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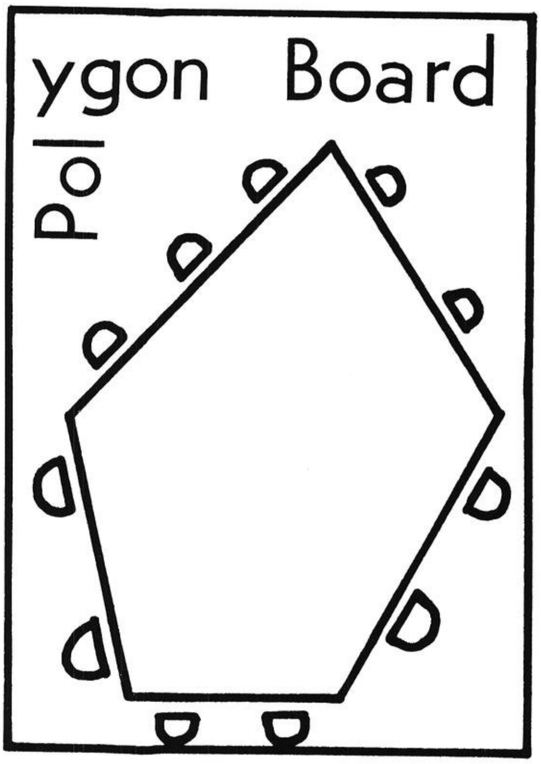
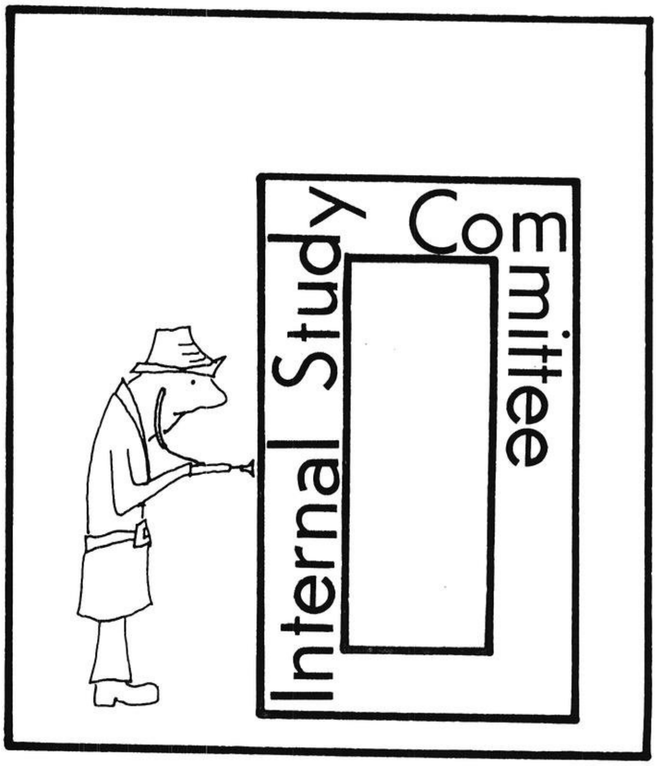
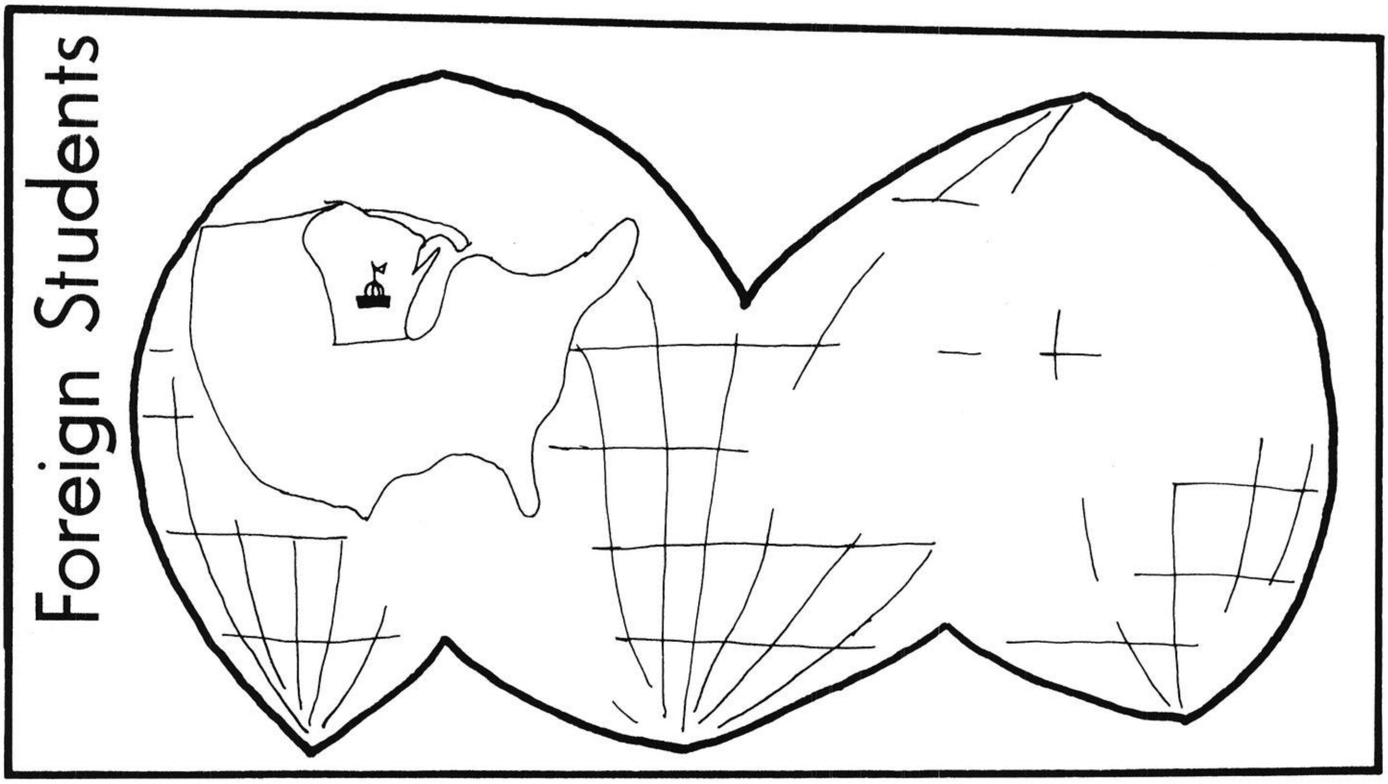
OL. 73, NO. 4 MEMBER ECMA 35 CENTS JANUARY, 1969







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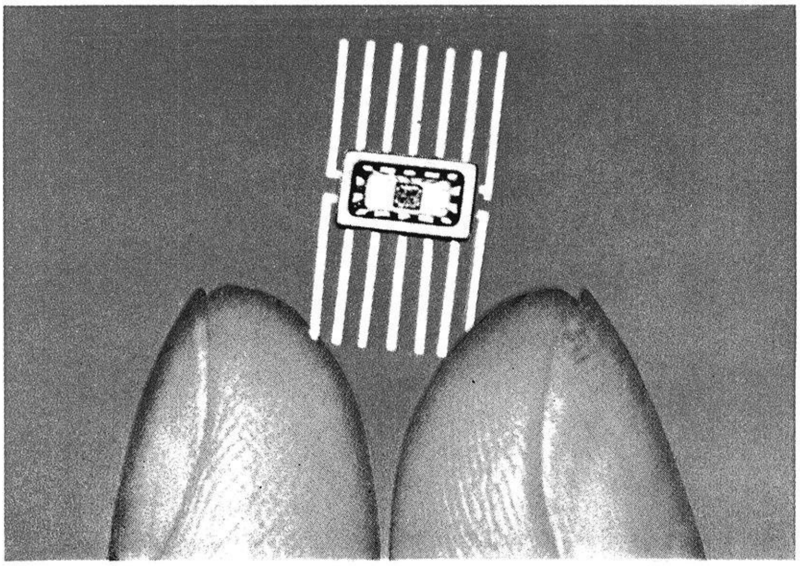

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wisconsin engineer

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Are You There?

by Abby Trueblood

The typical reaction to editorials we print in the *Wisconsin Engineer* is a complete lack of response from our readers, and I find this both puzzling and disturbing. While I, so far, have been able to sleep well assured that I face no torrents of letters from irate readers in the morning mail, nor telephoned bomb threats in the early hours, the seeming apathy which I *do* sense is a good deal more annoying. Letters to the Editor(s) are rare in this office, and, ordinarily, those which we do receive are very rarely with respect to the editorial page. The most recent barrage of letters from readers was when we tried a new "gimmick" and threatened to eliminate the Joke Page. I am sure that the small number of letters cannot be construed as evidence that the readers can find no fault with us, nor am I convinced that, with regard to editorials, opinions expressed in the *Wisconsin Engineer* are regarded by our engineering audience as indisputable truisms.

I would like to make it clear what I feel the purpose of editorial comment is. In the first place, editorials serve as an opportunity for the writer to publicize his views and, in the case of a highly specialized journal, to direct those views expressed to a particular audience. Editorials also have something of an educational purpose, for they serve to initiate what should, hopefully, become a dialogue between author and reader. It is *solely* for this end of creating a dialogue that I feel an editorial should be written. Apparently, though, our readers do not feel that this function of editorials is very important or, perhaps, they do not recognize that this *is* a purpose of editorials.

Responses from our reader preference cards in the November issue indicate that the majority of our readers wish to continue editorial comment, and, although they also appear to want to retain letters, there has not been a similar boom in letter-writing to match it. These answers could mean two things about our readers: It could mean that at least a good number of readers do not bother to read the editorials and, cannot, therefore, become particularly outraged by them and, hence, no letters concerning them reach our office. It could also mean that additional readers desire to be "spoon-fed" ideas without having to do any thinking on the matters themselves. If the former is the case, then I can do little more than feel disappointed that you are not reading that part of the magazine. You are, after all, free to read or not read anything in the magazine you please, and, frankly, I can be glad that there is at least *something* which interests you. On the other hand, if you desire to do little more than read what someone else has to say on an issue and to accept it or not accept it without so much as a comment, then you have failed to see the more subtle purpose of an editorial.

Doing More Than Selling Sliderules

George Doremus on Polygon

Polygon Engineering Council is *the* recognized student governing body on the engineering campus. This statement should not be taken to mean that the council represents a majority of engineering students. The council, on the contrary, is composed of two representatives from each of eleven professional societies whose combined membership totals about 800 students or 30 per cent of the total engineering body. Without a doubt, this is the largest student opinion group on engineering campus.

Having defined the composition and constituency of Polygon, it is now necessary to answer the question that the council members are most often asked — what does Polygon do? The standard answer to this question is: a lot of behind-the-scenes work. To an extent, this is true, although Polygon does coordinate the St. Pat's dance and activities and initiates the Engineering Exposition. Some of the more unobtrusive and yet necessary jobs that Polygon handles are representing the engineering body in student senate, interviewing both students and faculty for college of engineering awards, selling reduced price slide rules, and acting upon student suggestions for improvements.

Supposing that such a list of activities still breeds indifference and pained glances of mockery (as it has in the past) then I would offer you something to really sink your teeth into if, as I am told, that would make Polygon more credible.

Three new activities have recently been, or soon will be, initiated by the council. These include a new course and instructor evaluation program, an outstanding teaching award program on a departmental and an all-campus basis, and a student-faculty interaction committee for improvement of both social and academic relations between students and faculty.

The course and instructor evaluation program will bear no resemblance to past Polygon evalua-

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tions. It will presumably be carried out in conjunction with WSA and will be aimed at obtaining objective results which will be published and distributed to the students. (Past evaluations have gone directly back to the instructor to be used as seen fit.) In order that the new evaluation be carried out in a manner so as to emphasize *constructive* criticism of both course work and instruction, a great number of people and a great amount of participation will be necessary. Call the play on the field, not from the armchair.

Outstanding teaching awards may be a major step toward improving the quality of engineering instruction. A uniform set of requirements, based solely on teaching performance, will be drawn up by a committee of the council. Guided by these requirements, an outstanding instructor will be chosen from each department. From this group of distinguished instructors, an all-engineering-campus award winner will be chosen by Polygon on the basis of criteria not yet established. Once again there is a tremendous amount of work to be done to make this idea a reality. An opportunity for a maximum departmental participation exists if you want to help Polygon accomplish this task.

Program number three, student-faculty interaction, involves an area of student interest which, although much superior here to that found on the Hill, could still be greatly improved. Many may say that this presents no problem on our campus, but when a good number of seniors each year do not know three professors well enough to submit faculty appraisals for placement to them, then I can only assume that true student-faculty interaction is minimal. The committee being set up to deal with the interaction problem has a formidable job before it. Only your suggestions and aid can gradually close the student-faculty gap.

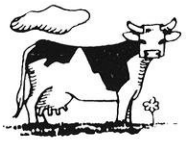
Polygon is doing something! And it's about time for some of you outstandingly apathetic critics-on-all subjects to quit grumbling about weak student governments which accomplish nothing. We can do as much as *you* want to see done, but it takes people who aren't going to run from responsibility (into the nearest bar where they talk about not having the time to get involved in anything).

Actively participate, attend Polygon's meetings (with suggestions and complaints) or drop your suggestions into either of two Polygon boxes located in the Mechanical and EE lobbies. If Polygon is weak or hung up in your opinion, ask yourself when you've ever tried to improve it.

by George Doremus
President, Polygon

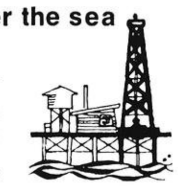
How to keep a cow's mind on milk. Instead of flies.

An informal report on a few current projects at Shell. Some of them might seem like offbeat work for an oil company. But this is a company that contributes broadly and significantly to society. A company of experts that brings out the best in its engineering, scientific and business people.



Shell scientists have come up with a vast improvement over even the most talented cow tail. It's called VAPONA® insecticide. A plastic strip impregnated with it will kill flies in a cow stall for up to three months. And VAPONA® insecticide combined with CIODRIN® insecticide keeps cows fly-free 24 hours a day—even out in pasture. Give you ideas for further applications?

Energy from under the sea



Shell is heading into ever-deeper water in the search for oil and natural gas. Recently we designed and installed permanent drilling/production platforms as tall as a 34-story building, with still bigger structures in the works. And we are operating in considerably deeper water from floating platforms. We are also searching on land in 16 states to help meet burgeoning energy needs.

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The main trouble with detergents is they don't go away. They pollute streams, make fresh water foamy. The solution: detergent compounds that organisms can consume. These "biodegradables" clean clothes just as effectively, but keep streams free of detergent foam. Elsewhere in the chemical part of our business, Shell research has resulted in a wealth of plastics for home and industry, and fertilizers to alleviate food shortages.

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The Internal Study Committee

by Jo Ann Albertson

Two years ago, in 1966, Chancellor Robben Fleming sent a charge to each of the colleges at the UW–Madison. The charge consisted of eight questions dealing with teaching, grading, student-faculty relations, and methods for improving the level of instruction. For two years the ISC's worked on these questions and wrote recommendations to the faculty. In the College of Engineering these recommendations included the institution of pass-fail, recommendations on teaching assistants and their qualifications and training, setting up of a Committee on Engineering Education to study the methods of instruction and their effectiveness, and general suggestions for better student-faculty interaction.

This year the ISC has some new faces and new ideas, but our first job is to present to the faculty the recommendations from the previous two years. Much of our work to date has been packaging the recommendations in a form acceptable to a majority of the faculty—and that's not an easy task. But we feel these recommendations to be extremely important to the college. The Committee on Engineering Education (COEE) which as yet has not been approved by the faculty will consist of both students and faculty and will study teaching assistants, flexibility in student programs (i.e., co-op study, foreign study, independent study, etc.), effective teaching methods, and other relevant areas, and will review the faculty advising system. An ISC sub-committee is studying instructor-course evaluation which, with Polygon and WSA, is working on an engineering campus evaluation to be undertaken in the near future. Another sub-committee is studying methods of furthering student contact with faculty. It will shortly be recommending departmental coffee hours, more faculty participation in professional societies and fraternities, and a general effort to encourage students to discover that professors are human.

Much of the above comes under the heading of "Old Business," but that is a misleading term. Every year a new group of students and faculty get together on the ISC and new thoughts are generated. This year Dean Wendt has asked us to continue our effort to improve student-faculty interactions and communication and to make the educational experience more meaningful for the student. And, as always, the main emphasis will be on the student.

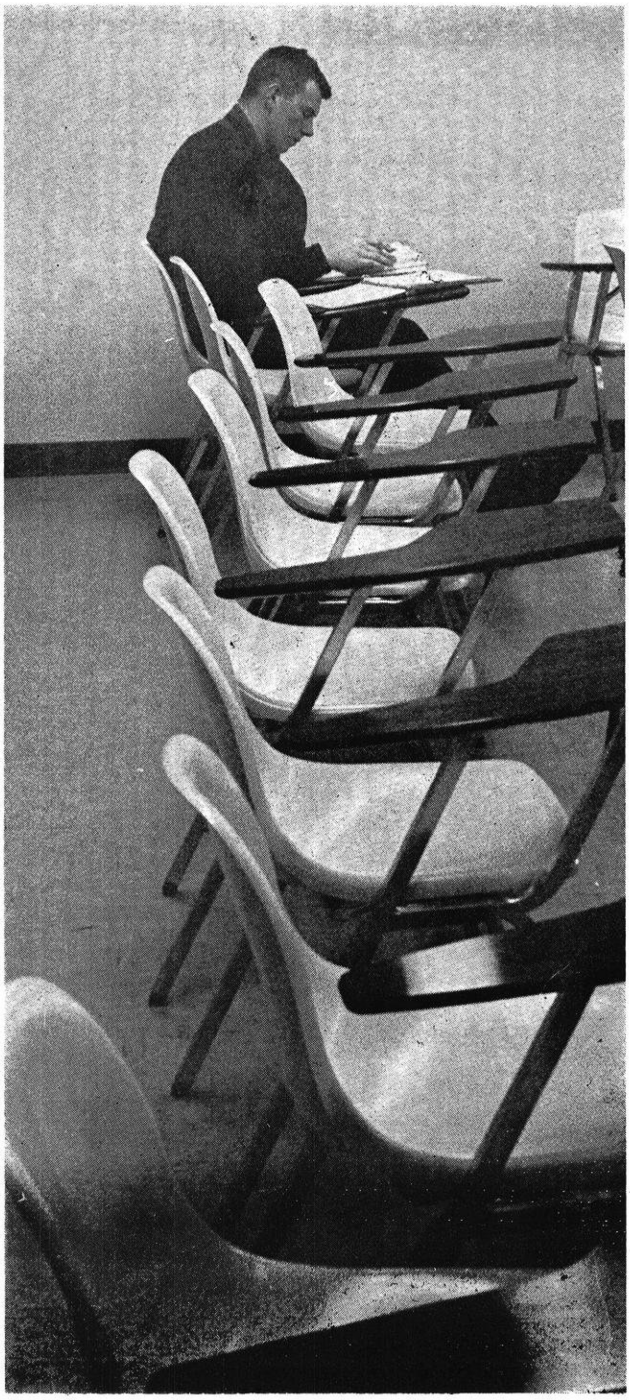
Jo Ann Albertson is a senior in Nuclear Engineering from Mt. Horeb, Wis. In addition to being a member of the Internal Study Committee, she also belongs to the American Nuclear Society, and Student Committee for Public Relations, and Polygon Engineering Council.

Members of the Internal Study Committee are:

- D. W. Novonty, EE, Chairman
- Jo Ann Albertson NE-4
- George Doremus E-5
- L. B. Greenfield, Admin.
- R. A. Greiner EE
- John Hulman CiE-4
- Geoffrey Jackson ME-4
- P. G. Kessel EM
- A. J. Kuhn CiE
- R. A. Moll MME
- W. A. Moy IE
- J. A. Niemeyer E-5
- G. A. Sather ChE
- Steve Smith EE-4

Students Who Become Teachers

by Edward F. Obert
Professor of Mechanical Engineering



Students with the aptitudes to become successful college professors can be recognized to a limited extent in the high schools, and much more strongly, in the junior and senior years of college. What is the primary characteristic of these embryo teachers of engineering or science? *It is a love of learning without regard for the passage of time.* If study is an enjoyable *recreation, you* have the basic prerequisite for college teaching. The joy of learning — the joy of pushing forward (or just denting) the frontiers of knowledge — the joy of experimentation—the joy of helping others—these are both the duties and the rewards of the professor.

DUTIES OF THE ENGINEERING PROFESSOR

Engineering education offers, more than any other profession, the broadest spectrum of activities, with the widest self-selection. These activities can be divided broadly into four general divisions: *teaching, research, consulting,* and *administration.* Each of these divisions can have many facets: *Teaching* may be at the undergraduate or graduate level; it may be informal with one or two students making up the group; it may be formal, with lectures to hundreds of students; it may be *guidance*—steering graduate students towards ends which are not yet evident (even to the professor). *Research* may be by groups or by individuals; it may be highly theoretical or highly experimental, or a combination of these; it may be educational: new subjects and new laboratories to be developed. *Consulting* may be technical, directed at a specific problem of an industrial firm or a government agency; it may be technical-educational to inform other universities (and other countries) of advances in research and educational methods. *Administration* may be the general supervision of a teaching unit (such as a department, or a division of the department, or the entire college of engineering); it may be supervision of a research unit (a group of professors and graduate students working on one project); it may be the supervision of graduate students working on many projects. Administration includes the preparation of proposals (contracts) for industrial and government sponsorship of new ventures in research and teaching, and also being the steward of literally millions of dollars of research or teaching equipment and facilities.

Other duties of the college professor are student guidance (personal problems) and student counselling (educational problems), at the high school, college, and graduate level. He must also devise new courses, new curricula, and new laboratories as new phenomena are discovered. He must write papers and attend conventions to keep the world (and himself) informed of the

(continued on next page)

progress in research, and he must write books so that students can be properly educated. Too, as a member of a community, he has civic responsibilities.

Although it is not unusual for the engineering professor to do *all* of the foregoing items (but not *all* at the *same* time.), the professors, and the colleges, tend to be divided into two classes (with no sharp dividing line) depending upon their primary function: Undergraduate or graduate education. In a college without a graduate program, the principal duty of the professor is formal teaching although research and consulting must be important adjuncts if he is to keep abreast of his field. His program might be to teach three or four subjects (12 to 20 contact hours per week), and do *individual* research and consulting. His research would tend to be theoretical rather than experimental (since research equipment is expensive). He may write books, experiment with teaching methods, or consult with local industrial firms. With a graduate program, emphasis shifts towards research and the individual instruction of graduate students. In a major college (almost invariably a unit of a large university) the primary goal of the professor (any age) is to be a leader in his specialty. This leadership is established when the research of the professor (and his team of graduate students) is evaluated and praised by others (and publication is a prerequisite for universal evaluation). It follows that the major professors in large universities have little time available for formal teaching (3 to 6 contact hours per week) and much of the undergraduate instruction is done either by teaching assistants (graduate students) or by the use of large lecture sections.

(Whether you, the high school or college student, should now aim for graduate versus undergraduate teaching is best left for the future to decide since the *same* educational preparation is demanded.)

COLLEGE PREPARATION

It is not at all unusual to hear students being advised to forsake engineering as a career unless they enjoy and have received excellent grades in mathematics and physics. Such advice is often unfortunate, if not wrong, since an engineering education (BS and MS) is the broadest background for the usual man who must earn his living in the technical society of today. Industry can hire over 50,000 graduates per year for the many engineering jobs (design, research, etc.) and the many more jobs that require engineering decisions with a minimum of mathematics (sales, management, etc.). Moreover, the students with poor grades in the sciences may be reflecting poor teaching of these subjects in the high schools (and the colleges) rather than a lack of aptitude. Many of our most creative engineers are relatively poor mathematicians (and many of our PhD students "discover" [i.e., enjoy] mathematics relatively late in their training).

On the other hand, the college professor must not only be creative, he must live and work in a community of scholars where mathematics is the universal language. If you intend to be a college professor (or if you intend to do original work in your field of research), not only is the PhD degree a prerequisite, but also, a strong minor in mathematics. Planning should start at the undergraduate level. The undergraduate curricula in engineering require a calculus sequence which may or may not include a fair amount of differential equations, statistics, linear algebra, numerical analysis, and computer science. Your job as an undergraduate is to cover all of these subjects with the help of free electives (or special dispensation of your engineering department). During the graduate years, the usual two-course sequence of advanced calculus is necessary plus separate courses in complex variables and vector analysis, and advanced courses, say, in numerical analysis (or in courses dictated by your research interests). Success is in sight when a course in real or complex analysis is enjoyable.

What about courses in physics? The undergraduate curriculum will dictate the primary courses of study while advanced courses should be delayed until you reach mathematical maturity (usually the second year of graduate work).

What about courses in your major department? Here your advisor (and the department) will specify a required sequence; any free time will be filled with mathematics, physics, and a possible elective or two of interest in another department.

Should I go to a small school or to a large university for my undergraduate training? It all depends on the *particular* small school and the *particular* university. In general, I would prefer the small school if ECPD accredited (better and more personal teaching) for undergraduate work, while the large university is practically demanded for a solid PhD degree. Which of the large universities to select, depends upon your field of specialization. Here your advisor can help, or see surveys such as "An Assessment of Quality in Graduate Education." (American Council on Education, Washington, D.C.).

Who will pay for your graduate education? If your undergraduate average is 3.5 (of 4.0) or higher, fellowships should be forthcoming from several schools (but not necessarily from the school of your choice) (apply before February1). Teaching assistantships are relatively easy to obtain (although several extra years in residence will be required).

Does the college professor have to be a brilliant speaker, quick of wit, good-looking, able to withstand the crossfire of eager questions? Not at all. College students respect a well-organized lecture, not verbal fireworks. Check the *good* teachers that you have already experienced and draw your own conclusions.

MOST IMPORTANT

I have delayed until the end to state *why* you should want to become a teacher. In industry, one has the satisfaction of a job well done. These same satisfactions are there for the college professor and, in addition, one other: The undying gratitude of the students you have helped—not all of the students—but a goodly number. This is the bonus reward for being a professor.

(This article first appeared in the February, 1968, "Jets Journal")

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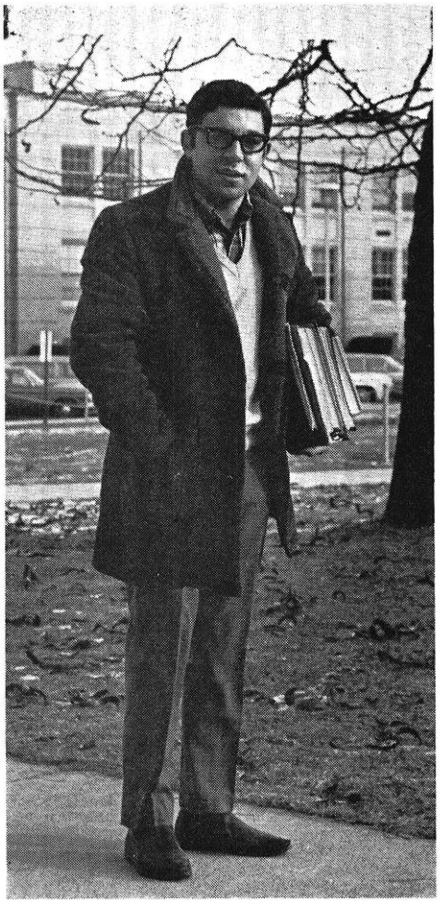


Foreign Students

Massoud Mishouil is a senior in Nuclear Engineering from Tehran, Iran. He is a member of Tau Beta Pi, Phi Kappa Phi, and the Wisconsin Engineer *business staff.*

by Massoud Mishouil

The percentage of foreign students at the University of Wisconsin is one of the greatest in the nation. Language barriers and deficiencies in the industrial development of their home countries urge many of them, mostly graduate students, to enroll in the College of Engineering.

On weekends, holidays and vacation, foreign students are sometimes the only ones in libraries and study halls, although some of them do stay home to watch television or stop at a tavern. This isn't unusual since most of us came to this country to study and learn. Very selective admission to the University is one of the reasons that this group is hard working. Most of the foreign students come from the top twenty-five percent of their class, while the state students are admitted much less selectively. Although in a given freshman class, foreign students enrolled in Engineering compose less than one or two percent, the number exceeds ten percent in the senior year. This increase is due to better background in high school, conscientious work during college, and not switching colleges in the University. Many Americans enrolled in Engineering as freshmen transfer to Letters and Science after a few semesters, while the situation is usually the reverse for foreign students.

Financial difficulty is one of the toughest obstacles faced by foreign students. High relative costs in the United States pressure foreign students into studying harder. Regulations from our embassies and fear of losing scholarships and fearing failure of our objectives force many of us to study harder instead of participating more in extra-curricular activities on campus. The lack of opportunities for social education hurts Engineering students more than the other students.

It may not be a bad idea to describe some aspects related to the life of foreign students. Besides English, which is a common difficulty, foreign students have to face a culture, society, and ideas different from their home lands. As a matter of fact, it is an education to be away from home. On the one hand is the challenge of being a good ambassador and a good spokesman for your country. On the other hand, there is the challenge of learning all you can from your sojourn in the United States. The lasting worth of our total experience results from the effectiveness with which we meet these challenges.

As part of my education, I realized that only two kinds of people exist in the world: those who believe everybody is alike, and those who believe everybody is different. In the beginning, I felt somewhat discountenanced when I had conversations like this:

"Where are you from?"

"I am from Iran."

"Oh, Iraq."

"No, Iran . . . Persia."

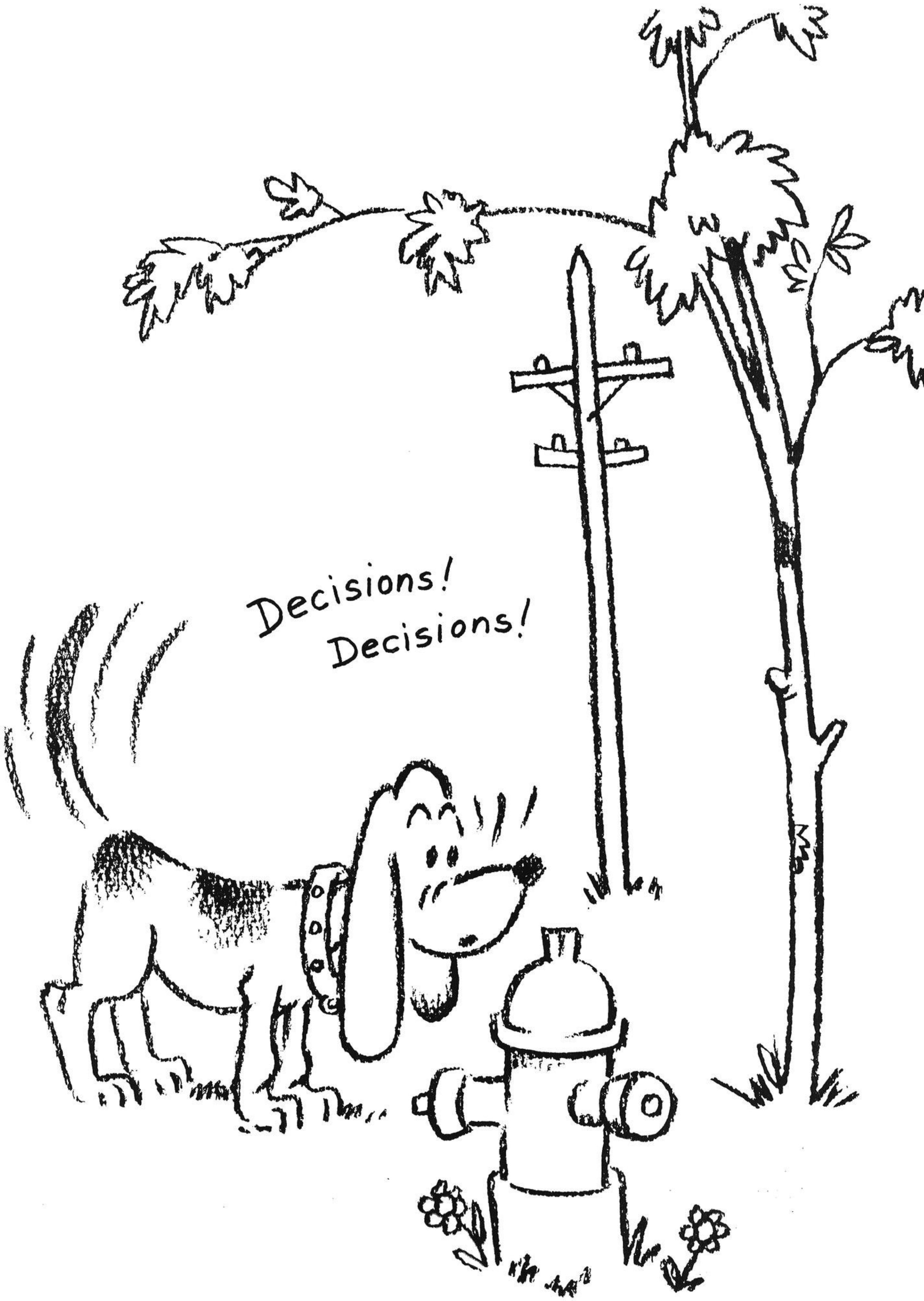
"Aha! Iran, I have read about your country in high school; isn't it in South America?"

"No, your geography is as bad as mine. It is in the Middle East."

"I thought so. How do you like it here?"

"Very much, indeed."

However, after a few years, I found myself becoming accustomed to hearing one of my professors who also hails from the Middle East referring to me as "The Guy from South America." I guess people are everywhere the same.


Decisions!
Decisions!

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EXPO

• 1969 COLLEGE OF ENGINEERING EXPOSITION

by Mary Ingeman

This year the engineering societies' part in the Engineering Exposition is going to be a little different than in past Expositions.

Previously, each society member contributed some arbitrary number of points to his society whenever he worked on Expo for an hour. These points were all totaled at the end of Expo, and the number of points determined how large a share of the profits that society would get.

Also, in pervious years, there were no set criteria for the type of project or what the project should involve.

Both of the areas have changed this year — there is no longer a "point-system" for dividing the money, but, rather, an equal division of profits among all qualifying societies, and there is a definite set of criteria for a society project.

SOCIETY PROJECT — 1969

This year, judging of the society project will be based:

- 60% on originality and appropriateness to the theme
- 40% on presentability and craftsmanship

THE THEME OF THE EXPOSITION

Comparison of historical engineering (Galileo, Copernicus, Harvey, Herod, etc.) to the current frontiers of science — or, really, engineering in depth.

Technology approached without perspective is somewhat vacant. Just a technical display leaves the viewer of a project feeling the ideas he's seeing are somewhat "magic". Actually, many, if not all, of our modern technical ideas have some origin far back in history.

For example, if a society, such as ASME, wanted to do a project on the jet-packs to propel a man through the air, they could show that as early as Da Vinci, plans were made for man to fly under his own power. Da Vinci designed both a set of individual wings and a bicycle-type helicopter as a means of self-propulsion through the air.

DIVISION OF PROFITS

This year, the profits of the Exposition will be divided evenly among the societies that qualify for their share. This eliminates a lot of messy book-keeping and a lot of unfair advantage. It is obvious that a larger society would find it easier to accrue large numbers of points than one of the smaller societies with about thirty members. Also, the smaller societies have much less income and really need more money than the larger societies do.

To qualify, a society must do three things:

1. Enter an exhibit in the Exposition (following the theme outlined above). This exhibit will be prejudged a week prior to the Exposition *only* to qualify for profits. Judging for prizes will be done at the Exposition.
2. Provide two members of your society to serve on a major Expo committee where needed.
3. Sell a proportionate amount of promotional buttons based on total society membership.

What this means, essentially, is that, if ten societies qualified under these rules, then a profit of $1200 would be divided evenly among them, and each society would receive $120.

These new rules were made only after long debate by the exhibits committee members. They would appreciate any comments or suggestions and would be happy to answer any questions you or your society might have.

JOB ENLA

by Dennis Kaetterhenry, IE4

"Higher societies can maintain themselves in equilibrium only if labor is divided; the attraction of like for like less and less suffices to produce this result. . . . We can then say that, in higher societies, our duty is not to spread our activity over a large surface, but to concentrate and specialize it. We must contract our horizon, choose a definite task, and immerse ourselves in it completely, instead of trying to make ourselves a sort of creative masterpiece, quite complete, which contains its worth in itself and not in the service that it renders. Finally, this specialization ought to be pushed as far as the elevation of the social type, without assigning any other limit to it. . . . We have shown above how activity becomes richer and more intense as it becomes more specialized."

In contrast, Peter Drucker has stated four requirements for optimum use of a production employee, which summarizes many years of his research. They are, one, the worker must understand what he is doing and be interested in it. Second, the worker must understand what is going on around him and how he fits into it. Third, he must feel that he is a real member of his working community. Lastly, he must get recognition, prestige, and a chance to participate in the government of this community.

The two paragraphs above illustrate the change, over the last seventy-five years, in management thinking from that of job specialization to that of job enlargement. The first paragraph was written late in the nineteenth century, and the second within the last twenty years. Both are generally representative of their generation's thinking. The term "job enlargement" was first coined by Charles Walker of Yale University, in 1947, after results of studies done at International Business Machines' Endicott, New York, plant. An appropriate definition of job enlargement for this paper is, "the expansion of job content to include a wider variety of tasks and to increase the workers' freedom of peace, responsibility for checking quality, and discretion for method."

What are the goals of job enlargement? The first reason that comes to the mind of many, including managers, line employees, and outsiders, is that job enlargement is a management scheme to increase productivity and thus profits. This is, incidentally, what it has done in most cases. However, these were not the initial nor most important reasons behind its development. Most of the companies that tried it were large and well established, for example, IBM and Sears Roebuck and Company. It might be said that companies had to be in a good financial state before they would be willing to underwrite such a change, because it went against all experience of scientific management. Witness Emile Durkheim in the opening paragraph of this paper and also Frederick Taylor's work. Indeed, two of Taylor's duties of management were to develop a science for each element of a man's work to replace old traditional methods, and to scientifically select, train, and develop a worker instead of allowing him to choose

RGEMENT

his tasks and methods. This type of management truly did raise production and efficiency from the traditional (at that time) haphazard ways, but what has happened is that managers have extrapolated this to minute degrees of specialization. Charles Walker found that the law of diminishing returns also applies to the subdivision of jobs in that a bored operator does not turn out a high quality product. Thus there must be a point of optimum subdivision of jobs.

Getting back to the original question about the goals of job enlargement, the first company to put it into operation was IBM, and their reasons for doing so are typical of the early innovators. Their initial reasons were to build morale, increase job interest, and to provide their employees with continuous education so as to make them more valuable to the company and also to increase the probability of continued employment. Perhaps, being that these were the goals, this is another reason why large companies were the first involved. They had the time, money, and interest to try and improve the condition of their work force. Regardless of the reasons for their involvement, the important point is that job enlargement was given the chance it needed.

Accepting the above mentioned goals, could not they be achieved by methods other than job enlargement? The answer is a partial yes. Many other methods have been tried but they have not been as effective. Before job enlargement and even now, firms tried job rotation (in this way a worker could get bored with more than one job at a time), more frequent rest periods (usually causes a decrease in production), music in the work area, and grouping of workers into competitive teams (this could result in a worker being bored with his job and being angry with his neighbor). These and other methods have not changed the job, but have tried to change the environment and the worker's attitude toward his job — trying to make him feel more important. I imagine that in some situations this might be successful, but I would find it quite difficult being honest in telling a worker of his importance when in fact most employees in repetitive jobs are really expendable. In fact, when successful, what of the employee when he knows that the most important thing he will do all day may be tightening bolts? Would not his evaluation of himself go down, thus a negative effect? I think it would and feel safe in saying that mine would. At any rate, the other methods are really only external to the cause of monotony—the repetitious job. That is where the problem is and where the change must come.

Thus far we have been looking at job enlargement generally from the top down, and have not said much about the needs and attitudes of the workers. It is unfortunate that the needs of the worker in order of importance to the worker are often confused by managers. Before I mention these needs, I want to recount a personal experience with a repetitious job I held for one summer a few years ago. I hope to illustrate that employees have to have some form of break from monotony and that they will find one if none is provided. I was employed in a paper converting plant which received paper in large rolls and then cut, printed, laminated, folded, and glued the paper into various paper cartons, such as ice cream or cookie. In the folding and gluing department, the machines would take the otherwise finished carton and fold and glue it into collapsible form. These cartons were then packed into cardboard boxes in quantities of two hundred and fifty. Machine speed was about one thousand cartons per minute. At the end of the machines two packers assembled the cardboard boxes, put in the spacers, packed the box, placed the filled box on the conveyor, and repeated the operations. Each box used had to be numbered, thus one could number them all at once or in small quantities. I found that I would only number perhaps twenty-five so that I would have to do it more often. I also limited the number of spacers I brought to my work-space so that I would have to go get more more often. This may sound quite stupid, but to me it was very important—I looked forward to the breaks in routine these excursions provided. Most of the other men had similar petty systems to beat the monotony. However, on some machines there was a special man who took care of the boxes and spacers and on these machines time went much slower. So one can see that even minor things like these make a difference—how much more job enlargement? Most of the men in the plant were more or less resigned to their work and had to be—they were too old to make a change and knew it. Their advice to me was, "get your self an education so you don't have

(continued on next page)

to do this all your life."

What are these men looking for in their jobs, not specifically, but generally? I mentioned before the order of needs in a job that the employee felt and how that list is seen by managers. In a study of twenty-four industrial plants, employees and foremen were asked the question, "which of these morale factors is most important to the workers?" and then were given a list of ten factors. Following are the ratings:

By Supervisors:

1. Good Wages
2. Job Security
3. Promotion and Growth
4. Good Working Conditions
5. Work That Keeps One Interested
6. Personal Loyalty to Workers
7. Tactful Disciplining
8. Full Appreciation of Work Done
9. Sympathetic Help on Personnel Problems
10. Feeling in on Things

By Workers:

1. Full Appreciation of Work Done
2. Feeling in on Things
3. Sympathetic Help on Personnel Problems
4. Job Security
5. Good Wages
6. Work That Keeps One Interested
7. Promotion and Growth
8. Personal Loyalty to Workers
9. Good Working Conditions
10. Tactful Disciplining

The conflict shown here explains many causes of unrest in industrial situations. Managers believe that the worker is motivated only by money, and thus will do anything or work harder if it is held in front of him. Actually, after a certain point, increased money, incentive systems, and so on, have little effect. That is not to say they are not important and the above list shows this. However, more important to the worker is the feeling of accomplishment and the feeling of membership, of belonging. The men I knew above always referred to the company as "they" and what "they want," never "we" or what "we need." These needs are met in part by job enlargement. When a job is enlarged the employee can usually point to something and say "I made that." Perhaps it even bears his initials as in some of the cases below. As a result of this, he feels more important and feels that he is a worth-while part of the production system. When this is accomplished his entire attitude toward the company is changed, they are now in a sense working for the same goals — a quality product.

Before illustrating the above paragraphs with actual cases, I want to make one point clear what job enlargement is not. Job enlargement is not job expansion. Just by expanding the repetition of a job is not enlarging it. For example, at IBM one girl attached all the yellow wires to a panel, another all the green ones, and so on. They then "enlarged" the job so that each girl attached all the wires. The results were rather poor. A job is not enlarged only by increasing the number of operations, though that can make it more interesting, but by increasing its depth.

Whenever one looks at job enlargement research, he is haunted by the studies done at IBM, where job enlargement was first tried. In 1943, then president, now chairman of the board, Thomas J. Watson was taking one of his customary strolls through IBM's Endicott plant when he noticed a woman standing idle beside her machine. Though she could have done it herself, she was waiting for a setup man to set up the machine and then an inspector to give a startup okay. Watson was disturbed by this and called a staff meeting where the job enlargement program began. Before the change, the machine operators only put the part into the machine, started and stopped it, and took the part out. Everything else was done by others. The machine was set up by specialists, the tools were sharpened by specialists, and inspection was done by specialists. Most of the operators, except the old who didn't care and the young who hadn't yet learned, could do the above equally well, but to have them do so would be "inefficient." Thus IBM added more skill requirements to each operator's job. Now he sharpened his own tools, set up his machine for new orders from blueprints, and inspected his final product. He also was required to know how deviations from tolerances would affect the part and how to use test equipment.

One of the more serious attacks against job enlargement is that, as a result, many workers, now excess, are laid off. At IBM, of the displaced setup men and inspectors, none took a reduction in pay, none were laid off, and many received promotions and higher pay. In the milling department, out of thirty-five displaced setup men, twenty-five became operators, twelve were promoted, and two voluntarily left the company. These changes, of course, did not all happen at once as some stayed longer as trainers and instructors. When applying job enlargement, not dismissing any present employees is one of the most important areas to take care of. If many dismissals result, the remaining workers will be resentful and community relations of the firm will be harmed.

The results at IBM more than repaid the risks involved in the new program. In 1940, before any changes, in the milling department, there was a ratio of one setup man for every sixteen operators and at the war's peak for fourteen. Enlargement started in December, 1943, and by July, 1946, the ratio had changed to one for every fifty-two. By then, all operators were making some of their own setups, and by 1950, the setup men had been completely eliminated. In the drilling department, the ratio went from one to eleven in 1943, to one per forty-eight in 1946, and none in 1950. The same process resulted for inspectors and by 1950 the number had dropped to a few who were necessary for complicated jobs. Cost results showed overall cost down but a ten percent increase in labor cost due to more employee responsibility and promotions. Offsetting the larger labor cost were reductions in scrap and defective parts. There was less machine idle time and the cost of setup and inspection dropped ninety-five percent. More important from the employees' point of view was that their jobs had been enriched and interest, variety, responsibility, and importance had been added. The company was satisfied because the workers were better satisfied, production

(continued on page 36)

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BETHLEHEM STEEL

A Puzzling Plot

by Holly Eva Wong

Yesterday I heard from a usually reliable source (I overheard two Ag. students talking on the bus) that the hill students were planning a march on the Mechanical Engineering building to occupy the lobby and liberate the capitalist-operated coke machines. Naturally alarmed by such rumors, I proceeded cautiously up the hill to Bascom Hall in hopes of discovering the truth. I found definite evidence of subversive activity, just as I had suspected. Hidden under a used-guitar-for-sale notice I found this $36x^2 - 16x - 244 = 0$. Taking out my slide rule, which I had lashed to the handle of my tennis racket so as not to arouse the suspicion of the hill students, I quickly did the calculation. Definitely strange, I decided. The answers written on the bottom of the card ($x = 45/17, x = -2$) were definitely strange. How, I wondered, did the hill folk figure? I was frowning intensely at the bulletin board when I heard a familiar voice. Turning, I saw a fellow ME, also in disguise.

"Hi man," I said, trying to sound cool.

"Groovy," he replied. He had also heard the rumors. He pointed to something written on the wall:

8 5 4 9 1 7 6 3 2 0

"Ah, the ten digits," I recognized them immediately.

"I noticed that," he said, "but why are they in that particular order?"

I almost had that solved for my fellow ME when an authentic hill student (I could tell by his colored socks) interrupted me to borrow a cigarette. I became immediately suspicious; he had six cigarettes in his hand already. I followed him to an empty classroom and watched through the window as he placed the seven unbent cigarettes such that each one touched the other six. By then I was certain that something was happening. Turning, I noticed something trampled in the snow on the mall in front of Bascom. A strange pattern indeed: O T T F F S S _ _ _. The last three letters were too smudged to read and I started down the hill for a closer look. I didn't even see the little kid on a tricycle parked in the middle of the sidewalk. He hollered when I stepped on him, though, and immediately I became aware of his presence. The kid, too, looked unusual. He had a moustache. Before I could walk around him, he jumped to the seat of his trike and dangled two lumpy mittens in my face.

"In each of these mittens I have twelve political buttons," his voice was militant. "I have four End-the-War buttons, four Pink Fuzz buttons, and four Love buttons in each mitten."

Thinking that finally I may have found a clue, I listened intently.

"Now, if I blindfold you and tell you to take enough, but only enough, buttons from the right mitten to make sure that you have two buttons at least of any one kind and one button at least of either of the other two kinds and to put these into the left mitten and then I tell you, still blindfolded, to take enough buttons back from the left mitten into the right mitten to insure that the right mitten will contain at least three buttons of each of the three kinds, how many buttons will be left in the left mitten?"

His tricycle began to slowly roll down the hill. I fled back to the Mechanical Engineering building to warn my fellows of the impending invasion and ask for help. If you, dear reader, have any clues to these subversive activities or further evidence of subversion, please contact

I. M. Wong,
308 ME Building, 009.

The following three articles were collected by Dick Wagner and discuss research work being done here in the fields of Biomedical Engineering, Air Pollution, and problems associated with aquatic vegetation.

Thermodynamics, Heat Transfer, and Medicine

Thermodynamics and heat transfer can play important roles in physiology and medicine. Professors J. W. Mitchell and G. E. Myers of the Mechanical Engineering Department are conducting several projects in cooperation with the medical school involving these engineering sciences.

Refrigeration anesthesiology refers to the application of cold in order to produce pain relief. This method is especially useful with elderly patients, about to undergo amputation of a leg, who cannot withstand the normal methods of anesthesia. A double-walled boot and a coolant circulating system have been developed to provide cooling for a leg. The method has already been used with considerable success on five patients, and is currently undergoing further development.

Prolonged elevation of body temperature may have a beneficial effect in the treatment of cancer. A heating cabinet has been developed that is capable of producing a body temperature of 107° F. and maintaining it for periods of 12 hours or longer if necessary. The heating is produced by a short wave heater and the elevated temperature is maintained by circulating warm, humid air around the patient to prevent energy loss by convection and evaporation.

Local freezing of tissue is known to be beneficial in the treatment of Parkinson's disease, the removal of warts, and the treatment of cancer. Present methods use liquid nitrogen and require large capital expenditures. A less expensive Freon-cooled probe has been developed and is presently being evaluated. Theoretical predictions will be compared to actual freezing rates in tissue.

In any prediction of temperatures within a living system, values for thermal conductivity must be available. Determination of tissue conductivity is difficult because meaningful values must be obtained in live tissue. A method for doing this is being developed and evaluated. Thermocouple measurements are compared to heat transfer theory to deduce the thermal conductivity.

Theoretical studies are being carried out to learn more about the thermo-regulatory systems in animals. Analysis of the counter-current heat exchange mechanism has yielded significant conclusions regarding this mechanism for conserving energy. A computer program to simulate the leg cooling process in the refrigeration anesthesia project is being developed. Accurate predictions of temperature-time curves will enable the medical doctors to use the cooling equipment more efficiently.

Air Pollution Research

During the past decade the automotive engine has emerged as one of the most serious contributors to the air pollution problem. Typically the exhaust of such engines contains small but significant quantities of carbon monoxide, nitric oxide and unburned or partially burned hydrocarbons.

Carbon monoxide is of course recognized as a toxic substance, and as a consequence has grown over its increasing atmospheric concentration in areas having a high density of motor vehicles. Nitric oxide is also a highly toxic substance which if present in the atmosphere in concentrations greater than one or two parts per million can produce chronic changes in the human respiratory system (the concentration of nitric oxide in the exhaust of current automotive engines ranges from 1,000 to 5,000 parts per million).

In addition to having a highly toxic nature, nitric oxide has also been identified as one of the *necessary* ingredients for formation of photochemical smog. Following emission into the atmosphere nitric oxide is oxidized to nitrogen dioxide giving rise to the typical brownish haze usually associated with smog. The nitrogen dioxide formed then reactt in the presence of sun light, with hydrocarbons in the atmosphere (also originating in part from the automobile engine), to form a number of objectionable smog compounds which produce eye and respiratory system irritation and which can be damaging to certain types of plant life.

The fundamental mechanisms of air pollutant formation in engine related combustion processes are being studied in the laboratories of the Department of Mechanical Engineering. This work, under the direction of Professor H. K. Newhall, is sponsored by the National Air Pollution Control Administration, U.S. Department of Health, Education and Welfare, and encompasses a number of related graduate student research projects. These projects are described individually as follows:

I. Formation of Nitric Oxide in High Pressure Flames

Using specially developed spectroscopic equipment Mr. Syed Shahed is investigating the chemical reaction kinetics of nitric oxide formation in high pressure flames. This study is performed with a closed combustion vessel operating under conditions similar to those occurring in engine combustion processes. With the spectroscopic equipment employed it is possible to continuously measure the concentration of nitric oxide during its formation in the immediate vicinity of the propagating flame front.

II. Inlet Manifold Water Injecting for Nitric Oxide Control

Mr. J. E. Nicholls and Mr. I. A. El Messiri have recently completed a study in which water was injected into the inlet manifold of a single cylinder research engine. Under appropriate conditions the use of water injection yielded reductions of nitric oxide in the engine exhaust of over 90 percent. At the same time a moderate increase in engine performance was realized.

III. Combustion Chamber Design

Mr. I. A. El Messiri is presently using a single cylinder research engine for study of the influence of combustion chamber design on air pollutant formation. His study, which involves radical departures from conventional combustion chamber design, includes measurement of nitric oxide, carbon monoxide and unburned hydrocarbons in the engine exhaust.

IV. Formation of Air Pollution in Diffusion Flames

Both gas turbines and steam engines have recently received widespread publicity as possible alternatives to the present reciprocating automobile engine. These alternative engines derive heat from a so-called diffusion flame which differs substantially from the combustion process occurring in conventional gasoline engines. While relatively little research has been devoted to air pollution from diffusion flames there is evidence to indicate that nitric oxide formation is significant. For this reason Mr. A. Tuteja is undertaking an experimental study of air pollutant formation in diffusion flames under conditions similar to those occurring in gas turbine and steam engine combustion systems.

Harvesting and Disposing of Aquatic Vegetation

This water resources research project is being conducted by Professor D. F. Livermore (ME), and Professor H. D. Bruhn (Ag. Eng.). They will work with co-investigators in the fields of Botany, Zoology, and Biochemistry from 1968 thru 1972. The following article delves into the background and significance of the project.

One of the many facets of accelerated eutrophication of our waterways has been the excessive production of aquatic vegetation. Control measures for such growths have taken a variety of forms depending on the nature of the problem and the desired objectives. While reductions in nutrient supplies to levels below those required to produce nuisance growths would represent a fundamental solution, this is not possible or practical in many instances. Hence other solutions or management procedures are sought.

Chemical and mechanical control measures are both quite widely used. However, with reference to chemical measures, biologists warn, "a great deal more research is needed to produce specific inhibiting agents which do not have undesirable side effects on other organisms and which disintegrate promptly after application.————. There are as yet no chemicals which are specific enough in their inhibiting effects to be used with impunity." (Corey, Hasler, et.al. 1967). Mechanical control or harvesting of excess vegetation is usually thought to be ecologically a more sound approach. First, it does not introduce foreign substance into the waters. Secondly, it may actually remove nutrient materials from the water cycle, and should tend to reduce the rate of filling by plant residues. Thirdly, if carefully done, it probably does not tend to alter the plant and animal-life balances as drastically as may chemical treatments.

Universal acceptance and wide application of mechanical methods will require that systems be developed by which the entire operation may be more completely mechanized and accelerated. While commercially available mechanical equipment can cut submersed or emergent plants quite rapidly in large, open areas, the economical collection of and disposal of the cut plants is quite a difficult problem. Harvested plants are often transferred from the harvester to a transport barge in the area where the plants are cut. The transport barge then travels to a dock area where the plants are unloaded onto shore or into a truck for remote disposal.

Systems for harvesting and disposing of aquatic vegetation should aim toward the efficiencies attained in modern agricultural and industrial systems. To compare favorably with present efficient agricultural practice, harvesting rates for large, open-water areas should be in the magnitude of 5 to 10 acres per man-hour required for transportation of the harvested material. While data on harvesting rates are scarce, the reported rates do not approach those achieved on land.

Objectives of Study

This research program proposes to investigate and evaluate methods for the increased efficient mechanical handling and disposal of cut aquatic vegetation. The aim is to investigate feasible alternatives to the handling and disposal methods, now commonly used, which are at the same time compatible with effective over-all water management.

Procedure

Knowledge concerning the physical processing properties of most aquatic plants is currently quite limited, except that they are very high in moisture content and low in dry matter and fibre. Initially research will be conducted to determine how these plants are affected by such standard operations as dewatering by compression, homogenizing, macerating, chopping, grinding, crushing, etc., the objective being to identify potentially effective procedures and to test certain of the more promising of these on a small scale. In this connection, the disposal studies program will be coordinated with the work of plant ecologists, water chemists, and limnologists currently engaged in related studies, and to enlist their collaboration in evaluating the various methods being studied.

Following acquisition of fundamental handling and processing data, research can proceed on an applied basis. This second phase of the work will attempt to determine, on a pilot scale, the most practical combination of methods for transportation and/or disposal of

a) the entire unprocessed plant,
b) the entire plant after processing in some manner.
c) a fraction of the plant, or complete disposal of the plant at the source,
d) the reduction of the plant to an ash and the transport of the ash only, or other combinations.

While it is expected that considerable work can be done on a pilot scale in the three-years' duration of this project, continuing efforts over a more extended period will be required to evaluate the real effectiveness of techniques and methods developed. Information obtained from this project will be instrumental in determining the nature and extent of subsequent longer term experimental and management programs.

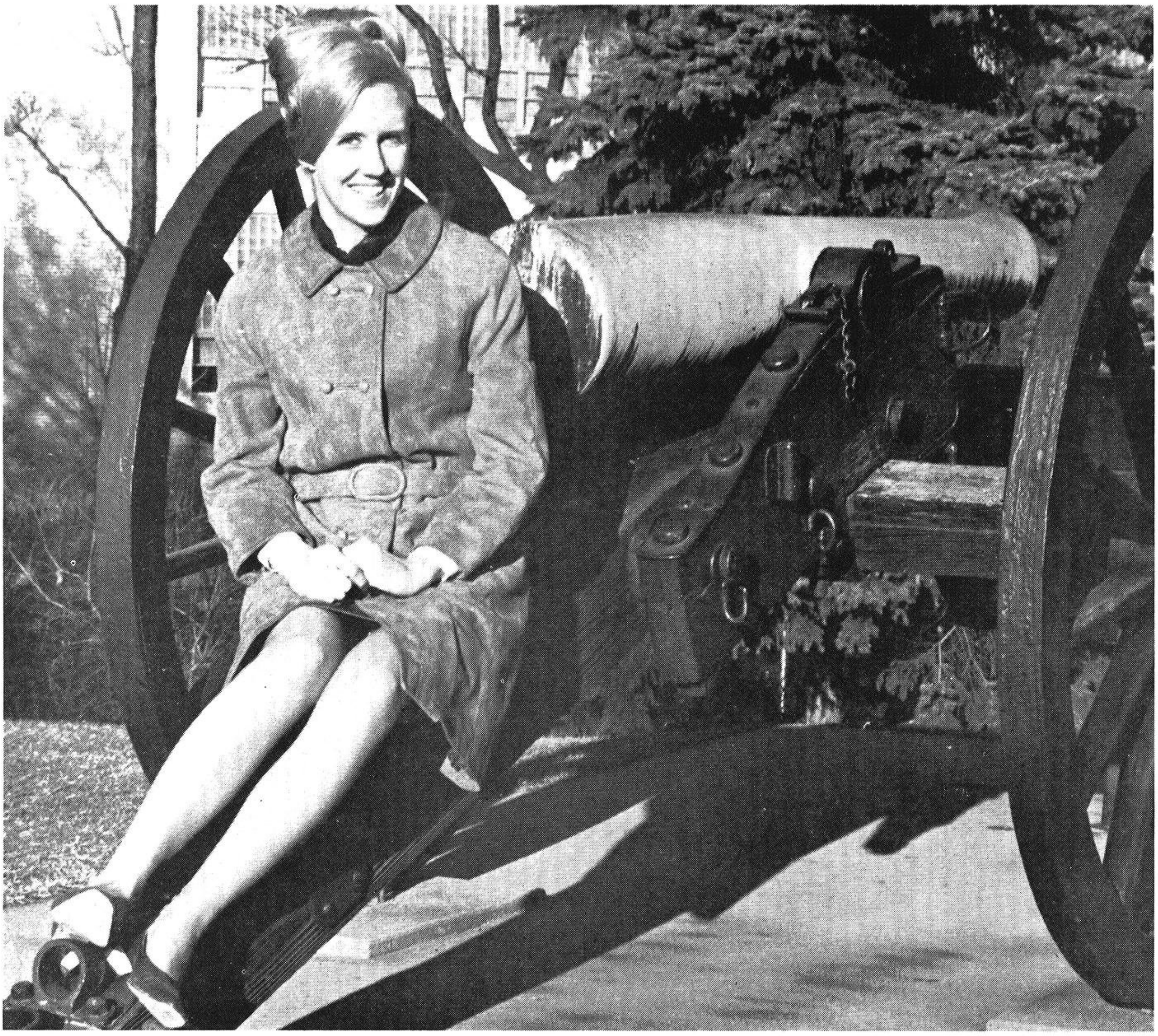
Significance

In many areas waterways remain one of the few natural resources available for public recreational use. Increasing density of population and greater leisure time activity strengthen the demand for recreational areas while, at the same time, increasing contamination and fertilization destroy the resource as the demand for it increases. Bottom rooted aquatics, often draped with filamentous algae and festooned by collections of trapped algae and debris, may produce particularly objectionable conditions if large areas are affected. If many of our lakes are to remain as beautiful public playgrounds, and if some which have degenerated into algae "pools" are to be resurrected to recreational usefulness, extensive efforts will be required. It seems unlikely that any pollution reduction measures can lower nutrient supplies sufficiently to eliminate aquatic vegetation nuisance problems. Thus effective methods for controlling, harvesting, or removing undesirable aquatic vegetation would be a significant advance in the struggle to retain attractive, usable waterways.

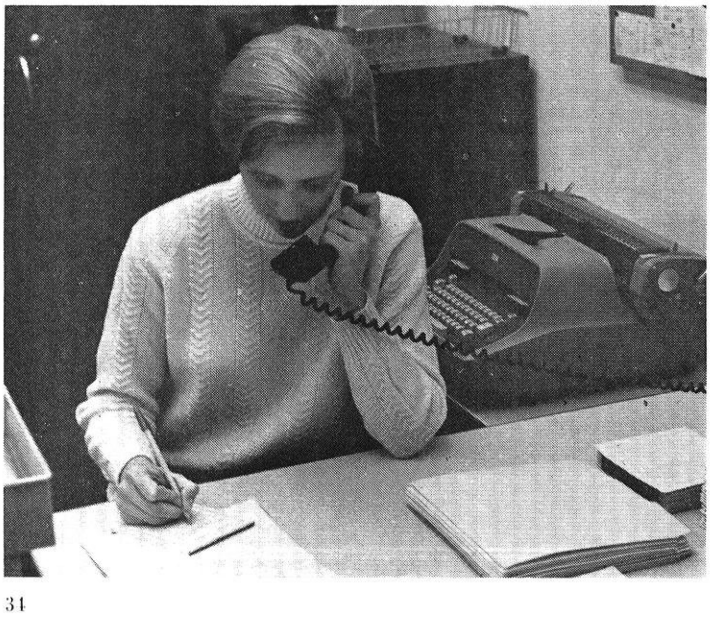
While present versions of machinery for the control of rooted, submersed vegetation are quite effective, truly high-acreage capacity systems do not exist. This project aims at opening some of the "bottlenecks" which limit the capacities and effectiveness of current machines and systems. It is an essential step in a continuing effort to evaluate the proper role of mechanical control measures in lake management. With proper utilization of today's technology, it seems reasonable that mechanical systems can be developed to operate in large areas at a fraction of the cost of chemical controls, and without the hazards inherent in the widespread application of chemicals. An official in the Federal Water Pollution Control Administration stated the case for mechanical harvesting very well in 1964 and concluded that "ultimately, harvesting techniques that are effective, feasible, and financially practical must be perfected."

It is anticipated that two graduate research assistants will be actively involved in the program and will use this work as thesis research. In addition, certain phases of the work may lend themselves to independent study projects or perhaps to senior design projects in Agricultural or Mechanical Engineering. Through their participation in the program a number of engineering students will become much more aware of and interested in the complex problems of water resources management.

The project is supported by a matching grant from the Office of Water Resource Research, U.S. Department of the Interior (OWRRB-018-WIS.), through the University's Water Resources Center.

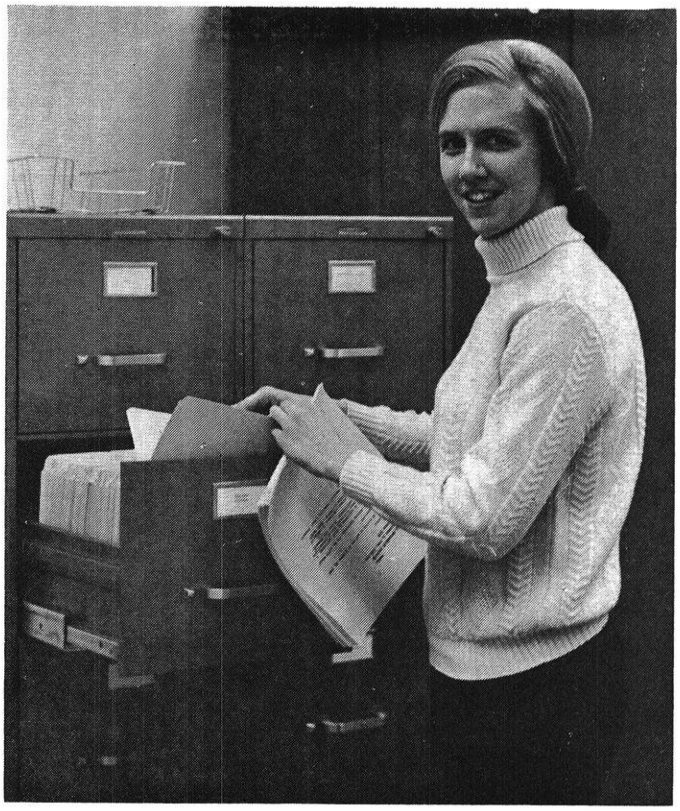


Photos by Bruce Pease



wisconsin's finest presents

Sharon Crace



Many of you engineering students will be happy to learn that the cute blonde girl who occasionally walks through the M.E. Lobby, is none other than Sharon Crace, our Wisconsin's Finest for January. Sharon is the secretary for the Industrial Engineering Division, located on the fourth floor of the M.E. Building.

Although technical consulting is not one of her secretarial duties, Sharon is willing to help out a student faced with a difficult experiment. At other times, she may be outdoors enjoying one of her favorite activities, swimming or snow skiing.

Sharon's friendliness and fun loving nature makes her a very pleasant person to be with. Without a doubt, many of you are looking forward to the day when you will be able to acquire a secretary as nice as Sharon.

costs were somewhat lower, and there was better product quality. Incidentally, the latter benefit also made their customers more satisfied.

In another department at IBM, three groups of girls were needed to make a component. The first group assembled coils for use in relays for business machines. Another group soldered the coils, and a third inserted hundreds of tiny silver wires, causing much eyestrain. One of the girls suggested combining the three operations and this was given a year's trial. After one year, eyestrain had disappeared, fatigue lessened, and production went up fifty percent. The girl who had made the suggestion was paid a bonus of $2,500. In this plant, including other job enlargement programs, scrapped parts now cost only ninety-six cents per one hundred dollars of output, whereas before it was one dollar and ninety cents. By-products of job enlargement were a cleaner factory, tripling of employee suggestions, and a world safety record for plants their size — 12,770,257 man-hours without a lost-time accident.

The second popular example of job enlargement is the Detroit Edison Company. Detroit Edison had, at the time of the study, over one million customers and billed over 30,000 accounts per day. Because morale was low, many mistakes being made, and long processing time, Douglas Elliott, head of the Customer Billing Department, suspected that the cause might be in overspecialization of jobs. Therefore, he had the billing machine operators check the bills themselves instead of special checkers and the file clerks answered customer requests and made out new cards. After the steady state was reached, overtime was cut in half even though the work volume was up, absenteeism dropped more than ten percent, a full day was cut in setting up new accounts, individuals received more pay, had more interest in their job, and overall costs for the company were down. Indeed job enlargement paid off—paid off for both management and employee.

In a textile plant in India, there were two hundred and twenty-four looms attended by twelve specialists. For example, one weaver attended thirty looms, one battery filler fifty, a smash hand seventy, and so forth. Production was low so the company organized teams and assigned each team a bank of looms for their operation and service. Within sixty days of the combination of activity, efficiency had risen from eighty percent to ninety-five percent, and damage dropped from thirty-two to twenty percent.

On the west coast of the United States, an industrial engineer studied a manufacturing department which used an assembly line of nine subdivided operations. Twenty-nine girls manned the line and in the study a similar group of girls were held as a control group. After the change, each operator now did all nine operations, did the inspection, picked up her supplies, and in only six days production was greater than by the old method. Not only was production higher, but rejected assemblies dropped to one-fourth the original level. The operators liked this method better because they could see that they accomplished something and because less direct supervision was required. Management was satisfied for the latter reason and because they now knew who had made a defective uit.

We turn now to a study that, for this specific case, proved that job enlargement resulted in a cost saving over the previous method. The study was done at a Midwestern company that made home washers and dryers. The department of concern assembled a centrifugal water pump about the size of a football and containing twenty-seven parts. In 1958, it took six men on a conveyor line 1.77 minutes per one unit or about 0.3 minutes per operator. A change was then made to four men on the line and the time was 1.76 or about 0.44 minutes per operator. It is interesting to note that they were doing more operations but the time required changed little. Then in October, 1959, they made another change and this to single operators doing all the work—and total time dropped to 1.49 minutes! They had four such stations. Thus, each operator had a more interesting job as he did his own inspections, initialed his work, varied his work patterns, and cut down the time. The following annual costs included labor cost, learning cost, physical space cost, total facilities cost, and annual facilities cost. The original plan was $20,678 per year, the four-man conveyor line $20,448, and the one-man stations $18,282. As a sidelight, the original method required the least training time, the second method the least space and facilities cost, and the enlarged method the longest training time, most space, and the most equipment because of duplication. The new way saved time and money in labor in that there was a one-third reduction in non-productive time and, of course, there were no line balancing delays.

In a system similar to the above, Non-Linear Systems, maker of electronic equipment, abandoned its assembly line and went to one man making the entire unit. This resulted in a fifty percent reduction in man-hours devoted to building the unit.

Harwood Manufacturing Company, maker of wearing apparel in Virginia, had tried several experiments in giving employees more responsibilities and authority in questioning work procedures. Thus, when production was lagging in one department, production workers were brought into the discussions with staff engineers. The ratio of the two groups was pushed around until finally the problems were given completely to the production employees with the engineers available as consultants only. With this system there was a marked increase in quality and production, and employee turnover dropped from eighteen percent to six percent a year and absenteeism from seventeen percent to four. The reason for the improvement is clear though many managers may not want to accept it. The production employee knows more about his job and job problems than any outside engineer, unless of course, the technology is very prohibitive. As a result his opinion is often more valuable than that of a staff group and this should be made use of.

There are other examples that could be mentioned such as those done by government agencies, but the above cases are enough to show that job enlargement is a useful practice for many jobs. It is not a necessary practice in all cases, nor is it successful in all applications. However, in the manufacturing world it must be at least considered, and perhaps given a trial run. Some might say that job enlargement results are really only natural results of added interest because the new job is something different. My answer to this is what of it? If production went up, costs down, and the workers are more satisfied, I don't really care *how* this happened. But since job enlargement caused it, I will thank job enlargement for it. If after a year or so production falls back to its former level or somewhere in between, we have not lost anything and usually have gains to show for the past year.

Another criticism might be in the personality or type of worker employed, that it is their nature to be dissatisfied and to have as low a production rate as they can get away with. In refutation of this, I cite an experiment done in Detroit a few years ago. Two ministers went to work on an assembly line and soon found themselves cheating on quality, lying to their foreman, and swearing at the machine. All the while they knew that they would eventually return to the church. This is relevant not because ministers aren't supposed to have such human reactions, but because they had all the more reason to hide such feelings so as not to harm the stereotype of a minister.

In conclusion then, job enlargement has shown many positive and worthwhile results and must be considered when plant layout or production changes are anticipated. But it must be done in an attitude of full cooperation of higher management so that it is given a reasonable chance of success.

Man, unlike any other thing organic or inorganic in the universe, grows beyond his work, walks up the stairs of his concepts, emerges ahead of his accomplishments.

— John Steinbeck

JOKES

The percentage of alcoholics in the United States is staggering.

* * *

Two duck hunters were sitting behind the blind, one drinking from a thermos bottle of coffee, the other from a jug of whiskey. After some hours of sipping they spotted a lone duck winging through the sky. Taking aim, the coffee drinker rose, let fire, and missed. The whiskey drinker rose, let fire, and brought the duck down. His companion, properly amazed, complimented him on the shot. He replied, "Aw, it's nothing. I usually get five or six out of a flock like that."

* * *

A Chinese scholar was lecturing when all the lights in the auditorium suddenly went out. Unperturbed, he asked the people in the audience to raise their hands. They did, and the lights immediately came on again. "Proves wisdom of old Chinese saying," he remarked. "Many hands make light work."

* * *

Did you hear about the man who dreamed he was forced to eat a six pound marshmallow? When he woke up his pillow was missing.

Cop (to man just struck by a hit-and-run driver): Did you get his number?

Pedestrian: No, but I'd recognize his laugh any place.

* * *

At a small hotel in Miami Beach a young lady was on the roof taking a sun bath clad only in a bikini. In looking around, she discovered that there were no tall buildings nearby so she decided to take a real sun bath. Taking off her bikini and lying on her stomach, she was enjoying herself when she heard footsteps approaching. She quickly grabbed a towel around her and looked up to see the manager approaching.

"Young lady, we don't mind your sun bathing, but we won't allow nude sun bathing."

She flushed and angrily replied, "but there aren't any tall buildings close enough to see me."

"I know," he replied, "but you're lying on the skylight over the dining room."

* * *

Little Boy: "May I come in your yard and get my arrow?"

Neighbor: "Yes, where did it fall?"

Boy: "I think it's stuck in your cat."

The day after finals a disheveled ME walked into a psychiatrist's office, tore open a cigarette, and stuffed the tobacco up his nose.

"I see you need some help," said the doctor, startled.

"Yeah," agreed the ME. "Got a match?"

* * *

And then there was the condemned golfer who asked the hangman, "Mind if I take a couple of practice swings?"

* * *

A certain Industrial Administration professor was unpacking some glassware he had received from the factory. Seeing that one jar was upside down, he exclaimed, "How absurd, this jar has no mouth." Turning it over he was once more astonished, "Why the bottom's gone too!"

* * *

The height of bad luck—seasickness and lockjaw.

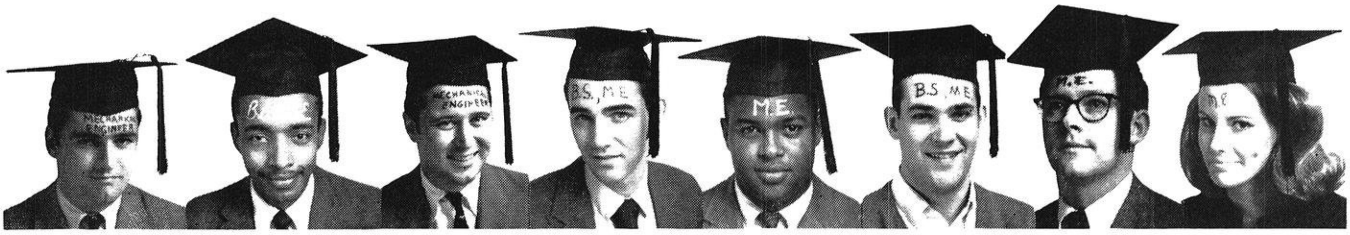
* * *

The frowning woman walked up to a little boy on the street corner who was smoking.

"Does your mother know that you smoke?" she admonished.

"Lady, does your husband know you stop and talk to strange men on the street?"

The label is the thing



(likewise for chemical engineers, electrical engineers, and industrial engineers)

Seems ridiculous. Maybe it is. But so far we have found that the official label guides us to those who have shown they can discern a goal and not lose their way towards it.

In general, however, the label does not guarantee a uniform product. That's good.

It is worn by some who have never dipped below the five percentile academically, who enjoyed doing a paper on the psychodynamic roots of Buddhist theology almost as much as they enjoyed constructing five different thermodynamic models of the pulsar phenomenon. That kind of mind can find comparable fulfillment in some problems ultimately involving our photographic systems, plastics, or fibers. Hard to believe but true.

The label is also worn by some who had to struggle for it because their minds don't work the way a professor's mind works. They are not unhorsed, however, to learn that sometimes a remark passed casually in a washroom can accomplish more than a 117-page technical report with 50 references in the bibliography.

Hope you will drop us a note telling what kind of mind you have. A wrong answer will not be held against you.

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Bob was Chairman of a special Jaycee project to select the "Outstanding Young Educator" in Schenectady, New York.

He began by rediscovering firsthand some of the vibrant situations that confront young teachers. With that background he was ready to coordinate the nominating and judging.

Planning and coordinating come naturally to Bob. As a Production Control Specialist with General Electric's Medium AC Motor and Generator Department, he keeps production lines running smoothly. Coordinating machinery, raw materials and labor is crucial to any efficiently run business.

With a mechanical engineering degree from Cornell, in 1962, and an MBA in personnel administration from George Washington, in 1963, Bob sought to plunge directly into meaningful work. He'd had enough theory and simulations to last him for awhile.

At General Electric he found people that agreed with his thinking, and what's more, GE offered him immediate responsibility via the Manufacturing Management Program.

Like Bob Nerad, you can get a fast start at General Electric, in R&D, design, production or technical marketing. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801B, 570 Lexington Avenue, New York, N. Y. 10022

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