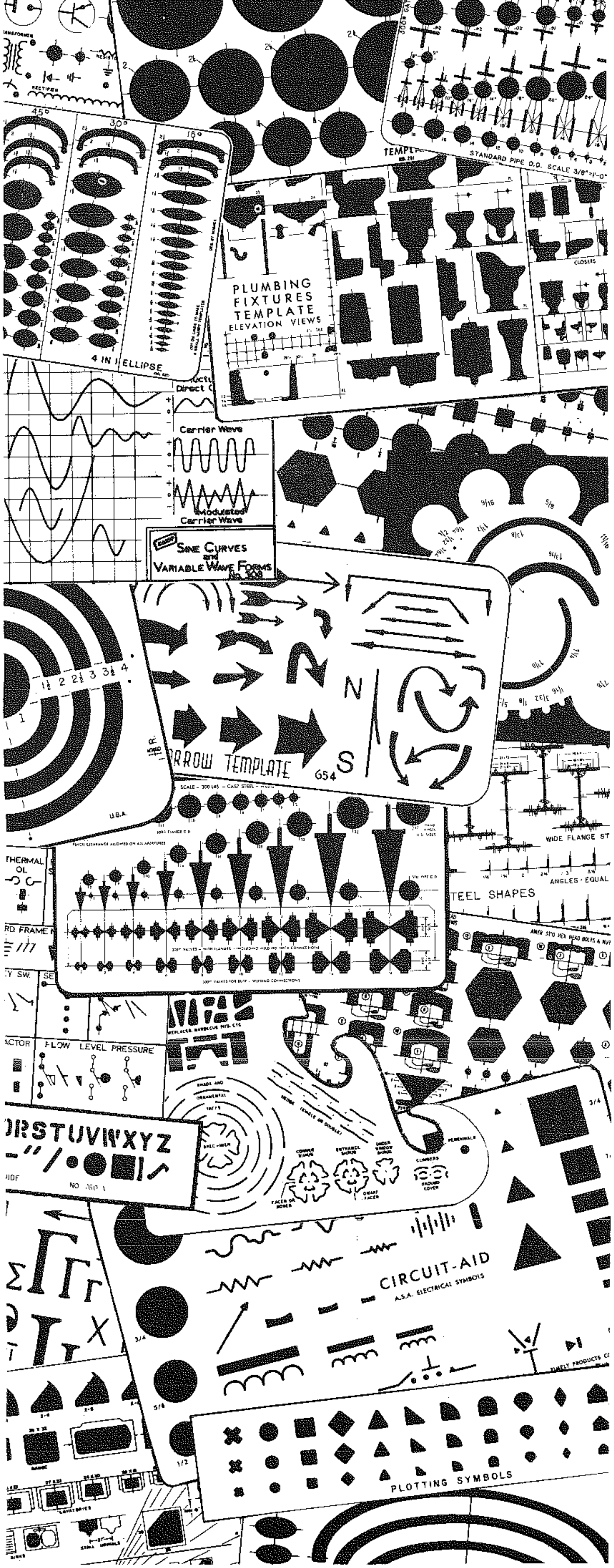
the journal of
engineering graphics

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

November (Fall) 1967 Volume 31 No. 3 Series 93



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The Journal of Engineering Graphics

Published by the Division of Engineering Graphics, American Society for Engineering Education

November (Fall) 1967 Volume 31 No. 3 Series 93

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REVISED

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New Problems

Book I

by **James S. Rising** and **Carl A. Arnbal**
Iowa State University

This set of engineering graphics problems is keyed to the first 16 units of the text and is designed for a semester's work. Contained are 76 sheets of problems; layouts for practice of graphical theory, engineering applications and worded problems; and quality green tinted drawing paper for all problems. **$3.50**

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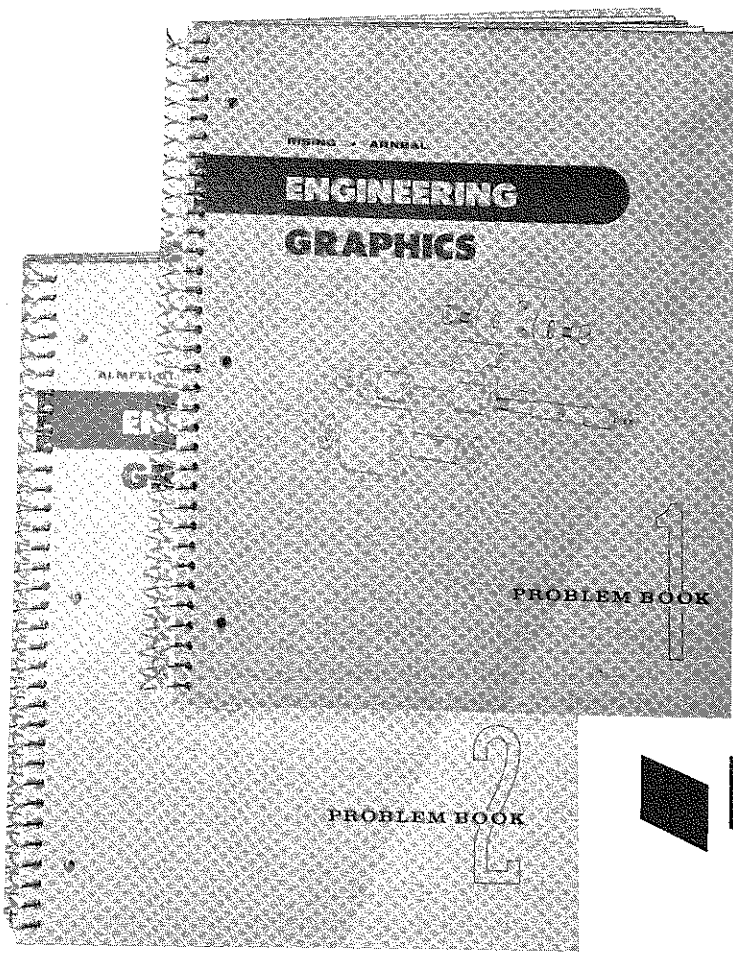

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Editors' Board

WILL YOU COOPERATE???

Every three years, the Engineering Graphics Journal finds itself with a new editor and editorial staff. During the next three years, the newly chosen staff will attempt to continue the outstanding work which was carried out by its predecessors. This, of course, requires the cooperation and assistance from every individual who is interested in our discipline.

The policy of the Journal has been to bring to its readers ideas which can be used as course material as well as information concerning the changes in the concept of engineering and engineering education. This policy will, of course, continue. We also feel that the purpose of this publication is to reflect the opinions of the membership of the Engineering Graphics Division of the American Society for Engineering Education and this can be accomplished only when these opinions are clearly conveyed to the staff of the Journal.

During the two annual meetings - the mid-winter meeting of the Engineering Graphics Division and the annual convention of the American Society for Engineering Education - we hear arguments giving evidence to many concepts of the purpose of our discipline. At the same time, we hear questions indicating confusion as to our goals. Although editorials may be presented in future editions reflecting a particular opinion - depending upon who will write that editorial - it may not be accepted by many. It is the responsibility of every capable individual to allow others to benefit from their knowledge and experience. The differences of basic concepts can best be "ironed out" on a continuous discussion rather than merely once or even twice a year at meetings. The Journal affords the opportunity for this continuity of discussion. From these varied opinions, we hope to find a firm concept of purpose.

Another item which seems to be under serious consideration is that of methodology. How can one best present the subject matter which will accomplish our goal? Many of our colleagues have carried out extensive experimentation of ways and means of presenting the discipline. Others would like to know what these were and what the results have been. The editorial staff would appreciate ideas which may be applicable in colleges where the Graphics discipline is as yet being taught. It is through this type of cooperation that we will find strength and through this strength others will realize the need for the knowledge and skills that we alone can impart to our students.

Some of our friends in the engineering degree-granting departments insist that courses in graphics and/or basic design are not necessary for the engineering student. As yet, their arguments have been somewhat vague and need clarification. Could it be that there is a lack of mutual understanding? Could it be that their reasoning is valid? Perhaps it might be best to eliminate graphics and basic design from the engineering curriculum. On the other hand, there is the possibility that our friends do not realize the service that we can perform in their behalf which would enable them to enrich their discipline as they may prefer. A better relationship and understanding may be accomplished through articles in our Journal written by members of these degree-granting departments. The editorial staff feels that through our publication we could arrive at a better understanding of the needs and goals of all professional and service disciplines in engineering. The Engineering Graphics Journal would like to present the thoughts of our friends concerning our discipline with reference to the professional disciplines and would welcome their remarks for publication.

Future editorials will be written by the various members of the editorial staff. We plan to present definite opinions concerning the goals, needs, and methods concerning the graphics discipline which we hope will stimulate discussion through the Journal. Whether you agree with us or not, it is our policy to report your opinions if the information reaches us in time for publication. We would prefer to have your comments or articles before October 1st for the November issue; before January 1st for the February issue; before March 1st for the April issue. This would insure your representation in the Journal.

WHAT NEXT

Every few years a change in our curriculum is being considered. Within the last fifteen years there has been talk of having an "integrated" course followed by emphasis on graphical analysis and now the teaching of creativity and design. What next?

It seems that the "integrated" course in graphics had a good reason for its quick and sudden death. After two or three years of discussion a logical definition has not been found for this concept. Some felt that the Engineering Drawing -- now called Basic Graphics -- and the Descriptive Geometry units should not be taught separately. However, try as we did the best that could be done was to mix the units which was not the purpose of integration. Others insisted that various disciplines should be included in the graphics course, but this needed cooperation from other departments which did not seem feasible. Hence, the demise of an "integrated" course.

Many of us felt that since we cannot find the necessary cooperation from others we would teach something of another discipline within our own. This gave rise to the pursuit of mathematics through graphics in the form of such subject matter as Graphical Calculus, Empirical Equations, Nomography and others. This had a more reasonable basis since adequate engineering solutions can often be more quickly derived through graphics than by other methods. In fact, a large number of graphics instructors now feel that this should be our principal concern.

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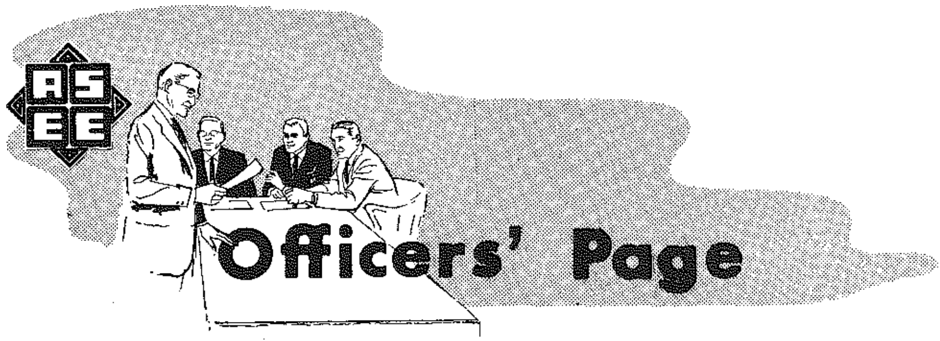

DISPLAY OF STUDENT DESIGN PROJECTS

A most successful design summer school, coordinated by Percy Hill of Tufts and Jack Jacunski of Florida, must have inspired us all to blend into our basic graphics courses a stimulating variety of engineering orientation and creative design projects, a practice that many in graphics have pioneered and which is now so strongly recommended by the ASEE Goals Report. By every means available to us, we must now strengthen our competitive educational posture by demonstrating our leadership in this paramount endeavor to incorporate creative engineering into engineering education. Nor should we be content just to enrich our own courses but should, in addition, encourage and assist other departmental colleagues to provide a more desirable balance in their courses between the science and creative artistry of engineering.

Consistent with this guidance activity, our plans for this year include a display of design projects at the June 1968 UCLA annual meeting of ASEE. Adequate funds will be available to assure a proper professional exhibit environment. Our display committee, with John Barylski as chairman, plans to mail details of this exhibit in the fall. At present it is essential that we all arrange to retain choice student design projects that will clearly portray to our deans and teaching colleagues the opportunities available to the imaginative engineering graphics instructor to initiate the beginning student to the type of creative educational experience that hopefully will be sustained throughout his college experience.

To enhance the promotional value of this exhibit, our awards committee, headed by Al Hoag, is completing arrangements to offer a generous number of suitable awards for the team and individual student projects. If this national display is supplemented by comparable locally sponsored student design competitions and exhibits, we in engineering graphics will be wisely advertising our current leadership in design education; and at UCLA by sharing our most successful design projects, we will be providing every graphics department the opportunity to establish a pattern of motivational engineering instruction that students and deans alike will expect from all.

Eugene G. Pare, Chairman
Engineering Graphics Division

U C L A EXHIBIT

As a result of a most fruitful and stimulating design summer school at Michigan State University, the Engineering Graphics Division has a significant message to convey to our deans and colleagues who are responsible for the development of the engineering curriculum. The message is a simple one: We in Engineering Graphics are leading advocates of the Goals' mandate to incorporate a meaningful creative design experience into our existing courses and trust that our success in this area will inspire others to strengthen the professional engineering aspects of courses under their supervision.

To implement our immediate objectives, your Display Committee has been charged with the responsibility of soliciting and organizing an outstanding display of freshman and sophomore student design projects for our June 1968 ASEE meeting at UCLA. Please plan now to contribute your best student projects to this exhibit. Carefully prepared specifications on posterboard of each group of projects should be included and contain such information as:

1. Team or individual effort
2. Time allocated to project
3. Freshman or sophomore level
4. Project specifications made available to students

Encourage your students to work with the thought that the better work will be recognized and exhibited before a large group of engineering educators and industrial representatives from all parts of the country. Awards will be granted to many of the best student projects. In this regard, plans may be developed to solicit the guidance of all visitors to assist the judges in their selections. If possible each exhibitor should plan to allot a few hours for informal discussions with interested visitors. However, your Display Committee will arrange to have some of its members on location at all times. Specific details for the shipment of displays will be outlined in a forthcoming letter that will be sent to all.

We are all anxious to have an outstanding display that will leave no doubt in the minds of our engineering colleagues that our Engineering Graphics Division has developed an appropriate vehicle for freshman engineering orientation and motivation. Your cooperation is, of course, essential.

John R. Barylski, Chairman
Displays Committee
Engineering Graphics Division of ASEE
Southeastern Massachusetts
Technological Institute
New Bedford, Massachusetts 02742

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1967 - 1968

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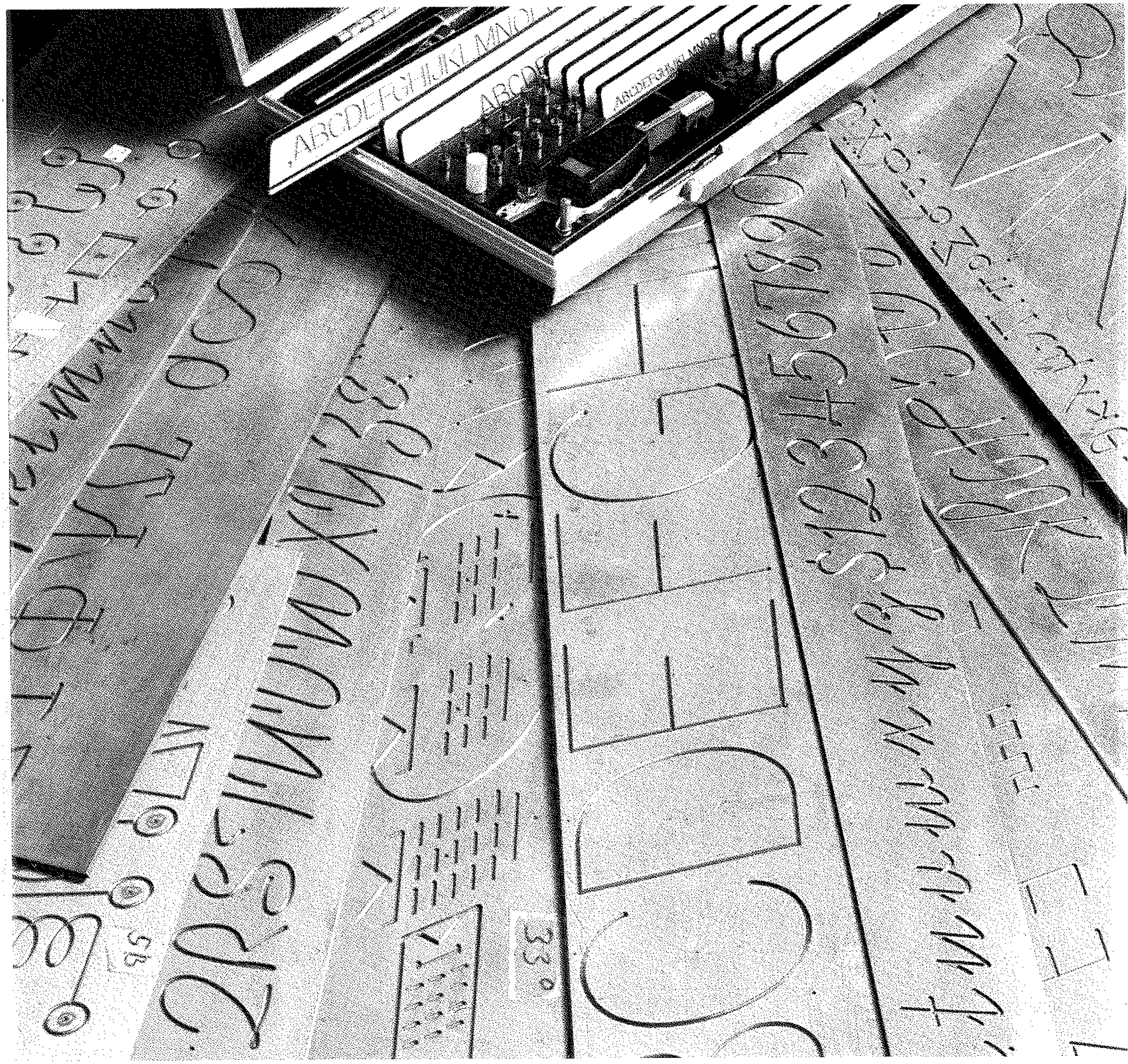
1967-68	U. of South Florida (Tampa)	UCLA
1968-69	Louisiana State Univ. (Baton Rouge)	Penn. State
1969-70	Cal. Poly. Inst. (San Luis Obispo)	Ohio State
1970-71	U. of Massachusetts (Amhurst)	USNA



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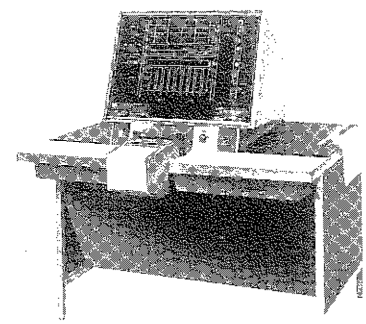

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Perspective

by

charles a. garniewicz

Each year, the Engineering Graphics Division of A.S.E.E. bestows upon one of its members its highest honor, the Distinguished Service Award. Candidates for this award can be proposed only by members of the Division and it is the duty of a Special Awards Committee to select the most deserving person for the award.

The award for the year 1967 was the 18th Distinguished Service Award presented to an outstanding member of the Division. The following are past recipiants of this honor:

1950 - Frederick G. Higbee
1951 - Frederick E. Giesecke
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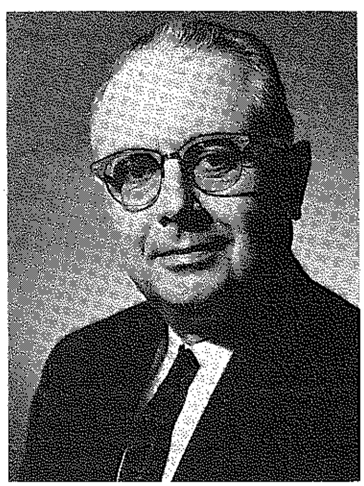
1960 - Clifford H. Springer
1961 - William E. Street
1962 - Jasper Gerardi
1963 - Theodore T. Aakhus
1964 - Warren J. Luzadder
1965 - Ralph T. Northrup
1966 - James S. Rising

The 1967 recipient was Ivan L. Hill of Illinois Institute of Technology.



Prof. Ivan L. Hill

DIVISION OF ENGINEERING GRAPHICS
OF THE
AMERICAN SOCIETY
FOR
ENGINEERING EDUCATION

RESOLVED:

THAT, WITH THE PRESENTATION OF THIS AWARD, THE ENGINEERING GRAPHICS DIVISION OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION BY THIS TOKEN ACKNOWLEDGES THE MANY DISTINGUISHED SERVICES RENDERED BY

IVAN LEROY HILL

THROUGH THE YEARS 1942-1967

THE SOCIETY EXPRESSES ITS DEEP APPRECIATION FOR THOSE SERVICES, AND THE GREAT PERSONAL PLEASURE OF THE INDIVIDUAL MEMBERS IN HAVING HIS FRIENDSHIP.

PRESENTED THIS TWENTY-FIRST DAY OF JUNE IN THE YEAR OF OUR LORD NINETEEN HUNDRED SIXTY-SEVEN.

E. W. Jacunski — Chairman of the Division

Edward W. Knoblock — Secretary of the Division

The following is the citation which accompanied the Certificate of Award.

CITATION
for the
1967 DISTINGUISHED SERVICE AWARD
of the
ENGINEERING GRAPHICS DIVISION, ASEE

To IVAN LEROY HILL, for outstanding devotion to the interests of his students and to the division of Engineering Graphics of the American Society for Engineering Education, the Division bestows its highest honor, the Distinguished Service Award.

IVAN LEROY HILL, Professor and Head of Engineering Graphics at Illinois Institute of Technology, is a 1938 graduate of Iowa State University where he later earned his Master of Science degree in 1950. After five years of teaching at Grove City College, he joined his present faculty as an assistant professor in 1942. After World War II he devoted two years to the organization of a new admissions office for the Institute, but then returned to a career in teaching. In 1962 he assumed his present position as Head of the Department of Engineering Graphics.

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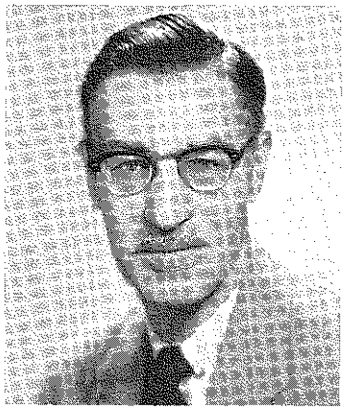


WHAT IS BASIC GRAPHICS

by

B. Leighton Wellman

Professor of Mechanical Engineering
Head of Division of Engineering Graphics
Worcester Polytechnic Institute

How shall we define basic graphics? In other words, how much of our graphical knowledge can we consider to be truly fundamental? Where do we draw the line? There are extremes in both directions. Some wag once suggested that there is only one basic principle in graphics: keep your pencil sharp! On the other hand, I have on my bookshelves three texts identically titled "Basic Engineering Graphics". They range from 300 pages to 700. Add to that the numerous texts entitled "Fundamentals of" and "Introduction to", and it becomes apparent that basic graphics cannot be measured in pages.

In the reduced time available today for graphics instruction, the teacher must identify and evaluate the graphical needs of the graduate engineer or scientist, and then tailor the course to fit those limited objectives. If we admit that our graduates will rarely prepare the final production drawings for his project, we are thereby released from the impossible task of producing draftsmen in 90 hours of instruction. If we recognize that the graphical efforts of a modern engineer will be largely confined to freehand sketching, the reading and interpretation of drawings made by others, plotting an occasional graph, and making design layouts that often require some graphical analysis, we can begin to select the basic elements of graphics for an engineer.

On the first day of the course let's capture the student's interest by explaining that this is not a course in mechanical drawing. Let's emphasize that graphics is not just blueprints; it is both a means of analysis and a method of communication. Let's stress the power and meaning of such a simple thing as a penciled line. It can outline a picture of something no man has ever seen before; it can be a symbol that says far more than a thousand words; it can vividly represent numbers and their complex relationships. Yes, the realization that all of these things can be done with a few strokes of the pencil is enough to stir the imagination of any student.

Thus the principal objective and underlying purpose of a basic graphics course should be to teach and encourage the student to think and operate graphically at every opportunity. This is no easy task. After twelve years of intensive instruction in symbolic mathematics, the student has been so thoroughly indoctrinated in the arithmetical approach that he will use it at all times - even though it may be tedious and painful. Let me illustrate with a very simple example.

It is required to draw a figure 5 7/16 in. long in the center of a sheet of paper that is 11 1/8 in. wide. This is a terribly unfair problem because everyone knows that classroom problems are always stated in nicely rounded numbers - a situation that has come about because of the notorious inability of modern students to compute without error in nonintegral numbers. Left to his own devices the student will valiantly struggle with the awkward fractions, and after a few miscarriages and erasures will come up with the marginal distance of 2 27/32 in. This he will then mismeasure on the paper.

Of course there is a much simpler way, but it is graphical hence it will never occur to mathematically trained students. The graphical thinking student will measure 5 7/16 in. along the edge of the paper, and then when he moves the scale to measure the remainder he will observe that there is an awkward distance of 5 11/16 in. To eliminate mental strain he will tilt the scale until the 6-in. division coincides with the paper edge, and then mark the paper at the 3-in. division. The deed is done without sweat, strain, or stress of arithmetical computation.

I believe that every course in basic graphics should emphasize and illustrate the remarkable equivalence of graphics and mathematics. Algebraic equations and coordinate graphs provide two different ways of expressing the relationship between variables. No engineer is really competent unless he can use both methods and appreciate the virtues of each. Calculus truly comes alive and takes on meaning when it is seen in graphical form. The fact that differentiation and integration can be performed without algebraic equations comes as a startling revelation to most students. Nomographic charts have a long history, and in our rapidly moving technology should therefore be passe. Instead they appear repeatedly in the latest research publications, and in one recent analysis nonograms were chosen in preference to computer derived results. Graphical analysis can find a place in any scientific investigation or engineering solution if the investigator has been alerted to its power; and that should be one cardinal objective of basic graphics.

On a recent project, I had the pleasure of rediscovering the mutual dependence of graphics and mathematics, and the utility of both the slide rule and the computer. You have undoubtedly encountered at some time Grant's Involute Odontograph, an approximate method of drawing gear teeth. Grant developed his tabulated radii in 1891, and his data is still being used despite the fact that the radii were based on a 15° pressure angle, and were empirically shortened to correct for interference at the tooth tips. I decided to compute new radii

(continued on Page 13)

for both $14\frac{1}{2}^{\circ}$ and 20° that would more closely approximate the true involute profile that is commonly used today. Where does one begin the search for an approximate solution, and how does one know when the approximation is close enough? On the drawing board, of course, with greatly enlarged teeth of accurately drawn involute profile. An approximation of visually satisfying accuracy was soon discovered - for a gear with 24 teeth. But radii were needed for every gear from 12 teeth to 300! To repeat the graphical process 289 times was obviously out of the question.

With the graphical solution clearly portrayed on the board, it was relatively easy to express the radii algebraically. Then the mathematical expression was given a rough check with the slide rule. Now to the computer. A program was written, and soon the computer disgorged several yards of tabulated radii. End of problem? Not quite. Back on the drawing board the theoretically correct radii did not satisfy the eye for all cases. A modified program, new radii, a recheck on the board, and the second solution proved acceptable. Here is the power of graphics: for discovery and innovation, and for a final check. For the time he spends on a 2 or 3 credit hour course in basic graphics where can an engineer find greater value?

The value of graphics as an analytical tool must not be underestimated, and I would suggest that allocating one half of a basic course to that area is not disproportionate. In fact, this is quite reasonable if we observe that in actual practice most of the engineer's space problems soon reduce to a series of coplanar problems. Much of his graphical work is confined to two dimensions at any given instant, and his graphical computation is largely in the X-Y plane. Only recall your own personal experience with a multitude of graphical problem solutions and design layouts: you used vector force analysis, you plotted displacement curves and the locus of moving parts, you made velocity and acceleration determinations, found stresses in a truss, drew cam profiles, conics, and roulettes, and 95 per cent of these problems were completely resolved in the plane of the paper.

This is not to deny the tremendous importance of multiview drawing, and the simple power of descriptive geometry. No system for the representation of three dimensions, whether graphical, mechanical, digital, or computerized, has yet surpassed or superseded the multiview method for truth and accuracy of description. How often have we wished it were otherwise, that there was some easier way to describe physical objects? Two thousand years ago the Egyptian king, Ptolemy, posed a similar question about geometry, and Euclid wisely replied, "No, sir; there is no royal road to geometry." Regardless of how drawings are made today or in the future, the grammar of the language of engineering will still be basic knowledge for every engineer.

All of this, I think, is basic graphics, and the topics I have named seem to challenge the best of our freshmen. Graphics is not the easiest course in our freshman year. Still I have colleagues - far too many - who think I am training draftsmen and teaching a manual skill. The first is manifestly absurd, but the second I cannot wholly deny. An unintelligible drawing is as useless as illegible writing. The simple and less obvious techniques of freehand sketching must be taught. The ability to manipulate a T square and a pair of triangles with modest competence should certainly not strain the intelligence or coordination of a normal college freshman. The utility of these simple skills far outweighs the short time required to learn them. And if a few students achieve a high degree of dexterity in drafting, should they not be proud of their craft? What surgeon ever boasted of his awkwardness with the scalpel? Not yours, I hope. When Michelangelo created his masterpieces in marble, who laboriously wielded the hammer and chisel? Not the plodding stone cutters of the quarries.

At the highest levels engineering will always be a creative art, sustained by science but conceiving plans that no man has ever seen before. Only graphics can bring those plans into being and make them available to you and me. Basic graphics is the seed; plant it and nourish it well.

BERNARD WELLMAN NAMED TO HIGGINS CHAIR AT TECH

The appointment of Bernard L. Wellman as John Woodman Higgins professor of mechanical engineering was a surprise announcement made by Harry P. Storke, Worcester Polytechnic Institute president, at graduation exercises yesterday.

Wellman is the second Tech professor appointed as a Higgins professor. The first was Carl G. Johnson, who died in May 1966. Since his death the Higgins professorship has been vacant.

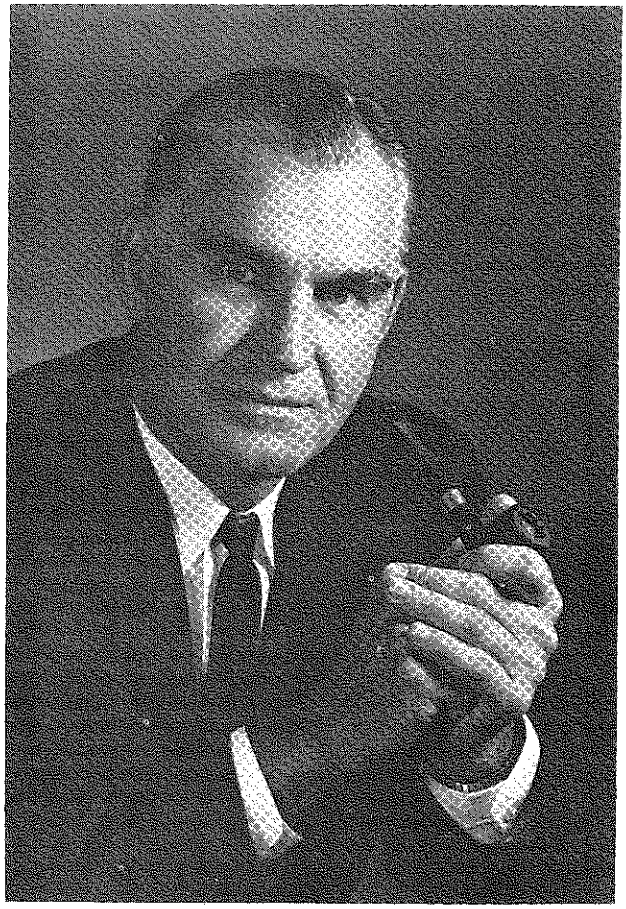
A member of the Tech faculty in mechanical engineering since 1930, Wellman is also secretary of the faculty. He is a recognized authority on the subject of engineering graphics. In 1964, he was awarded an honorary doctor of engineering degree by Tech. He received his bachelor's degree from the University of Illinois and his master's from Worcester Polytechnic.

Johnson, the first John Woodman Higgins professor of mechanical engineering, was in charge of the metallurgy courses within the department. He was considered a national authority on powder metallurgy.

The Higgins professorship was established in the fall of 1961 in a bequest of $200,000 under the will of John Woodman Higgins, a WPI alumnus who died in October, 1961.

Wellman lives at 45 Hancock Hill Drive.

(This article was taken from the Worcester Telegram Newspaper of Saturday, June 10, 1967.)



Professor E. W. Jacunski
University of Florida

It was through the tireless efforts of Professor "Jack" Jacunski that the Engineering Graphics Summer School on "Creativity and Design" was organized. While vice chairman of the Engineering Graphics Division of the American Society for Engineering Education, he initiated the organization for the successful operation of the school by appointing a most capable director in the person of Professor Percy Hill of Tufts University. As chairman of the division, Jack made sure that progress was made and cooperation was proceeding as planned. His term of office as the chief executive was obviously filled with concern and activity for the summer school causing many to wonder whether his position at the University of Florida required any work for the school.

The Journal extends its most heartfelt THANKS to Jack for the work that he did and to Percy for the leadership to successful accomplishment.

Gentlemen, well done!

ADRESS OF WELCOME

E. W. Jacunski
University of Florida

This address was given at the Seventh Annual Summer School of Engineering Graphics and Design in June 1967 at the Kellogg Center, Michigan State University.

I want to welcome each and every one of you to the 1967 summer school. This is probably the most significant summer school that the graphics division will have had in its existence. Significant in that the results of this conference may very well determine not only the future value of graphics as significant to engineering education, but also the effectiveness of the Graphics Division within the ASEE.

I will dwell briefly on the purpose of this summer school and try to explain why a new look in engineering graphics education is of paramount and of utmost importance.

By a by-law in its constitution, the drawing division established a very important plank in its platform. In Article VI it reads as follows: "The Executive Committee shall arrange for special summer schools to be sponsored by the society, or by the society and other cooperating organizations. These special summer schools shall be held as need arises but they shall not be more frequent than once every five years." Accordingly, just prior to the annual ASEE meeting summer schools were held. The wise thinking that established this by-law had a most serious objective in mind: each five years the division would meet, review the progress of the past five years and to chart a course for the next five. The annual and mid-year meetings in between were held to maintain continuity.

When the drawing division was first organized within the SPEE - now the ASEE - in 1928 it became the only common meeting ground for teachers in the drawing field. And under the guiding hands of such illustrious leaders as Thom E. French, F. G. Higbee, George J. Hood, O. W. Potter, P. P. Hoelcher, and many others, it grew into a lusty child. It became one of the most numerous groups among all engineering teachers. At one time consideration was even given to establishing an "American Society of Engineering Drawing" and the "American Society of Descriptive Geometry" and to bring it up to par with such societies as the ASME, ASCE and IEEE. Its importance and influence as a division in engineering education was undisputed.

Through the years, from the days of its conception, the drawing division exerted a tremendous influence in standardizing the course contents and the teaching of drawing in practically all engineering schools. Each meeting became an occasion for the renewal of old friendships, a re-telling of old stories, and a discussion of mutual problems. We entertained distinguished speakers from engineering schools here and abroad. We invited industry to share in our programs and appointed committees to explore and further refine the graphics curricula. The drawing division maintained a unity of purpose throughout the years and became the most vigorous division within the ASEE and its Journal the outstanding divisional publication.

But in the late forties, underlying this atmosphere of complacency and apathy that had settled about us, an uneasy feeling of insecurity and unrest began to intrude. Nationally our expanding technology and advances in science in the world was demanding revisions and up-dating of the entire engineering educational structure.

In keeping with this unrest the division began to hear new voices expounding new objectives for graphics. From our traditional entrenchments these voices were heretical in sound, and, often as not, branded as radical - a disturbing element! It was shocking to think that the graphical language of engineering communications should in any way alter its basic format! That time for its instruction should be reduced! Its course contents altered, or its objectives changed! Today we realize that these early voices, although they lacked a goal, were voices of prophecy. The 1952 Grinter Report, therefore, was not a sudden overnight release - it was the culmination of a long study made under the auspices of the ASEE. All factors relative to our technological and scientific growth were reviewed and related to our academic structure. To update, to keep pace and project into the future, called for criteria and guidelines - and these were stated in broad and general terms. They had to be, in order to allow for flexibility within the objectives of our nation's many engineering schools.

The preliminary Grinter Report of 1952 suggested two types of curricula: The Professional General and the Professional Scientific and that there should be a separate curricula for the two objectives. However, the schools of the nation, sharply aware of the exceedingly revolutionary changes in our science and technology - and spurred on by the tremendous success of Sputnik - elected to pursue the Professional Scientific route. This decision, more than any other, withdrew drawing - and other tried and time-tested traditional courses - as having little professional usefulness in the new scientific concept. No degree granting department went to bat for us, nor supported our very fine statement of objectives that W. E. Street and his committee submitted to the Grinter study group.

All of you are aware of the intervening years. We've worked vigorously at overhauling our courses. We've changed and upgraded their contents. We've worked hard to make ourselves respectable and acceptable. As a division, we continued to meet and to discourse. We discussed our mutual problems, compared notes, swapped information and continued our efforts to do our best within the circumstances our schools allowed us. Each one of us had to ad-

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just differently.

Even though we've been hurt time-wise, during this passage, we have been made to learn a lot about graphics. We have learned of its versatility and its many sophisticated uses. We know that it is not and should not be taught as a terminal course outside of the engineering context. We have also learned that it is not a single course but a sequence of courses that can be put to practical use on all levels of engineering. Our job is to convince those who up until now have not wanted to be convinced that graphics is essential to engineering literacy.

I know that practically all of you are asking in your minds, why did the division wait until 1967 to do something about it - some fourteen years after the so-called Grinter Report labelled it a "non-departmental engineering course" and gave it a down-hill shove?

The truth of the matter is that the division has not been inactive and has not lost sight of its original mission to promote graphics. The division through many of its dedicated members, working within the time impositions and academic goals and engineering objectives of their schools, continued to experiment and to re-evaluate their courses in order to retain them as effective and essential to engineering.

In several schools the efforts of these individuals have been successful and they have received recognition and have been placed on an equal footing with other engineering courses. It is from these schools that your summer school committee is borrowing some of the strength for this summer school.

The division was unable to make a salvage effort until now because it was boxed in. To borrow a popular phrase - the political climate was never just right. We never knew which way to turn, what guidelines to follow, or what were our goals. We had no unity and could offer no clear objectives. We were in a period of incubation and just had to wait for the right moment - and that moment, we feel, it at last at hand.

Just as a rising ground swell of opinion culminated in the Grinter Report of 1954 and provoked massive changes in engineering education, an equal rising protest, in the interim years, has induced the ASEE to undertake a nation-wide study and indicate, in broad and general terms, the direction which engineering education must take if it is to meet the demands of the future. Accoridingly, four years ago, ASEE established a committee on "Goals of Engineering Education". This time the graphics division has asked to present its views and objectives. The graphics committee, charged with this responsibility, decided to be positive and realistic and its report and stated the position and objectives of the division clearly and simply.

The preliminary report of the goals study was published in 1965 and several helpful references to graphics were made. This recognition - although conditional in nature - was the very encouragement the division needed. It was inspirational! At last there are general guidelines to be interpreted and developed.

In the 1967 interim report, under a section entitled "Communications" the following significant statements are made:

> "All engineering languages should be utilized - verbal, pictorial and symbolic."

> That "engineering graphics as a method of communication is a critical but controversial element of engineering education. Some schools have eliminated the subject from the college curriculum. Instead they require it as a prerequisite for entrance or include it as part of other courses such as design."

> That - "the engineer should be able to visualize spatial relations and so supply graphical techniques for the analysis and synthesis of complex relationships."

And in commenting on new developments in certain advanced areas in graphics - such as the computer - it states:

> "--hopefully these developments will stimulate and attract the vigorous and creative teachers in this important field."

Another feature of the interim report is the knowledge that the professional-scientific curricula advocated by the old Grinter Report has come full circle and the professional-general is recommended with a definite stress on creativity and design in engineering.

In planning this summer school it was decided that this advocation of creativity and design should be our theme and that by concentrating our efforts in this direction we will be riding in a vehicle that was no longer traveling on a down-hill road.

1967 is the year of opportunity for graphics. Everything seems to dovetail as though by plan - but whether by plan or coincidence the advantage is here.

The years of self-analysis and reappraisal has given us a new graphics perspective that is meaningful, up-to-date, and of true engineering value. We have learned that graphics cannot be separated from the mainstream of thought and development in engineering education - that it can be used as an effective engineering tool by the freshman in his daily assignments and by the graduate in his original research. We have learned all this and welcome the opportunity to implement this learning.

The goals study has come at a time when we can meet its challenge with a more forceful graphical image in engineering education.

The goals study is recommending a professional-oriented curricula with emphasis on creativity and design at all levels of engineering study - and graphics in the design function in engineering has a strong position.

(continued on Page 19)

Address of Welcome (Cont'd)

The wonderful coincidence, therefore, that our five-year summer school should come at this time, has given us a purpose and we can chart our course, for the next five years, with a greater feeling of confidence and well-being than we have enjoyed in the last fourteen years.

This summer school was not designed to be a panacea and cure-all for the many graphics ills that you may have at your respective schools -- in one form or another we have all taken a beating. Its purpose is to give you something tangible and definite to take back with you and use as a basis upon which to build and survive and perhaps even rebuild. If you have a one-semester course you will have to abridge and improvise. If you have more time you will have more justification for doing a better job.

The division through its membership, its committees and its leadership will work with renewed vigor to maintain and support you in your efforts.

I personally wish you success.

COMMENTS ON THE ENGINEERING GRAPHICS SUMMER SCHOOL

The Seventh Summer School of the Engineering Graphics Division was an unqualified success. Held at the Kellogg Center of Michigan State University on June 15, 16, and 17, it instilled in all participants an awareness of and an enthusiasm for the role of design in the graphics curriculum.

The morning sessions were devoted to lectures and discussions concerning design case histories and task specifications, while the afternoon meetings were given to workshops where the participants were able to suggest and then work on possible design problems. There they gained practice in writing up case histories for different problems. The various workshops then exchanged problems and attempted to arrive at task specifications and conceptual designs to fulfill the requirements.

As with anything new, there was a great inertia to "get into the act" on the part of most participants. The workshop leaders had to diplomatically prod and suggest to get their groups started, but soon their problem was to cut off the flow of new ideas and direct the group to the task at hand. Once started, the discussions usually continued after the end of class. Often they lasted late into the night. In fact, the concepts and problems presented were still the topic of conversation for many informal gatherings of graphics people during the following week at the Annual Meeting.

Those who participated in the Summer School may have come as skeptics, but they left believing that conceptual design belongs in and is an important part of graphics. The course sequence at one school may not be desirable or even feasible at another school, but the use of design problems provides the incentive and the motivation necessary to attract and retain students in engineering. The freshman graphics course is the natural vehicle for design; there remains only the task of building the best course sequence for each particular school.

The Graphics Division owes an emphatic "Well Done" to the Summer School Committee: Earl D. Black (GMI), Peter Z. Bulkeley (Stanford), Jerry S. Dobrovolny (Illinois), Mathew McNeary (Maine), William B. Rogers (West Point), Wayne Felbarth (Detroit, James R. Burnette (Michigan State), and Percy H. Hill (Tufts), Chairman. In addition to the Committee, the workshop leaders gave of much time, thought, and effort to their respective sessions. These leaders were Ernesto E. Blanco (Tufts), William S. Chalk (Univ. of Washington), Ronald J. Placek (Western New England College), Borah L. Kreimer (Northeastern), and Wilfred P. Rule (Northeastern). In addition to these men, two members of the Committee, William B. Rogers and Peter Z. Bulkeley did double duty; each ran a workshop group in addition to their Committee work.

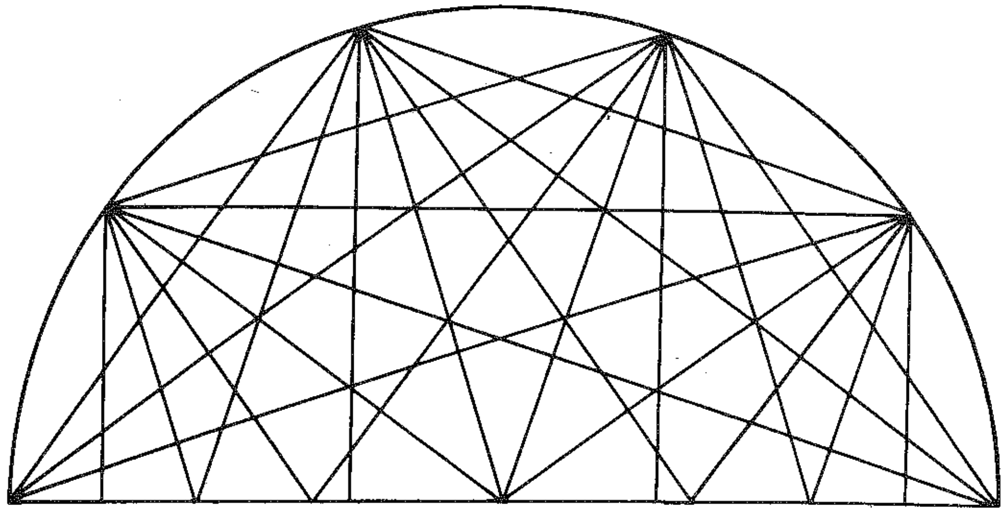
Percy Hill
Director
Summer School 1967

All participants in particular, and the Graphics Division in general, owe a debt of gratitude to those who conceived and operated the Summer School. Now it is up to those participants to carry the word to their colleagues who were not fortunate enough to be able to attend these informative days. To assist them, the JOURNAL OF ENGINEERING GRAPHICS will publish a special issue giving the papers presented and discussing many of the design problems proposed by the various workshops. Appropriate case histories and task specifications will be presented. All graphics teachers should make sure their subscription is current and then eagerly await this special issue.

Robert H. Hammond

COVER

Professor Percy Hill of Tufts University planning the session for the Summer School on "Creativity and Design" which was held at Michigan State University on June 15, 16 and 17 of 1967. The sessions were enlightening as well as interesting through his tireless efforts.



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An introduction to the analog computer. The purpose of the book is twofold: (1) to encourage teachers to include in their courses instruction in analog computers and their application and (2) to present basic analog-computer concepts, along with suggested problems, in a manner that can be readily understood by a student having nominal background in physics and mathematics.

COMPUTER GRAPHICS IN COMMUNICATION
By WILLIAM A. FETTER,
The Boeing Company, Renton, Washington.
128 pages, $4.50 (clothbound), $2.50 (soft-cover)
Explains the increasingly important field of computer graphics —a technique for producing drawings, stereo views, and motion pictures by computer. Typical problems illustrate current applications, potential applications, and representative projects.

FOUR-DIMENSIONAL DESCRIPTIVE GEOMETRY
By ERNESTO S. LINDGREN, U.S. Steel Corporation; and
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Examination copies available upon request

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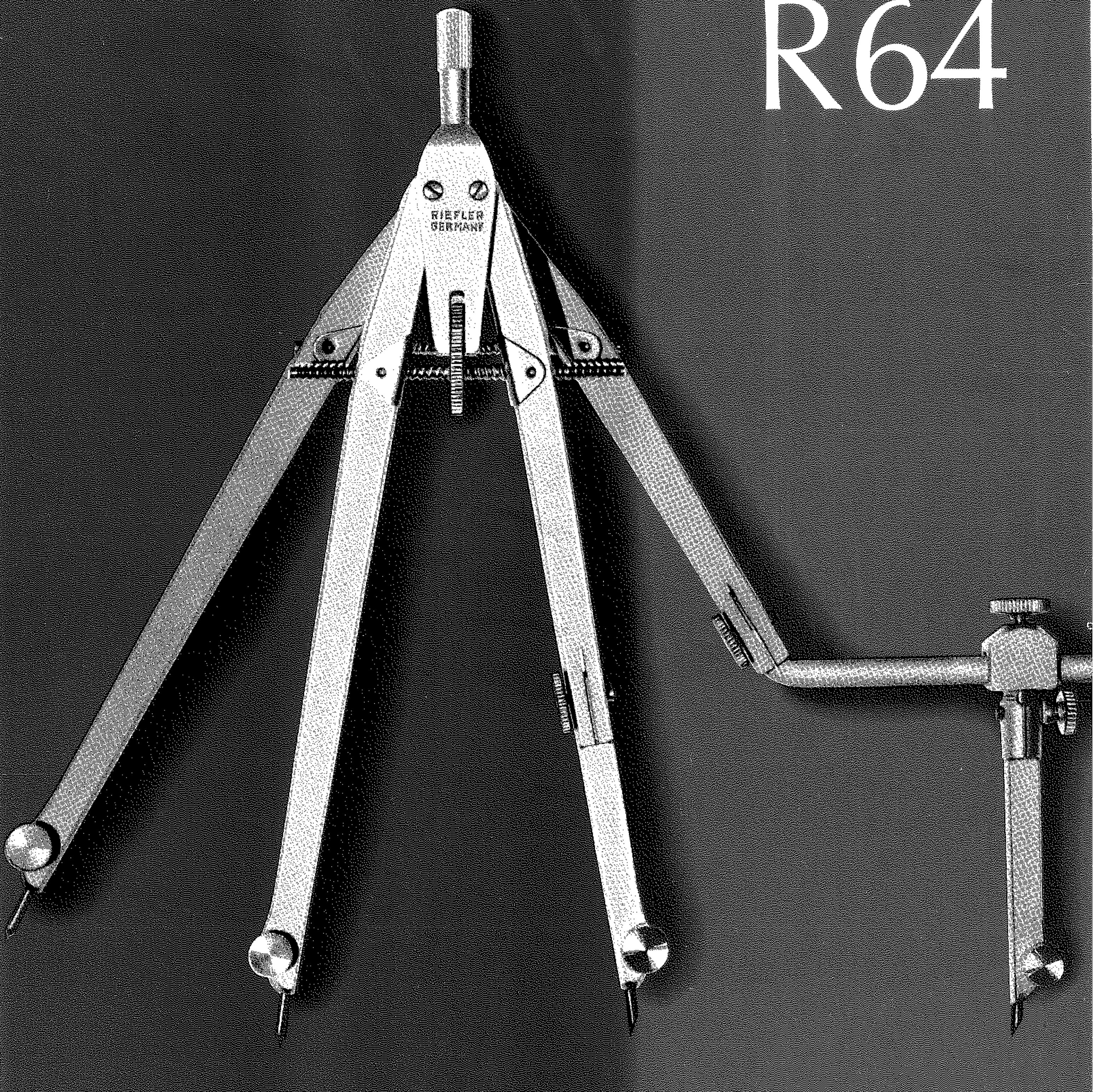
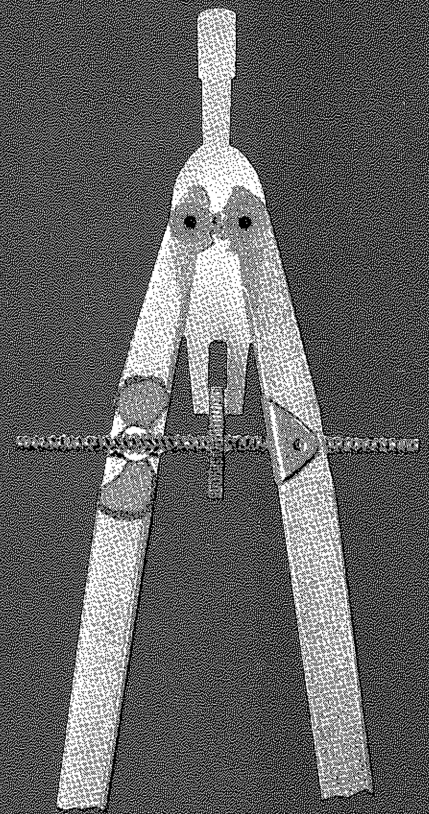
RIEFLER

R64



QUICK-ADJUSTING BOW COMPASS



RIEFLER R 64

Distinctive clean lines are the characteristics of the shape of the new R 64 Compass. In its construction only the function was the prime consideration in its design. No wonder this instrument was chosen by a panel composed of leading designers in Europe for the Exhibition "Good Industrial Form 66".

The main features are as follows, and we are certain that you will be amazed at the ease in which this instrument operates and in the high quality of its presentation and finish.

* **Surface Material Finish:** Guarantees that it is rust proof and the finish which we call "Antireflex" because it eliminates altogether any light reflection, this over a period of time is a cause of fatigue to the eyes.

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* **Robustness:** This high quality production ensures the stability and positive action of the R 64 over many years.

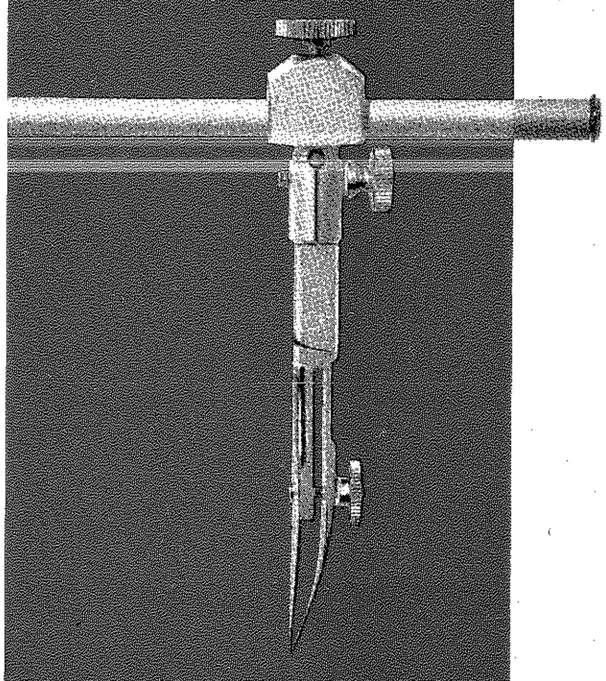
* **Precision:** Is of course an essential part of a draftsman's instrument and in producing the R 64 these qualities have been maintained with the development of the "Springing Nuts" which jump over the centre screw. This mechanism enables the arms of the compass to be moved rapidly open or shut without the laborious turning of the centre wheel and yet enables the instrument to retain the centre wheel for fine settings.

The opening of the compass is positive even with this remarkable action, even when pressure is applied when firm pencil lines may be required for pencil reproduction work.

With these "Springing Nuts" action there is a clicking noise when the arms are opened but do not be afraid, the instrument has been thoroughly tested and has been opened and shut over 25,000 times in our own test laboratories and no wear whatsoever had been found on the plastic insert cups which jump over the rolled thread.

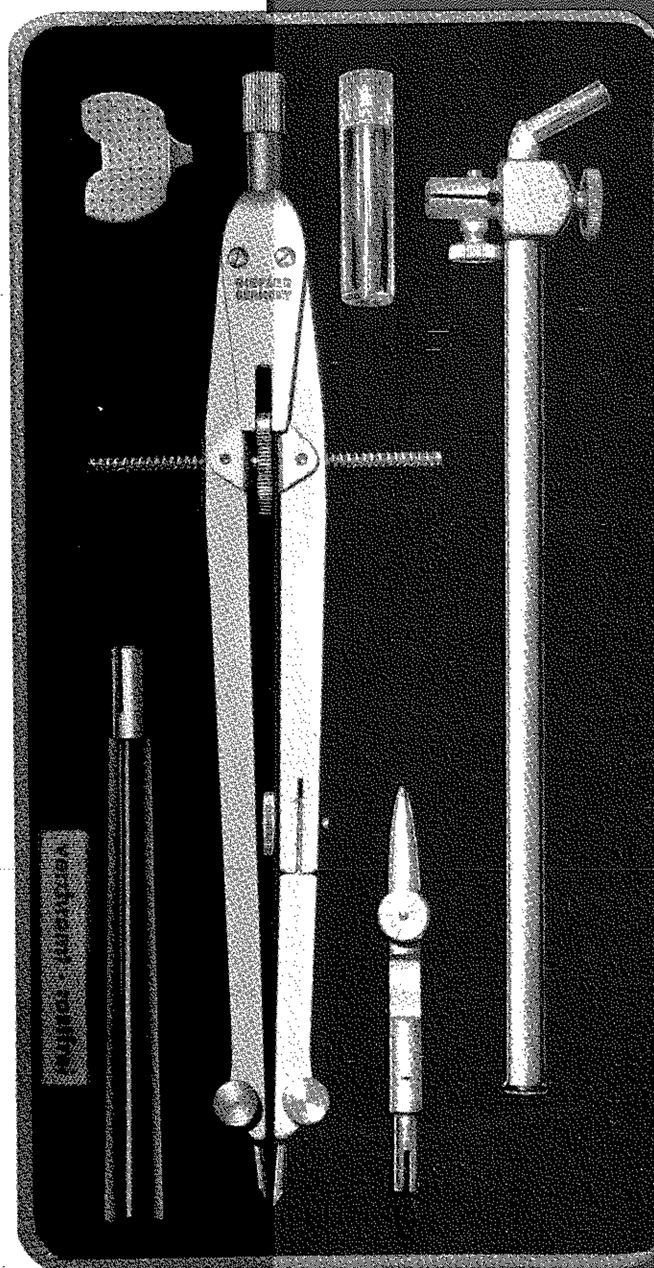
* **Versatility:** The design of this instrument enables the owner of the R 64 Compass to have at his fingertips one instrument to give him the maximum working capacity.

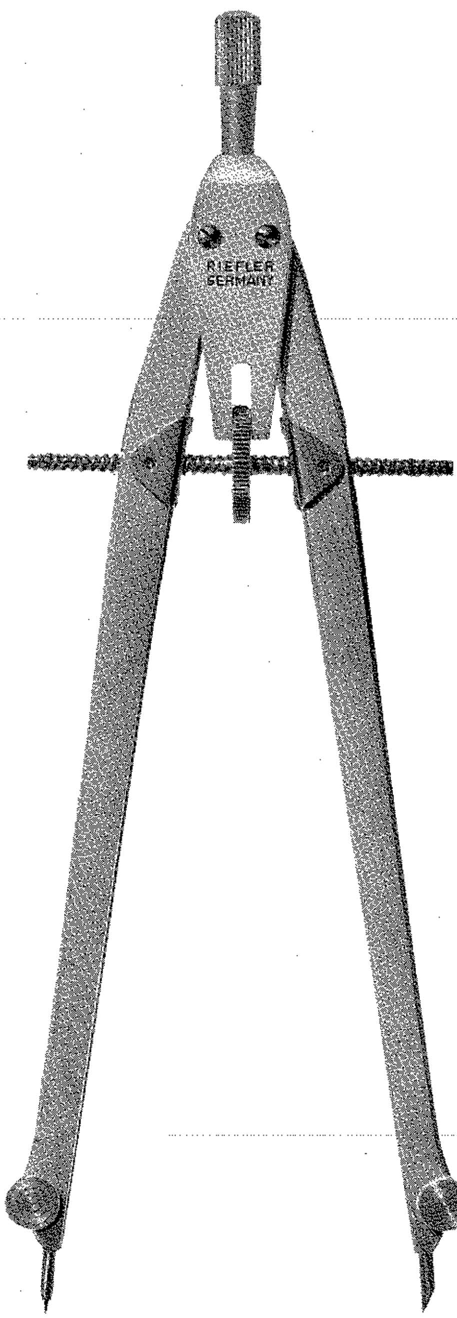
It can be used for small circles say of 3 mm, up to large circles of 520 mm when using the beam extension supplied with the R 64 together with a pen point which of course belongs with every good quality instrument.



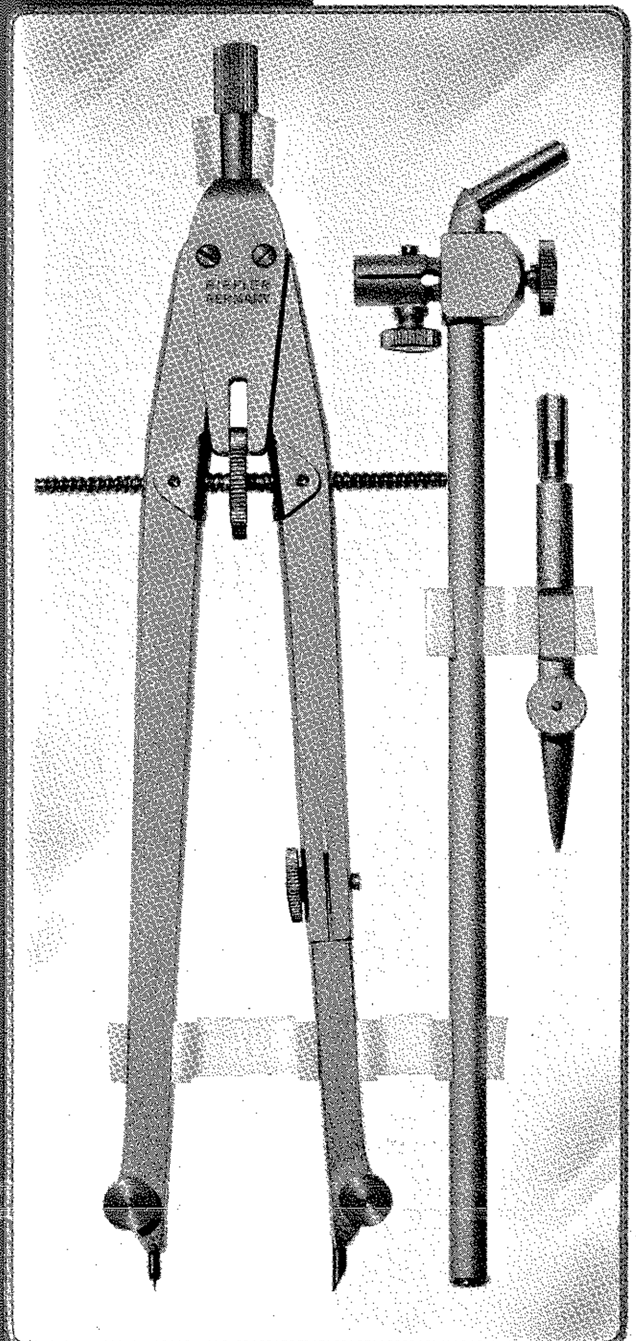
R 64 COMBI

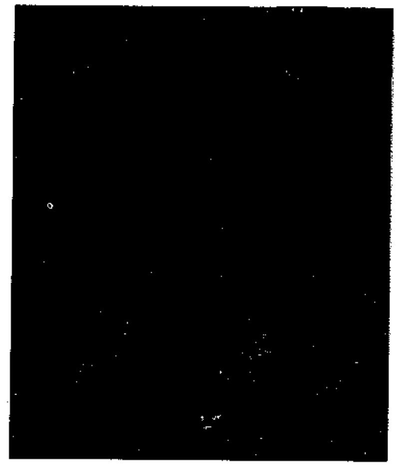
The packing of the R 64 is made in several ways its standard pack is in a transparent case of a Polystyrol material. It is also available in a barlock case with quality velvet lining to protect your instrument. Other sets comprise the basic R 64 combined with conventional instruments, or should you only require a pencil compass the R 400 was produced, in all respect similar to the R 64.

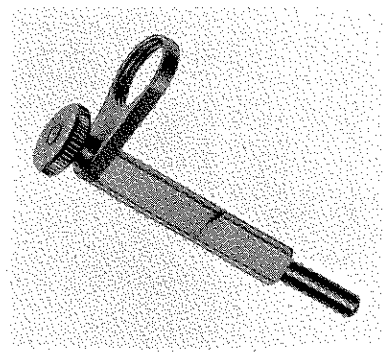




R400







Intermediate piece 90-U 10 for Radiograph

The R 64 had been chosen for the Exhibition "good industrial form 66"

[redacted]

For further information please [redacted] CONTACT

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[redacted]

REALISM FOR FRESHMEN ENGINEERING

Alan K. Karplus, Assistant Professor
School of Engineering
Western New England College
Springfield, Massachusetts

The First Intercollegiate Design Demonstration Program gave freshman engineering students a public platform on which to present their efforts as engineers. The idea for this type of a program started when several professors[1] teaching Freshman Engineering Topics agreed that a program presenting the approach to design used at their schools, followed by a supporting student group discussing the project undertaken, would provide for a stimulating exchange of ideas when reinforced by the observations of practicing professional project engineers as evaluator-critics from industry.

On Saturday, May 13, 1967, Freshman engineering students and their instructors from Tufts University College of Engineering, Northeastern University - Burlington Engineering Division, and host, Western New England School of Engineering met in Springfield, Massachusetts to present and discuss Freshman Engineering Design. The INTERCOLLEGIATE DESIGN DEMONSTRATION CONFERENCE sought to reveal techniques for augmenting their Graphics programs. Presentation of basic Engineering Design Concepts utilizing an applied project approach has become more common in many schools[2] to help the student develop a realistic acquaintance with his career choice and "what engineering is all about". Early introduction of 'authentic' engineering experience has potential as a preventative measure in relation to the increasing problem of student attrition and transfer out of engineering curriculums. With these bases in mind, the conference was initiated this spring. Following welcoming remarks by George A. Marson, Dean of the Engineering School, Western New England College, the program proceeded under the moderation of Professor Alan K. Karplus of the host institution.

Professor Borah L. Kreimer of Northeastern University presented an approach in which students search their environment for human need factors which might be applied to individualized projects for the purpose of giving the engineering freshman a thorough introduction to the basics of the design process. The design process is initiated by a statement of a goal for the proposed design and specific indication of the human need for such a product. A survey follows to discover what is available on the market that serves a purpose comparable to that of the considered product. Design can then be addressed to either product improvement or basic innovation. Product task specifications are established, after which research indicates the components and hardware required to accomplish the task. Following these preliminaries the concept stage of the design process is entered, entailing development of several general ideas about how the configuration or componenty may be uniquely arranged to achieve the goal. Students are encouraged to develop and draw up three concepts. Translation of the modes of problem solution into competitive approaches requires the use of design specifications for a given approach and analysis to support the outcome. Comparison of potential outcomes readily gives rise to a solution. This is the best of the considered concepts. Communication of the concept solution is made through the mediums of Graphics and English. This aspect is given important emphasis since the concept solution can be effective only as it can be made understood by others. This method for the induction of the Freshman student to design morphology was demonstrated by Lawrence Miscowski and Anthony Delicate who presented their solution to the development of a more positive windshield washer system that will improve the distribution of automobile windshield washer fluid to cover wherever the windshield wiper is.

Professor Ernesto Blanco outlined the Tufts College effort to present the morphology of the process of Engineering Design in a logical sequence to Freshman students. The first step is identification of an apparent problem, the nature of which is defined. It is understood that this problem is in interaction with a series of peripheral problems which are often difficult to identify and quantify but which, if understood, can be integrated so that the goal can be defined. The goal is an expression of what the problem really is. An attempt is then made to define the characteristics that the proposed system should have. These features are set by task specifications which may or may not be incorporated entoto into the final item, but which give a point for take-off. Through a series of analyses and selections the task specifications become the design specifications. The next step is the concept analysis phase which is viewed as the most difficult phase of the process and the one in which is found the greatest amount of disagreement among engineers. Professor Blanco implies careful and strict definition of concepts, which facilitates selection of the most optimal one, ultimately leading to a design with the determination of solution specifications. Consideration is then given to the manufacturing of the proposed design. Tufts students are taught each phase of the process in relation to design problems selected to meet needs in relation to their own environment. Students work individually on projects, each one being asked to identify five realistic situations which could stand engineering improvement. Considerable freedom is given in selecting means through which to solve the problem, although some aspects of the problem are specified for him. James Calm of Tufts demonstrated this approach through presenta-

(continued on Page 26)

1 Professors Percy Hill and Ernesto Blanco, Tufts College, Borah Kreimer, Northeastern University, and Alan K. Karplus, WNEC.

2 "Authentic Involvement in Interdisciplinary Design", Proceedings of Third Conference on Engineering Design Education held at Carnegie Institute of Technology, Pittsburgh, Pennsylvania, July 1965.

tion of his solution to the last of five projects employed in the educational sequence. The project involved the implementation of an atomic powered sonar unit to defend an ocean island from trespassers because of a new mineral discovered there.

Professor H. Jack Apfelbaum of Western New England College explained how in the past years the two semester formal Graphics course had changed to a one semester Descriptive Goemetry and Introduction to the Digital Computer followed by a semester of Engineering Design. The students are acquainted with the faces of the design problem in several phases. Through an area of general need chosen by the faculty for the project, the social aspect, the economic constraints and the engineering aspects must be integrated by the students. Guest speakers are invited to present information germain to the project in areas that the faculty feel will not only aid them, but also broaden the background and orientation of the student. Teams of students formed into engineering companies are asked to prepare a problem definition through the construction of a project proposal which is received in oral and written form by the faculty and which is followed by progress reports and a final report with an oral presentation. As the term progresses, lectures on topics such as Project Planning, Market Analysis, Ethics, Inventivity, First Order Analysis, Engineering Experimentation, Oral and Written Techniques are presented to create a realistic design experience in which the teams must weigh all information and criteria, develop an understanding of human relationships in a professional setting, select task and design specifications as well as produce recommendations and drawings to be included in the final report. To exemplify this approach the student team, Eastern Engineering Associates, comprised of Carl Cichetti, Don Fleming, Paul Duquette, Richard Lewenczuk, Paul Belanger and Edward Laughran, presented their answer, in the form of a Deodesic Dome Communication Center, to the improvement of playgrounds and playground facilities in Feldspar, a ficticious city modeled after Springfield, Massachusetts.

Victor Matonis, senior research engineer for Monsanto Chemical Co.; Raymond Mermet, chief engineer, Standard Electric Time Corp.; and Lawrence Shoppe, senior project engineer, Package Machinery Corp., the evaluator-critics from greater Springfield industry, presented several revealing observations. Each had come with the idea that task and design specifications are paramount and most supplement and exemplify the problem statement. To their surprise each of the schools had placed a major emphasis on this particular aspect of the design process. A comment on the nature of the projects revealed that the windshield washer sprayer was industrially oriented, while the atomic sonar unit is a defense project and the recreation dome a publically supported community facility, demonstrating the preoccupation of the society of today with public expenditures in place of entrepreneurial profit. The students were interested in how the individuals get along as an engineer in industry. The evaluators agreed that the individual is the most valuable asset industry has. He is the worker. He creates and provides the incentive for operating successful businesses. Today the individual does not work alone but with others. As a member of a design team, an engineer contributes. He is responsible for compiling progress reports and making oral presentations. His contribution may be

(continued on Page 29)

In his twenty-five years of service to the Division, he has unstintingly given of his time and exceptional talents to many offices and duties, especially as Secretary in 1953-54, and as Chairman of the Division in 1956-57. He has long and successfully served as the Chairman of the Descriptive Geometry Award Committee.

His authoritative knowledge of graphics is demonstrated in the several texts and workbooks that he has co-authored. Through his teaching and writing thousands of students and engineers have achieved professional competence; through his leadership and generous sharing of knowledge hundreds of teachers and friends have immeasurably benefited.

For his attainments as a scholar, author, and teacher, the Division is honored to bestow upon Ivan Leroy Hill its 1967 Distinguished Service Award.

RESPONSE
FOR THE
1967 DISTINGUISHED SERVICE AWARD
OF THE
ENGINEERING GRAPHICS DIVISION, ASEE

I am extremely grateful and I must say truly surprised to receive this signal honor. It is a rare privilege and a responsibility, indeed, to be invited to join a fraternity of men so honored on seventeen such previous occasions by this Division.

This honor is especially significant to me for it coincides with my twenty-fifth year of my association with Professor Spencer and the Illinois Institute of Technology.

As I began to collect my thoughts concerning the problems that I have in graphics, I found they centered around this problem that we all have; and that is of keeping up and adapting to change.

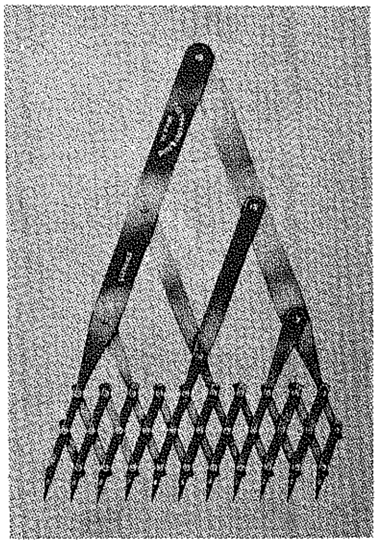
Rapid changes are going on today, as we all well know, in practically all areas of endeavor - ethics, morals, religion, science, technology, graphics or whatever you care to name.

Fortunately, we live in a society that pays well for the new and/or the improved, and this is the basis for much of our progress. We in Engineering Graphics have excellent opportunities and a vital role in the stimulation of this desire for progress in our students, and I wish to add that the 1967 Summer School has provided us with an excellent study in depth in this area.

We hear a lot today about obsolescence. I don't care for this term as related to graphics for to me it means pitching what we have or are now doing to the ash heap and starting over again. This may be change but it doesn't guarantee progress. I much prefer the term continuing education for us in graphics for it more accurately describes the very activities

(continued on Page 31)

THE SPACING DIVIDER



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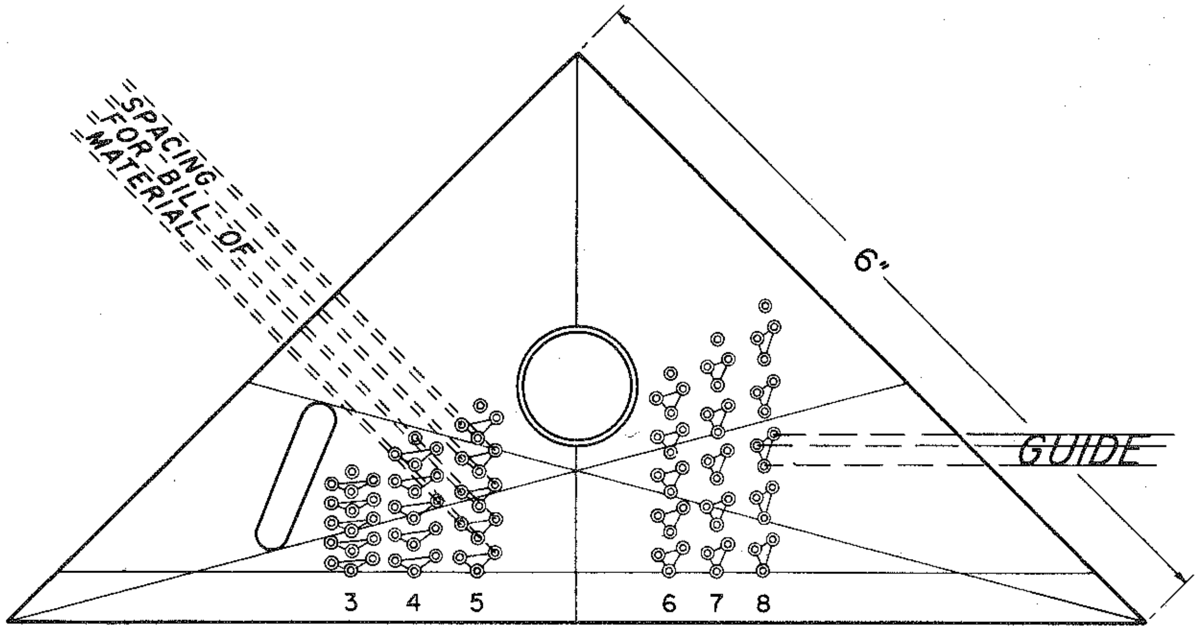

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What's Next (Cont'd.)

Recently, the teaching of the Creativity and Design has found its way into the thoughts of many of our colleagues. Of course, there are those who insist that creativity cannot be taught and that design is too advanced for the freshman student. There are those who claim that without Basic Graphics design cannot be taught. There are those who feel that Graphical Analysis is a definite prerequisite to any engineering problem. Still others believe that no engineering problem can be solved today without the knowledge and ability of computer programming. There are those who will argue against all of these contending that Creativity and Design should be considered without the consideration of any other subject matter.

When one stops to think of the avenues open to us which will enable the engineering student to enrich his knowledge in his chosen profession, it seems that an inclusive curriculum would be most appropriate. It is, therefore, necessary to present a course of study which will include as many of the tools of engineering that we can teach without encroaching on the work done by others who are better prepared in their areas than we. It is also our obligation to assist the student in identifying himself as an individual with his own creativeness. These can best be accomplished through a course in design.

There are many respected people in our discipline who argue against the teaching of design to freshmen. Yet, these same individuals have been doing just that during most of their teaching lives. The difference lies more in emphasis rather than subject matter. In the past, emphasis was placed on the communication rather than the creativity of design. Today, it seems more appropriate to emphasize the creativity with the graphics being taught as is necessary for the creative design.

There are those who prefer to provide the students with specific components and hardware to accomplish required results in design. This seems to limit whatever creativity the individual may have in creating a new or improved object or method. Part of the learning process toward creativeness seems to be the requirement to search for items that will assist in developing the students' ideas. To teach the student to create as the instructor would create is depriving him of the full use of his own ability.

There are those who feel that the course in design should include all the necessary disciplines. They contend that we should teach the necessary mathematics, physics, chemistry and English as well as the graphics. To begin with, there are people available who are better prepared than we to teach most of these tools of design. Secondly, this would necessitate many more contact hours than could be available in a school week if we are to teach rather than expound. Wouldn't it, therefore, be more expedient to present to the students what they will not get from others and what they will not get from others and what we can do best?

There are many who feel that a thorough knowledge of computer programming is a definite necessity in Design. Although it is a very useful tool in the analysis of a design, it does not seem to play an important role in the creative process as yet. Could it be that there are a great number of people who are glamour gullible rather than realistic? There are many types of computers available to the engineer and it seems that a thorough knowledge of the programming for one will not always be even a basic knowledge for others. Therefore, shouldn't the principals of digital computer programming be taught in the same context as another type of computer -- the slide rule -- is taught?

There are also those who contend that a course in Design which affords us the best opportunity to fulfill our obligation to the student should combine all of the ideas and beliefs of our colleages. Let us use whatever disciplines are required to accomplish our goal with necessary moderations. It would be a great assist if we can be sure that our students came to us with a background in Graphics as they do in other subjects. This would permit more time to pursue the philosophy of creativity and the processes involved in design. Unless all of the students have a basic knowledge of graphics as well as computer programming from other sources it becomes necessary for us to teach these. Our main job, concerning these tools, is to show how they are used in design rather than to teach them as separate disciplines. The design problems and projects should be carefully prepared so that the individual will have the opportunity to coordinate what he has learned and thereby "integrate" all of the subjects to accomplish a desired result. It should be our purpose to help the student to find things for himself and to use original judgment rather than insist that he be a carbon copy of us. In short, there are those who believe that through a course in Creativity and Design we can best teach the student to think as an engineer while he is learning an important aspect of the profession which seems to be lacking today.

The summer school on Creativity and Design was to acquaint us with the methods of teaching these. However, it should have also given everyone who attended -- faculty as well as students -- a better concept of our responsibilities. These are not yet completely defined nor has everyone of our colleagues had the opportunities of those in attendance. Therefore, it behooves those of us who were there, the privileged few, to help the unfortunate colleagues. This can be done through the organization of local area seminars and summer schools. Initiative on the part of the 1967 summer school alumni must be taken to start the ball rolling. The editorial staff of the Journal will be happy to pass along any helpful information that it can to assist those with that initiative.

Let us hear from you!

Realism (Cont'd)

greater through the reinforcement of other opinions. The engineer working as a team member shares the responsibility and risk for the life of a design project. This permits him to concentrate on his portion of the design project rather than the whole. Interwoven through the evaluator-critic comments was a discussion on specific aspects of the student project presentations. The program adjourned into an informal conversation.

SPECIAL JOURNAL

There has been much talk about the teaching of "Creativity and Design" at the freshman level, but until the 1967 Summer School nothing much has been done to aid the individual instructor to pursue this course. For this reason, the proceedings of that most successful Summer School is being prepared for a special issue of the Journal of Engineering Graphics.

Among the valuable features this issue will contain information concerning the workshop procedures. Since the workshop leaders use methods in their classes which differ, one would realize that the differences were carried to the groups at the Summer School. The report of workshop activities will undoubtedly indicate some of the methods which may be used in presenting "Design" to a section of freshman students.

It is, of course, necessary to know the types of designs that an instructor may expect his students to carry out at the freshman level. This "Special" will list design topics with the necessary accompanying text for each. An instructor will, with this guide, be in a position to choose problems and/or projects that have been tried and proven for the beginner.

Many other features will be included to make this issue an excellent reference for an instructor of basic design. Not only will it be necessary for each of us to have a copy of these 1967 Summer School procedings but each graphics department should have it available for students who may be interested in a better understanding of the design process.

The subscription price of one dollar ($1.00) has been set to cover some of the expenses involved in compiling, printing and mailing. The Journal of Engineering Graphics will make up any deficit incurred by this issue since the contents are of such great value to the future of the teaching of our discipline. One may reserve copies by filling out the coupon below and sending a dollar for each copy ordered to Professor James H. Earle, Texas A & M University, College Station, Texas 77843.

To:

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Response (continued)

which have been provided us over the years by our wise and forward-looking leadership in the Division. I feel I have been most fortunate, indeed to have had the benefits of the mid-year Division meetings, the periodic summer schools, the Society meetings, the journals of Engineering Graphics and the Society, the numerous other periodicals devoted to graphics, the steady flow of the many contributions to the literature of my profession, and most importantly the fellowship with friends and colleagues. All of these activities have enabled me to keep up to some degree at least.

We of the Division must continue our never-ending search for progress in graphics for nothing is ever finally done. We must continue our search for new knowledge, for new approaches in our presentations, and for new and more meaningful applications of this graphic language. For those in science and technology, graphics is essential to the creation, manipulation, and transmission of ideas.

And in this never-ending search for progress, we must neither forget nor abandon the fundamentals and the methods of representation upon which our specialty has been built. The fundamentals of the graphic language must be taught and learned in the educational process just as importantly as the fundamentals for mathematics - the symbolic language, and English - the verbal language.

Finally, I wish again to express to you of the Division and to the Award Committee my sincere appreciation of your generous evaluation of my efforts in the area of graphics education. Engineering graphics and the wonderful people associated with it mean a great deal to me and Mrs. Hill. We will forever cherish the many friends we have in this Division. For all this and this award we are most grateful. Thank you.

Ivan L. Hill

AN ULCER IS SOMETHING YOU CAN GET MOUNTAIN-CLIMBING OVER MOLEHILLS.

COUNT YOUR BLESSINGS -- THEN RECOUNT THEM. YOU WILL PROBABLY FIND YOU MISSED SOME.

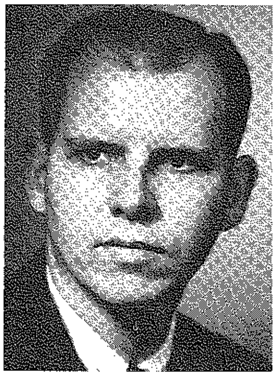
THE PERSON WHO KNOWS EVERYTHING HAS A LOT TO LEARN.

MAKING A LIVING IS LIKE PLAYING GOLF. YOU DRIVE HARD FOR THE GREEN AND WIND UP IN THE HOLE.

IT TAKES MORE THAN SQUARE MILES TO MAKE A GREAT NATION; IT TAKES SQUARE PEOPLE TOO.

KEEPING YOUR EYE TOO CLOSELY ON THE FUTURE MAY OBSCURE PRESENT OPPORTUNITIES.

LEAVE WELL ENOUGH ALONE UNLESS YOU ARE CERTAIN YOU CAN IMPROVE IT.



James H. Earle
Texas A.& M.

DESIGN PROBLEMS IN PRODUCT DEVELOPMENT

Instruction in introductory engineering design is a highly vital part of the content of engineering graphics and descriptive geometry courses offered to freshmen engineering students. Although there is general agreement that design is a necessary, or even a primary part of these courses, there are many approaches to the accomplishment of the desired goal. The design process is directly associated with the engineer's ability to originate, analyze and communicate his ideas graphically. In effect, graphics is the engineer's process for thinking when solving a design problem.

Achieving results in design instruction requires the proper selection of problems that will provide the necessary exercise in as many of the graphical processes as possible. These problems can be of one of two types: (1) systems design or (2) product development. System development deals with broad problems involving the relationship of various factors. Traffic design is an example of this type of problem requiring consideration of economic limitations, dimensional specifications, human factors, legal problems, and social requirements. On the other hand, product development is more specifically applied to the refinement of a device or mechanism to satisfy a rather well-defined need.

The Engineering Graphics Department of Texas A & M University has attempted to incorporate each of these types of design problems in the two graphics courses with product development being assigned as part of descriptive geometry. The particular problems assigned can be adapted from industrial examples designed by teachers or originated by students. Brain-storming is a unique process for stimulating a flow of ideas that can be a source of many problems. This method was used in each class of students where the students spontaneously gave ideas for problems that were in need of solution. These were recorded and reproduced for further evaluation. Approximately 150 ideas can be gathered from a typical 30 minute brainstorming session.

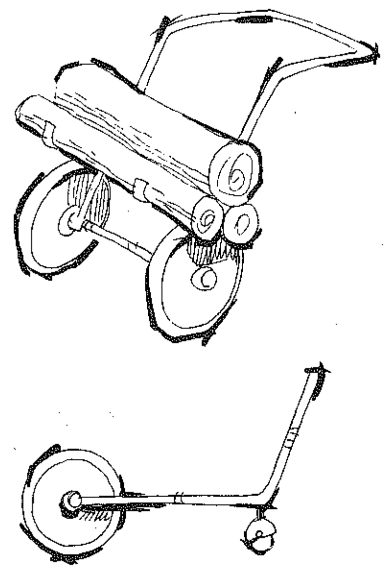
Problems Selected

Problems that appeared to provide for a wide variety of interests while requiring the application of the design process were: (1) Home Caddy, (2) Drawing Table, (3) Playground Apparatus, and (4) Hunting Seat. Explanation of each problem is given below.

(1) Home Caddy

Household duties, gardening, and hobbies requires that various loads be carried a considerable distance. Housewives must move garbage cans, take wet clothes to the clothes line, and bring in groceries after shopping trips. There are many other similar activities that require the transportation of loads from place to place. Heavier loads to be carried are logs to the fireplace, fertilizer to the yard, or camping supplies to the car.

Your company has recognized this area as a possible market for the development of a portable device, called a HOME CADDY, that could be used to transport various loads. This device must be light, economical, portable, and easy to store.



Display Illustration
"HOME CADDY DESIGN"

Analyze the design needs of the Caddy to establish its most important features. It will be impossible for it to serve all possible needs, so you must determine which needs are the most basic to the design. Consideration must be given to the surface on which it will be used and whether or not it will be used on stairs.

Convertible features would improve its sales appeal. For example, it could be designed to convert into a child's toy when not in use. List as many alternate uses for the Caddy as possible.

Prepare drawings and a model of your design as outlined in the design specifications. Make an estimate of the manufacturing costs, sales price, shipping weight and other pertinent information.

(continued on Page 34)

(2) Drawing Table

As a student of engineering graphics, you are aware of the limitations of many existing drawing table designs. Assume that you have been assigned the responsibility of designing a more suitable drawing table for classroom use that will appeal to the national market. This table must be reasonably economical, be of a practical size, and be as functional as possible.

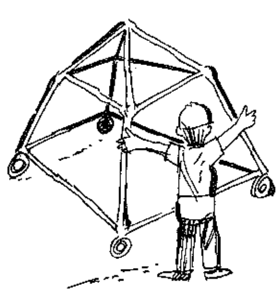
Display Illustration
"DRAWING TABLE DESIGN"

Make a thorough study of the various needs that must be served by the table such as: optimum area of drawing surface, lighting, storage of equipment, reference book space, and adjustable features. Allow your imagination to extend beyond present designs to models that you feel will offer as many features as possible while being marketable.

Much of your basis data must be obtained from actual body measurement and movements involved in the different operations that will be performed at the table. Prepare drawings and a model of your design as outlined in the design specifications. Make an estimate of the manufacturing costs, sales price, shipping weight and other pertinent information.

(3) Playground Apparatus

Your company has asked you to design a playground apparatus that could be marketed for home or for public playgrounds. The potential of this market will depend to a great extent on the originality and uniqueness of design. The unit should be economical to ship and assemble.



Display Illustration
"PLAYGROUND APPARATUS DESIGN"

The apparatus must be sized to accomodate the age group for which it is designed. Consider the types of activities enjoyed most by this age group while alleviating the possibility for accidents or injuries. Consideration should be given to durability, multi-uses, eye-appeal and function.

Estimate the manufacturing cost, sales price, shipping weight and other pertinent information. Make a study of the market potential for your design including numbers that could be sold. Determine who your potential customers would be and how they could be made aware of your new design.

(4) Hunting Seat

Many deer hunters prefer to hunt from a tree above the ground where they will have less chance of being detected. Your company would like for your engineering team to develop a portable seat that would attach to a tree and provide a comfortable seat fulfilling hunting requirements.

Display Illustration
"HUNTING SEAT DESIGN"

You should analyze the size of the chair and the weights to be supported. Determine the desireable heights for suspending the seat, features that would add comfort and convenience. Some assessment of tree trunk sizes would be helpful in designing the seat. Suggest a method of climbing the tree and installing the seat. Perhaps the seat could be designed for use on the ground at a campsite.

Your design must be an outgrowth of analysis of the movements involved in the hunting process during a period of several hours. Prepare drawings and a model of your design as outlined in the design specifications. Make an estimate of the manufacturing costs, sales price, shipping weight and other pertinent information.

Class Organization

A more meaningful experience would be provided the student if he was able to solve these problems (continued on Page 35)

as a member of a design team that simulates an industrial approach to the design solution. Each class of 36 students was divided into teams of three who were assigned four free periods during which they would arrive at their solution. Emphasis was placed on working within a specified time limit as part of the problem.

Problem Specification

The teams were required to analyze their problem for its total requirements. They were to develop their design through sketches and graphical techniques to enable full communication of their ideas. Their solutions were to be analyzed graphically to determine limiting design stresses through vector analysis when applicable. A market analysis was conducted to determine information concerning the market potential including members, ages, and income brackets of the consumers for which it was designed. A cost analysis of the completed product was required to consider weights, volumes, shipping costs, advertising expenses, wholesale and retail costs. These estimates were only rough guesses, however, this introduced the student to an evaluation of factors unfamiliar to him.

The total findings were presented in the form of a technical report with the procedure of approach outlined in the text with graphical presentations of data and findings with market analysis information. The necessity for a thorough engineering report to explain the engineer's activities became rather apparent at this stage of the problem.

A complete working model was specified to carry the conceptual idea through to its finished stages. Models enabled the students to further analyze and evaluate their designs and were also helpful to them in communicating their ideas to others. Models were made mostly from balsa wood and other readily available materials, however some models were quite sophisticated.

Results

This method of presenting design problems as a vital part of engineering emphasized the importance of engineering graphics as a means of achieving a workable design. Graphics was also a necessary medium for displaying data and statistical information in a form suitable for interpretation in an engineering report.

An example of a hunting seat design is shown as a scale model in Figure 1, that was constructed from aluminum scraps furnished by a local manufacturer. This team also completed a full size prototype of their design for further analysis and modification. The seat was designed to have a dual purpose of serving as a back pack in addition to its major function as a tree seat, Figure 2. A thorough analysis of the manufacturing and overhead costs was made by the design team for producing the final design. Their engineering report included a survey of the potential consumers of products of this type, the number of hunting licenses sold in the state, hunting habits, and other information of this nature that would affect the economics of manufacture. The general response of potential customers was sufficiently favorable to this product that a patent is being applied for by the design team.

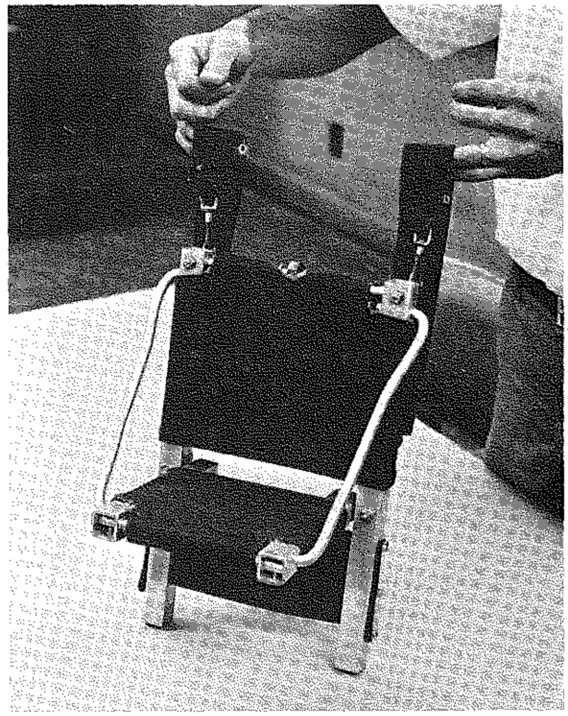


FIG. 1

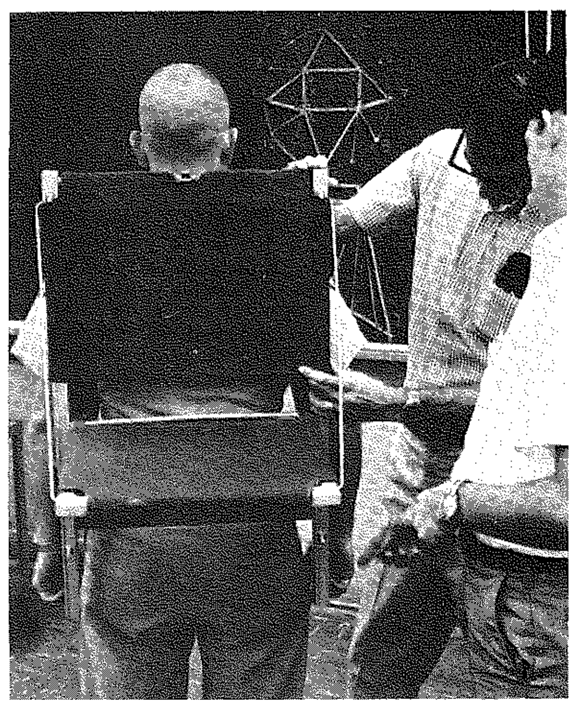


FIG. 2

(continued on Page 36)

One team's solution to the home caddy is shown in Figure 3. This balsa wood model demonstrates a unique linkage system that is operated at the handle of the caddy, Figure 4. A dial can be turned to collapse the wheels for easy storage.

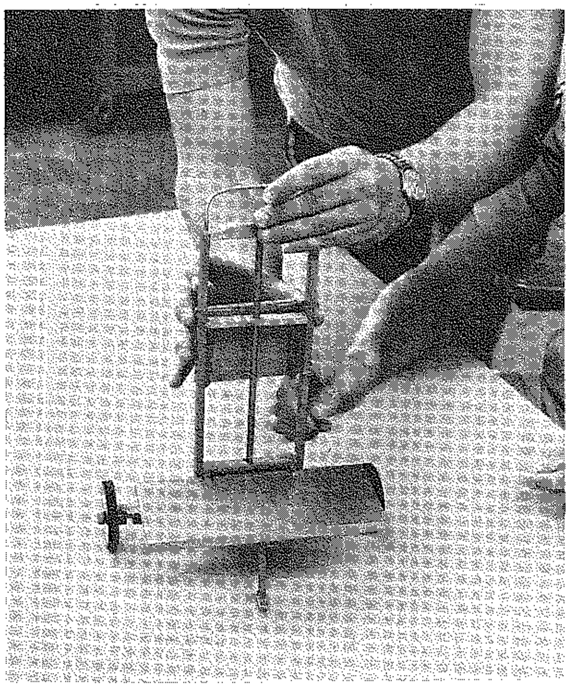


FIG. 3

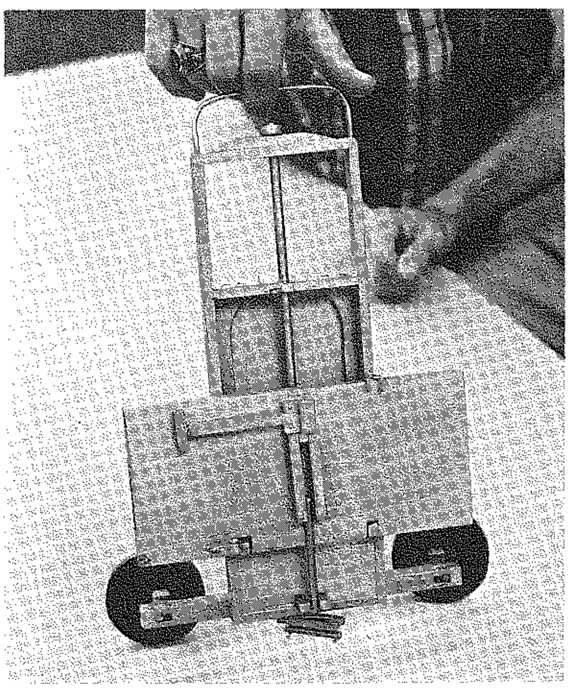


FIG. 4

Many unusual and effective designs emerged from this series of problems while each solution was different. Competition among the teams created an environment more stimulating than the usual classroom situation. The final step was the presentation of the completed designs before the class as depicted in Figure 5. Graphical displays and flip charts were used to sell ideas and emphasize design features. The entire class participated in asking questions and making comments after each presentation which served to develop criteria for evaluation of an engineering design.

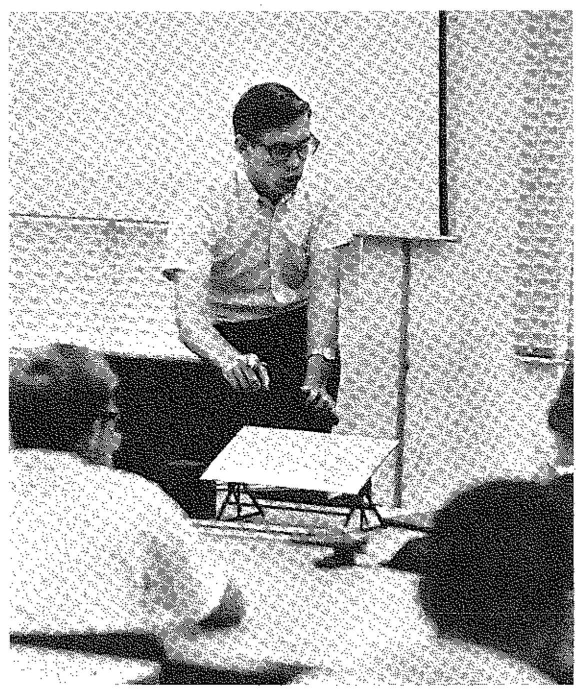


FIG. 5

Conclusion

The assigned problems, (1) hunting seat, (2) playground apparatus, (3) drawing table, and (4) home caddy, seemed to involve a proper blend of ingredients to provide a basis for an elementary design problem that incorporated the basic steps of the design process. Graphical principles offered the best means of approaching these problems with applications of vector analysis, descriptive geometry, sketching, working drawing and the presentation of data.

Problems selected for inclusion as design projects in engineering graphics courses should be of interest to the student while being within their scope of knowledge. Emphasis should be on the organization and procedure for developing a completed design involving creative solution in a systematic manner. Properly selected problems will enable an engineering graphics class to gain a better grasp of graphical fundamentals while receiving a working knowledge of engineering design. Engineering Graphics appears to be the best vehicle for introducing the freshman to engineering and design.

MID-WINTER MEETING

TAMPA, FLORIDA

The annual meeting of the graphics division of the A.S.E.E. will be in session at the International Inn, Tampa, Florida from January 18 - 20, 1968.

Early arrivals will be greeted with customary southern hospitality; free orange juice will be dispensed to one and all. A tour of the University campus with a stopover at the Engineering College and the Technitarium are the order of the day. The tone for the session will be set by a display of "Cosmic Fireworks" at the University Planetarium.

On Friday morning, members of the division will discuss the Dr. Jekyll-Mr. Hyde aspects of graphic curriculae. In the afternoon selected topics by industrial and educational leaders are so designed to induce one to eventually travel by tube, interspace missile, or submarine.

After a bit of socializing Saturday morning, Herb Yankee will present core studies of design projects and summarize an evaluation of the division's summer school.

Plans for our ladies incude a tour of Florida's Cypress Gardens, America's tropical wonderland is famous coast to coast for lovely Southern belles, exotic tropical flowers, and entertainment in the form of a ski ballet by beautiful aqua maids. Don't forget the cameras.

Busch Gardens on Saturday morning presents an opportunity to travel by monorail over an Afridan veldt and an American range to see wild animals in their natural habitat. In the gardens many brilliantly plumed birds provide color seldom seen elsewhere. Many are trained to do acrobatics and dancing and are presented several times daily in an open air amphitheatre. Do enjoy a complimentary drink of Budweiser or Michelob. And, ladies, let's not forget those famous gourmand restaurants that are included in the itinerary.

Further entertainment is provided for all who come to Florida vacationland. Fishing, golfing, boating and skiing will be arranged, if requested, at a nominal fee. For those who indulge in the "Sport of Kings" or Jai Alai, and for those who like to go to the 'dogs', there will be complimentary tickets at the registration desk.

The weatherman says our skies will be sunny and the temperature an average 72 degrees. Plan on a swim in the Inn's king-size heated pool, a stroll along the beach. Do what you so desire, but do come and bring the family.

A CORRELATION BETWEEN PERSPECTIVE and SHADOW

by

NEAR POINT SOURCE OF LIGHT

N. VITIAL
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Regional engineering College
Rourkela, India

Among the projections in Practical Geometry, the conical ones are the most interesting, in which the projectors converge to a point. The famaliar examples are the perspective and the shadow by near point source of light.

A perspective of a body is the cross section of the pyramid of sight lines by a vertical plane (picture plane) interposed between the body and the observer.

A shadow of a body by a near point source of light on a plane (shadow plane) is the trace of the pyramid of rays of light on it. Hence these are identical projections which is further clear from the following comparison of their elements.

Perspective projection	Shadow by a near point source of light
1. Observer (Station point)	Source of light
2. Lines of sight	Rays of light
Picture plane	Shadow plane

A shadow also can be seen as a perspective projection when the picture plane is placed away from the observer beyond the body. Therefore it should be possible to apply the usual methods of perspective in obtaining the shadows cast by a body due to a near point source of light. The following illustrations (in first angle projection) indicate such possibilities.

In Fig. 1 ab, a'b', a"b" and s, s', s" are the orthogonal projections of a straight line AB and station point S (or source of light) on horizontal plane (HP), vertical plane (VP) and auxiliary vertical plane (AVP) respectively. The AVP serves here both as a picture plane and shadow plane. $a_p b_p$ is the persperctive of the straight line as obtained by the fundamental method and $a_s b_s$ the shadoe of it on the AVP. These are identically the same. It ca also be noticed from the figure that the shadow obtained is exactly in the same manner as the perspective drawn in a second method with the help of the projection on the picture plane. Similarly if the shadow is possible on any other plane, it can be obtained by imagining the whole system of planes, for easiness of understanding, to have the particular shadow plane as the picture plane and drawing the perspective on it, using the orthogonal projections on another two perpendicular planes. This is shown in Fig. 2 in which the shadow is completely on the HP.

In Fig. 2, a cylinder and station point (or source of light) are shown in projections. For simplicity, the station point is chosen to be centrally opposite the cylinder in plan. The rays corresponding to the top and bottom circles of the cylinder form oblique cones whose traces on the HP when combined together by tangential lines, constitute the shadow of the cylinder on the HP.

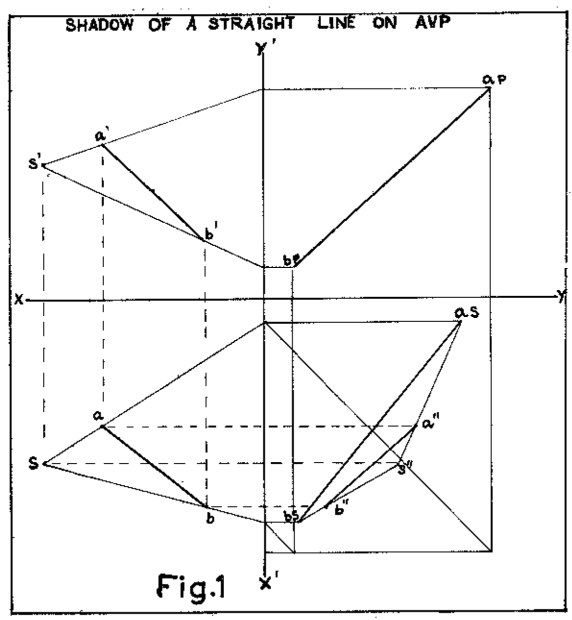


Fig.1

(continued on Page 39)

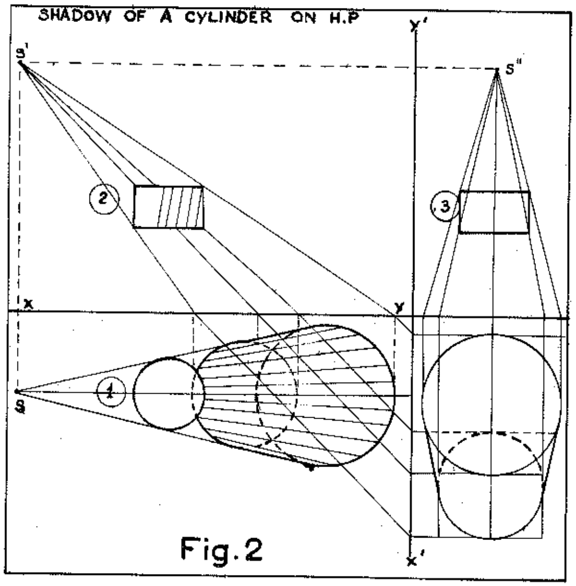


Fig.2

Since shadow is occurring fully on the HP, taking the ground line XY as the picture plane and using the projections 2 and 3, the perspective is obtained which is identically the same as the above shadow. Even if the shadow accurs on more than one plane, the perspectives obtained by taking the shadow planes independently as picture planes and using the necessary **orthogonal** projections, will give the required shadow. This is shown in Fig. 3 in which the shadow of the cylinder is occurring partly on the horizontal and the vertical planes.

In Fig. 3 the projections of the cylinder and the source of light to give shadow on both the HP and VP, are shown. Taking XY as the picture plane and using the projections 2 and 3, the perspective obtained gives the complete shadow $A_1B_1C_1D_1$ on the horizontal plane, of which $A_1B_1C_1$ is only possible on it because of the presence of the vertical plane. Similarly taking XY again as the picture plane and using the projection 1 and 2, the perspective obtained gives the complete shadow $A_2B_2C_2D_2$ on the vertical plane of which $A_2B_2D_2$ is only possible on it because of the presence of the horizontal plane. Hence A B C D shown separately is the combined shadow of the cylinder occurring on both the HP and VP.

(continued on Page 41)

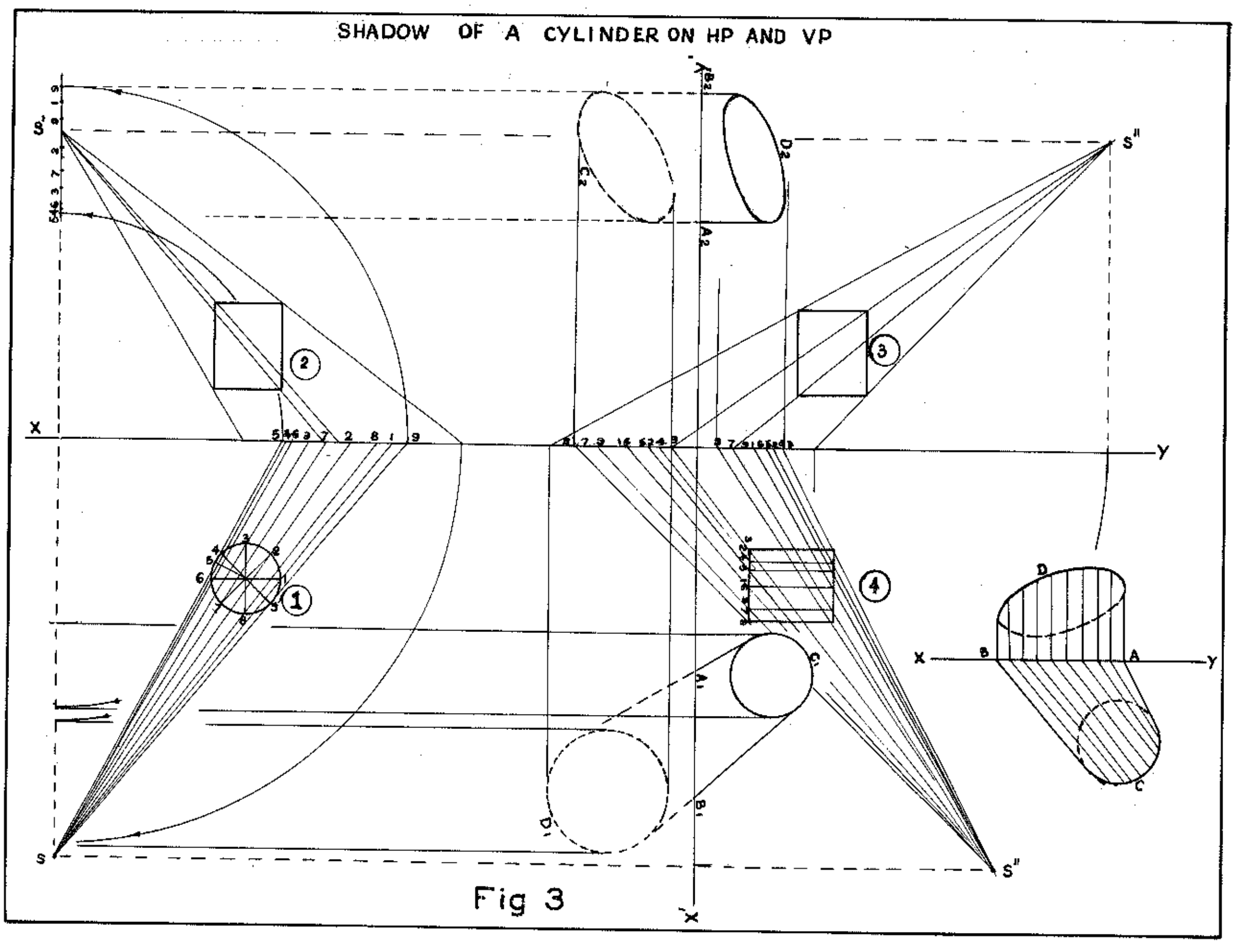
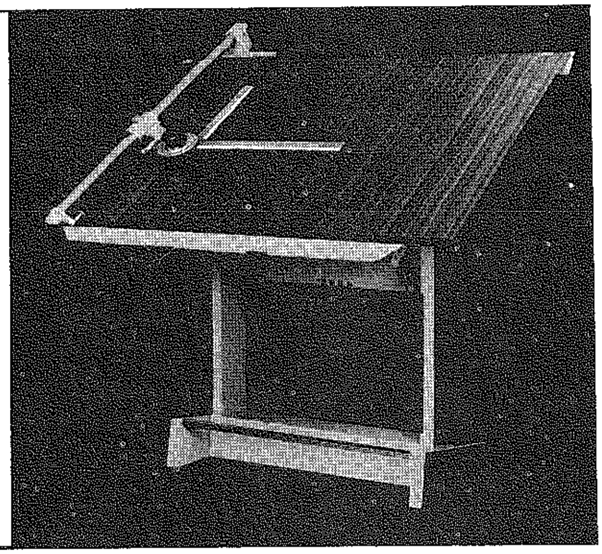


Fig 3

The UNIC CL Drafting Table

It's what happened when design engineers did something for themselves.

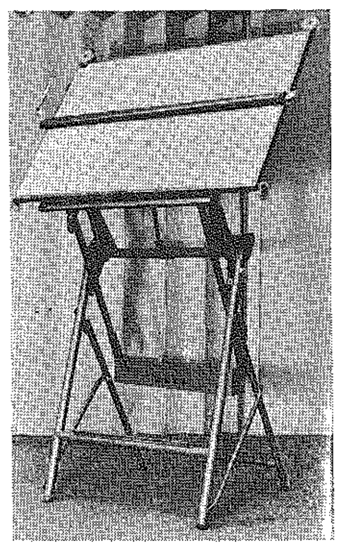


When engineers put together something for engineers, there's no margin for error. Trouble is, there's usually no margin for looks. The UNIC CL Drafting Table is different. It's the complete workhorse that stayed good looking. And Formica almost everywhere keeps those good looks looking good practically forever.

But the big question is how is it to work with? Try this for size:

- UNIC CL Drafting Tables are available with big 36 x 50" and 40 x 60" boards — with laminated cores, lacquered wood veneers and hardwood edges.
- The UNIC has a single, hand-controlled lever that takes care of all positioning. When the lever selects a position, it's there to stay — absolutely rigid!
- Then there's balance. Nothing else comes close; perfect balance is the prerequisite of any UNIC Drafting Table. Whether carrying a straight edge or a drafting machine, a finger's touch will control the table. The reason? An adjustable counterbalance with stabilizers accurate to fractions of an ounce.

Write for complete information.



Another popular UNIC model is the JS series. Constructed of round steel tubing, they're ideal for smaller board sizes. Other features identical to CL models.

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As the vanishing points method of perspective requires the least number of projections and involves lesser construction lines, it is desirable, wherever possible to obtain the shadow by the vanishing points method with the shadow plane as the picture plane. In fig. 4, the projections of cube and the station point (or the source of light) to give the shadow only on the HP, are shown. Taking HP as the picture plane, XY as the base line and using the projections of the cube on VP, the perspective obtained gives the shadow on the HP. For the purposes of comparison of the construction work involved, the same shadow is obtained by the usual method of traces.

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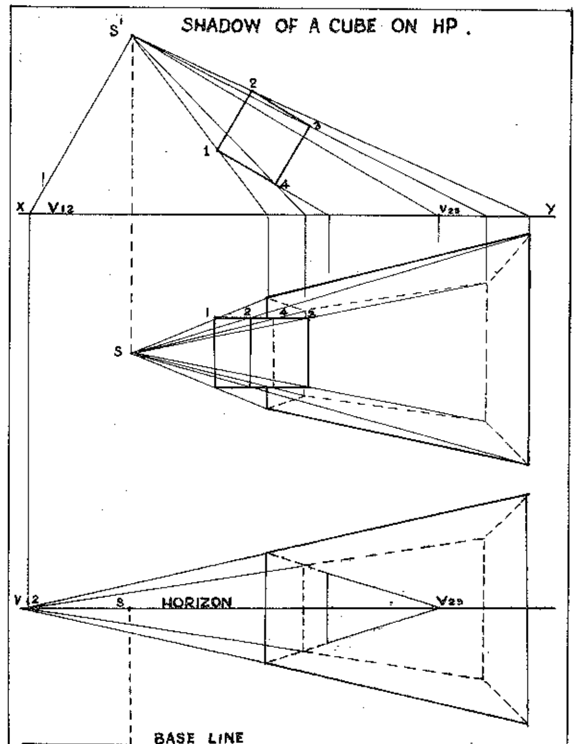
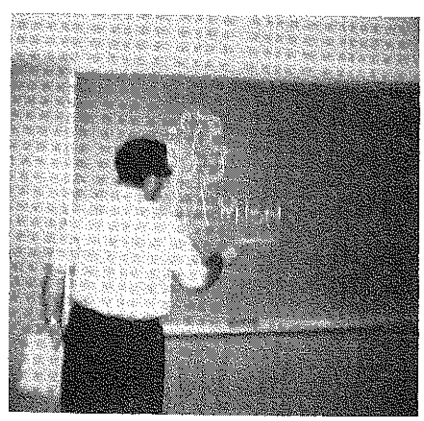


Fig.4

A B S T R A C T

The shadow of a body by a near point source of light is usually obtained by the method of traces on the shadow plane. It is shown that the shadow by a near source of light is the same as the perspective obtained by taking the shadow plane as the picture plane, placed away from the observer beyond the body. This is illustrated by giving examples with a straight line, cube and cylinder with suitable positions for the source of light, to obtain the shadow on one or two planes. The advantages of applying the vanishing points method of perspective, which requires the least number of projections and involves lesser construction lines, in obtaining the shadow, are indicated.

ADVERTISING INDEX



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