

Spring 5-1966

Volume 77 - Issue 7 - May, 1966

Rose Technic Staff

Rose-Hulman Institute of Technology

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Recommended Citation

Staff, Rose Technic, "Volume 77 - Issue 7 - May, 1966" (1966). *Technic*. 25.
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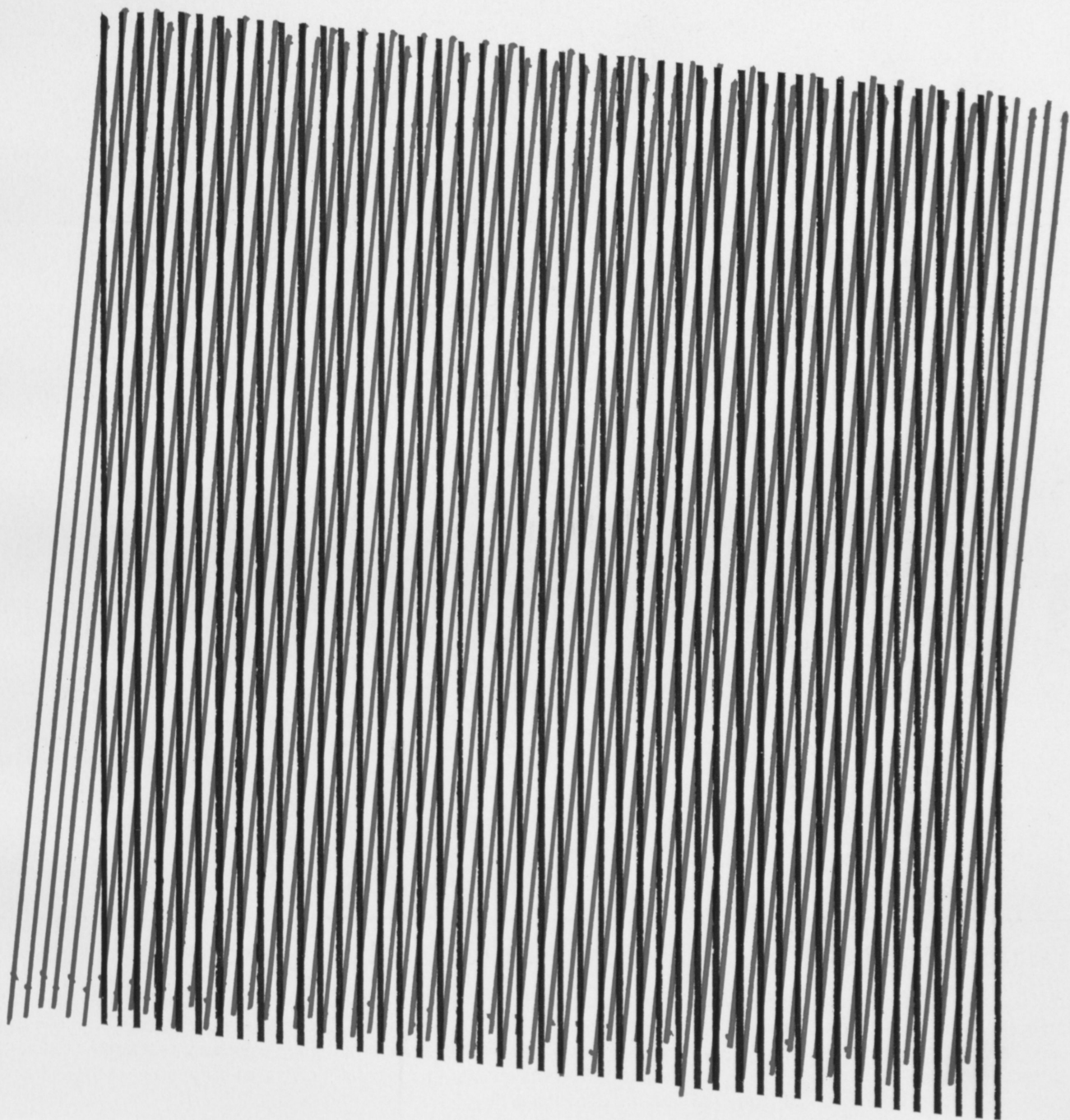
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Rose Technic

May

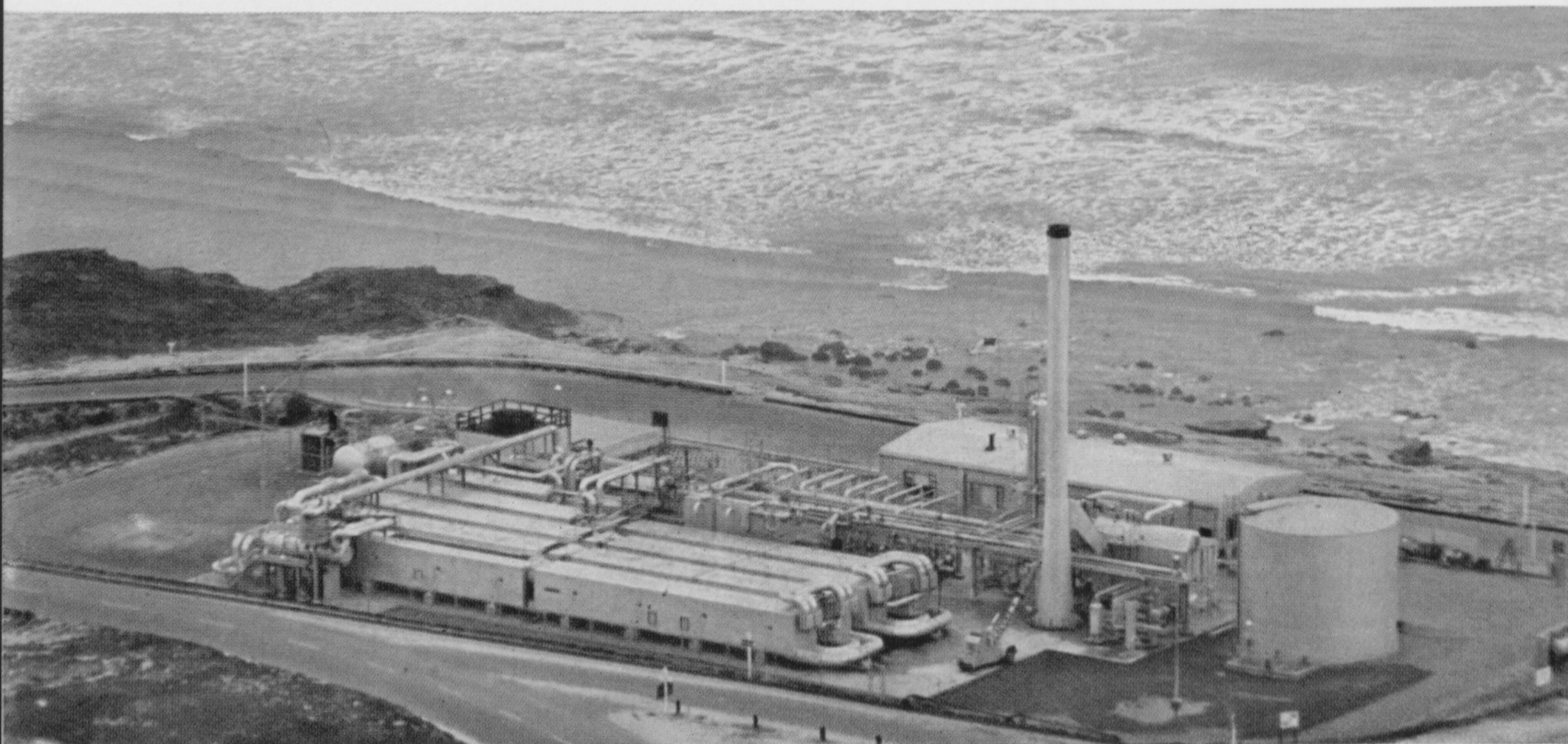
1966



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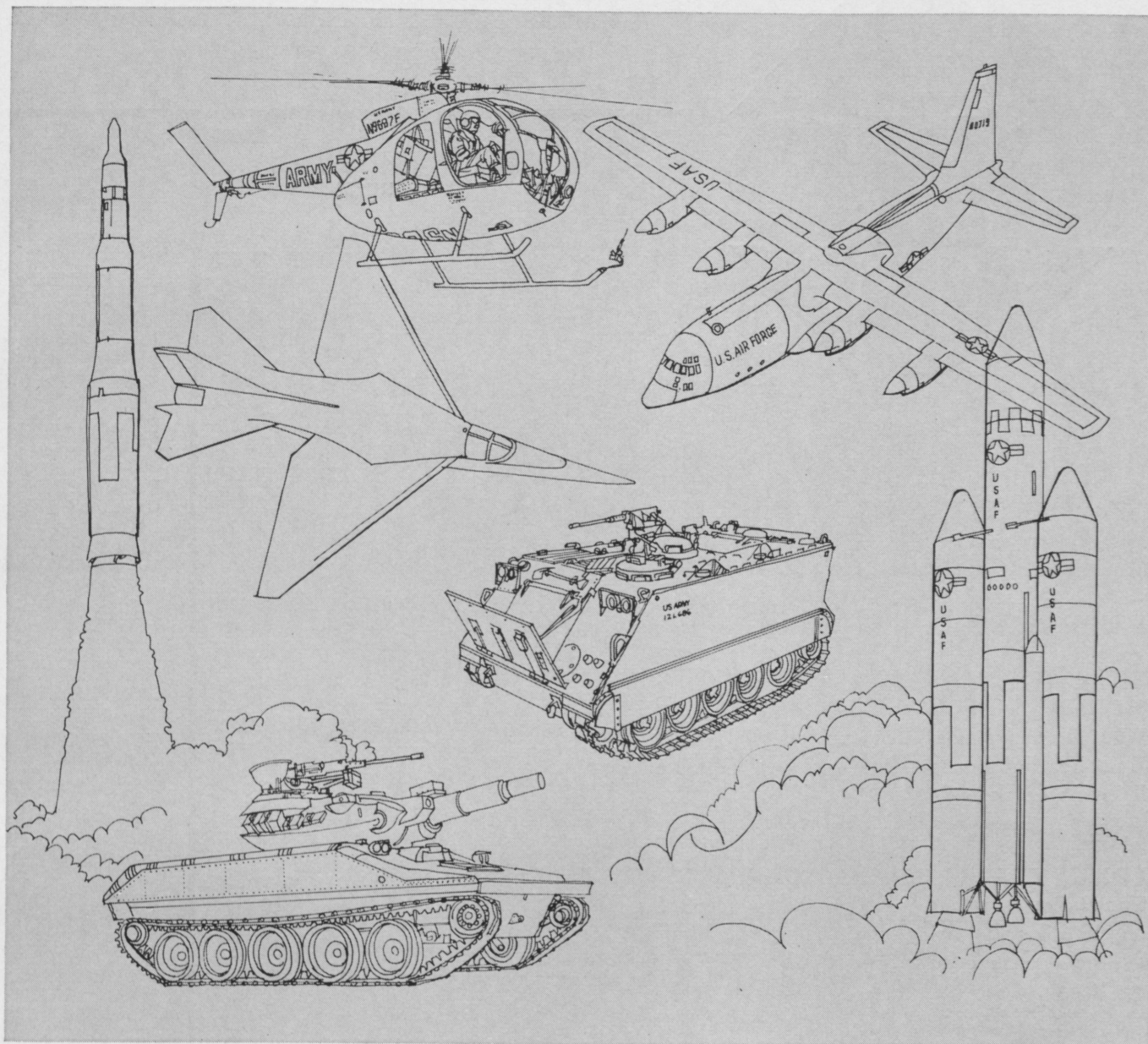
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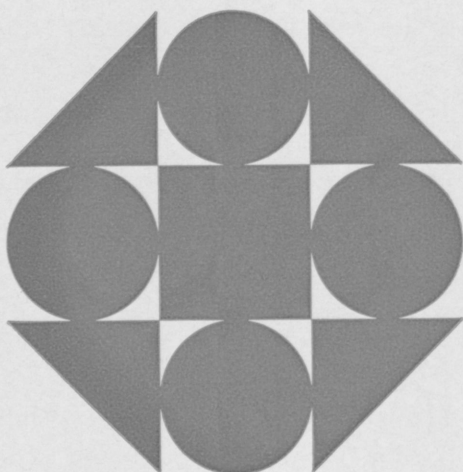
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AMERICA'S OLDEST ENGINEERING COLLEGE MAGAZINE IN
CONTINUOUS MONTHLY PUBLICATION — 1891-1966

IN THIS ISSUE

AYN RAND'S INFLUENCE ON MODERN DAY LAW

What influence does this controversial contemporary philosopher have on modern day law? Find out from Bill Lewis on page 6.

MODERN SERVICE STATION DESIGN

The station at which you "gas up" is something more than just a building with some gas pumps. Find out how they are designed in the article by Ed Zaenglein on page 10.

MOIRE PATTERNS

What is a moire pattern? I'm sure I don't know so why not read the article by Tom Sprouse on page 24 and find out.

COVER NOTE

This month's cover is by sophomore Terry Joyce. It is his representation of our feature article, "Moiré Patterns."

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Volume LXXVII, No. 7

May 1966

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PRINTED BY MOORE-LANGEN PRINTING AND PUBLISHING CO.
140 North Sixth Street, Terre Haute, Ind.

Publisher's Representative
LITTELL-MURRAY-BARNHILL, INC.
369 Lexington Avenue,
N. Y. 17, N. Y.
and 737 N. Michigan Avenue,
Chicago 11, Illinois

ECMA Chairman
PROF. J. R. BISSETT
Civil Engineering Department
University of Arkansas
Fayetteville, Arkansas

Published monthly except June, July, August, September and January by the Students of Rose Polytechnic Institute. Subscriptions obtainable by a \$3.00 donation to the Student Activities Fund of Rose Polytechnic Institute. Address all communications to the ROSE TECHNIC, Rose Polytechnic Institute, Terre Haute, Indiana.

Entered in the Post-office at Terre Haute as second-class matter, as a monthly during the school year, under the act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized December 13, 1918. This magazine does not necessarily agree with the opinions expressed by its contributors.



ROSE



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TERRE HAUTE, INDIANA

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ROSE POLYTECHNIC
INSTITUTE
TERRE HAUTE, INDIANA

More Than Just A Statistic

Americans have become nearly immune to statistics. They are fired at us so often — in newspapers, on radio and television, in magazines — that we are unaffected by their significance. Thousands who heard or read of the crash on April 27, which took the lives of three women and severely injured one man, merely shrugged, if even that, and immediately found something more pleasant to occupy their minds.

To those of us who knew these four people though, the crash was a shocking tragedy, Mrs. Dorothy Logan, Mrs. Lillian Ross, Mrs. Gloria Dougherty — ladies familiar to nearly every Rose student. Dean of Students Ralph Ross — seriously injured — a man with whom every student has had contact. This was news that reached the feelings of even the most callous of the often-insensitive students at Rose. There were expressions of emotion reminiscent of those seen after the death of John F. Kennedy. And there were the unspoken feelings.

Mrs. Logan and Mrs. Dougherty represented well the new attitudes and interests which have been brought to bear on Rose Polytechnic Institute. Mention of their names brings to mind immediately their efforts to instill in the atmosphere of the campus an interest in the arts — paintings, music, guest lecturers.

They brought a much-needed breath of fresh air to the halls of the Main Building.

Mrs. Ross was a capable woman filling a difficult job — that of trying to operate dormitories filled mostly with freshmen on their own for the first time. She tried to allow as much freedom to the residents as possible without permitting total anarchy.

Dean Ross, whose comments have appeared in the *Technic* a number of times, survived the accident, but will be several weeks recovering. To quote one senior, shortly after the accident, "Dean Ross and I have had our differences, but I sure hope he makes it. He's holding about the toughest job on campus, and he's doing a helluva good job. Who could replace him?" We ditto that comment!

The establishment of a memorial fund in honor of Mrs. Logan, Mrs. Ross, and Mrs. Dougherty has drawn several hundred dollars in donations. We feel it would be especially fitting if this fund were used to carry on the work to which these women had given so much of themselves. Specifically, we propose that Dormitory C be named Logan-Ross-Dougherty Memorial Hall; that a suitable plaque be placed in the lobby of this Hall, and that the balance of the fund be applied to the purchase of objects d'art for the new Campus Center.

To Mrs. Dorothy Logan (and in memoriam also to Mrs. Gloria Dougherty and Mrs. Lillian Ross, companions in death):

REQUIESCAT IN PACE

V-8 piston-propelled, it purring bore
her swifter than old Charon ever dreamed
of transport; no sweet chariot before
with polished chrome as eloquently gleamed.
O streamlined trap of cruel, tempered steel!
It caught one who in youth was lithe and swift,
winner of many a race, Olympia's gift
to husband, sons, admiring friends who feel
the grief that only this mechanic age
could spring untimely in split-second time;
for tragedy of loss, let sorrow rage
in hearts subdued by death to muted rhyme:
now shall the memory of her, who passed
so gallantly our way, as bronze be cast.

—Eugene W. Sutherland

AYN RAND'S INFLUENCE ON MODERN DAY LAW

by BILL LEWIS

Layout by Terry Joyce

Bill Lewis is a senior Electrical Engineering major who hails from Gary, Indiana. Bill has been active in varsity sports and student government, lettering four years in football and track and heading up his graduating class as president.



Mrs. Ayn O'Connor, more widely known as Ayn Rand has, in the span of some 50 years, emerged as one of the most controversial writers of the modern age.

She was born on February 2, 1905, in St. Petersburg (later named Petrograd then Leningrad), Russia. Inquisitive as a child, she had taught herself to read and write by the age of six.

A husband sentenced to death, a wife's plan for his rescue, a seriously ill daughter that needed the constant care of her mother forms the basis for a story written by Ayn Rand. The mother must choose between saving the life of her husband or her daughter; she chooses the former for this is where her essential love lies. Ayn Rand wrote this at the age of eight and in it displays an amazing amount of maturity and intelligence for a person so young.

Until the Russian Revolution of 1917, her family had been living comfortably, supported by her father's privately owned business. Af-

ter the communist regime had taken power, her father's store was nationalized and the family lived on the brink of starvation for several years afterwards. Her primary objection to the Revolution was not the private hardships the people were bearing but the idea that one had to work and live for the betterment of the state.

BEGINNING AS A WRITER

In 1921, Ayn Rand entered the University of Petrograd to study history. She had by this time decided that her life's work would be that of a professional writer. Her freedom to express herself in print was censored by the Communist Party and many of her fellow students were arrested for criticizing the Party.

The year 1926 marked a turning point in Ayn Rand's life, for it was in this year that she obtained a visa to come to America. She settled down in Hollywood and began writing plays for an American movie

producer. In 1929, she married Frank O'Connor, a man with a personality as dynamic as her own.

Ayn Rand's professional career as a writer commenced with the sale of her first play in 1932, entitled, *The Red Pawn*. Her first widely recognized play was, *The Night of January 16th*, a dramatic court room trial case.

We the Living was the first of her novels and dealt with the idea of collectivism as it applied to the Russian people. Her first truly successful book was, *The Fountainhead* published in 1943. Warner Brothers bought the movie rights for 50,000 dollars and by 1945 the book had sold over 100,000 copies.

In 1946, Ayn Rand started *Atlas Shrugged* and 11 years later she completed it. Presently Ayn Rand is compiling a book of her philosophy. She also is the editor of the, "The Objectivist Newsletter," a monthly publication applying her philosophy to the contemporary problems of our culture.

Ayn Rand has deserved the recognition she receives. She has earned it through a practice of her own philosophy, part of which is that true success comes only to those who are willing to work, and think independently, and fight for their own personal ideals and convictions. She has dedicated her life to the formation of new philosophy as she so aptly writes:

My most important job is the for-

mation of a rational morality of and for man, of and for his life, of and for this earth.¹

The twentieth century has seen the emergence of a profoundly intellectual and highly controversial philosophy: the philosophy of Ayn Rand. Her ideas are novel and shocking and in a general sense are opposed to the cultural tradition of the past two thousand years.

The moral code that Ayn Rand is challenging is the creed . . . which has dominated mankind's history: the doctrine that man has no right to exist for his own sake.²

AYN RAND'S INFLUENCE TO BE FELT

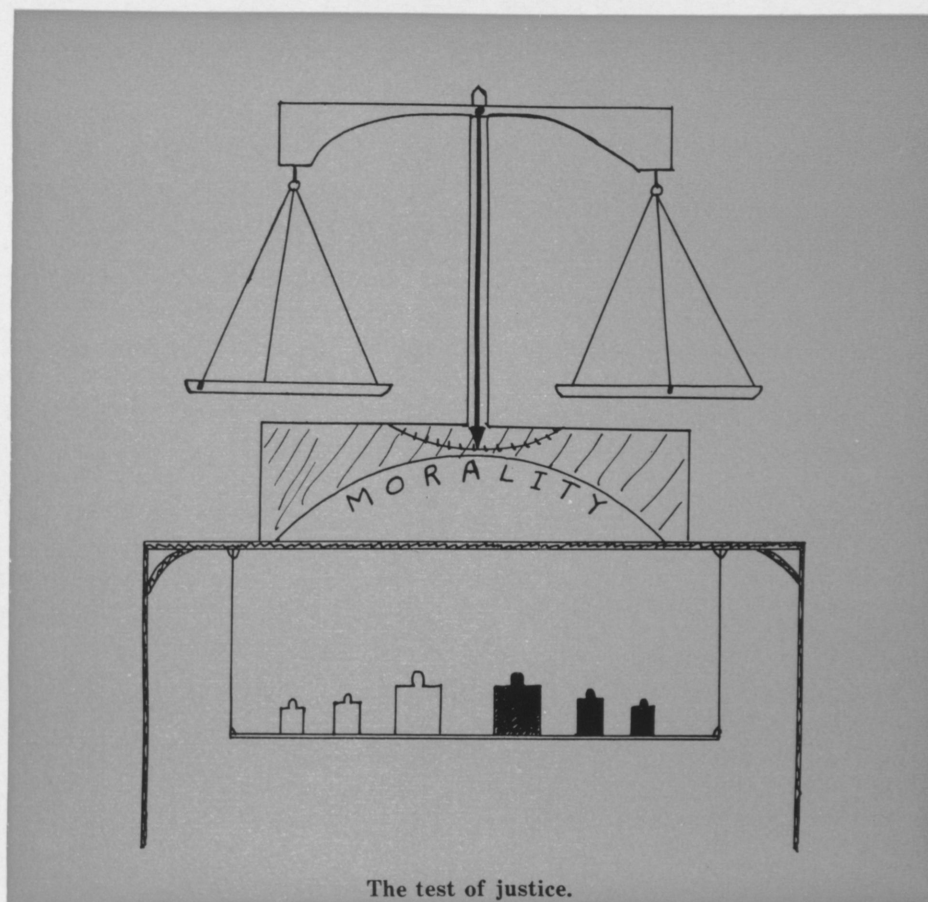
A fundamental objective of law is the ordering of society: to provide an atmosphere where man may live without constant strife and conflict. A basic ingredient in the formulation of this law is the cultural, moral, and political philosophy of the society wishing to be encompassed by it. It is my belief that the writings of Ayn Rand will have a profound influence over the philosophy of future generations as well as affecting the thinking of the present day intellectual world.

By the intellectual world, I refer to those people who have the willingness and ambition to strive for new ideas, new heights of human endeavor in an ever advancing technological world. It is in this frame of reference that I find the study of Ayn Rand's philosophy applicable to a course in legal institutions and functions of law.

The law of the land aims at justice, at what is fair and equitable to the parties involved. Justice is one of the underlying principles upon which Ayn Rand has based her philosophy.

. . . that to place any other concern higher than justice is to devalue your moral beliefs and defraud the good in favor of the evil, only the good can lose by a default of justice and only the evil can profit from it.³

She regards justice as one of man's highest virtues. From Ayn Rand we find the notion that all men must be judged as conscientiously as one would judge inanimate objects. A



person would not pay more money for a used automobile than for a new one and in the same light one should not value the incompetent man over the man of high character.

No man may seek a gain through the use of physical force; this is not just. Such an act forces a man to act against his will, *forces* him to act for the benefit of another.

In such a case Ayn Rand justifies the use of physical force as a retaliatory measure only so that a man may protect that which is rightfully his. Either man gains value by voluntary consent, persuasion, appealing to one's mind, or else he gains value by physical force, coercion, or fraud. The latter is unjust and is a hindrance to the progress of society.⁴

IMPORTANCE OF HONESTY

There can be no justice without honesty. If there were no honesty in mankind, people would attempt to make personal gains through corrupt practices. Honesty is one of the essential bricks used in the foundation of any moral code as Ayn Rand expresses so directly:

Honesty is the recognition of the fact that the unreal is unreal and can have no value, that neither love nor fame nor cash is a value if obtained by fraud . . . honesty is not a social duty not a sacrifice for the sake of others, but the most profoundly selfish virtue man can practice: his refusal to sacrifice the reality of his own existence to the deluded consciousness of others.⁵

To be just is not to grant the unearned. In Ayn Rand's philosophy justice is inseparable from her concept of self interest. For men to live together as civilized beings, they must declare justice to be the ruling principle guiding their conduct. Justice must be the primary expression of man's rationality in his relationship to other men. The characters in Ayn Rand's novels are sympathetic toward those who have been harmed by an injustice. Her heroes condemn injustice and extol the logic and rationality of fairness as practiced equally among all men.⁶

An essential part of Ayn Rand's philosophy is her concept of government and the role it should play in

today's world. During the 19th century in America, men were relatively free of governmental control in the field of industry. Once the Industrial Revolution opened men's finds to the advancements of technology, they developed, within the span of 80 years, the highest standard of living the world has ever known. Governmental control and regulation lowers the standard of living, for in many instances it stifles the expansion of industry into newer markets. The purpose of government should be to protect man's rights.

A proper government is only a policeman acting as an agent of man's self defense and as such may resort to force only against those who start the use of force.⁷ The function of government is to protect men from criminals, foreign invader, provide courts for the protection of property and contract against breach or fraud.

GOVERNMENT'S ROLE IN ECONOMICS

In a society where men are governed by objective law and where government has no other function or power, men may choose the type of work they desire, trade effort for effort, offer services, ideas and products on a market free of fraud. Under such circumstances men do not reach for a crutch, such as Congress, to get for them what they cannot get through voluntary exchange.

Ayn Rand believes in a laissez faire capitalism, a separation of state and economics. In this manner the individual producer is made important by the doctrine of self interest. Government should not have the power to dispense economic favors. It should be forbidden, by the Constitution or law, not to be able to abridge freedom of production or to trade on the behalf of any one particular group.⁸

Underlying the whole of Ayn Rand's philosophy is the concept that man ought to exist for himself, that man as a rational, thinking individual is important. She vehemently opposes the complacent, the mediocre, the lazy, the people who live off of the minds of the active. This is her central theme in *Atlas Shrugged*.

ged as John Galt expresses:

... we are on strike against the creed of unearned rewards and unrewarded duties ... against the dogma that the pursuit of one's happiness is evil ... against the doctrine that life is guilt.⁹

Ayn Rand has an answer for those who think that success brands one as an opportunist existing on the exploitation of others. Her answer lies in the concept of rational self interest, which is the most sensible and intelligent idea America has heard, in a long while, on the principle that has made her a great nation. Ayn Rand is for the man that has made America strong, the man who is not afraid to stand on his own and fight for what he believes is right.

... the only value I care for is that which has never been loved by the world, has never won recognition or friends or defenders: human ability. That is the love I am serving ...¹⁰

Man's life depends on thinking and achievements as testified by the tremendous strides he has taken in technology. Ayn Rand is against anything that attempts to reduce or limit man's mind, his capacity to think. She advocates that man must live his life for himself and that his happiness is of prime importance. She is against the idea that man exists solely for the purpose of helping others.

... we are told that happiness, self interest and the profit motive are ignoble, that man must live for others, that the competent must exist for the sake of others ...¹¹

AYN RAND CRITICIZED

Ayn Rand's critics argue that her concept of self interest merely extols disregard for the rights of others, an air of doing what you feel like doing, a sort of animal self indulgence. They argue that Ayn Rand's heroes are ruthless and devoid of compassion. As proof they offer the strike by the men of the mind in *Atlas Shrugged*. Here were the top individuals in the nation sitting idly by and watching the country falling to ruin. They say this is selfish and not moral.

In recent history this is exactly the story of East Germany. Here the

men of the mind could not tolerate the ideology of existence only for the state, so they escaped in any manner that they could, with the result being the almost total collapse of East Germany in an economic sense. Why should they stay as martyrs and work for the sole benefit of others? Here is where Ayn Rand's concept of self interest and man's existence for himself enter and give man a moral, logical reason to govern his actions.¹²

Many people will agree and disagree with the philosophy of Ayn Rand, but all must admit that she is certainly one of the dynamic personalities of the twentieth century.

Her works will continue to stir up controversies among the intellectual world, and it is my contention that her viewpoints will affect society politically, legally, and ideologically. Her philosophy extends as a fresh new approach to a world stagnated by the incompetency, by the man who looks to the government to provide for him, by the man who is afraid to stand up and be counted.

The man who refuses to judge, who neither agrees nor disagrees, who declares that there are no absolutes and believes that he escapes responsibilities, is the man responsible for all the blood that is now spilled in the world.¹³

¹Rand, Ayn, *For the New Intellectual the Philosophy of Ayn Rand*, p. 8.

²Branden, Nathaniel and Barbara Branden, *Who is Ayn Rand*, p. 12.

³Rand, Ayn, *Atlas Shrugged*, p. 425.

⁴*For the New Intellectual the Philosophy of Ayn Rand*, pp. 150-160.

⁵*Ibid.*, p. 158.

⁶*Who is Ayn Rand*, pp. 40-55.

⁷Rand, Ayn, *The Fountainhead*, p. 120.

⁸*Who is Ayn Rand*, pp. 45-60.

⁹*Atlas Shrugged*, p. 820.

¹⁰*For the New Intellectual the Philosophy of Ayn Rand*, p. 218.

¹¹*Ibid.*, p. 38.

¹²*Who is Ayn Rand*, pp. 55-67.

¹³*For the New Intellectual the Philosophy of Ayn Rand*, p. 216.

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5. Rand, Ayn, *We the Living*, Random House, New York, 1936, (RPI).

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As part of a continuing effort, programs have been designed to analyze communications needs of an area for determining the best plant network layout and switching office location.

In general, the necessary data are collected and the

engineer selects a number of alternative plans to be analyzed in detail by a computer. His final decision is based primarily on an analysis of the computer output.

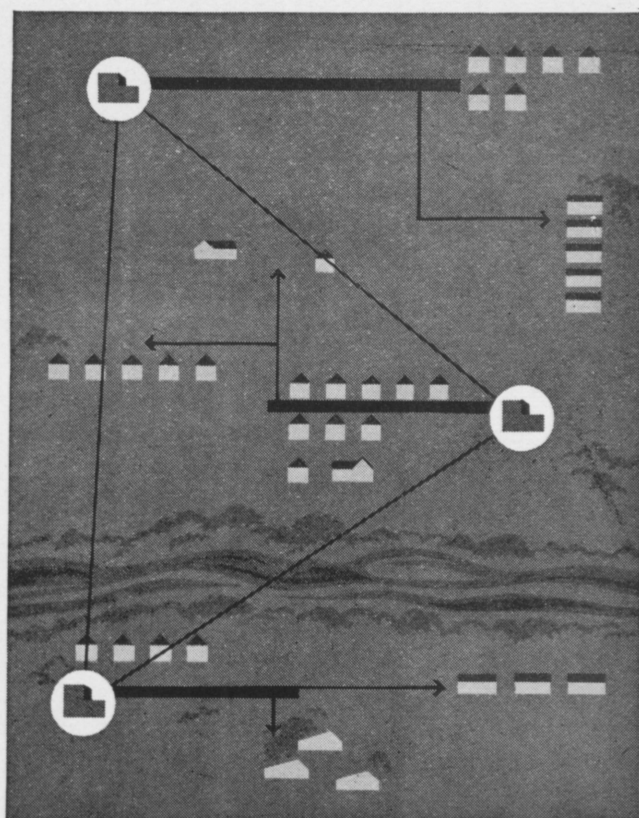
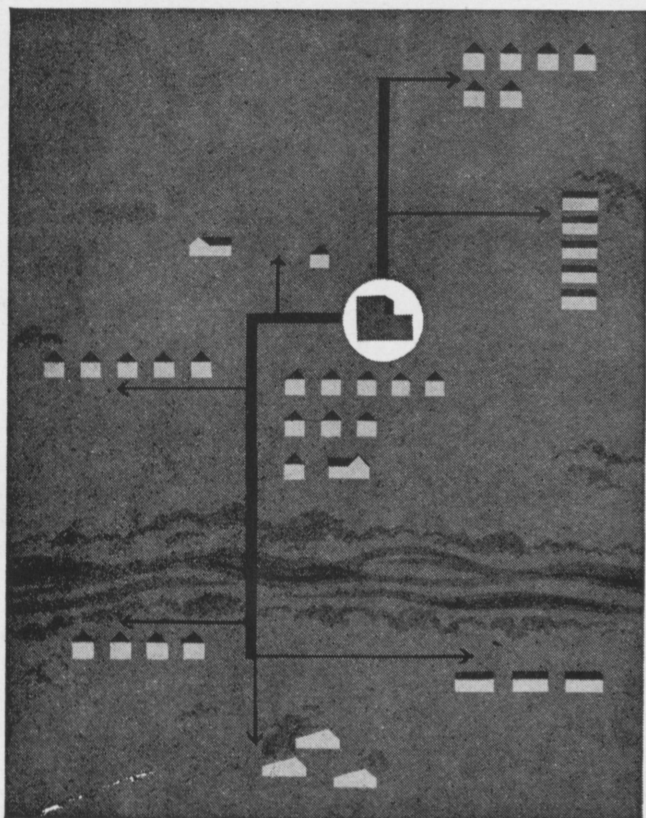
The computer supplies more significant data, and supplies it much faster, than laborious, manual calculation methods. The engineer is thus relieved of dull, time-consuming computation, and he plans facilities with increased confidence—knowing that he is providing efficient and economical communications, tailored for a given area.

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This?

In this hypothetical geographical area, communications could be supplied with one large telephone switching office and a network of cables (left), or with three smaller offices and a different network (right). Many other combinations of offices and cable networks might be possible. This situation, although hypothetical, is typical of the complex telephone engineering problems that are being solved with the aid of computer programs designed at Bell Laboratories.

Or this?

MODERN SERVICE STATION DESIGN

by ED ZAENGLEIN

Layout by Tom Trueb



The author of this article is Ed Zaenglein. He is a senior majoring in Civil Engineering. Ed has been busy this year as a member of Blue Key and Sigma Nu.

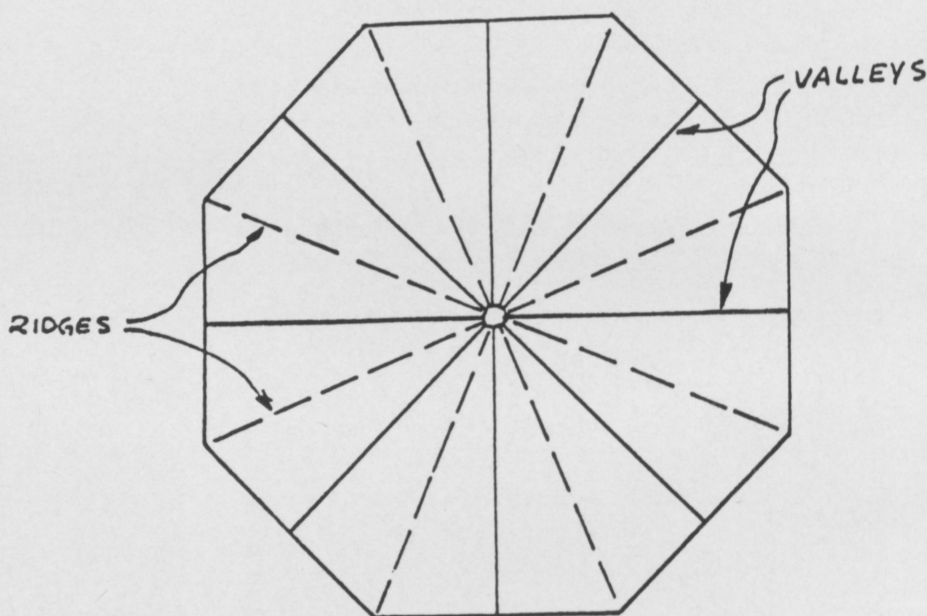
Drive-through refueling areas seem to be the latest innovation in service station design (based on Marathon Oil Company's newest design). Using this and the name of the company (Space Age) as a basis for design, this article presents a circular, drive-through refueling area design for the station.

Vending areas within the service stations are being provided in the newer designs, which appears to be very necessary in service stations that are located on interstate highways. A motorist in a hurry will be more likely to take the time for a cup of coffee in one of these areas and rest for a few minutes than he would be if only a restaurant were provided.

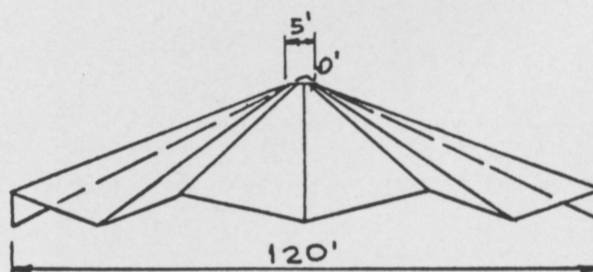
For the roof design, a triangularly folded plate concrete roof of umbrella shape was chosen. This particular type of roof will give the desired circular appearance if enough plates are used.

The service station is designed to be built together with a restaurant, motel, and garage, but could be built independently if certain modifications in the design were made. Since it was designed to be built in a complex of buildings, including a garage, no areas have been provided for changing tires and oil, lubrication, or repair work. The service provided at this station will be those of refueling, airing of tires, and adding water and oil. The storage space required will be small since oil is the only major item which will require storage.

ROOF GEOMETRICS



PLANE VIEW



PROFILE VIEW

FIG. 1

SERVICE STATION PLACEMENT

The Indiana State Highway Commission does not permit the building of service stations on the limited access interstate highways. In some cases, service station oases have been built on tollroads, but the tollroad authorities are separate from the State Highway Commission and access on their highway mileage is not subject to the same requirements.

The only design requirements available were those of a rest area designed by Homer L. Chastain and Associates, are used as a basis for designing the ramp geometry. If

this were a real situation, the State Highway Commission would set the requirements on what type of ramps, tapers, and degrees of curves were to be used.

The locations of high volume service stations are pretty much hit and miss. For different reasons, not fully explainable, some locations that should do a great deal of volume, do not. Others, which may or may not appear to be in a very good location, do a great deal of volume.

First hand observations as to where service stations are located, indicates that it will not be very difficult to get fuel and other sup-

plies to a service station no matter where it is located on the interstate highways. This is based on the assumption that the company does a volume business in the state of Indiana, although service stations are located near large cities so the supply lines will be reasonably short.

Distances between service station locations did not prove to be a problem. The longest distance between stations is 180 miles and most cars will easily make this distance without the need of refueling. Signs could be erected along the highway, advising the locations of these service stations.

STATION GEOMETRY

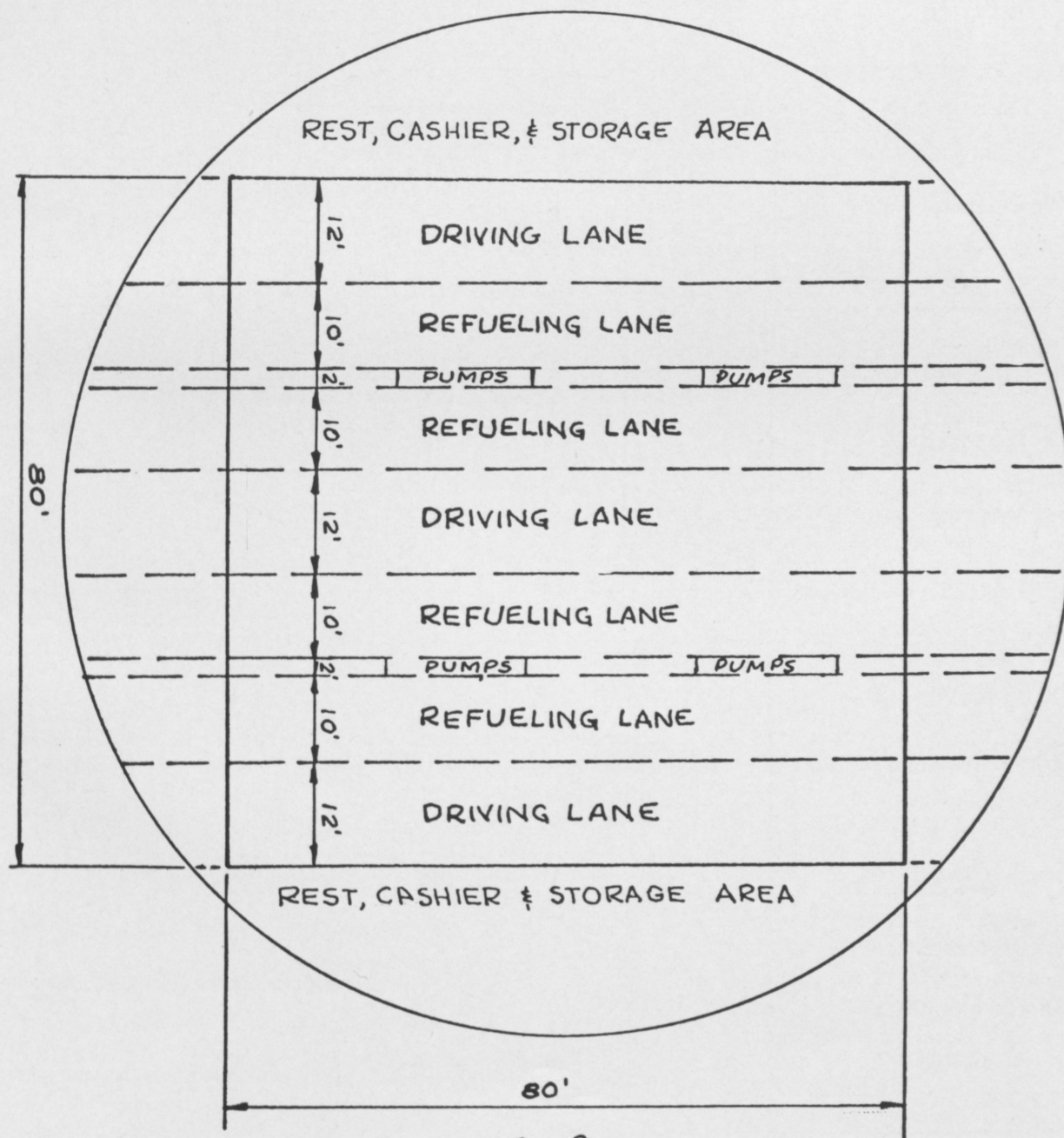


FIG. 2

MEN of ROSE

Remember that
Special Occasion

*Give her a Corsage
by HEINL'S*

HEINL'S FLOWER SHOP

129 So. 7th St.
Terre Haute, Ind.

Tracy Page Pharmacy

2253 Wabash Ave.

TERRE HAUTE, INDIANA

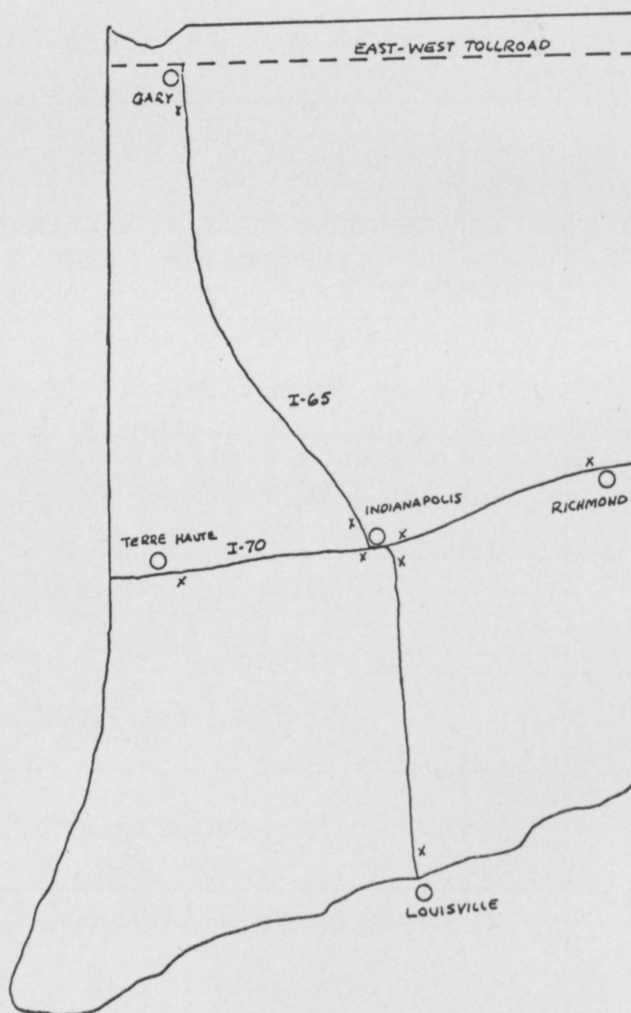
Magazines
Pipes - Tobaccos
School Supplies
Drugs and Sundries
Prescriptions
Soda Fountain
Lunches

The only written source of information on automobile service station design available is a book written by C. A. Petersen in 1952. Although outdated in many respects, it did provide some of the dimensions and ideas used in this design. No other written source of information on service stations specifically could be found so most of the ideas came from interviews, architectural magazines, and modern service station plans. Much has been done in service station design but unlimited possibilities still exist.

Selecting an overall design proved to be a challenge in the respect that everyone has a different idea of what is modernistic and appealing. A design which appeals to one motorist

may prove to be repulsive to another, so the design must feature those characteristics which will appeal to as many drivers as possible. The station must give a general appearance of efficiency and cleanliness. In trying to give these features, the designer must be careful not to sacrifice too much of the economy. He must face the question of how much can you spend on a station which has not yet been proven. If enough money isn't spent, the station may lack one of the overall customer attractions listed above. If too much money is spent, it may take a very long time, if ever, to get the investment back.

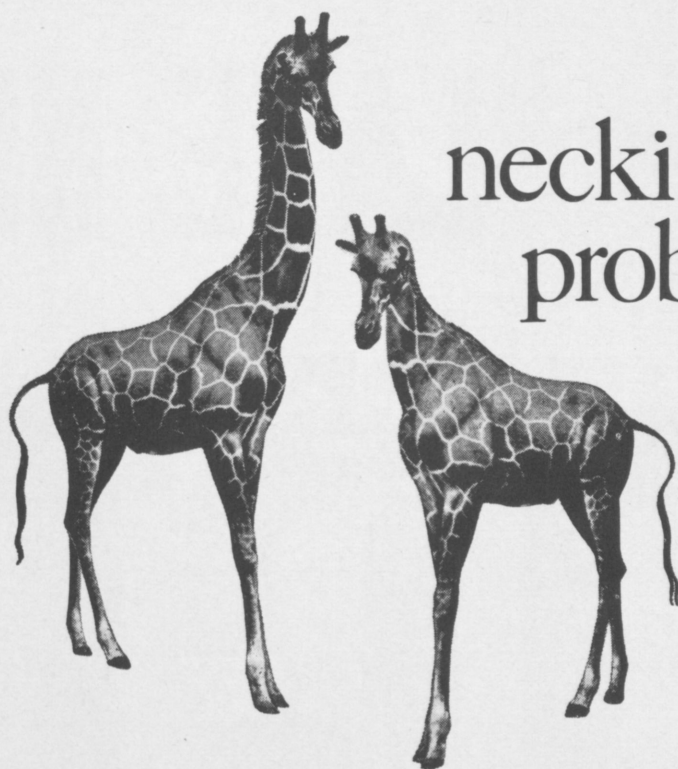
The selection of a roof to fit the
(Continued on page 27)



X-PROPOSED SERVICE STATION LOCATION

MAP OF INDIANA WITH PROPOSED PLACEMENT

FIG. 3



necking problem

To build a rectangular color TV tube with more of a picture than the earlier round tube type, and then squeeze it into a dimensionally attractive cabinet—you face almost insurmountable challenges.

Just to build a conventional color tube, you must . . .

1.—with absolute precision, lay more than a million red, blue, and green phosphor dots in a perfect triad pattern over the entire surface of the picture screen. Why so tough?—because the light source for the dots is a single ray coming through a pinhole. And it must be bent by a correction lens with precise mathematical calculation (different for each dot) to pass through over a third-of-a-million pinholes and fall exactly at a given spot on the screen.

2.—Once you've figured out the phosphor dots, you must then bend the electron beam broadcast by the TV station so that it too passes through the third-of-a-million pinholes.

These are just some of the feats you must perform. But after going through all this, you wind up with a tube with a neck so long it requires a cabinet nearly a yard deep to hold it. To shorten the neck requires mathematical calculations and engineering techniques so demanding they fall beyond any brief description.

The complexity of the 23-inch rectangular color tube development is considered by some of our consumer products engineers even more of a technological challenge than designing some of the sophisticated command systems required for space flights.

Motorola military engineers tend to disagree.

But now that we've brought it up, Motorola has accomplished both.

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WHEREVER YOU FIND IT

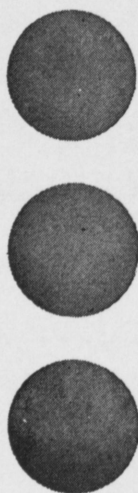
MOTOROLA

LATE NEWS

for

1966

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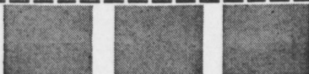


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TRANSMISSION LINE EQUIVALENT OF AUDITORY NERVES

Layout by Terry Joyce

This article shows that the auditory nerves of a cat may be simulated by electronic components. The basis for this simulation is transmission line, or cable, theory. Certain properties of the nervous system of a cat require that a very special type of transmission line be developed; one containing active elements.

This article treats only the auditory system of a cat, but proper changes could easily extend it to many other mammals and other animals. By changing certain capacitances, the frequency range may be modified, and by varying certain resistive elements, the amplification may be altered.

The article is presented in three main sections. The first discusses the nervous system which we wish to represent and its properties. The second presents the circuit which may be used to do this. The third section is an analysis of the circuit and its responses. In conclusion, a

comparason of the circuit to that of the cat is made. The circuit's possibilities and limitations are noted.

AUDITORY NERVES OF A CAT

Sound is transmitted through the air as pressure waves. These pressure waves are received by the tympanic membrane. The ossicles, three small bones, concentrate these vibrations and transmit them to the cochlea. The cochlea, a tube shaped like a snail shell, is filled with lymph. In the cochlea are the organs of Corti—sensitive "hair" cells which receive the vibrations. The auditory nerve then carries these signals to the brain. It is this auditory nerve which we are interested in representing.

The basic unit of impulse transmission is the neuron (Figure 1). The cytoplasm inside the cell is negative with respect to the fluid surrounding the cell by 0.075 volts. The active transport of sodium and

potassium ions create this potential difference. When the nerve is stimulated, its permeability to sodium ions increases and the ions re-enter the neuron. If the voltage is reduced to 0.06 volts, the inflow is sufficient to cause the membrane to break down in adjoining areas. It is this phenomena which propagates along the neuron. in my lined fibers (as shown in Figure 1), the breakdown occurs at the nodes of Ranvier—jumping from one to another. A refractory period of 0.001 seconds is required for the outflow of potassium to return the cell to its initial conditions.

The signal is transmitted by bundles of these neurons, since one neuron fires at one repetitive rate and with one constant strength. The system we design will be dealing with the signal as transmitted by bundles of neurons.

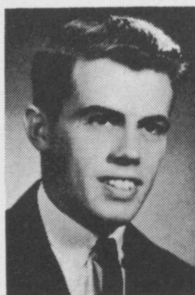
The signal transmitted by the left cochlear nucleus to the right superior olive is stronger than that to the left. This is the feature which we wish to incorporate in our artificial nerve bundle.

THE TRANSMISSION LINE

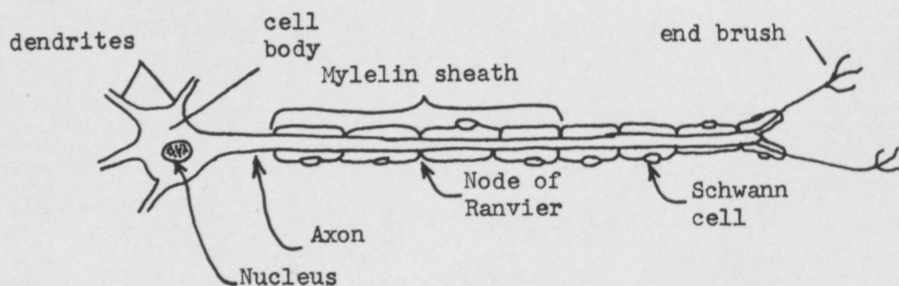
The transmission line suggested by the above development must be active. The most practical solution in the laboratory is to use a lumped-parameter, artificial line. The basic section is shown in Figure 2. The transistor is a Texas Instrument Co. 2N1565, The 160 and 290 kilohm resistors are used to stabilize the the operating point. The 1000 microfarad capacitor is chosen to pass signals down to approximately 20 cycles per second.

A separate section was devised to couple the sections together. In coupling the sections, it is necessary to match the input impedance of one section to the output impedance of the previous section. Also, in coupling the sections, we wish to make sure that the second section is not overdriven and the transistor ruined. Figure 3 shows the coupling section with the potentiometer used to match impedances. The capacitors are used to isolate the d-c currents in the separate sections.

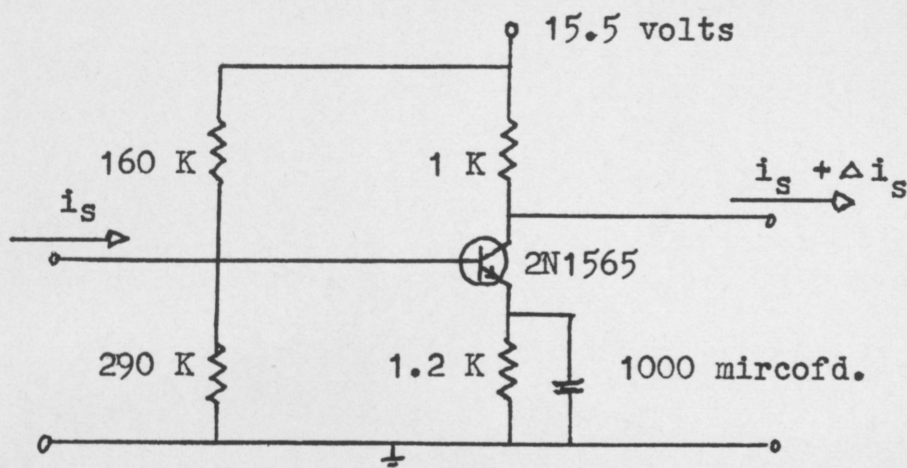
As our source, we used an audio



Author Tom Wilhoite is a senior electrical engineer from Indianapolis. Tom is an active member of Lambda Chi Alpha fraternity, I.E.E.E. and A.I.P. societies as well as the glee and rifle clubs and has made numerous contributions to the Institute Inklings.



The Neuron

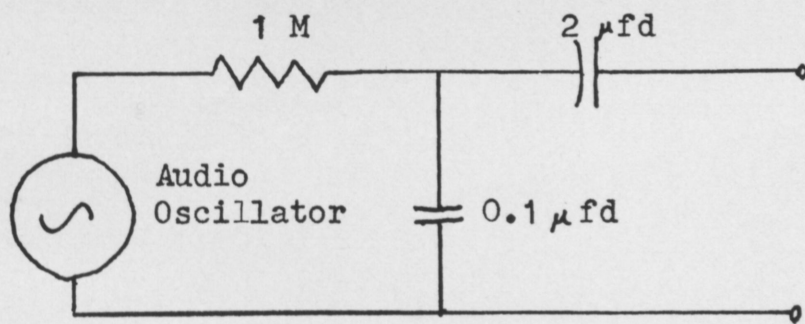


Basic Section

oscillator. The oscillator is a voltage source which we needed to change to a current source. Figure 4 shows the source. The 0.1 microfarad capacitor is used to shunt the high frequencies in order that the input be limited to the range of the ear.

The termination was chosen to be a resistive load adjusted to match the last section. Figure 5 shows this circuit with coupling capacitor and a 660 ohm decade box representing the approximate input impedance of a section.

The greater the number of sections and the less the current ampli-



Source

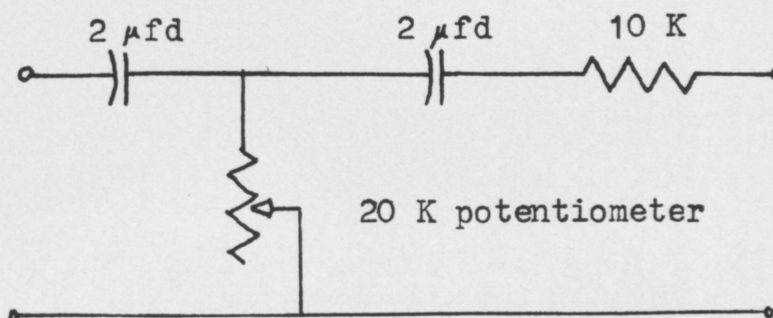
fication of each section, the better the model. A single stage amplifier is a crude approximation. Ten stages are better and a hundred are better yet. The more sections, the smaller the increments of i , the better the model.

ANALYSIS OF THE CIRCUIT

Three sections of a proposed and designed ten-section, equivalent line were built and tested. A dual-trace oscilloscope was used to monitor the input and output of the system after it was built and adjusted for proper gain.

The frequency response has a slight value starting at 25 cycles per second. The output is best in a range between 140 and 4000 cycles per second. The one feature which is not included in this model is the threshold stimulation. If such a device were included and the threshold of the input set between 0.40 and 0.45 hundredths volt, the signal would be limited to around 30,000 cycles per second. These results agree well with the audio range of a cat.

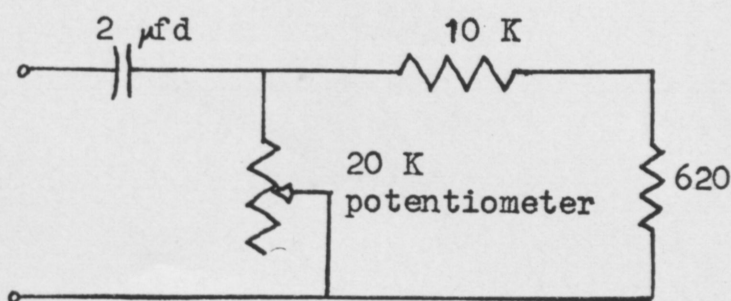
The laboratory experiment has several advantages over work with actual nerves. First, electronic components can be assembled much easier than a cat can be operated on.



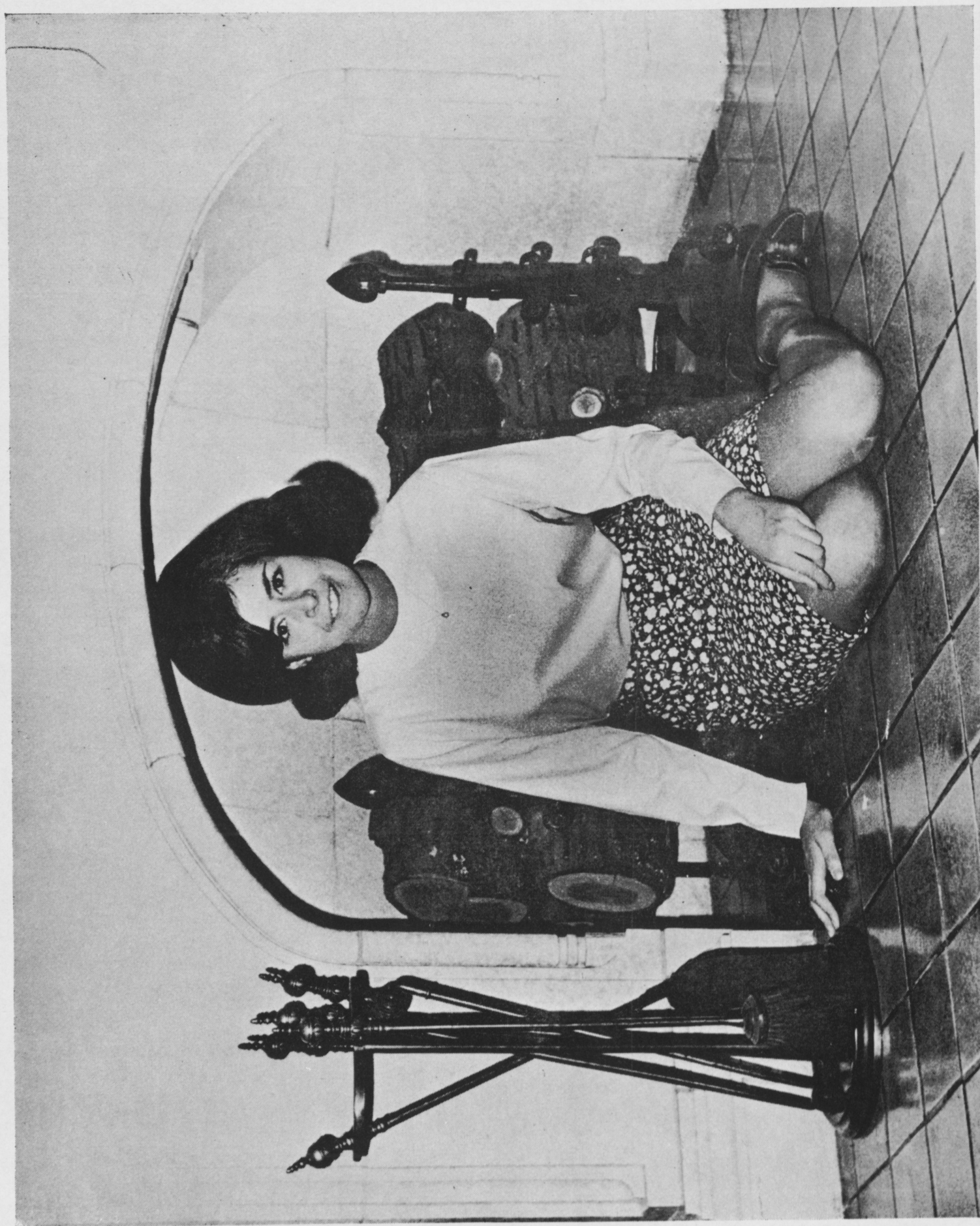
Coupling Circuit

By proper adjustments the electronic system can simulate any of a great number of nerves. One further advantage is the uniformity of electrical values and components—an experiment on a cat may be difficult to reproduce, but many people are capable of setting up the electric circuit.

In summary, it has been shown that many of the features of the auditory nerves of cats can be represented by an electric circuit. Also, it has been indicated that, for its failures, the electronic equivalent possesses certain advantages over work on an actual nerve.



Load



MAY MISS TECHNIC



KATHY WILLIAMS



Our offering for May is Miss Kathy Williams. She is a sophomore majoring in history at Saint Mary-of-the-Woods College. Kathy calls Melrose Park, Illinois her home.

Her sparkling personality is complimented by her other aesthetic attributes. Our Spring beauty has dark brown hair and eyes to match. Her 5' 5½" frame is augmented by a well placed 34-22-35.

Kathy enjoys outdoor activities and names water-skiing as her favorite hobby. Who could think of a better companion on these warm Spring evenings?

Photography by Charlie Rupp

Read and Decide

"Professor... or Mr. Computer"

by Frank Nigh

Since the days of Sputnik, the criteria of top-flight education at all levels has been continually discussed. The major portion of the unanswered questions concern the best method of learning.

In the 1920's, Sidney L. Pressey, a university psychologist at Ohio State, developed a rudimentary version of what is now called a teaching machine. Its chief disadvantage was when the student made a mistake, he was just told that he had chosen the wrong answer and was given no help.

This handicap has been answered by a system called intrinsic programming. If the student assimilates the new material, he moves ahead. If not, he is "branched" to a remedial presentation. Two distinct problems exist. First, the student has to choose one of the alternate answers instead of formulating his own solution. Second, the number of branch levels could not be extended to a significant extent.

In the late 1950's when the idea was sparked that computers might be suited for programmed instruction, some of the qualitative differences were envisioned.

The computer can continuously compare the student's performance

with criteria established by the teacher, and present new material, or direct the student to the teacher or the library, depending on his performance. (A performance that can be judged on the basis of a rather large number of individual responses by the student.)

The ability to do what amounts to continuous testing can be used to prevent a student's moving ahead before he has mastered the material at hand, as well as preventing his being held back by the logistics of a classroom.

The computer can keep quite elaborate records of the details of each student's progress, and the teacher can query the computer about any student at any time. Ideally, the teacher can be far better informed about his student's progress than is possible in an ordinary classroom situation or with simple teaching machines.

Since course material is stored in a computer's memory, it is easy to change. Thus computer courses can be improved quite easily with experience, while it is relatively difficult to change teaching machine programs or programmed textbooks once they have been printed.

One of the chief results of this effort by IBM is a programming

language called *Coursewriter*. Using this language, a course author enters the code QU with a question he wants to have typed out at the student's terminal. The computer then generates its own instruction to type out this question to the student at the proper point in the course, along with a variety of housekeeping information to enable the machine to keep the questions in the proper sequence, direct the student to the next question or present additional information depending on his answer.

Student terminals built for research purposes include, in addition to a typewriter, a random access slide projector, and a tape recorder. Then the course author can include instructions in his program to show a certain slide or play a certain portion of the tape just as easily as he can have the typewriter type a question or instruction.

How flexible must the system be for effective instruction? If little or nothing is required of the student in the way of special codes and procedures, an excessive amount of computing time may be consumed. But minimizing the computing required may put too many exasperating procedural problems between the student and the subject matter.

The balance is dependent on the cost per computation and has been shifting toward greater flexibility on the part of the computer. The level of flexibility of current programs is indicated in a general way by the illustration, which shows a simple form of editing of a student's response, and the use of key words in evaluating the response.

The problem is to identify an unknown peptide. The student's printout gives some information about the unknown. He is to request the laboratory tests necessary to identify the peptide and, based on their results, give the peptide composition. He is graded as shown after SCORE near the beginning of his printout.

When the student has typed "conclusion," indicating he thinks he can identify the peptide, the computer has checked to see that he has re-

quested the two essential test. If not, the system would tell him so, and subtract two points from his score. (Note also that the system accepts minor misspellings - hydrolysis and hydrolisate - in the student's response.)

On the flow chart, the system asks the student to type his conclusion, and waits for his answer. The answer is edited and compared with two version of the correct answer. If it matches either, the program informs the student he was correct and goes to "RD," where the student's score is typed out.

If the answer doesn't match either correct answer, the program subtracts two from counter 9, where the student's score is being kept, and adds one to counter 7, where the number of incorrect answers is stored. The program then

tests counter 9 to see if it is zero; if so, the student is "terminated!"

A partially correct answer, causes the system to type out a different hint. The final box, corresponding to an unanticipated answer, brings forth a general hint: "Review the data and try again." Each of these operations returns the student to the "wait" instruction.

Experiments in programmed instruction have shown two ideas with reasonable certainty. First, the hopes of early proponents of programming that the process would teach more effectively than human teachers have not been demonstrated. Second, Pressey's original idea, that programmed teaching could free the human teacher from a good deal of the drudgery of presenting straightforward factual material, and drilling students on it, seems valid.

An Example Problem

INSTRUCTIONS: Request, in the order of usefulness, those procedures you would carry out to solve the analytic problem posed.

SCORE: Maximum score for the problem is +20.

PENALTIES:

- 1 for attempting a test before it can be done
- 1 to -4 for each unnecessary procedure received
- 2 for attempting conclusion with insufficient data
- 2 for each wrong conclusion.

PROBLEM: A peptide in pure form as a crystalline solid has been isolated from the enzymic hydrolysate of a newly discovered protein hormone. Assume that a molecule of this Peptide X contains 12 or less amino acid molecules, that the amino acids are those normally found in protein, and that they are bound together by the usual peptide linkages. Your task is to determine the structure of Peptide X.

Request one procedure (at a time) and EOB.

When you feel you have adequately

determined the structure of Peptide X, type the word conclusion and EOB.

What is the molecular weight?

Molecular weight: 230 ± 10 .

Partial hydrolysis and chromatograph of hydrolisate.

Partial hydrolysis: Supervisor suggests you try some other procedure. *Exhaustive hydrolysis and chromatograph of hydrolisate.*

Exhaustive hydrolysis and chromatography of hydrolisate:

Two spots appear in each of two solvent systems.

Rf's identical with those of glycine and lysine.

Comparison of electrophoretic mobility of hydrolisate and amino acids. Electrophoretic mobility of hydrolisate constituents compared with standard amino acids: Mobilities identical with those of glycine and lysine.

The molar ratio of amino acids in hydrolisate.

Molar ratio of amino acids in hydrolisate:

glycerine: lysine is 2:1.

Conclusion.

The MOST you can conclude from the data gathered thus far is that the unknown substance, Peptide X, is a

Tripeptide

The data allow you to do better than this. Try again.

Tripeptide with two molecules glycine and one lysine.

Correct.

End of problem.

The only essential tests were the molecular weight and the exhaustive hydrolysis with chromatography.

Your final score is 12.

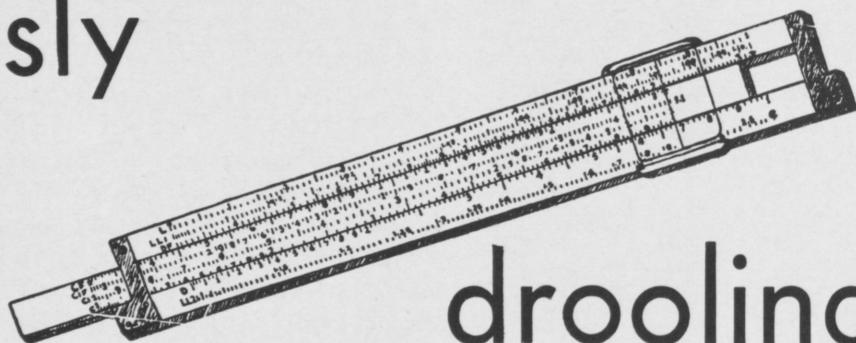
You requested 3 unnecessary procedure(s).

You were penalized -4 for ordering the molar ratio of amino acids in hydrolisate when you already had both the molecular weight and the exhaustive hydrolysis with chromatography.

(-1 is deducted for each other unnecessary procedure.)

You had 1 try before you correctly gave the most specific description of Peptide X.

sly



droolings

Stolen by Chuck Risch, Jr. M.E.

M.E.: "I like mathematics when it isn't over my head."

Ch.E.: "I feel the same way about pigeons."

* * *

Prof: "Well, what did you think of the course?"

M.E.: "I thought it was very well covered. Everything that wasn't covered during the quarter was covered on the final."

* * *

He: "What happened when you whistled at that beautiful girl walking her dog?"

Him: "She walked past me as if I were a lamppost, but her dog didn't."

* * *

No snowflake in an avalanche ever feels responsible.

* * *

There once was a man named

Round

While cutting his lawn he drowned,
'Twas dark and he fell, down the
shaft of a well.

Couldn't tell his grass from a hole
in the ground!

* * *

Golf is a game in which a ball,
1½ inches in diameter, is placed on
another ball 8,000 miles in diameter.
The object is to hit the small ball
and not the big one.

* * *

While travelling through the
jungle, a missionary met a lion.
Seeing that his plight was hopeless,
he fell to his knees in anxious
prayer.

A few moments later, he was
greatly comforted to see the lion
on its knees beside him.

"Dear brother," said the relieved
missionary, "How delightful it is to
join you in prayer when a moment
ago I reared for my life."

* * *

A young girl went into a doctor's
office and he gave her a thorough
examination.

Doctor: "What is your husband's
name?"

Girl: "I have no husband."

Doctor: "Then what is your boy-
friend's name?"

Girl: "I have no boyfriend."

The doctor went to the office
window and raised the shade. The
girl asked what he was doing and
he replied: "The last time this hap-
pened a star rose in the East and I
don't want to miss it."

* * *

Once in a certain city that shall
remain unnamed for no reason at
all, a seventy year old man was re-
covering from an operation. He was
very sad. It was his birthday and
he hadn't received any gifts or
greetings. At long last his three
sons showed up, each one empty
handed.

"Well, I see all of you forgot it
was your dad's birthday, didn't
you?" mumbled the hurt old man.

"Gee, Dad, we've been so busy we
just forgot all about it."

"I guess I should forgive you.
Forgetfulness runs in our family. I
even forgot to marry your mother."

"What!" shrieked the sons in
unison. "You mean we're . . ."

"Yes," replied the old man. "And
cheap ones at that."

* * *

She: "If you do I'll scream."

He: "Do what?"

She: "Well, you're not going to
just sit there, are you?"

* * *

Every day the guards in the Rus-
sian work camp checked out the
workers as they left the grounds, to
prevent stealing. For several days
a guard had been watching one par-
ticular man pushing out a wheel-
barrow full of straw. Every day he
examined the straw suspiciously
but could find nothing hidden in it.

One day, after inspecting the
wheelbarrow, he said, "Look, Com-
rade, tomorrow I am being trans-
ferred to Siberia. I'll never see you
again, and I promise to keep your
secret—what in the devil are you
stealing?"

The worker looked around cau-
tiously and whispered, "Wheel-
barrows."

* * *

Once upon a time, as the story
goes, the fence between Heaven and
Hell broke down. Satan appeared at
his side of the broken section and
called out to St. Peter: "Hey, St.
Peter, since all the engineers are
over on your side, how about send-
ing a few to fix the fence?"

"Sorry," replied St. Peter, "my
men are too busy to fix the fence."

"Well then," said Satan, "I'll have
to sue you if you don't."

St. Peter answered, "Guess you
will win. You've all the lawyers on
your side."

* * *

Definition of a baby—Something
with a lot of noise on one end and
a complete lack of responsibility on
the other.

* * *

The ship was sinking rapidly. The
captain called out, "Anyone here
know how to pray?"

One man stepped forward and
said, "I do captain."

"Good," said the captain, "You
pray. The rest of us will put on life
preservers. We're one short."

* * *

Employer: "Are you looking for
work, young man?"

Engineering student: "No, but I
would like a job."

Sports

College Professionals versus Athletic Students

by Don R. Riley

Last Sunday evening, I watched two Pro basketball teams play forty-eight minutes of gruelling basketball. These teams were good. They played well as a team and as individuals. This is what the American sports public loves to see—well-polished teams competing in sporting challenges. These pro teams are good because the athletes are recruited from the college teams they starred with, by men who are paid to get the best. Colleges, by the same token, recruit prospective athletes from high school teams. For many athletes, healthy scholarships are offered as an incentive to play with top college teams. I can't go against all public opinion and say that recruiting is bad for prospective college stars, because I'm in partial agreement with this competition.

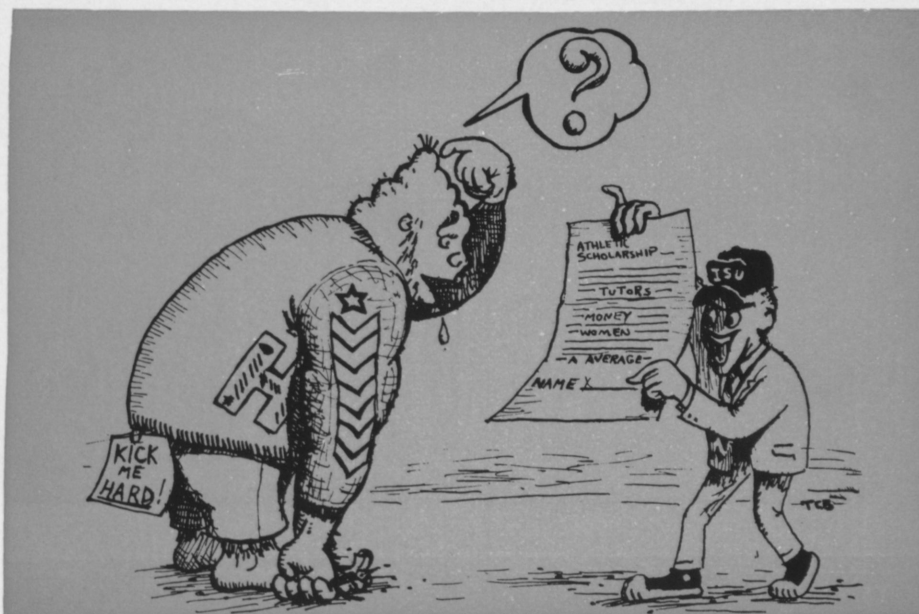
However, I'm against any college attitude that offers a healthy baseball scholarship to John Doe when John Doe barely passed his high school requirements. John Doe may be Mr. Baseball, but he certainly needs to consider his chances in the college classroom before accepting his baseball scholarship. Too often, when a high school athlete is approached by five recruiters from different colleges, he faces pressures which cause him to forget the main purposes of college life. And, regretfully, many of our college classrooms are filled with "deadwood" like John Doe, and are impeding the learning progress of others around him. I

cannot justify in my own mind this type of college recruiting of top athletes. Maybe college recruiters listen to the avid sports public and fail to heed the national pressures demanding from our colleges, leaders for tomorrow.

I feel that our college halls are being used incorrectly.

It is in this train of thought that I turn to our own sports program at Rose. Rose doesn't offer athletic scholarships and I hope it never does. Rose is an excellent school with a tremendous image in engineering and science circles in the United States. Our attitude towards sports is different from those of the Big Ten and other similar conferences. Rose administrators and

Coaches Mutchner and Martin first concentrate on the individual's ability to persevere in our classrooms. And then, they concentrate on his ability to play varsity sports. Those individuals who couldn't make it academically at Rose aren't encouraged to come just so they could hit a homerun for the Engineer's baseball team. I commented earlier on the new sports image of Rose generated by Coach Mutchner. This new image is one of healthy competition among Prairie Conference teams and not one belonging to our sports public. And yet, the Fighting Engineers are winning. We don't need athletic scholarships to produce winning teams. We need to maintain our healthy attitude towards sports.



Feature Article

MOIRÉ

by TOM SPROUSE

Moiré is the French word for watered, and in English it is most commonly used in the term "Moiré silk", a fabric which has a shimmering effect much like that of the reflections on a pool of water.

Authentic moiré silk was first produced in the Orient where the process has been handed through generations. The exact date of discovery is not known.

The silk is produced from a glossy fabric with a pronounced weave of parallel cords. The fabric is folded so that the cords are nearly aligned and the two layers are pressed so as to engrave the parallel weave of one onto that of the other. When the material is unfolded, it displays a

moiré pattern due to the superposition of the slightly misaligned parallel lines.

Moiré patterns are not limited, however, to silk and window screens. They occur wherever a repetitive structure is overlayed with another structure and the line elements are nearly superimposed. For example, two sets of railings on a bridge produce a moiré pattern. The distance between the posts nearer us appears slightly greater than those further away and so we see a beat when a post of the nearer railing catches up with that of the further railing. The beat moves along faster than our actual movement. You can also see moiré patterns in wire trash

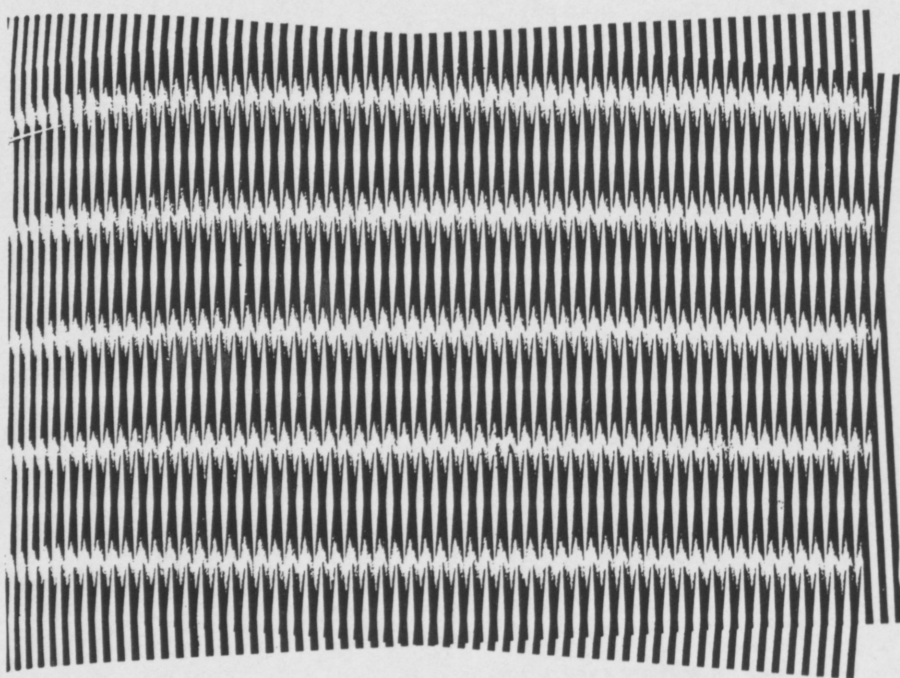
cans. If you look at it in a certain direction you will see a huge enlargement of the repeat unit in the wire mesh. This is another feature of moiré effects, it magnifies repeated structures.

Look through a screen door at the landscape. Wherever some structure in the landscape has elements of apparently the same repeat unit as the screen, a moiré pattern will appear in the door. Such repeat structures include shingles, bricks in a wall, or even windows of a very large apartment house. In other words, by the moiré technique we pick out periodic structures from an otherwise random landscape. Mathematicians would call this process a Fourier analysis.

WHERE ARE THE PATTERNS AVOIDED?

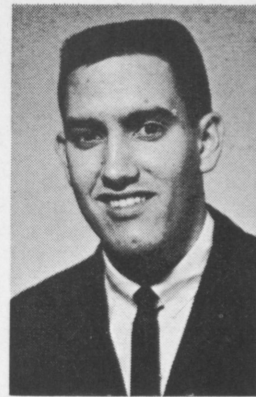
Despite the beauty of moiré patterns, some people try to avoid them. Imagine what an engineer would think if, after he had designed a great structure, he would find that the moiré effect produced by window screens with their reflection against the glass moved madly about ever with the slightest of breeze and completely dominated the appearance of the building.

Printers working with halftone screens in multicolor processes go to considerable pains to remove any moiré patterns (which appear as colored streaks) between the screens they lay down to produce the printed dots. All sorts of unwanted moiré patterns appear in television. Entertainers are urged not to wear



Effect of slightly misaligned parallel lines.

PATTERNS



Tom Sprouse is a senior civil engineering major who commutes from Staunton, Indiana. Active in extra-curriculars, Tom is in Lambda Chi Alpha Fraternity, the ASCE, and a letterman on the baseball team.

striped clothing. The slightest moving moiré pattern filling the entire screen. Along with this, when you are at the zoo, look at a zebra some distance from the screen of his cage. You will see his breathing as an enormously enlarged moiré pattern.

Thus far, we have seen only where moiré patterns may occur in everyday life. However, the application to science of these patterns went unnoticed for many years. In 1874 the British physicist Lord Rayleigh sug-

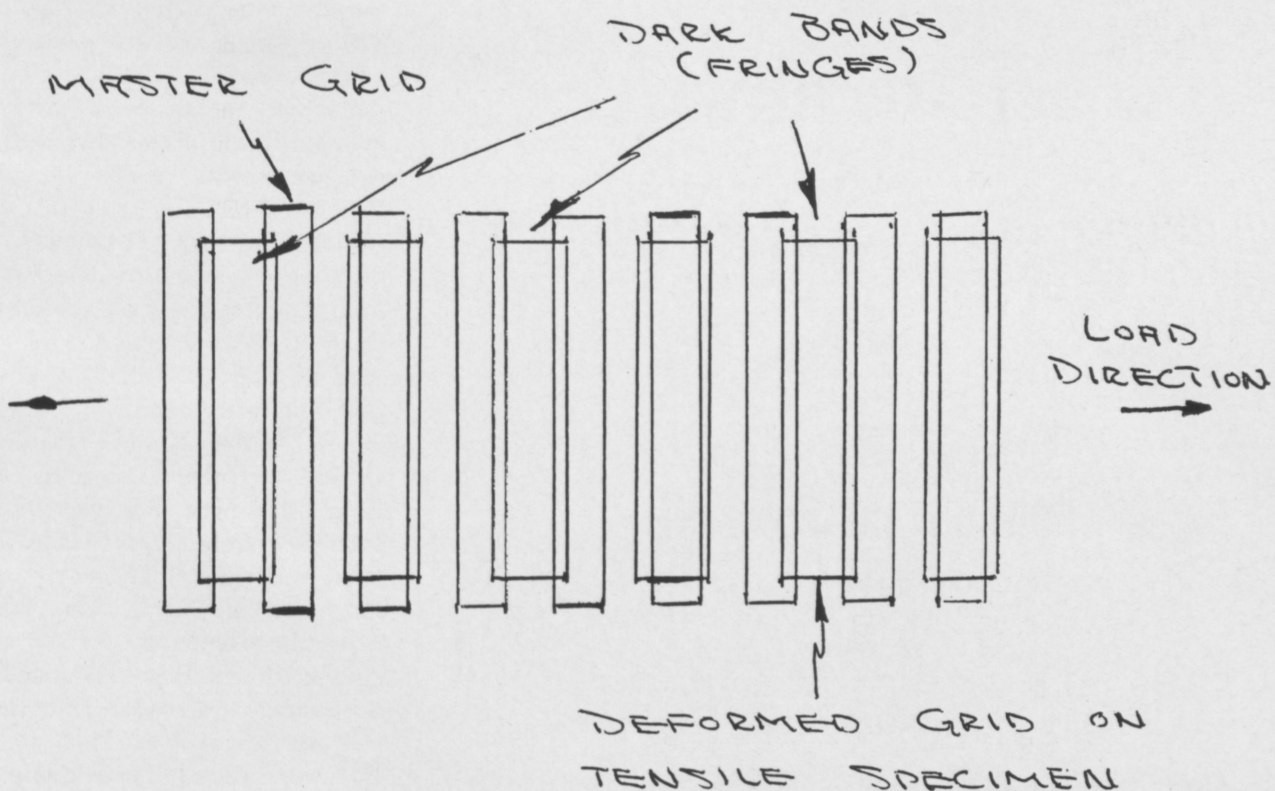
gested that moiré patterns could be used to test the perfection of ruled diffraction gratings. In recent years, this technique has been extensively employed at the National Physical Laboratory in England.

The simplest form of moiré patterns arises from the parallel superposition of two sets of equidistant parallel lines. This is the type of pattern mentioned above in connection with the bridge railings. This

is also the type of pattern that is now being used extensively in the stress and strain fields.

ORIGINAL USE OF THE PATTERNS

Moiré fringes were first applied to the subject of strain determination in 1952 by J. K. Kaczer and F. Kroupa of the Physics Institute of the Charles University in Prague. The basic idea behind the approach of these two men was the following.



As the model is loaded, the grid lines, initially the same as those of the master grid, are deformed in the above manner. Since the model is essentially homogene-

ous, the stretching is uniform and both the grid lines and spaces are stretched in the horizontal direction. As the grid is deformed some of the lines on the

model coincide with the spaces of the master grid, thus causing dark bands to appear.

HAHN

VERY
VERY
IN

SHOES
FROM
HAHN'S
at Meadows Center

MOIRE PATTERNS

(Continued from page 25)

Moiré fringes are the result of two interfering line screens. One is printed in the model and is subjected to deformations produced by the applied loading. The second, which is a duplicate of the first, is printed upon a transparent material, such as a clear acetate plate.

The second is known as the master grid and is rigidly fixed exactly over the first grid but not connected to the model. As the model is deformed so is the first grid thus causing moiré fringes to occur. Knowing the distance between the master grid lines and measuring the distance between the fringes, it is possible by geometric analysis of the intersections of the two systems of lines to compute the new distance between the model grid lines and also any change in direction of those lines.

With these data, normal and shear strains can be computed. The values obtained for the strain are the average values in a region limited by two

fringes since the applied formulas are valid for a homogenous field.

The geometric derivation of the applied formulas is much too involved to be shown here but for a further reference it is suggested that the reader refer to the *Journal of the Engineering Mechanics Division* of the A.S.C.E. proceeding, Volume 87, No. EM1, February, 1961.

FURTHER USES OF MOIRE PATTERNS

Although the use of moiré patterns in the field of strain analysis is varied and useful, its scientific application by no means ends there. The effect is widely used in many physicist's problems. For example, it can be used in the design of a microwave horn. For further reference the reader should see the article by Gerald Oster entitled "Representation and Solution of Optical Problems by Moiré Patterns" from the *Symp. of Quasi-Optics*, Polytechnic Institute of Brooklyn Press (1964), distributed by Wiley-Interscience, New York.

Moiré patterns describe fields in two dimensional potential problems. Such fields occur in electrostatics, magnetostatics, hydrodynamics, elasticity (as described above), and gravity theory. The moiré technique is very useful in describing fluid flow.

Moiré patterns can be used in the description of crystalline structures. Moiré effects are even used in the field of psychology. All the above uses of moiré patterns are given in much greater detail in either the article entitled "Moiré" Patterns" by Gerald Oster and Yasunori Nishijima in the May 1963 issue of *Scientific American* or Dr. Gerald Oster's book entitled *The Science of Moiré Patterns*, copyright 1964, Edmund Scientific Company.

It is hoped that this article has acquainted the reader with the fascinating and varied field of Moiré Patterns. It is because moirés provide simple analogues of complex phenomena that they have such a wide range of potential usefulness.

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SERVICE STATIONS

(Continued from page 12)

design, once the specific design came to mind, was probably the hardest problem faced. A circular roof without a support in the center is hard to design. The 120' span also provided headaches. Luckily, there was available a thesis written by Dr. Dukhyun Kim which provided a basis for the structural analysis. Literature on triangularly folded plate roofs is very scarce since it is a relatively new type of roof design.

Many other smaller problems were incurred, such as the building of a plastic model and the cost estimate, but listed here are the three major

ones to give an idea of the challenge provided by this type of project.

The service station is designed to accommodate twelve cars at once. On the recommendation of employees of Marathon Oil Company, they're capable of serving eight cars at one time. This will cut the number of employees by two until the site has been tested and proven. If the volume is high enough to warrant the other two double unit pedestals, they can be installed in a very short period of time, disrupting service to only one lane at a time. This will also allow room for expansion with the increasing amount of traffic on the roads each year.

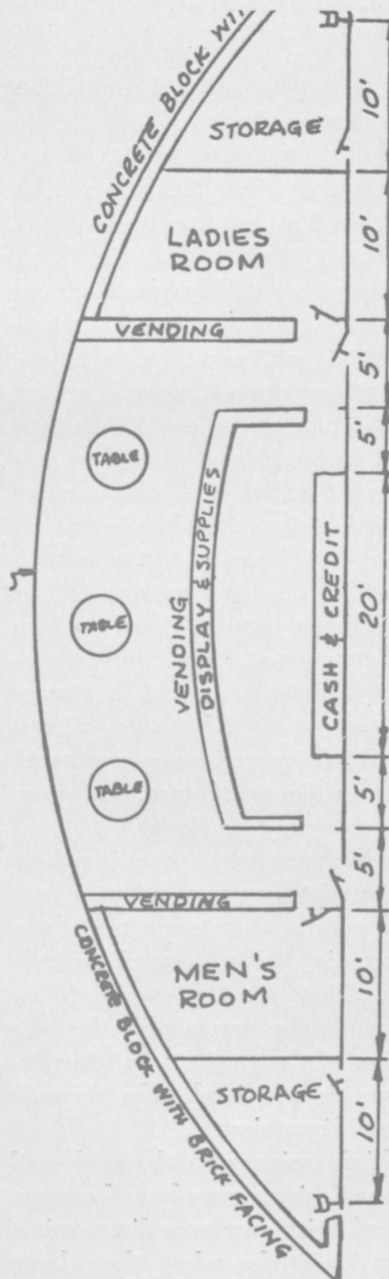


Fig. 4A. Left half of service area.

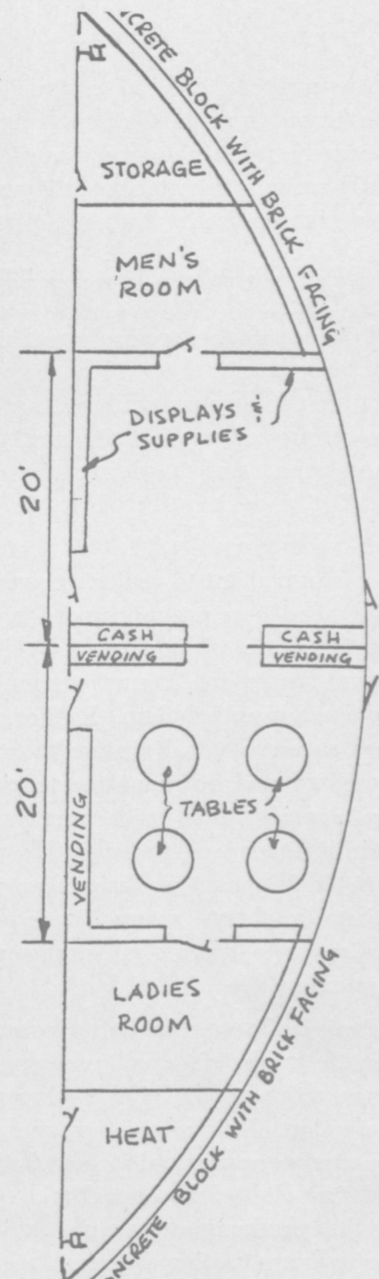


Fig. 4B. Right half of service area.

WHY PROJECT SALVAIR?

by DR. DENNIS SAPP

One purpose of civil engineering is to reconstruct parts of the human environment into more functional configurations in order that they may be of greater use for human activity.

To accomplish this goal, it is necessary, first of all, to bring to bear the full force of the technological factors of our culture which may be pertinent to any particular situation. The group of procedures and processes one uses in doing this has commonly been referred to as the design process.

It is important to realize, however, that there is no prevailing order to a "design process" and that technological data alone cannot completely solve a design problem. Rather, the total socioecological system must be examined and relevant facets given due consideration with respect to their influence on the ultimate product. This aspect of design has, traditionally, been given inadequate treatment in most civil engineering curricula.

Project Salvair is an attempt to provide a brief, quasi-professional introduction to the civil engineering profession. It involves a restudy of the existing municipal airport facility at Terre Haute: Hulman Field. One of the predominant values of this particular situation lies in the fact that the airport does exist and many

of the technological problems have already been solved.

A major emphasis of the study can, therefore, be placed on the socio-ecological aspects of the system. The availability, in the local community, of many professional people who are vitally concerned with the airport, provides an excellent, ready source of information for treating this phase of the design. These people are eager to relate and discuss the ideas and philosophies they have acquired while living in the area, and in using the airport.

Since the project was started, six of them have come to Rose to present their points of view to the students, others have agreed to discuss the situation in their own offices, and still others are being contacted by the students themselves when they feel a need to do so.

The students are conducting their affairs as if they were in fact a consulting engineering team, and their classroom is being treated as the "home office" for the group. They are completely responsible for the direction of the project, and faculty guidance is provided only through informal discussion.

A chief engineer has been elected and four design teams have been established, with corresponding project leaders to study what they have decided to be the four most import-

ant aspects of the situation: demand on facilities, legal factors, economics and engineering.

At the present time the six speakers have expressed six points of view, no one of which is in complete agreement with any other. The students, too, although trying to keep open minds on the subject, have, on occasion, been overheard to express somewhat divergent opinions. They are quite aware, however, that this natural tendency can prove to be a most useful tool to assist them in the evaluation of the project data.

In addition to its usefulness as a method of exposing the students to the environmental, sociological, political and philosophical problems involved in civil engineering design, we in the C. E. Department feel that the structure and conduct of the course have merit as effective means of motivating the students. At the present time this seems to be true.

They have accepted the project with enthusiasm and are talking, completely of their own volition, of presenting their solution to the Rose student body during the final week of the spring quarter. Of course, only time can reveal the success or failure of the project. We all are confident, however, in the soundness of this approach, and are looking forward to the final presentation.

RESEARCH OPPORTUNITIES IN HIGHWAY ENGINEERING

The Asphalt Institute Suggests Projects in 5 Vital Areas



Phenomenal advances in roadbuilding techniques during the past decade have made it clear that continued highway research is a must.

Here are five important areas of highway design and construction that America's roadbuilders need to know more about.

If you or your department are planning research studies, you can make important contributions to highway technology through projects in one or more of these areas:

1 Rational Thickness Design and Materials Evaluation.

Much remains to be done in the refinement of thickness design concepts for asphalt pavement structures. Research is required in areas of asphalt rheology, behavior mechanisms of individual and combined layers of the pavement structure, stage construction and pavement strengthening by Asphalt overlays.

Traffic evaluation, essential for thickness design, requires the development of improved procedures for utilizing loadometer and other traffic data. These new procedures will more adequately permit conversion of mixed traffic loads into terms of 18,000-lb. single-axle loads as required by design guides of the American Association of State Highway Officials, The Asphalt Institute and others. Also needed are better methods for predicting future traffic volumes and characteristics.

2 Materials Specifications and Construction Quality-Control.

Needed are more scientific methods of writing specifications, particularly for determining rejection and acceptance criteria. Also urgently needed are speedier methods for quality control tests at construction sites, such as improved air- or water-permeability procedures for controlling pavement density.

3 Drainage of Pavement Structures.

Better and more positive methods are needed in this area. Suggested are experiments with two-layer systems and investigations of differing roadbed cross sections.

4 Compaction of Pavements, Traditional Lifts and Thicker Lifts.

Rolling procedures, compaction equipment and compaction testing-methods for traditional thin lifts of asphalt

pavements need further study. The recent use of much thicker lifts in asphalt pavement construction suggests the need for new studies to develop and refine techniques of compaction to obtain the densities desired.

5 Conservation and Beneficiation of Aggregates.

In light of greatly increased road and street construction, in which high-grade materials are being used in abundance, the conservation of aggregates has become a pressing requirement. A study of the use of Asphalt in membrane form to envelop low-quality base courses and soils would be helpful. Other procedures utilizing Asphalt also could be studied.

For basic background information on Asphalt construction and technology at no cost, fill in and mail the coupon.



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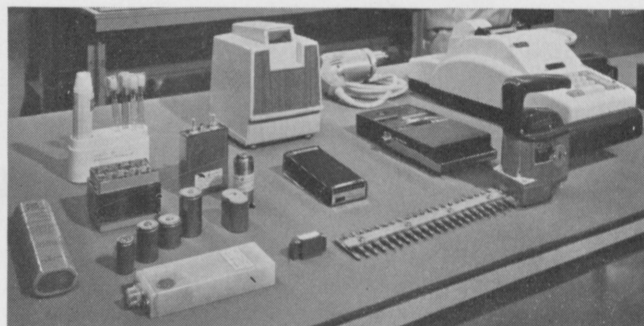
A PREVIEW OF YOUR CAREER AT GENERAL ELECTRIC



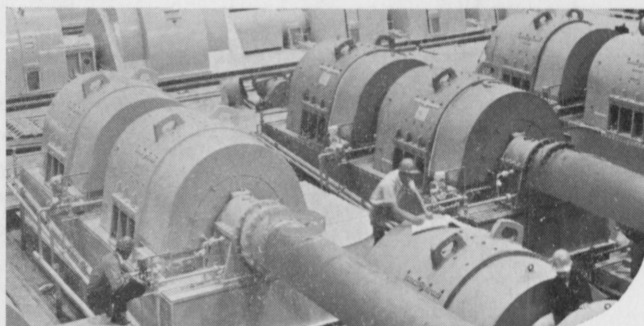
DEFENSE—G-E engineers designed and produced six J93 engines to push USAF XB-70 to Mach 3.



ELECTRIC UTILITY—Built by G.E., the Dresden Station produces commercial electric power from the atom.



CONSUMER—Nickel-cadmium batteries for cordless products were created by G.E. for new business demands.



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