely categorical, an analysis of the complete semester program will indicate testing, development of modern art, industrial design and constructivism to be our important areas of creative endeavor.

Our continued research has provided the current sequences shown in Figure 1 as the most meaningful and stringent series of experiences:

Sequence of Instruction for a Semester Course in Creative Expression

Period*	Sequence
1	- Psychological Testing
2	- Introduction to Modern Art
3	- Development of Cubism
4	- Abstract Sketching
5	- Collage
6	- Dadaism, Surrealism and Purism
7	- Purism
8	- Field Trip - Idea Analysis
9	- Constructivism
10	- Project Development
11	- Design Fundamentals
12	- Sketching
13	- Problem Solving Techniques
14	- Functional Problem
15	- Functional Problem

Figure 1.

*Two Hours

The purpose of the course is not to dominate the student, but rather to lead him in a series of exercises and expressions, the solutions of which cannot be found through preconceived fantasies or environmental influences. These exercises, drawn together through an understanding and appreciation of aestheticism of art movements, may develop the imagination, wit and judgment of the student and thus build confidence in his creative ability.

"Art educates the receptive facilities and revitalizes the creative abilities. In this way art is rehabilitation therapy through which confidence in one's creative power can be restored."³

We are not trying to teach art, and surely our

laboratory assignments do not suggest this endeavor. The collage, shown in Figure 2, a creation of cardboard and color paper, is an example of immediate response utilizing the "Building Blocks"⁴ or intellectual abilities relative to creativity, i. e., flexibility, fluency, originality and the ability to think in images and analogies. The subject for the collage exercise was "The Burden of Freedom," but it could have been anything. The title is not important and is subservient to the creative expressions involved. The techniques of construction and the beautiful colors are not to be completely appreciated in a black and white reproduction, but the student's own explanation of his work will indicate the vigor with which he has applied his abilities in a heretofore unexplored creative activity. He explains,

"..... Experience dictates that man is easily able to grasp ideas concerning physical reality since he is surrounded by objects of this nature. Difficulty is encountered, however, when a person is called upon to depict, describe or define abstract concepts such as happiness, justice, and a host of others. It might be stated, then, that the physical world is clear whereas the mental is somewhat obscure. Consequently, the illustration of an item such as freedom calls for a reversal of the normal.

"Such being the case, the background of this work was composed of pictures of physical objects which were deliberately concealed to the point of near total obscurity. Though these 'real' items may be found and identified, it requires a great amount of study to do so, the same being a prerequisite if one is to seek out and define mental pictures in everyday life.

"This same background also pictures the encompassment of the human race (the group of faces) and the earth (the dark blue circle) with devices of a material nature.

"The blue circle, a representation of not only earth but also man's mind is the base of a huge balance on which is weighed good (the white shape) and evil (the black). These were left as abstract forms for two reasons: (1) It is often difficult for the individual to differentiate between good and evil, in fact, it is sometimes hard to even find and/or identify them. (2) 'Good' and 'evil' are abstract concepts.

"It should be noted that 'good' points upward and 'evil' downward - a simple symbolic sign.

"The balance is constructed off-center, and by recollection of a simple law of leverage this may be determined to represent the fact that a small good may do much to correct a great evil. The horizontal position of the arm indicates the existing equilibrium in the interplay of these forces. The mechanism is 'supported' on the point of a nail which connects this abstract with reality.

"The rough black 'cross' behind the scale recalls the Crucifixion, the event and the party (Christ) both having more to do with man's freedom than any others in history. The six red spikes joining at the focal point of the collage represents his six wounds (five of them the physical wounds, the sixth Christ's great mental anguish).

"A top view of the balance is also depicted by these spikes, the inference being that a particular evil must be balanced by a diametrically opposite good if the arm is not to tip from its mounting. That is to say, a certain evil may not be counteracted by indiscriminate good, the correction must be of the right 'weight' and must be properly placed if balance is to be maintained.

"The large size and mass of the scale are indicative of the great weight (responsibility) which man must bear if he is to deserve and maintain his freedom."

Marc B. Rojzman, 42 year old president and general manager of the J. I. Case Company of Racine, Wisconsin, finds art "a terrific stimulant for design-- it gives me a sense of balance and aesthetics that helps translate machinery into industrial design."⁵

Perhaps the most exciting experiences derived from the series of expressions are those in constructivism. The idea, the collection of materials and the implementation, all utilize the previously mentioned intellectual abilities to derive stimulating and completely satisfying sequences of creative responses. The form, shown in Figure 3 and entitled "Activities in Front of the Room," may be termed a classic in non-objective construction. The materials, form, and the very conception of the idea have been combined by its creator into a meaningful and beautiful expression.

The artist conceives the graceful, melodic motion of the curved surfaces at the very top of the model to represent the student's open mindedness and thoughtful observation of material being presented. The sharp, crisp lines of intersecting surfaces indicate alertness, while the white planes are symbolic of his awareness of professional ethics in relationship with fellow students. A strong scholastic background is characterized by the sturdy, dark base.

To paraphrase a statement by Nagy,⁶ the student has thought a thought and worked around the think. Interpretation by others is not important. True evaluation will have been realized by the artist, in this case the student, whose collective responses have been expressed in the finished model. If provocative in its final form, the model will surely stimulate a sense of inventiveness in others through judgment, particularly if curiosity is culminated without obedience to the original idea.

Other results of the expression laboratories in sketching, The Collage, purism, and constructivism are shown in Figure 4, and are representative of a public exhibition recently shown in the Marquette Memorial Library. ". . . The exhibition has probably attracted more attention than usual and the comments ranged from surprise to appreciation. . . ." ⁷ William Ready, Director of Marquette University Libraries has qualified the "surprise" in his analysis as indicative of the unique and excellent results by freshmen in a heretofore little explored area of engineering education.

A block to creative expression in the area of constructivism has been experienced by our students who lacked facilities to implement an idea. This situation is expected to improve when proposals for laboratory space and equipment are realized.

To be completely entrenched in a realm of fancy

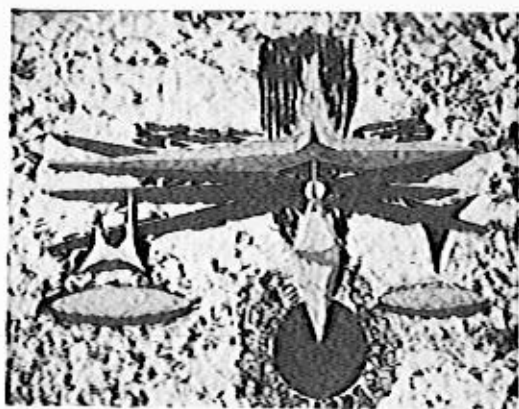


Figure 2
"The Burden of Freedom"
Paper and cardboard collage

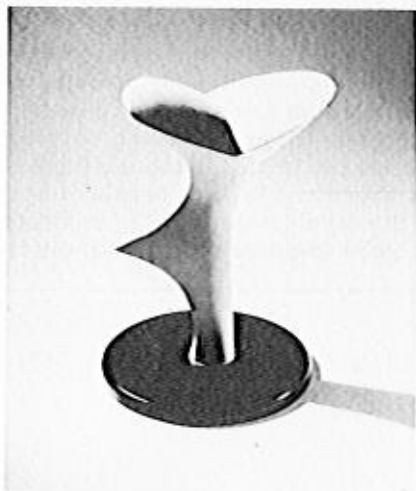


Figure 3
"Activities in Front of the Room"
Abstract in plaster & plastic --
an assignment in constructivism.

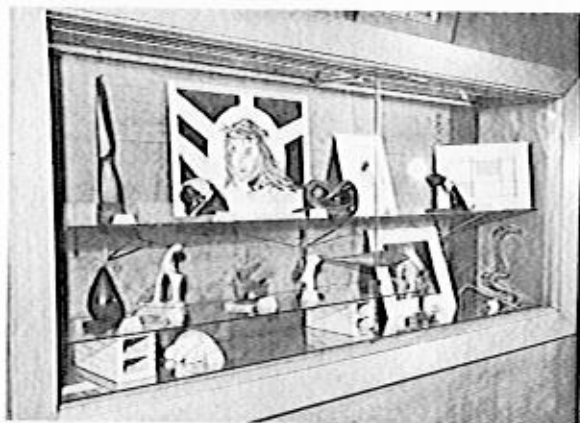


Figure 4
Display of work completed by students
in creative expression laboratory.

would invite serious criticism. Our educational business is competitive and demands a touch of reality to permit the successful realization of the University Aim. We may shy from the dictates of an outside curriculum expert who feels obligated to advise relative to our course content and objectives. However, total disrespect for industrial wishes will certainly promote contempt among those eventually interested in our product.

Marquette's venture in Creative Expression has sought the opinion of industry. A forceful member of this industrial group is Mr. Thomas G. Johnson, Assistant Director of Industrial Relations, Danly Machine Specialties, Chicago, Illinois. Inasmuch as he has been extremely critical of recent movements to curtail graphics activities at the University level, his comments relative to our Art oriented experiment should be provocative. Mr. Johnson says,

"We in industry find that the beginning engineer very frequently has difficulty visualizing in three-dimensions the product he designs or develops. With automation engineered into the industrial equipment of today, this difficulty becomes even more serious and pronounced. A clear conception of the space relationship of parts--one to the other--becomes absolutely essential. It is interesting to note that the 'visualizing of relationships' is a basic building block in the approach of this Creative Expression course.

"We have wondered why this inability to visualize is so common. Perhaps exercising the imagination is too often done for all of us by others--our thinking is channelled and too often creativity is stifled.

"The graduates acquired from engineering colleges usually have a firm grasp of the subject matter of their profession--but in many cases they are so disciplined in only objective subject matter that they lack even the approach to creative expression which is so essential at this time when all things are pyramiding in complexity.

"We find there are two weaknesses in the new graduate--one is the lack of creative thinking--and the other is the inability to communicate. It appears to us that this communication weakness is also attacked in this course.

"As new complexities develop, one can't always get the precise answer from text books. There must be new educational methods developed to meet changing conditions. The mere exercise of the brain to be imaginative will improve individual capacity to visualize. It is vitally important to us to know that the engineer is creative--is aware of the importance of originality--and has the thinking process to implement it.

"We endorse this creative expression emphasis as a supplement to the other necessary academic course work. Creativity to an engineer is like a spark plug that starts an engine. The trained engineering mind needs an injection of creativity to get going--otherwise he may become nothing more than a draftsman or lab technician--vocational rather than professional in outlook.

"We are looking for the kind of person this course can produce. We, and others in our industry, are carefully watching the development of this course with considerable interest."⁸

The committee for the study of the Visual Arts at the Massachusetts Institute of Technology has considered this definition of an ideal Creative Expression program:

"It will include means to establish the nature and differing qualities of vision; it will extend its discipline to amplify and enrich other forms of communication. It will develop aesthetic sensitivity and encourage discrimination generally. It will draw attention to the human control of form and space and color no matter where it occurs, in the land or in the machine, in the monument or within the home; and will relate varying styles to the societies which have fashioned them beyond the requirements of pure utility. It will foster a coordination between eye and hand to qualify the theoretical by the empirical; but it will also tolerate the person who is realistically afraid of his manual awkwardness and will at least make him aware of the values which he might better learn by skillful doing. It will exercise critical faculties by challenging prejudice and by provoking imaginative opinion. It will avoid the narrowing dogma of a single educational medium; rather, it will depend on self-motivating practicalities such as studio experience, exhibitions, lectures, motion pictures, and library references for its source material and will urge the discovery of museum facilities farther afield. Art should be sought in the life of the individual and the community, not alone in history book or classroom. It will utilize

recreational as well as assigned hours and make certain that the prescribed duty of the latter never infringes on the liberty of personal exploration permitted by the former. It will explain that aesthetic 'good' and 'bad' are relative terms, not absolutes, and that although the forms of civilizations improve technically throughout the centuries, their artistic significance cannot be counted by time but is borne on the tides of man's fluctuating consciousness..."⁹

In conclusion, we admit that these exercises, even if followed with purpose and a real sense of self-duty, may not necessarily guarantee the ultimate development of a better engineer. Their completion, however, should provide a serious sense of reverence relative to the measure of man's ability to reason, to inquire with purpose, and to avoid the spontaneous infliction of meaningless ridicule, to regard cultural artifacts with a more generous understanding, and to behold a more complete awareness of creative expressions existing as evolutions of contributions through past generations.

Our purpose is not to destroy the Graphics program, but to strengthen it through a united effort with all curriculum agencies for a contribution toward a more meaningful engineering education. We sincerely hope continued experimentation will indicate to some degree the implementation of our Creative Expression objectives to have been an important element in the development of good students, and ultimately, good engineers--and good citizens too.

¹ Frank Barron, The Psychology of Imagination, Scientific American, September, 1958, pp. 151-169.

² Louis Cassels, Eight Keys to Creativity, Nations Business, February, 1959, pp. 58-64.

³ L. Moholy Nagy, Vision in Motion, p. 28.

⁴ Eugene Raudsepp, The Creative Engineer, Machine Design, June 11, 1959.

⁵ Business in Person, The Milwaukee Journal, October 24, 1959.

⁶ L. Moholy Nagy, Vision in Motion, p. 26.

⁷ Marquette University Library Bulletin, Vol. 2, No. 4 and 5, September-October, 1959, p. 2.

⁸ Program, Annual Meeting, Engineering Graphics Division, ASEE, June, 1959.

⁹ Art Education for Scientist and Engineer, Massachusetts Institute of Technology, 1957, pp. 15-16.



BIG COVERAGE: 34" x 44" tracings

LITTLE PRICE \$71.00 (subject to regular educational discounts)

The VEMCO "3300" Drafter with **20" Arms** has all the balance, precision, stability, maneuverability of drafting machines selling for twice as much, *plus* VEMCO quality and dependability. Simple, automatic indexing in 15° intervals. Wide variety of VEMCO 9", 12" and 18" Scales available, or use your own scales having standard chuck plates. For further details write for *free* Catalog DM4.

V. & E. MANUFACTURING CO.
766 So. Fair Oaks Avenue
Pasadena, California

VEMCO

New Engineering Drawing Texts and Problems Books

A MANUAL OF ENGINEERING DRAWING FOR STUDENTS AND DRAFTSMEN

New Ninth Edition

Thomas E. French Charles J. Vierck

8½ x 9¾, Ready in July
and
University of Florida

FUNDAMENTALS OF ENGINEERING DRAWING

By French and Vierck.

8½ x 9¾, Ready in May

A MANUAL OF ENGINEERING DRAWING FOR STUDENTS AND DRAFTSMEN, *New Ninth Edition*, is the long-awaited revision of the distinguished standard book in the field. FUNDAMENTALS OF ENGINEERING DRAWING consists of the first 13 chapters of the larger book. It is identical in format and design to the new ENGINEERING DRAWING, and is designed for the short freshman course. It presents the fundamentals of engineering drawing, but without the advanced or applied material necessary for the practicing draftsman. However, the appendixes from the *Ninth Edition* are included.

The *Ninth Edition* of ENGINEERING DRAWING, like its predecessors, is aimed at supplying a complete text on the subject. Curricula in most engineering colleges have been changed radically in the past few years, and the *Ninth Edition* is designed to keep pace with present conceptions and to point the way for better teaching and better curricula in engineering drawing.

Workbooks by Vierck and Hang (8½ x 11) will be available for each text.

Text-films are available. For information, please write to

McGraw-Hill Book Co., Text-Film Department

330 West 42nd St., New York 36, N. Y.

From McGraw-Hill Book Company

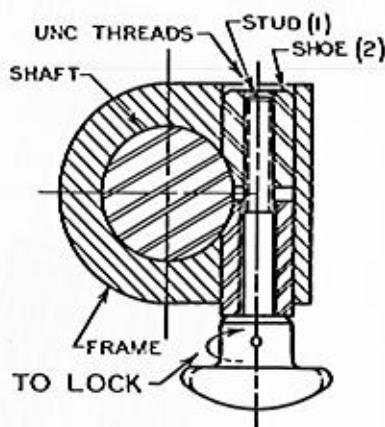
Just Published . . .

**ENGINEERING
DRAWING
PROBLEMS**

SERIES I

by Hiram E. Grant
Washington University

\$4.75



Check These Special Features:

- ✓ Every problem is a practical problem, secured directly from industry.
- ✓ Individual sheets of the workbook are available separately.
- ✓ The book is distinguished by its excellent draftsmanship.
- ✓ The material has been thoroughly class-tested.
- ✓ Grid formation backgrounds reduce the time required to solve the problems; grid formations, graph paper and plain borders on the reverse side of the sheets make it possible to use the reverse sides of the unassigned sheets.
- ✓ Keyed to A MANUAL OF ENGINEERING DRAWING FOR STUDENTS AND DRAFTSMEN, *New Ninth Edition*, FUNDAMENTALS OF ENGINEERING DRAWING, and other important engineering drawing texts.
- ✓ An INSTRUCTOR'S SOLUTIONS BOOK is available.

McGraw-Hill Book Company, Inc.

330 West 42nd St.

New York 36, N. Y.

KOH-I-NOOR

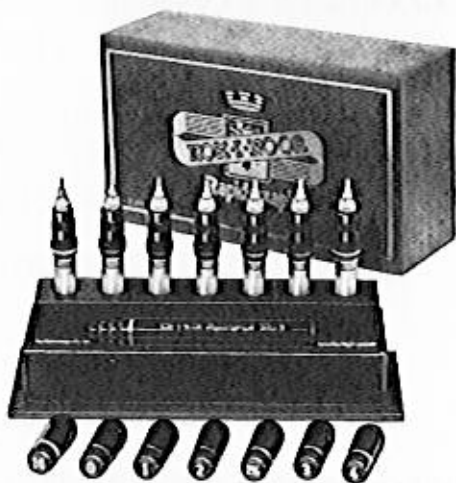
Precision-Matched Instruments

Koh-I-Noor offers draftsmen an important new dimension in a comprehensive line of instruments and accessories meticulously matched to provide new high levels of professional performance, efficiency and convenience.



MODEL NO. 3089: The regular Koh-I-Noor Rapidograph "Technical" Fountain Pen with self-contained automatic filling system, and pocket clip is a standard drafting room tool.

MODEL NO. 3065: A new model with 7 interchangeable drawing point sections, each color-coded to indicate a different line width. Best buy for the professional who requires frequent change of line widths. Each drawing point section complete with airtight refillable ink cartridge. Interchange is accomplished quickly, cleanly. Comes in handy desk top container.



NOW... TWO KOH-I-NOOR RAPIDOGRAPH TECHNICAL FOUNTAIN PENS

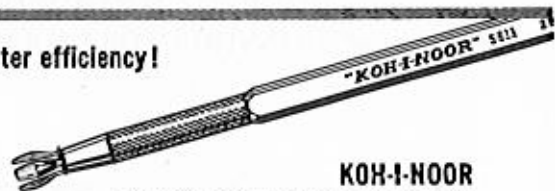
In 7 "color-coded" precision line widths: 00, 0, 1, 2, 2½, 3, 4. Uses India (or regular) ink for ruling, lettering, tracing or writing with equal facility.

(Write for catalog.)

Two Koh-I-Noor products designed to work together... for greater efficiency!

KOH-I-NOOR EJECTOMATIC LEAD DISPENSER

Automatically feeds lead to holder without need to touch lead. Transparent container permits constant inventory check on lead supply. In 17 degrees. Widest choice of containers with 2, 6, and 12 leads.



KOH-I-NOOR ADAPTO-CLUTCH LEAD HOLDERS

Widest choice of holders, all metal, perfectly balanced, with non-slip, turn-proof, replaceable clutch; knurled finger grip. With or without pocket clip, lead degree indicator, Color-Coded.

KOH-I-NOOR PENCIL CO., Inc.

BLOOMSBURY 6, NEW JERSEY

**ON YOUR MARKS -
GET SET -
GO !!!**

Take Your Choice of

WHICH Hoelscher et al:

Problems in Engineering Drawing*

and or

Problems in Engineering Geometry*

YOU will use in the 1960-1961 School Year!

4 Drawing Workbooks — 4 Geometry Workbooks

ALL DIFFERENT!

Solution Manuals for all books.

We will appreciate hearing now which
books you will use.

Drawing Workbooks - \$3.00

Geometry Workbooks - \$2.75

STIPES PUBLISHING CO.

10-12 Chester Street — Champaign, Illinois

Also, a real student "help." Walraven's: Quiz and Study Material.*

*All books accompany John Wiley & Sons, Inc., Hoelscher
and Springer text: Engineering Drawing and Geometry.

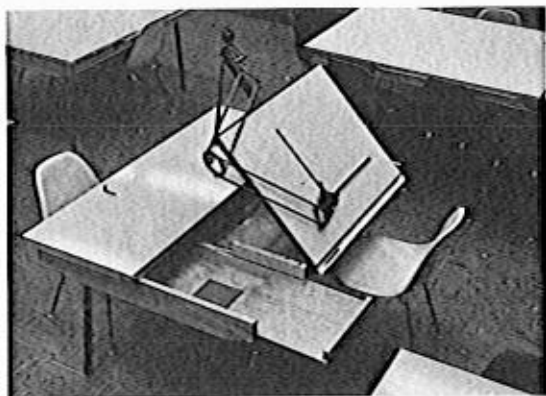
NEW DRAWING DESKS

at

M.I.T.

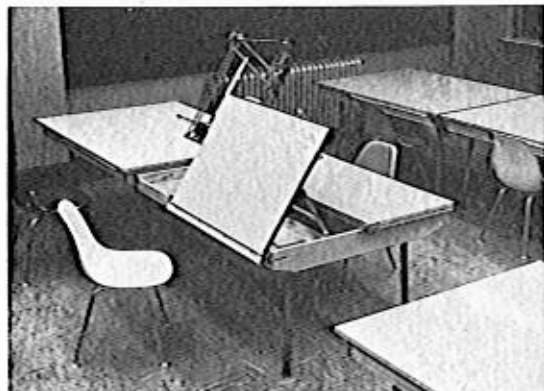
The Gramercy Guild Group has developed a new style of desk in cooperation with the Design Division of the Department of Mechanical Engineering at the Massachusetts Institute of Technology.

The design procedure involves not only drawing, but careful study and analysis carried on concurrently with drawing. The designer needs a desk at which he can study and make computations, write reports, and refer to literature; he also needs a drawing board equipped with a drafting machine on which a condensation of his ideas can be presented in graphical form. This suggests a combination desk and drawing table to meet these two requirements, and at the same time economize on space.



At M.I.T., in addition to design courses, freshman subjects in graphics are offered. These are taken by a larger number of students, with less stringent requirements on refinement of equipment. The same drawing desks are used for these elementary subjects, but each desk is occupied by two students at a time, working on the closed desk top on small portable drawing boards. The ability to use each drawing room in these two different ways results in

more efficient use of facilities, and the rooms can be in service a larger proportion of the time.



The normal height of the desks with cover closed is 29 inches, standard desk height, and contoured fiberglass chairs are used in place of the old-fashioned drafting stools.

The legs of the tables are tubular steel, with provision for height adjustment up to two inches.

The tops measure 44 x 60 inches. They are hinged in the center as well as along one edge, so as to be easy to open.

The internal drawing boards measure 26 x 36 inches. The angle of the boards is adjustable in increments from about 15° to about 75°. The drafting machine linkage is counterbalanced by a spring whose tension is adjustable to compensate for any angle of the board. The board may be removed from its frame for storage. In this way the same desk may be used by different students at different times.

Tops are covered with a very hard durable plastic, and four compatible colors have been selected, so that the design rooms have a light, cheerful atmosphere.

When used in the open position, there is a space for drafting tools and equipment at the left of the drafting board, and the hinged back cover serves as a desk, so that the occupant may make use of both types of working area simultaneously.



There is incidentally an inducement to the freshman to continue into more advanced courses in which he will be able to use the more advanced professional equipment.

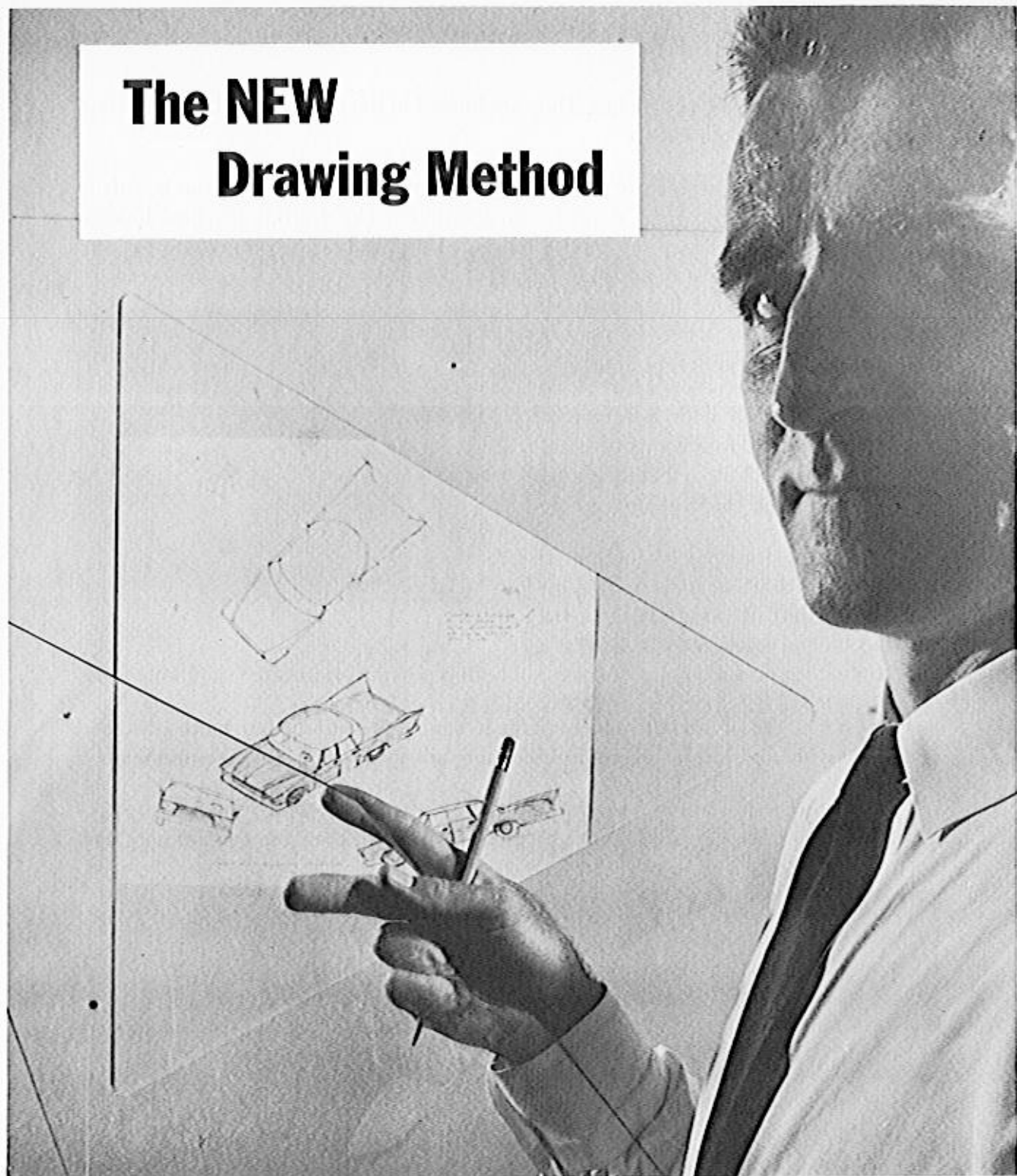
The drafting rooms are also used quite extensively as conference rooms and regular classrooms, since the desks do not by their nature limit their use to drafting alone.



Steven Anson Coons
Assistant Professor
of Engineering Graphics
Massachusetts Institute of Technology
Cambridge, Massachusetts

For full information please contact:
Gramercy Guild Group, Inc.
116 Broad Street
New York 4, N. Y.

The NEW Drawing Method



The UNITED DRAWING SYSTEM

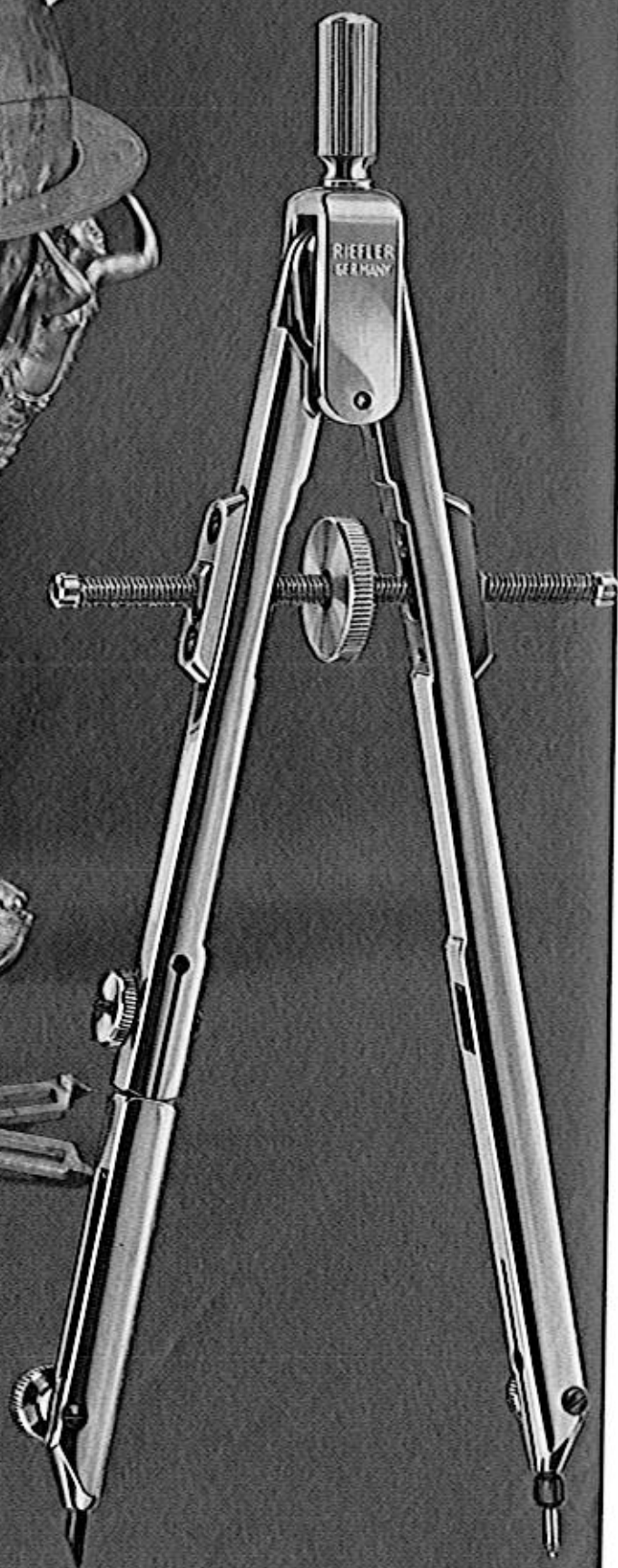
More Precise • More Direct • And Faster

By Wayne L. Shick, Professor in General Engineering,
University of Illinois, Urbana, Illinois

Available
From

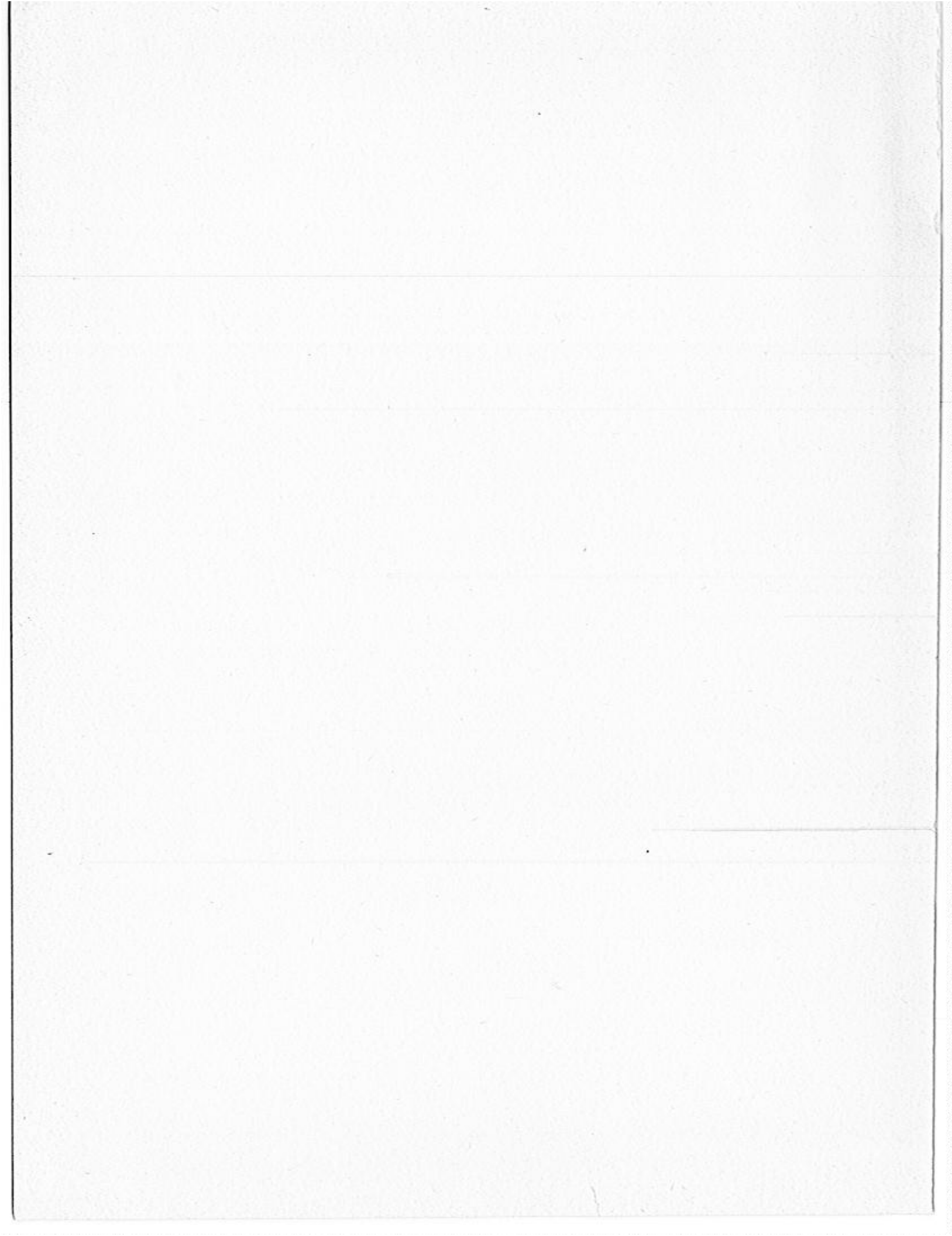


Ramercy 116 Broad Street
New York 4, N. Y.



J. Ramercy

116 BROAD STREET, NEW YORK 4, N.Y.



forthcoming:

The briefest of Macmillan's three problems books . . .

TECHNICAL DRAWING PROBLEMS, Series 3

By *Henry Cecil Spencer* and *Ivan Leroy Hill*, both Illinois Institute of Technology

This brief, up-to-date workbook contains 80 sheets and includes the following problems: functional scales, coordinate systems, roots of equations, simultaneous equations, empirical equations, nomographs, and graphical calculus, plus the usual worksheets on drawing fundamentals. The tear-out sheets are standard 8½ x 11 size and sixteen are printed on tracing paper.

Spring, 1960

Solutions manual available gratis

Spencer-Hill is keyed to a leading text adopted by more E.C.P.D. accredited engineering schools in 1959 than any other drawing text . . .

TECHNICAL DRAWING, fourth edition

By *Giesecke, Mitchell, and Spencer*. Fourth Edition prepared by *Henry Cecil Spencer*

The revision of this important text incorporates over 700 new figures, illustrations, and tables within a total of more than 1200; a complete list of the best visual aids and a valuable section on the do's and don'ts of practical design. In addition, three new chapters examine various methods of graphical computation, tolerancing, and the history of technical drawing.

1958

844 pages

\$7.50

Already well-known workbooks accompany GMS . . .

TECHNICAL DRAWING PROBLEMS, third edition

By *Giesecke, Mitchell, and Spencer*. Third Edition prepared by *Henry Cecil Spencer*

Provides a comprehensive series of problems on the fundamental aspects of technical drawing and emphasizes practical drawing room problems taken from industry.

1959

98 sheets

\$4.90

TECHNICAL DRAWING PROBLEMS, Series 2

By *Henry Cecil Spencer*; and *Hiram E. Grant*, Washington University

Presents such topics as trimetric projection, left-hand and right-hand drawings, first-angle projection, buttress threads, detail drawings, blueprint reading, and detailing from design layouts and assembly drawings.

1948

138 sheets

\$5.00

The Macmillan Company 60 FIFTH AVENUE, NEW YORK 11, N. Y.

FIVE NEW AND TESTED TEACHING AIDS FOR ENGINEERING DRAWING

BY CARL L. SVENSEN AND WILLIAM E. STREET

FOR USE WITH ANY TEXT OR NO TEXT

DRAFTING PROBLEM LAYOUTS

SERIES D

Work sheets covering Vertical and Inclined Lettering, Sketching, Use of Instruments, Engineering Geometry, Scales, Orthographic Projection, Revolution, Auxiliary Projection, Sections, Isometric, Oblique, Dimensioning, Developments, Intersections, Screw Threads and Bolts, Perspective, and Working Drawings for a Complete Course.

95 Work Sheets, 8½" x 11" _____ \$3.50

DRAFTING PROBLEM LAYOUTS

SERIES C

Work sheets covering Sketching, Use of Instruments, Engineering Geometry, Scales, Orthographic Projection, Revolution, Auxiliary Projection, Sectional Views, Dimensioning, Screw Threads and Bolts, Isometric, Oblique, Perspective, Developments, Intersections, Working Drawings. SERIES C and LETTERING EXERCISES cover a Complete Course.

69 Work Sheets, 8½" x 11" _____ \$2.50

LETTERING EXERCISES

A DIRECT METHOD -- NEW AND INTERESTING

Vertical and Inclined Lettering with eight sheets of extra problems. LETTERING EXERCISES AND SERIES C cover a Complete Course.

20 Work Sheets 8½" x 11" _____ \$1.00

VERTICAL LETTERING EXERCISES

Vertical Lettering with instructions

6 Work Sheets, 8½" x 11" _____ \$0.50

INCLINED LETTERING EXERCISES

Inclined Lettering with instructions

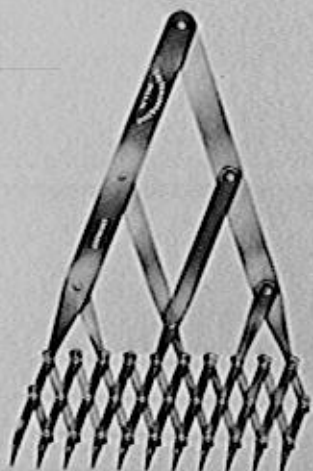
6 Work Sheets, 8½" x 11" _____ \$0.50

WRITE FOR EXAMINATION COPY OR ORDER FROM

W. E. STREET

ENGINEERING DRAWING DEPARTMENT
A & M COLLEGE OF TEXAS
COLLEGE STATION, TEXAS

THE SPACING DIVIDER



No. 2960—6 INCH
(ILLUSTRATION HALF SIZE)

This instrument consists of eleven points so adjusted that they divide their variable setting into ten or less equal parts. It can also be used inversely to give multiples up to ten and in graphic solution of ratios. Adjustable distance between points on the 6 Inch Instrument is minimum $\frac{3}{16}$ " , maximum $\frac{3}{8}$ " and on the 12 Inch minimum $\frac{1}{4}$ " , maximum $1\frac{1}{4}$ " .

Catalog on Request Covering:

Drawing Instruments

Protractors

Rolling Parallel Rules

11 Pt. Spacing Dividers

Drafting Scales

S.S. Straightedges

S.S. T-Squares

S.S. Triangles

Circular and Linear Engraving

for the

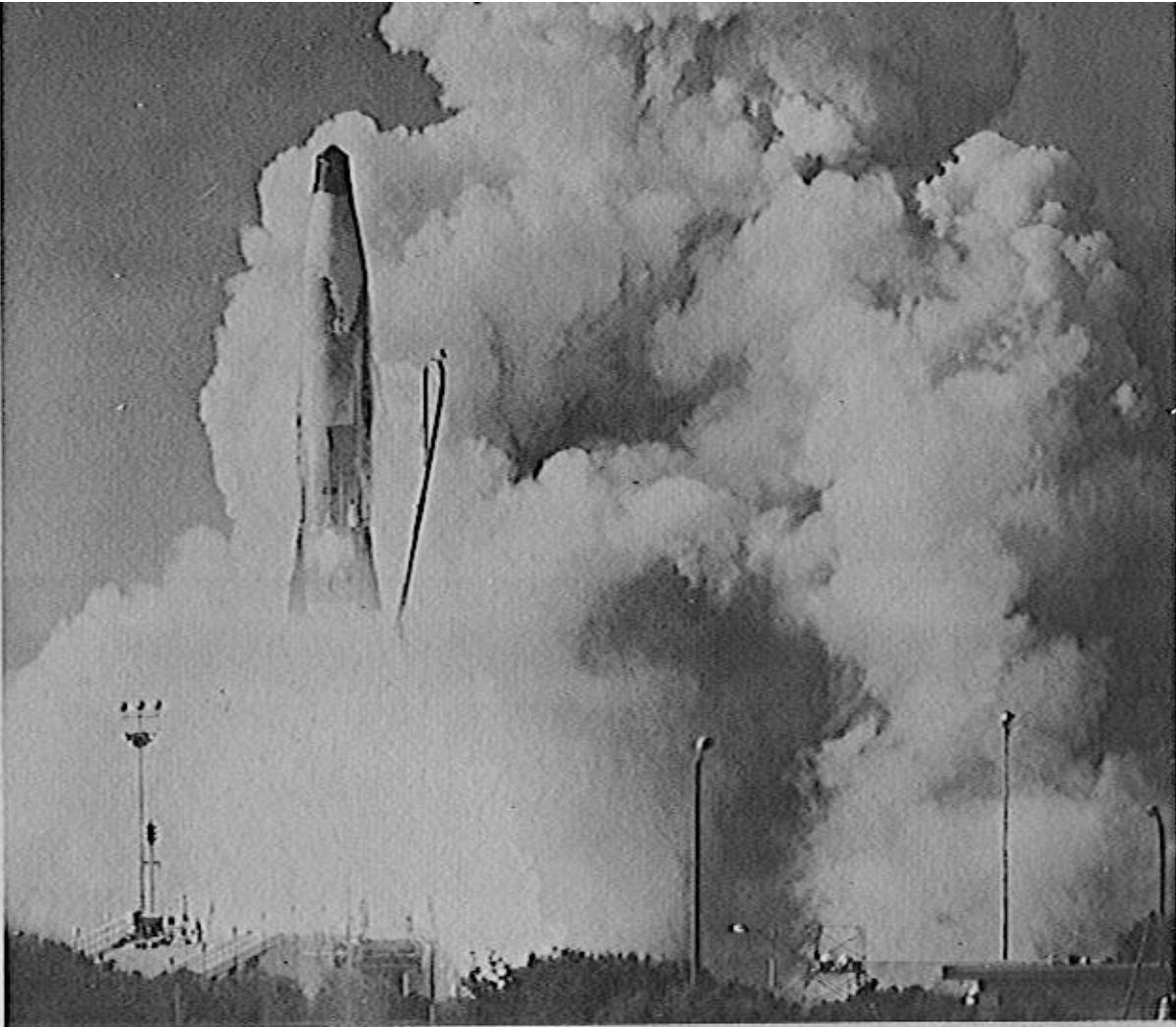
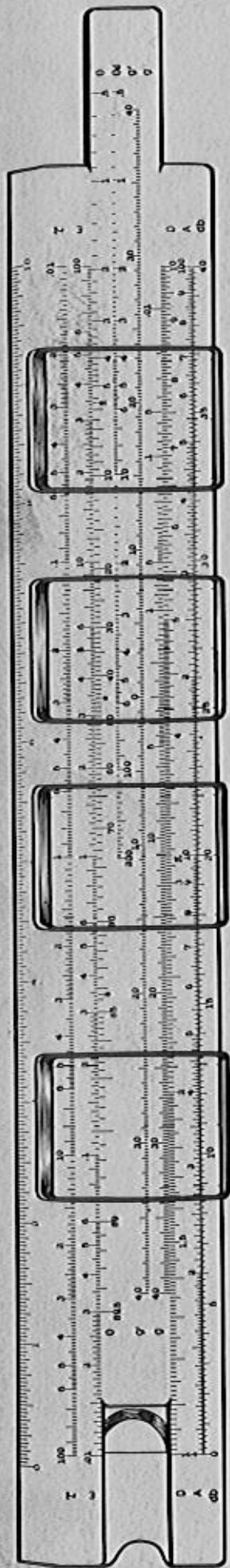
DRAFTING ROOM—PATTERN LOFT—LAYOUT TABLE

THEO. ALTENEDER & SONS

Makers of Fine Instruments Since 1850

1217 Spring Garden Street

Philadelphia 23, Pa.



Official U.S. Air Force Photo

POST Control Engineering Slide Rule...

a convenient calculator for use by the individual engineer in solving dynamics and control problems

The Post 1490 Slide Rule is designed for independent use by the control engineer to avoid tedious written calculations in cases where electronic programming is not readily available.

This specialized rule is used in computing magnitude ratios and phase angles of systems subjected to sinusoidal inputs where the transfer function of this system is a product of real linear and exponential factors or a quotient of such factors.

As illustrated, four cursors, each with three hairlines, store information for extended computations. Precise, machine-cut graduations in a white plastic face are permanent—will not wear off.

Additional durability is guaranteed by laminated bamboo construction, which resists distortion caused by varying humidity conditions. Sealed-in silica particles provide smooth action, self-lubrication for life.

In addition to its special functions, the rule is calibrated with A, C, C1 and D scales for multiplication, division, square and square root processes.

Reasonably priced, the Post No. 1490 Control Engineering Slide Rule is furnished complete with top-grain leather case and detailed instruction book for only \$24.00. Learn more about the advantages of the Post 1490 Slide Rule—and how it can benefit your advanced students in servo-mechanisms.

FREDERICK POST COMPANY



See your local POST dealer or write Frederick Post Company, 3664 N. Avondale Avenue, Chicago 18, Illinois.