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MICHIGAN STATE UNIVERSITY

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MAY, 1970
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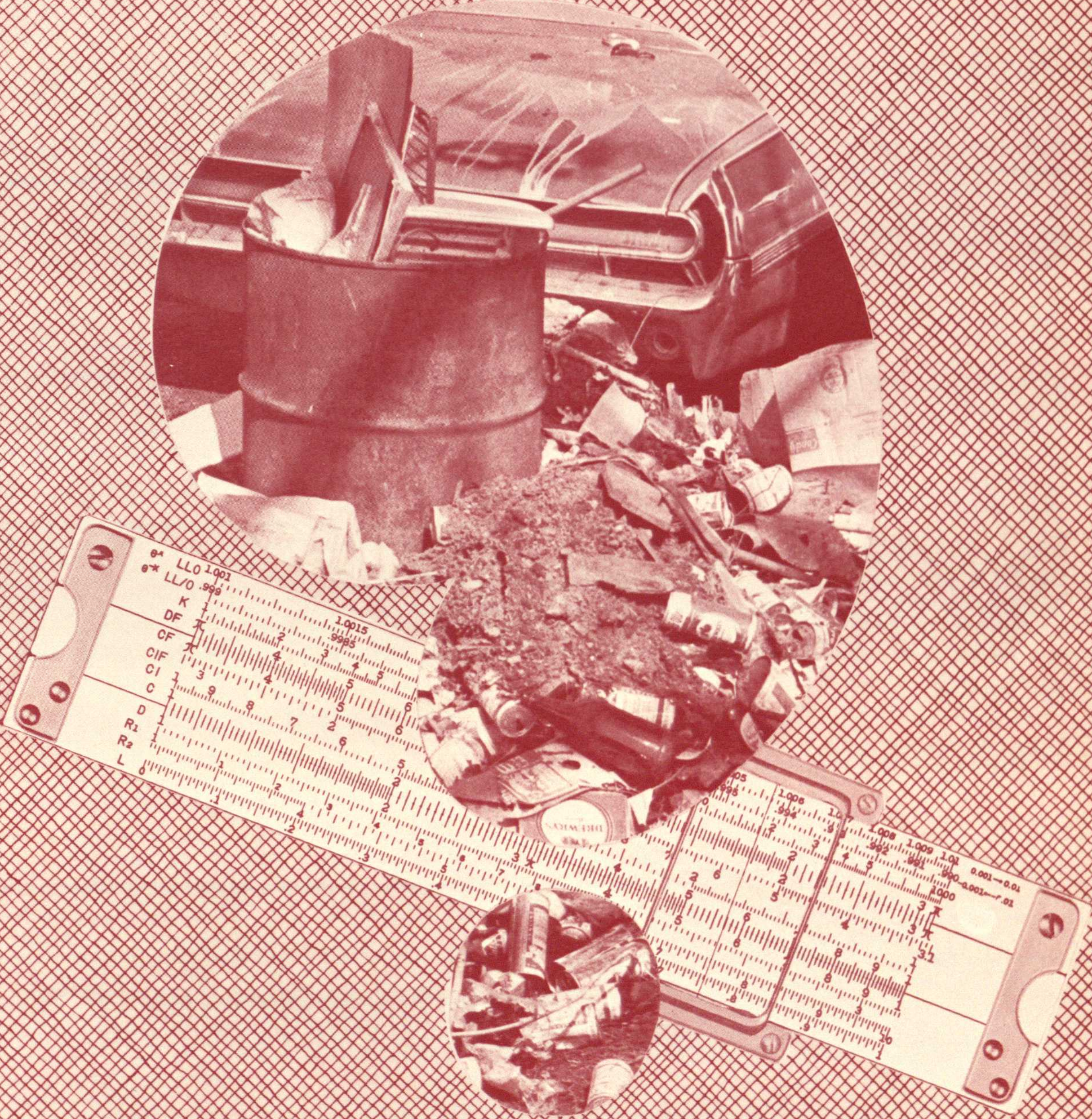
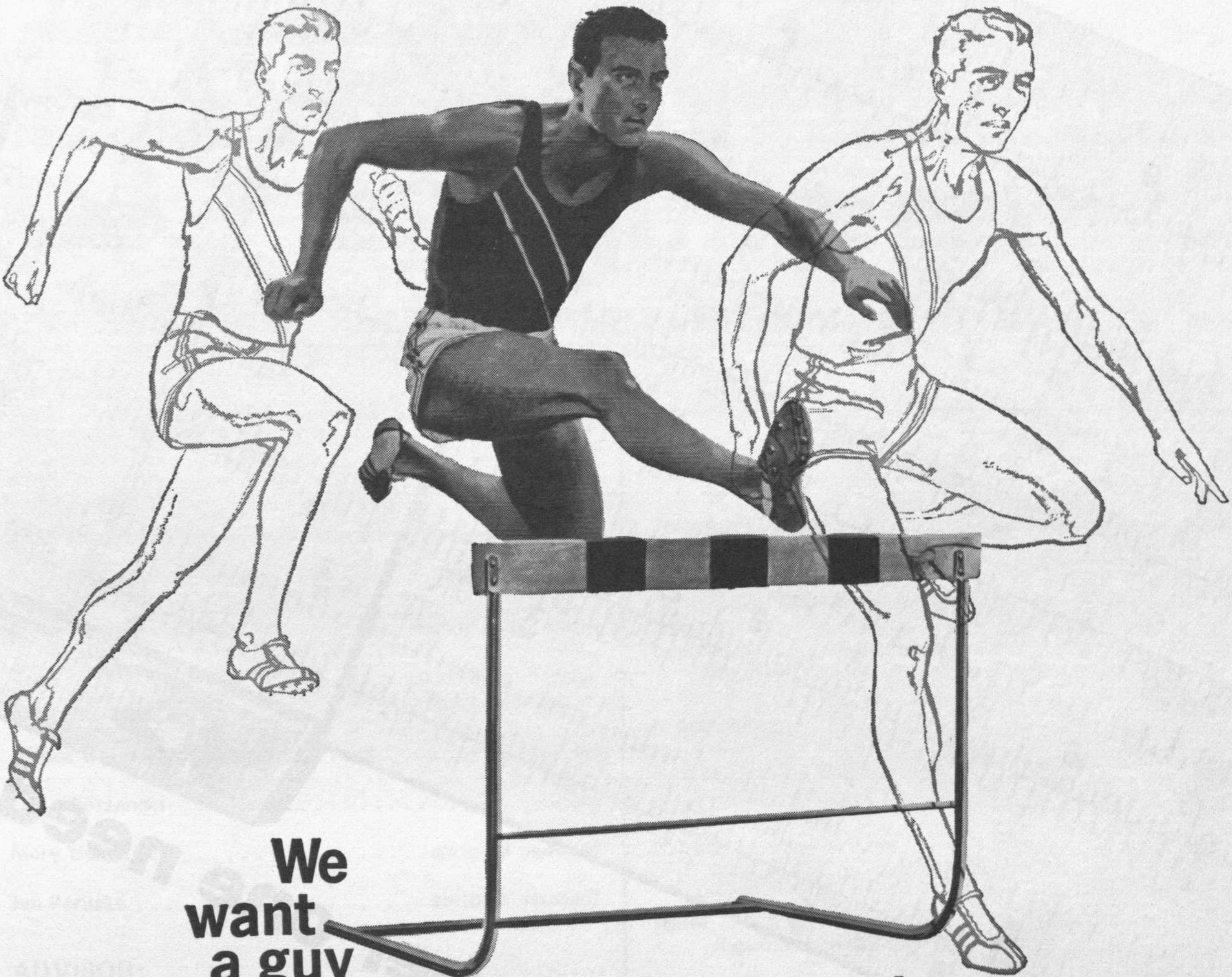


M. E. UNDERGRADS! CHECK CURRICULUM CHANGES, PAGE 16



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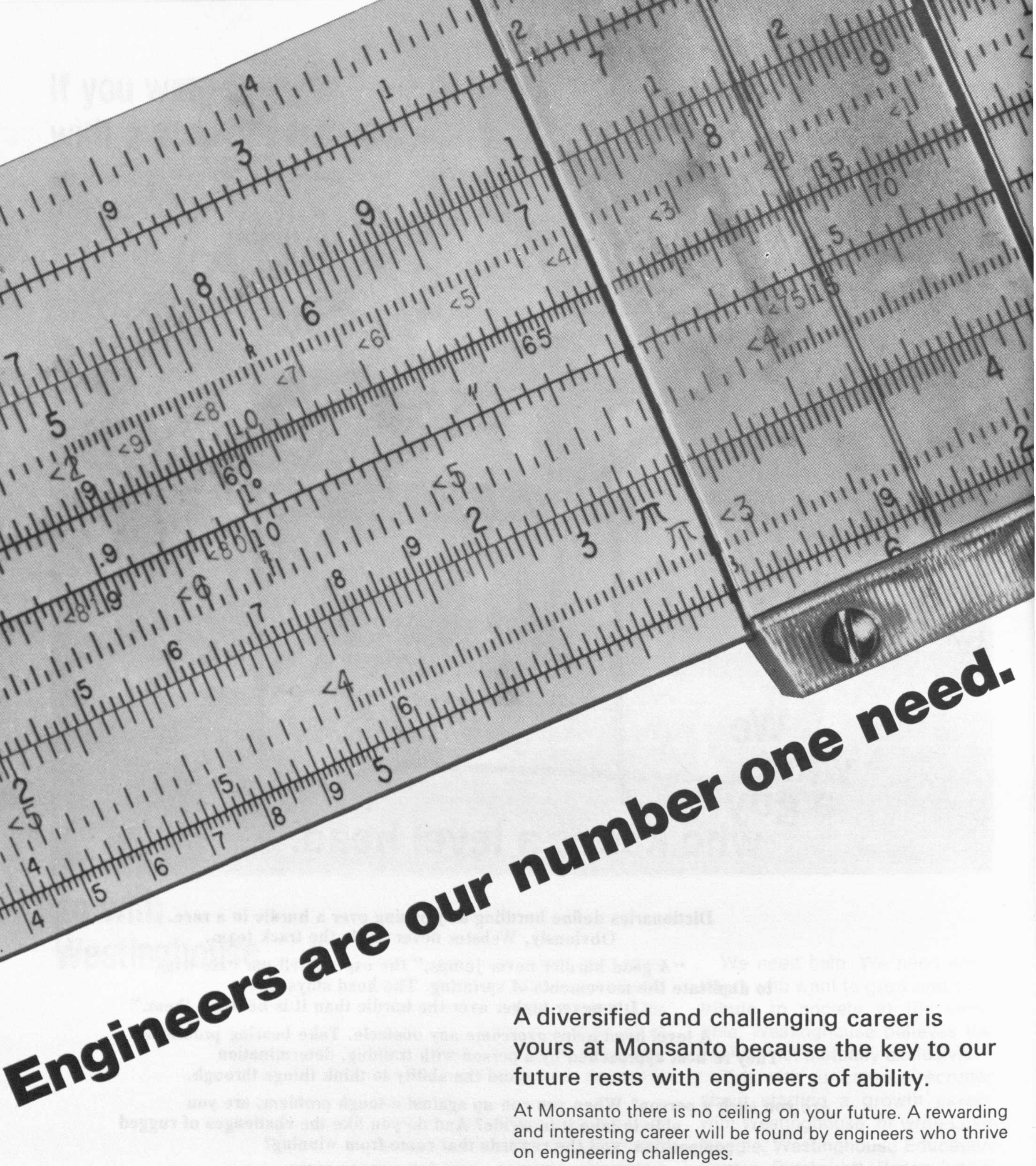
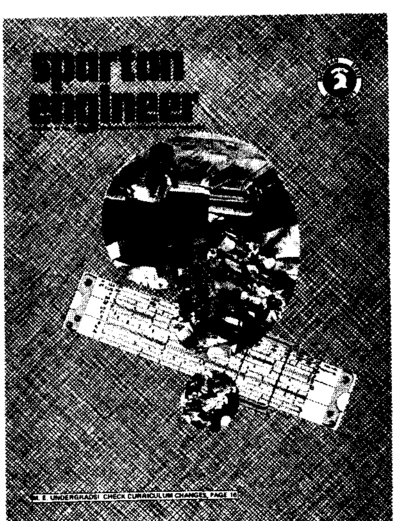


SPARTAN engineer

MICHIGAN STATE UNIVERSITY

VOLUME 23 | **NUMBER 4** | **MAY, 1970**

STAFF



This month's cover, designed by Bill Hull and photographed by Dave Karrer, shows a few of today's engineering problems.

FEATURES: PAGE

DEPARTMENTS:

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Editorial. . .

ENGINEER'S AWARENESS

As of recently, I have become increasingly depressed at the actions of many of my classmates. I have found them to be exceedingly dry and sterile on all topics outside of "Engineering" in the strict classroom sense of the word. In case any of you haven't been duly informed there has been an Environmental Teach-in held on campus since the middle of April and just because it isn't sponsored by the Engineering Department per se, doesn't mean that its worth is negligible. On April 23, as a single example, there was a Panel Discussion held in the Engineering Building in conjunction with E-QUAL and the Environmental Teach-in on thermal pollution. I would venture a guess of approximately 30% engineering students, 20% girls, and the rest radical followers whose only interest was in posing more problems and no solutions. The point is that the small group of engineering students in attendance were hardly representative of the large group of engineering students on campus. Where were you? Watching TV? Playing euchre? (Look it up. It's the correct spelling.) Or trying to solve some crummy math problems maybe? You have to realize that the environmental problems of today will be ours tomorrow. We must accept the responsibility for these problems and become acquainted with them before they become crucial issues.

I'll tell you the truth; it took a Home Economics major to make the point clear to me. I sat down and talked to her one afternoon and found out that classroom discussions include such things as zero population growth, famine and food shortages, and various other related topics. Granted, engineering students are not exposed to problems such as these in their curriculum, therefore, it is our duty as engineers to delve into contemporary subjects on our own.

Stop dreaming about your monthly paycheck come graduation. Stop being the stereotype engineer that your father is and wake up to the things around you. The Environmental Teach-in offers about fifty-two opportunities for students to find out about various aspects of their environment. Have you attended even one? Two maybe? Congratulations! You have attended about 4% if you went to two lectures. Attendance is not required and that, my friends, is what makes it so worthwhile. Those speakers didn't come here for their health; they came to help us understand.

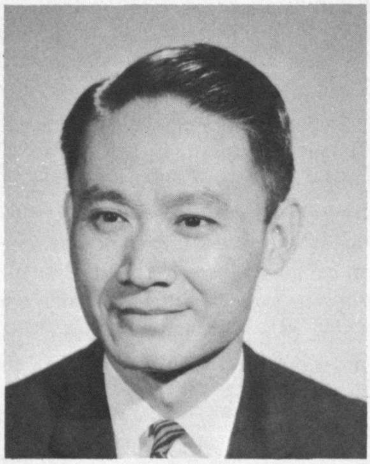
If you haven't already turned the page as many others will do to avoid embarrassing themselves you either have some feeling for what I have written or you will turn the page now. (I challenge you!) Therefore, I assume that those of you who are reading on have an interest in the things around you. Don't be afraid to get involved: ask questions, be activists. For your information, our world goes far beyond this magazine, your books, and our multiversity. Your awareness of your major and its application on the things around you are all the tools you have to work with to make our world a better place to live. Your ideas may be the beginning of a solution; without them we will wallow in the beginning of the end.

David R. Karrer

Editor's Note: Dave Karrer has recently been selected as the 1970-71 *Spartan Engineer* Editor.

PROFESSOR'S PROFILE

NOTE: Professor's Profile is not a revolutionary new idea but it was instigated to help the younger students become acquainted with some of their professors before the classroom situation gives them a different impression.



ROBERT K. WEN

Robert K. Wen presently is Professor and Acting Chairman of the Department of Civil Engineering. Born and raised in China, Dr. Wen came to America in 1952 after receiving his B.S. in Civil Engineering from St. John's University in Shanghai, China, to attend the University of Virginia where he received his Masters in C.E. in 1954. He holds his Ph.D. also in Civil Engineering from the University of Illinois in 1957.

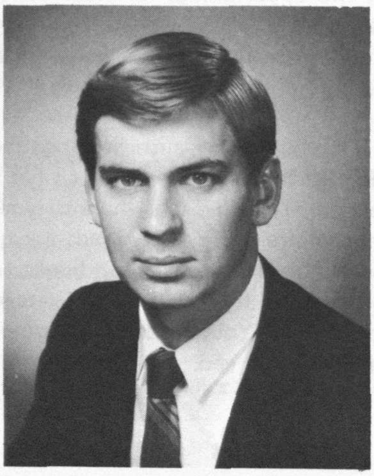
Dr. Wen came to Michigan State in 1959 as an Assistant Professor after serving as assistant professor for two years at the University of Illinois. He was promoted to Associate Professor in 1962 and full Professor of Civil Engineering in 1966. His work experience also includes Project Supervisor of Planning and Interpreting Dynamic Testing of Highway Bridges, Highway Research Board Road Test Project in 1958-59. He holds a chair on the Committee on Structural Dynamics, American Society of Civil Engineers. Structural engineering and Civil Engineering Systems are his professional interests.

Dr. Wen's family consists of his wife, Judy, also from China, and their three children, two boys and a girl.

Dr. Ronald L. Kerber is a very dynamic instructor and currently with the Mechanical Engineering Department. Dr. Kerber received his B.S. degree from Purdue University and his Masters from California Institute of Technology. He holds a Ph.D. in Engineering Science also from Cal. Tech. "Engineering Science has always been my major", Dr. Kerber commented, "and I'm extremely interested in the theory of liquids and blood flow and other areas of applied mathematics and physics."

Dr. Kerber is presently teaching Thermodynamics on the junior level in the Mechanical Engineering Department here at Michigan State and will be again in the Fall beginning with ME 311. He has only been in the department since fall of '69 but already is very popular because he is willing to discuss any and all topics of engineering concern in Room 236 of the Engineering Building.

He enjoys participating in tennis and basketball but indulges in all sports. At the age of 26 Ron has been happily married to his wife, Claudia, for six years.



DR. RONALD L. KERBER

CHALLENGE TO ENGINEERS

by D. D. McGrady

The United States started along the path to industrialization in the early 1800's and as a nation and as a people has treated its natural resources and its environment with considerable violence ever since. The development and perfection of steam power for locomotives and steamboats, together with mechanical inventions such as the reaper and threshing machine, created demand for machinery and for the means to transport raw materials and finished products.

America was soon tied together by parallel ribbons of steel rail. The "iron horse" had arrived. Metals were in great demand, steel in particular. During the period 1866-90 the Bessemer process, used to convert crude pig iron into steel, was developed and expanded. Great tongues of flame and fumes shooting 30 feet or more from the nose of the converter were a common sight at the centers of steel production. The spectacular display of the Bessemer flames playing against the night sky was the subject of poems and essays relating to America's growth and expansion and emergence as an industrial giant.

Pig iron, the raw material supplied to the converters, also had to be produced in greater and greater amounts. Thus, more and larger blast furnaces were soon constructed to supply this demand for pig iron. The blast furnace uses tremendous tonnages of iron ore, coke, limestone and pre-heated air blast and reacts these materials under inferno-like conditions at 3600°F to produce molten pig iron. The heat energy is supplied by the combustion of coke, and coke in turn is a product of the distillation of soft coal.

The common equivalent used in the middle 1800's for producing coke was the beehive coke oven. By 1880 this coking process was responsible for great volumes of smoke, soot, and noxious gases being evolved (wasted) into the air. About 35% by weight of the soft coal charged into these coke ovens was slowly volatilized as gases, leaving behind the desired coke residue. The local atmosphere in the area near the location of coke ovens was mightily contaminated . . . even in 1880.

Eventually engineers developed the by-product coke process and the necessary equipment so that the volatile gases, formerly wasted, were now trapped, collected, and processed to produce ammonia, benzene, toluene, xylene, creosote, and coal tars. The modern by-product coke plant is now a major source of chemicals, as well as a supplier of coke for industrial use. This is an example of good engineering practice helping to make a once discarded material into a useful and valuable by-product and at the same time greatly reducing the extent of air pollution.

Vast areas of the plains states were plowed and planted to wheat in the early 1930's. With the first period of sparse rainfall the "dust bowl" years were upon us. Hot dry southwest winds blowing over the parched and powdery soils of Oklahoma and Kansas lifted great clouds of dust into the sky. The sun was nearly obscured. Cars drove with headlights burning in the midday twilight. The plowed-up prairie was blown and drifted like the blizzard snows of Winter. Habitation became nearly impossible. Dust settled upon states hundreds of miles to the north and east . . . yes even in Michigan, and very much so in Iowa and Illinois.

Soil conservation was indeed at a low ebb. Gradually improved tillage methods and the recognition of the value and importance of grass lands, wind breaks, and moisture retention in the over-all conservation picture has served to diminish this violent form of environmental pollution and destruction.

Waste disposal and associated stream pollution and environmental problems have long been an area of research and interest for MSU's College of Engineering. Records show that between 1925 and 1953 some 35 research bulletins and reports of sanitary engineering projects were published by the Michigan Engineering Experiment Station on the allied topics of waste, disposal, sewage treatment, and stream pollution.

During the coming years America must address itself politically, economically, and technically to the problems of mass transit, housing, and air and water pollution. The engineer, whatever his major interests, will be able to use his training, knowledge, skills, and understanding to help solve the immediately pressing and critical problems of pollution and to plan and implement longer-range programs to restore and environmental balance.

The practicing professional engineer of the future will have a real opportunity—indeed a necessity—to design and operate the physical facilities and systems demanded by civilization in a manner to effectively protect and conserve all aspects of the environment.

This is the challenge facing the young engineer today. Good luck. □

"Welcome, sulfur dioxide
Hello, carbon monoxide
The air, the air, is everywhere
Breathe deep while you sleep,
breathe deep . . .
Vapor and fume at the stone of my tomb
Breathing like a sullen perfume
Eating at the stone of my tomb . . ."

EVERYBODY TALKS ABOUT POLLUTION, BUT . . .

by James E. Scott

Reprinted from Northwestern Engineer, *March, 1970.*

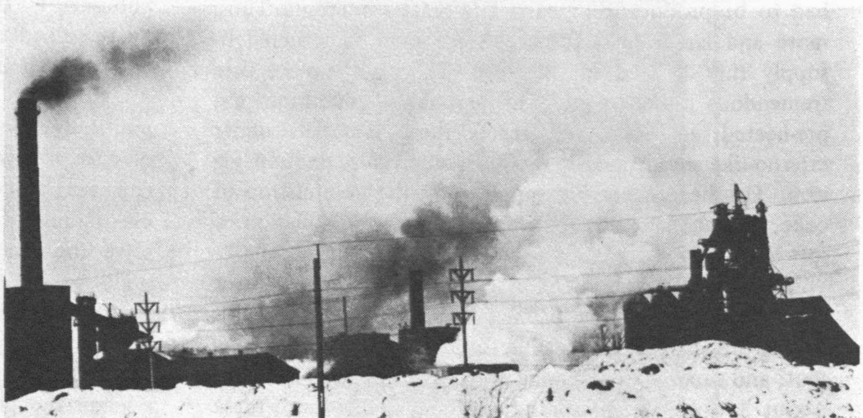
Anthropologists of the future will probably consider as one of the most important aspects of the present society the general inability of man to sense that he had at his control the power to permanently change his environment. Only now is it becoming clear that (1) the earth's vital systems can very quickly be adversely altered by the quantities of pollutants they are exposed to, (2) there is a limit to the extent to which we can exploit our natural resources and (3) there are continuing cycles and balances in nature that can be drastically changed. It is a startling revelation to realize that the earth *is* finite. A picture of the earth as a "space ship of limited carrying capacity" has only come into focus after man has looked back at the earth from the lunar surface.

An Atmospheric Sewer

The first of the three observations above is the most obvious to the general populace, because it involves a relatively quick physical change in the environment. Hundreds of millions of years of evolution have programmed man to be most at home in a setting of clean, warm, humid air; green plants; and even animal companions. Man's continued interest in greenhouses and outdoor swimming pools, his fascination with the antics of animals in zoos and his annual pilgrimages to seek out beauty in nature are obvious evidences of this evolutionary past.

But long-term changes ("long-term" relative to human clocks) are frequently not consciously noticed. Paul Ehrlich of Stanford University once remarked, "A gradual forty-year transition has permitted southern Californians actually to convince themselves that the Los Angeles basin of 1967 is a suitable habitat for Homo sapiens." It took a tremendously noxious smog in November of 1969 to awaken many Chicagoans to the possible link between air pollution and mortality rates. A shake-up in the city's air pollution control department and the establishment of a city department of environmental control to coordinate work on pollution problems were to follow shortly thereafter. Some have set as high as 50 the number of people who died as a result of the smog. City Health Commissioner Dr. Murray Brown reported just after the inversion, "The death rate of tracheal bronchitis in children has been running about 50% higher than it was expected." Recently, several types of cancer have been found to have significant correlation of mortality with chronic exposures to sulfur dioxide and nitrogen dioxide.

But in spite of growing evidence, there are those who still refuse to admit that air pollution is a health hazard. In a recent article in *U. S. News and World Report,* the President's Science Adviser, Dr. Lee DuBridge, was actually quoted as saying in regard to air pollution, "Those with ailments such as asthma or emphysema often suffer seriously — though normal people, in spite of their



Effluents from large industrial complexes contribute heavily to air pollution.

No Recycling of Resources

Realizing that we are using up many of our finite natural resources much too quickly is a far more difficult task than sensing pollution in the earth's vital systems of air and waterways. We cannot physically see the reserves we have to start with, nor can we actually realize the tremendous amount of raw material which we fail to utilize to its fullest capacity. Very few people would react unfavorably if this fictitious news item were flashed over the UPI wires: "Federal Can Company yesterday announced, just two hours before the close of the stock exchange, that it has developed the can all America has been waiting for—the no-deposit, no-return, reclosable, pop-top, self-heating, self-cooling, INDESTRUCTO-CAN. Considered a giant technological step forward in an industry usually regarded as very staid and conservative, this can (made of 40% aluminum, 40% steel, 10% plastic and 10% copper) was the cause of Federal's stock's jumping from 43 to 49½. Federal thereby posted the largest gain on the American board yesterday."

It would not be at all surprising to hear such an item considering the trend toward almost total disposability of packaging and containers. The glass industry can only bemoan the fact that it was not able to produce a no-deposit, no-return bottle earlier.

Few realize that even if one wanted to reclaim these cans for reuse of their materials, it would probably be totally uneconomical to do so. The Reynolds Aluminum Company has realized that although "there is an abundant supply of aluminum for the foreseeable future, the fact remains that the supply is not unlimited—and aluminum usage has been doubling roughly every ten years." As a result, this company has offered payment for the return of all-aluminum cans. The phrase to note is "all-aluminum." Even this huge industry obviously finds it uneconomical to bother with removing the aluminum "easy-open" ends from the steel bodies of very prevalent beverage containers.

The figures that deal with disposability are incredible. Each year, **"Americans junk 7 million cars, 100 million tires, 20 million tons of paper, 28 billion bottles, and 48 billion cans."** Not only are these resources being literally thrown away, but the cost of disposing of the garbage costs Americans $2.8 billion per year. It is estimated that each Californian disposes an amount equal to his weight in solid wastes *each week*. The federal government and many industries seem to be concerned in this area. They are concerned about how we can more effectively dispose of all this garbage. Very little thought seems to have been given to the process of recycling any of these waste products, the great bulk of which is containers. Perhaps adding the cost of disposing of these containers (from beverage cans to automobile hulks) to the initial cost of the item could make more visual, and thereby more evident, the outrageous price we pay for disposability.

Lake Erie is being used as an automobile dump.

Cycles of Life

The most obscure and perhaps the most important of the three observations at the beginning of this article is the realization as to what man is doing to upset some of the cyclic processes in nature. Perhaps if modern society had held to a more Buddhaic rather than Judaic philosophy of life, we would realize that there are many cycles and balances in nature, and that *every* action has an effect on some other aspect of the environment. Buddha once said to his followers, "I will teach you the doctrine; when this exists, that exists; with the arising of that, this arises; . . . with the cessation of that, this ceases."

Our superficial knowledge of natural cycles has resulted in some "technological backfires." The Nile River has for centuries been the "life blood" of the habitable Egyptian river valley. The gigantic Aswan High Dam project was a tremendous technological feat that was to provide cheap electricity to the nation of Egypt. But ecologists have recently come up with some interesting facts about the dam's effects on the Nile. Waterweeds are clogging the shorelines of Lake Nasser behind the dam. These may speed evaporation of the lake water to such an extent that there may not be enough water to drive the huge generators. Silt, which used to replace the land worn away by erosion, is now blocked from sweeping down the valley. As much productive farm land may be washed away by erosion as will be created by the irrigation system behind the dam. Furthermore, without the nutrient-rich silt, the sardine population has declined so that only 500 tons were caught in 1968 as opposed to 18,000 tons in 1965.

There is also a danger closer to home. The primary and secondary sewage treatment plants that will be financed by the ten-billion-dollar federal appropriation will not exterminate man-killing viruses, nor will they get rid of the nitrates and phosphates that fertilize aquatic plants and kill lakes.

Through heating, power generation and transportation, we are destroying fossil fuel at a greater rate than in each preceding year. And while this is going on, we are paving over one million acres of land annually which will itself require more and more fuel consumption to be heated, to be lighted and to get to. This land is taken out of the cycle of photosynthetic productivity. Therefore, we are reducing the rate at which oxygen in the atmosphere is regenerated and we are, at the same time, using up large quantities of oxygen. There seems to be no immediate danger of running out of oxygen since 70% of this life-sustaining element is produced in the oceans largely by planktonic diatoms. But what if some factor should interfere with the oceans' systems?

The Government Optimism

Again a quote from the President's Science Adviser, Dr. DuBridge: "The oceans of the world are so vast in size and volume that it would take an inconceivable amount of waste products to make them into cesspools. Furthermore, natural processes go on in the ocean—processes of oxidation and processes caused by the plant and animal life in the ocean—which degrade most waste products, even including oil, into relatively harmless forms. . . Since we want to keep our air and our rivers and lakes pure, it seems inevitable that we must dump large quantities of our wastes into the ocean. But we should be careful to dump them far from shore. . . ."

It seems almost unbelievable that a science adviser to a grade school biology course, let alone the President's Science Adviser, would claim such statements to be his own.

anger and discomfort, do not suffer serious impairment to their health." Sulfur dioxide, the most detrimental pollutant in Chicago's air, refracts light in the blue range and thus is not nearly so visible as Los Angeles' infamous amber-colored smog which is composed of great quantities of nitrogen dioxide. The cheaper "soft" coal that the utilities burn (Commonwealth Edison's plants are the major ones) is the source of nearly 70% of the SO_2 in the Chicago atmosphere. Therefore, there is currently a great deal of pressure on Com Ed, by the state as well as by students, to help clean up the city's "atmospheric sewer."

In 1965, an analysis of Chicago's air revealed an average concentration of carbon monoxide of 17.1 parts per million and a maximum concentration of 78 ppm. A CO concentration of 50 ppm is considered dangerous by air pollution experts. This data was available five years ago, yet automobiles continue to create nearly 3,000 tons of carbon monoxide per day inside the Chicago area! Is it merely a coincidence that carbon monoxide is a colorless, tasteless, odorless gas and that not nearly so great an issue is raised about CO as is raised about the noxious-smelling SO_2?

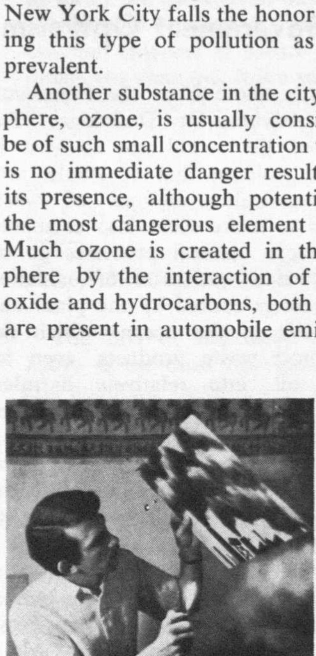
As more research is done in the area of air pollution, a more pessimistic picture is formed. Over 20 tons of particulates are created each day, again by automobiles, in the Chicago area, and these particulates can react with SO_2 in the air and carry more of this toxic substance into the lungs than normal. Upon New York City falls the honor of claiming this type of pollution as its most prevalent.

Another substance in the city's atmosphere, ozone, is usually considered to be of such small concentration that there is no immediate danger resulting from its presence, although potentially it is the most dangerous element in smog. Much ozone is created in the atmosphere by the interaction of nitrogen oxide and hydrocarbons, both of which are present in automobile emissions. It is interesting to note here Detroit's well-advertised plan to cut pollution resulting from the internal combustion engine. Manufacturers will cut by two-thirds the emission of CO by raising the working temperature of the engine. However, they fail to mention that the nitrogen oxide emission will greatly increase, perhaps causing serious levels of ozone concentration.

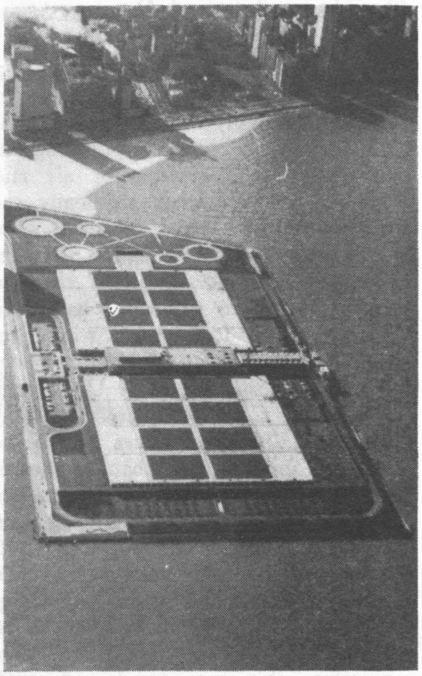
Water Pollutants

Earth's other vital system, its network of waterways, is also the subject of immediate concern because of the severe physical degradation that one can detect almost daily. This degradation is, in fact, so apparent that it is in this area that President Nixon has planned to spend $10 billion (which is really only $4 billion) over the next five years to create "adequate" sewage treatment plants across the nation. Dr. Lamont Cole, vice president of the American Institute of Biological Sciences, proclaimed, along with other ecologists recently at Northwestern's "Teach-out," that the U.S. has to spend somewhere near $30 billion annually, not $2 billion, "just to stay even with pollution." These speakers seem to have overlooked the fact that Nixon did *not* claim he would clear up *all* pollutants with the $10 billion in grants and financing, just water pollution from out-dated sewage treatment plants.

Chicago's sewage treatment plants are not at all among the worst in the country. They, in fact, operate at a 90% efficiency level. But because of the huge amount of waste they must cope with, the raw sewage equivalent of one million people is one of the main constituents in a stream that quickly becomes the Illinois River. This main artery of Illinois flows into the Mississippi River at St. Louis where, for example, an additional 300,000 gallons of urine are dumped every day.



Out of Jim's main contention about engineers arose the idea for this article. This contention is that for too long engineers have actually been "slaves" to industry and government. They have been leaving to others the total responsibility for the results of their developments, whether it be a pesticide not fully tested or a dam that may drastically change a river valley's ecological balance.



Although 90% effective, Chicago sewage treatment plants pass the raw sewage from the equivalent of one million people into the sewage canal.

One of the first signs that our waterways were in danger was the suds that used to make the downstream side of every spillway look like a washing machine. The ingredient was removed by detergent manufacturers, but now it is realized that the phosphates which make up about 40% of a detergent are a major nutrient source for prodigious growths of algae. Oxygen is removed from the water and many animal forms die. Lake Erie, America's equivalent of the Dead Sea, is the classic case of what can result from over-fertilization of algae. Presently, only the vastly expensive tertiary treatment sewage plants can reduce the phosphates from detergents and fertilizers alike to harmless ash.

Nevertheless, as a result of the federal government's assistance and men like Illinois Attorney General Scott, it seems clear that waterways pollution may be the first of the "obvious pollutions" to be lowered to an acceptable level. One of Scott's first targets in his "get tough" policy with polluters was a sanitary district. As he told *Time* magazine, **"I sent a team of our guys up to Lake County to find out why the Lake Michigan beaches were being closed. The first man to check the water supply passed out. The second man threw up. The North Shore Sanitary District was pouring raw sewage into the lake. This was what our kids were swimming in!"**

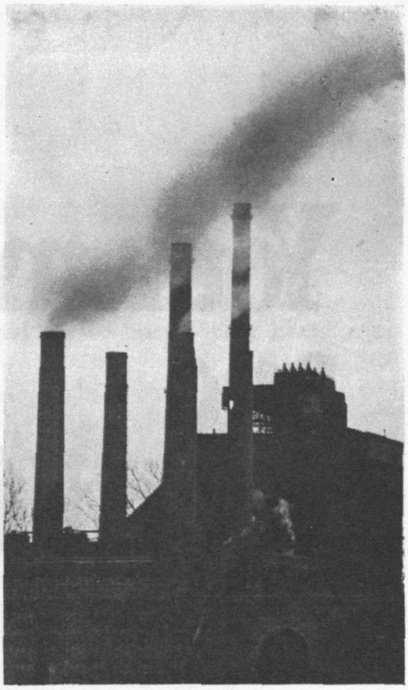
EVERYBODY TALKS

(*Continued from page 16*)

There is factual evidence that a more realistic picture of the oceans can be gained by what Dr. Paul Ehrlich has written in a scenario entitled *Eco-catastrophe!*: "The end of the ocean came late in the summer of 1979, and it came even more rapidly than the biologists had expected. There had been signs for more than a decade, commencing with the discovery in 1968 that DDT slows down photosynthesis in marine plant life. . . . It was clear by 1975 that the entire ecology of the oceans was changing. A few types of phytoplankton were becoming resistant to chlorinated hydrocarbons and were gaining the upper hand. Changes in the phytoplankton community led inevitably to changes in the community of zooplankton, the tiny animals which eat the phytoplankton. These changes were passed on up the chains of life in the ocean to the herring, plaice, cod and tuna. As the diversity of life in the ocean diminished, its stability also decreased." In this article, Ehrlich envisions huge blooms of diatoms by 1979 that break down the chlorinated hydrocarbons into a substance lethal to all marine life.

The article is perhaps a bit too pessimistic, yet its predictions have become a reality on a smaller scale in many areas of the world. DDT breaks down only very slowly and will last for years in soil. A Long Island marsh has been sprayed for the last 20 years to control mosquitoes. An analysis of the upper layer of the mud revealed up to 32 pounds per acre of DDT. It has been found that among the huge populations of pests there is likely to be the kind of reserve genetic variability which leads easily to the development of resistant strains. Extermination of a pest by use of a synthetic pesticide like DDT is almost unknown.

"The usual pattern is one in which the pesticide decimates the natural enemies of the pest, while the pest develops resistant strains." Farmers not knowledgeable in the pesticide field are tempted to pour on more and more pesticide as the pest returns, but to no avail. The pesticide can easily find its way to man. At Clear Lake, California, DDT was used at the miniscule concentration of two one-hundredths of a part per million to kill off a troublesome insect. The plankton, as a result, accumulated DDT residues at the rate of 5 ppm. Fatty tissue of fish feeding on the lake bottom life was found to contain up to 2,000 ppm of DDT. Grebes and other diving birds *died* from eating these fish.



Electric utility plants such as this one are responsible for 70% of the SO_2 in Chicago's atmosphere.

Population Increase

There is one factor which is always mentioned in regard to pollution: the world's population and its unimaginable growth. Even without pollution factors compounding the situation, the problems associated with the earth's population doubling by the year 2007 are totally staggering. According to Washington University's expert ecologist, Barry Commoner, there *may* be enough food then to feed all adequately, *if* it can be dispensed equally. *Time* magazine-type charts show the earth's population doubling between their estimate for the year 2007 and that for the year 2044. Obviously, the hyberbolically-shaped graph will be quite drastically altered long before that year is ever reached. Man may voluntarily and rationally control this alteration of the population growth. It does not take too imaginative a mind to envision other factors which will lead to the inevitable alteration.

As this aerial photograph shows, the view from above Earth is even more astounding than the average citizen probably realizes.

Instant Replay of the End

Centuries ago, Jeremiah conveyed these words of Jehovah to the chosen people of Israel: "And I brought you into a plentiful country, to eat the fruit thereof and the goodness thereof: but when ye entered ye defiled my land, and made mine heritage an abomination."

There is no question as to whether or not we should listen to the words of our modern-day Jeremiahs. Our next steps of proving the true worth of this prophecy and acting according to our documented findings are ones that will be decisive in Man's history. Perhaps there are actions we can take *before* ABC's live and in-color documentaries on the death of the oceans. □

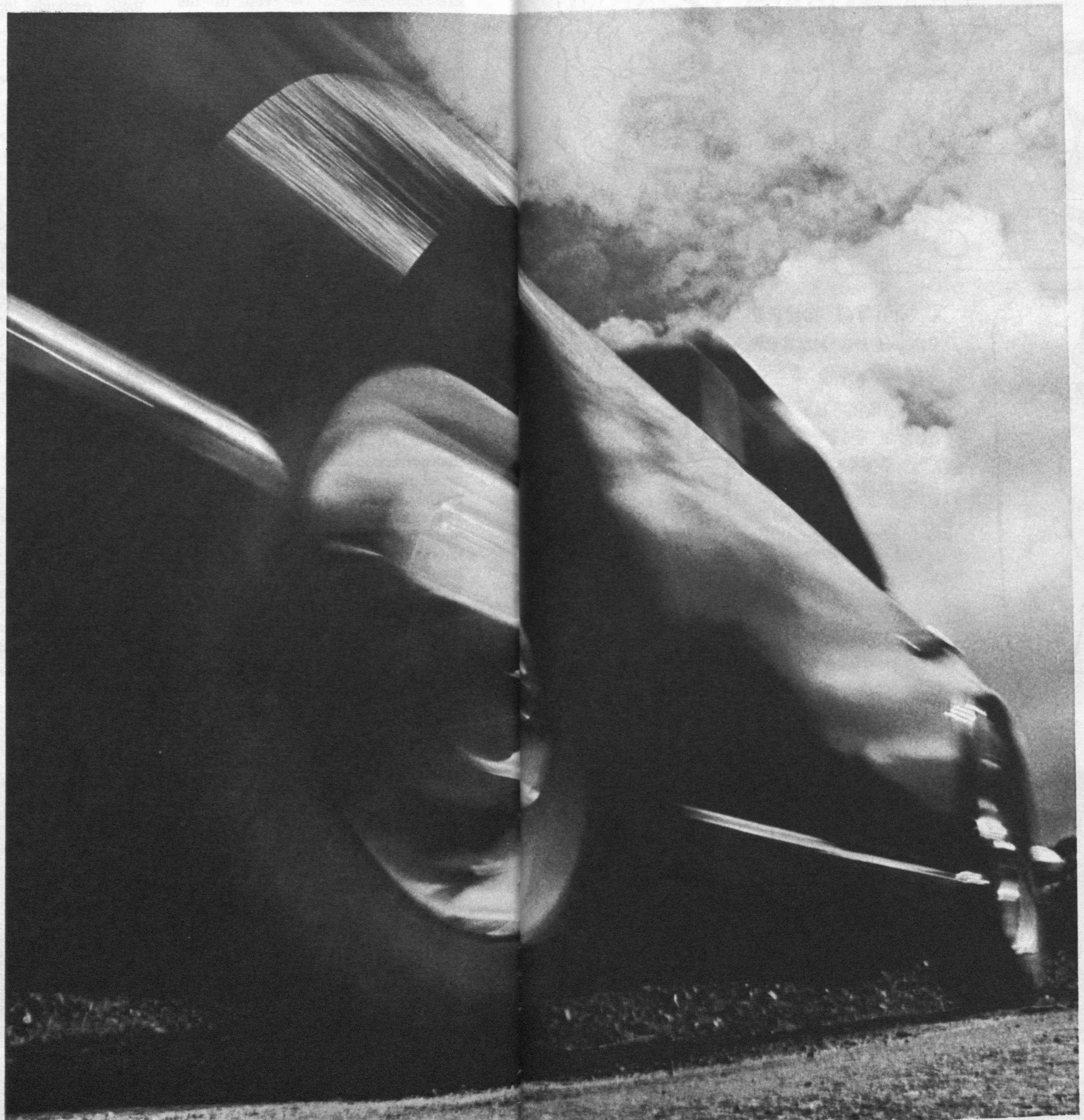
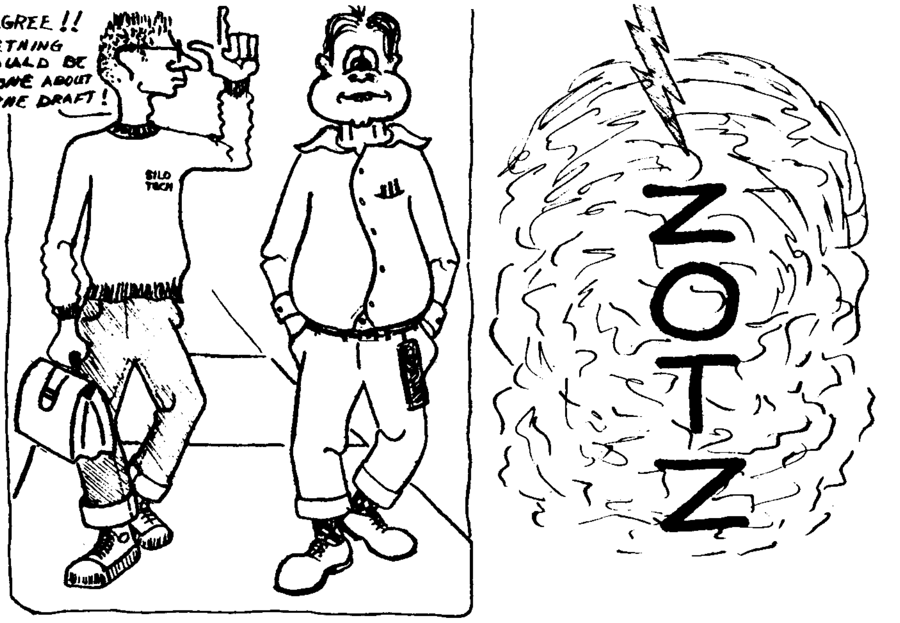
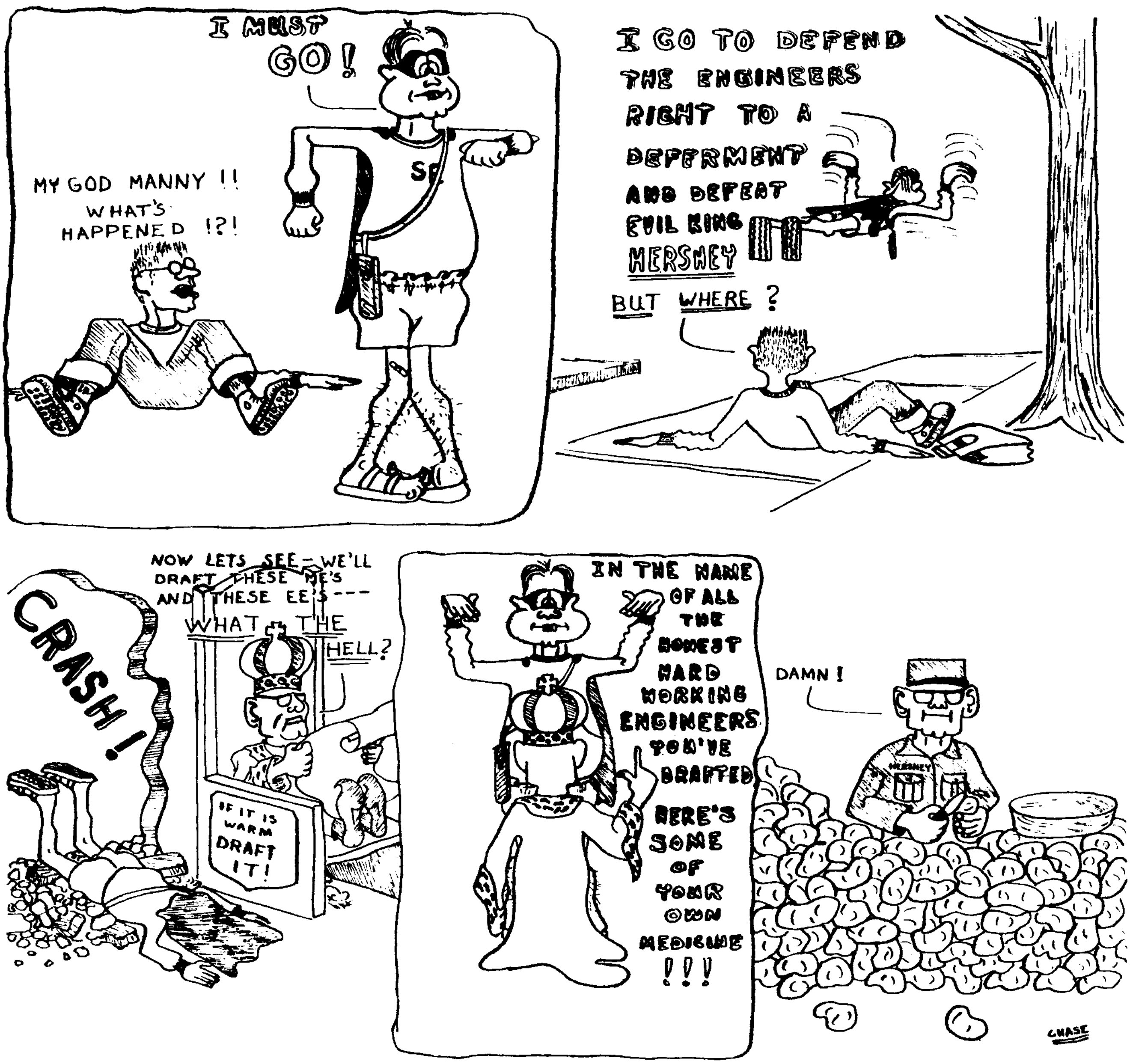


PHOTO: ERNEST BRAUN

AND SO BEGINS THE CAREER OF MANSFIELD FINSTERWALL AS SUPER ENGINEER

Editor's Note: In view of recent executive decisions on the draft, the staff wants to reprint the first Super Engineer cartoon ever printed from the March, 1968, issue. Super Engineer was a creation of Davis Chase, an ME graduate in 1969, who since has fallen prey to the U. S. Navy.





NEW
MECHANICAL ENGINEERING
CURRICULUM

by Professor Potter

After two years of many meetings, innumerable private discussions, and even some heated arguments, the Faculty of the Mechanical Engineering Department has introduced a new curriculum that brings unprecedented flexibility to the undergraduate engineering student. The curriculum is designed so that the student can tailor a program to best fit his professional objectives. There are 40 hours of course work over which the student has control and from which the student can form a program of his choice. His program can include study in several areas of mechanical engineering or in a number of other areas in the college. These areas include Aerospace, Design, Systems, Thermosciences, Metallurgy, Bioengineering, Computer Science, etc. Often, however, a student's interest may be confered in an engineering related area outside the college such as applied math, physics, or astronomy. He may even wish to prepare for a management or sales type profession for his projected engineering career and hence be interested in business and management courses. Without a definite idea of what he will do upon graduation a student may select a program of course-work which will give him a broader engineering base by choosing courses from various areas of study. All this flexibility is now available to the mechanical engineering student.

The curriculum contains 65 hours of an engineering core area which includes courses in computer science, graphics, mechanics, metallurgy, electrical engineering and basic courses in mechanical engineering. There are also 42 hours of math, physics, and chemistry. The 33 hours of general education courses round out the curriculum of 180 hours. The 3 HPR hours are in addition to this. With this required core in engineering, math, physics and chemistry, the student is then encouraged to choose a program of courses which will best enable him to pursue his professional goals. The new curriculum appears in detail in the following description:

MECHANICAL ENGINEERING CURRICULUM

I.	General Education ATL 111, 112, 113 SS 231, 232, 233 HUM 241, 242, 243	33
II.	Basic Sciences MTH 111, 112, 113, 214, 215 PHY 287, 288, 289 CH 141, 161	42
III.	Mechanical Engineering Core CPS 120 - Elems. of Comp. Prog. EGR 260 - Machine Design MMM 205, 206 - Mechanical I and II MMM 211, 215 - Mech. Def. Solids, Testing Lab MMM 370 - Metals and Alloys I EE 345 - Instr. and Comp. Lab ME 311, 312 - Thermodynamics I and II ME 332, 333 - Fluid Mechanics I and II ME 351 - Mechanical Engineering Analysis ME 352 - Intro. to Systems and Control ME 411, 412 - Heat Transfer I and II ME 320, 421 - Kin. of Mach. I, Mach. Des. I	65
IV.	Guided Electives Additional courses subject to the approval of the department shall be taken to build upon the core content by allowing the student to gain either greater depth in certain subjects or greater breadth in areas related to mechanical engineering. Major fields in mechanical engineering are Thermo-mechanical Sciences, Systems, Design, and Aerospace. Supplementary fields include computer science, metallurgy, electromechanics, applied mathematics, physics, bioengineering, environmental engineering, life sciences, business and economics, and certain social-humanistic areas.	21
V.	Electives	19
VI.	Miscellaneous HPR Physical Education	3
		183

Your Instamatic a scientific instrument?

PHOTOGRAPHY AND SCIENCE

Reprinted from Pennsylvania Triangle, *October, 1969.*

Jeffrey Sterling

PHOTOGRAPHY is an outstanding example of the symbiotic relationship between art and science. In return for the vast body of technical expertise which is the heart of modern photography, science receives an invaluable tool. Such techniques as X-ray photography, infrared photography, and schlieren photography provide scientists in various fields with quantitative data of immeasurable importance.

CHEMICAL ROOTS

As all people must surely know, photography is the art of producing images on chemically sensitized material by the action of light. Within this broad definition fall a large number of processes serving various useful purposes. One of the most illustrative of these is the process of black-and-white photography.

The heart of the simplest form of black-and-white photography is a celluloid backing coated with a thin gelatin emulsion of finely divided silver bromide. Exposure of the minute silver bromide crystals to light produces an activated form of silver bromide in a process which probably involves some sort of crystal defect. Hence, a pattern of light and dark areas projected onto the emulsion through a suitable optical system will result in an identical pattern of activated and non-activated silver grains. Such a pattern is frequently referred to as a *latent image*.

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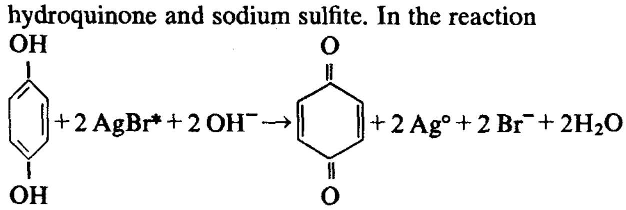
Mr. Sterling is a member of Alpha Chi Sigma and Photography Editor of the *Daily Pennsylvanian.*

To convert such a latent image to a usable form, the emulsion is immersed in a developer. A suitable developer might typically be an alkaline aqueous solution of hydroquinone and sodium sulfite. In the reaction



the activated silver bromide particles are reduced to metallic silver much more rapidly than the nonactivated grains. The sodium sulfite in the developer has a preservative action on developer solutions and also converts the quinone produced in the above step to hydroquinone-sulfonic acid, which also acts as a developer.

Immersing the developer in a *fixer* such as sodium thiosulfate removes the unreduced silver bromide to leave a suspension of finely divided metallic silver in the areas formerly occupied by activated silver bromide. Such patterns of silver suspended in a transparent emulsion constitute the familiar photographic negative.

As most people know, a photographic negative reverses the values of the original scene. The areas of the emulsion that were exposed to light are opaque on the negative; the areas that were not exposed remain transparent. Although it is possible to see a scene as it originally appeared by viewing the emulsion side of the negative from an oblique angle, it is more common and more practical to make a positive print. In a darkroom a strong light is used to project an image of the negative onto a sheet of white paper coated with an emulsion material similar to that which coated the celluloid. Developing the latest image on the paper effects a second reversal of light and dark areas, thus recovering the original scene.

The process outlined above is, of course, a gross oversimplification of the chemistry involved in the photographic process. It might, for instance, be pointed out that the simple silver bromide emulsion used as an example is predominantly sensitive to blue, violet, and ultraviolet light. Hence, a photograph made with such a material would render blue and violet subjects as white, while rendering subjects of other colors as varying shades of gray and black. It has been discovered, however, that certain organic dyes, most often of the cyanine family, are capable of sensitizing silver bromide to other wavelengths. It has thus been possible to produce emulsions that are sensitive over the whole visible spectrum, as well as the infrared.

SPEED

If two different emulsions are exposed to light of identical intensity and duration and are developed under an identical set of standard conditions, the emulsion that produces the darker negative is said to be the faster of the two. The relative speed of an emulsion is expressed quantitatively by a number known as the Exposure Index, or E.I. (formerly A.S.A.) Thus, an emulsion of E.I. 50 requires twice as much light to produce a negative as dark as one produced by an emulsion of E.I. 100.

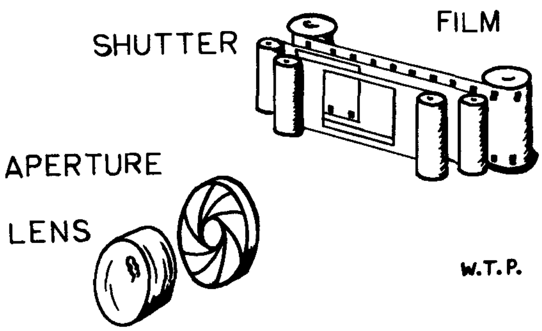


Figure 1. A simplified camera.

The speed of an emulsion is largely governed by the size of the silver bromide grains: larger silver bromide grains yield faster films. Upon development, these silver bromide grains are transformed into larger silver grains, and the silver grains tend to clump together. Unfortunately, large grains become quite visible in the gray areas of a photographic print, and tend to obscure fine details. Thus, there arises a stand-off between fine grain size and increased speed, which permits pictures to be taken at faster shutter speeds and in less intense light. Since the dark ages of photography (sometime back in the 1950's), emulsion chemists have succeeded in increasing the fastest available emulsions from E.I. 40 to well over E.I. 500; and the grain of today's fastest films is nearly as fine as that of the slower films of yesterday. Improvements, however, continue to come at a rapid rate.

CAMERAS

A camera is basically composed of four elements: a light-tight box to contain the unexposed film, a lens to focus an image onto the film, a variable aperture to control the amount of light admitted to the camera, and a shutter to control the duration of the exposure (See Figure 1). The embodiment of these features in the typical sophisticated, modern camera strains the limits of modern technology.

As an example, consider the shutter. Until recently, the best shutters available consisted of complicated, relatively inaccurate trains of gears and mechanical linkages designed to open the shutter for a fixed reproducible length of time. Some of the more modern cameras, however, rely on an electronic timing circuit to regulate precisely the length of time the shutter is allowed to remain open. And this timing circuit may itself be connected to another circuit which meters with a cadmium sulfide cell the amount of light falling on the camera's lens, monitors the manually set shutter speed and E.I. values, and automatically adjusts the aperture so as to produce a properly exposed negative. In essence, such a system is a tiny computer programmed to solve the equation

$$A^2/T = BS_x/K$$

where A is the *f*-number of the lens, T is the effective exposure time in seconds, B is the average field luminance in nits, S_x is the arithmetic E.I., and K is a constant with a numerical value of 11.4.

LENSES

The sophistication of modern lenses also deserves mention. As Figure 1 illustrates, the function of the lens is to focus an image of the scene to be photographed

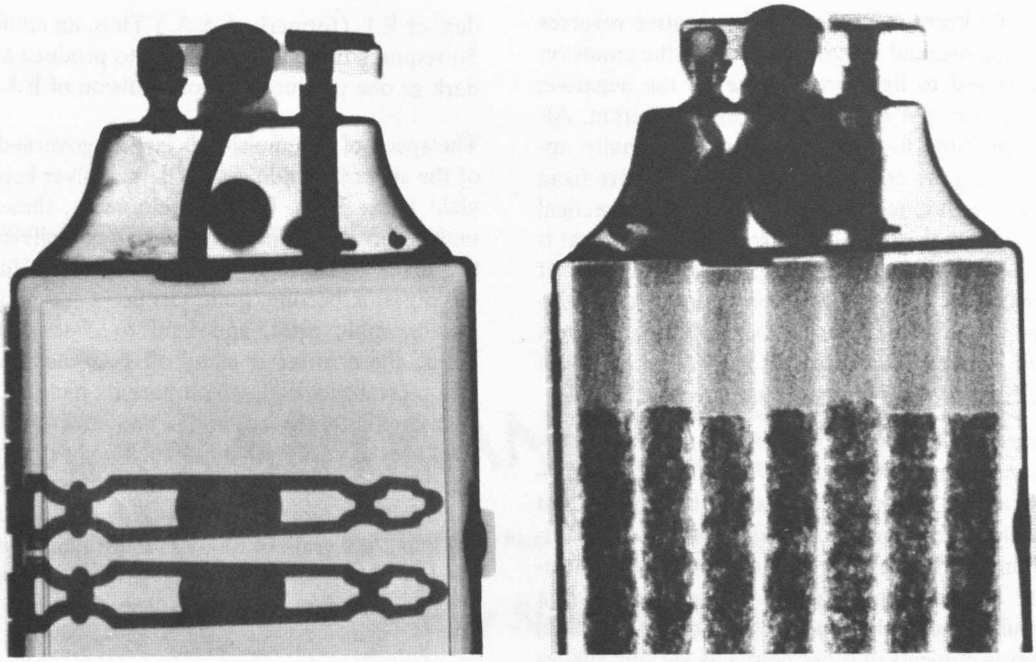


Figure 2. On the left, an X-ray photograph. On the right, a neutron beam photograph. Note the visibility of individual tobacco grains in the latter.

onto a film plane. Since any given glass refracts light of different wavelengths different amounts, a camera lens composed of a single element which would bring red light into focus exactly on the film plane might bring blue light into focus somewhere behind that plane. The result would be a picture which was unsharp except for the details which happened to be red. To avoid such difficulties, high quality lenses are composed of a number of complex-shaped elements (as many as a dozen) composed of glasses with varying refractive indices. When properly constructed, such lenses are capable of accurately focusing polychromatic subjects.

It is not hard to imagine the mathematical complexities involved in the design of such multi-element lenses. Hence, it is only natural that some optical firms rely on computer technology to help them design the vast array of telephoto, wide angle, and special purpose lenses that they market today.

THE BENEFACTOR REPAID

Yet, even in light of all these bounties that it receives, it would be grossly incorrect to consider photography a ne'er-do-well step-child of the sciences. Some of the scientific applications of photography are obvious and well known: X-ray photography, astronomical photography, and photography of the lunar surface are a few.

Less well known is the science of photogrammetry. In this discipline a specially calibrated camera equipped with a particularly distortion-free lens is used to take aerial photographs of an area to be mapped. The resultant set of photos is correlated and assembled to produce a map of the specified area.

A photographic technique similar in many ways to X-ray photography is that of neutron beam photography. Their major difference stems from the fact that X-rays pass through organic material rather readily but are quickly stopped by metals. Just the opposite is true for a neutron beam. Thus, in Figure 2 the cigarettes within the metal cigarette-case are not discernible in the X-ray photograph but are clearly visible in the neutron-beam photograph. Financially remunerative uses of this relatively new technique include the determination of fluid levels within sealed containers and the inspection of the distribution of pyrotechnic materials within vital rocketry components.

SCHLIEREN PHOTOGRAPHY

Schlieren photography, a technique used for graphing the gradient in the refractive index of a system of flowing gases, is an excellent example of photography being used as an instrument to provide quantitative data.

In the schlieren method (*schlieren* is a German word which may be translated as "optical inhomogeneity") the narrowly defined edge of a beam of light is projected

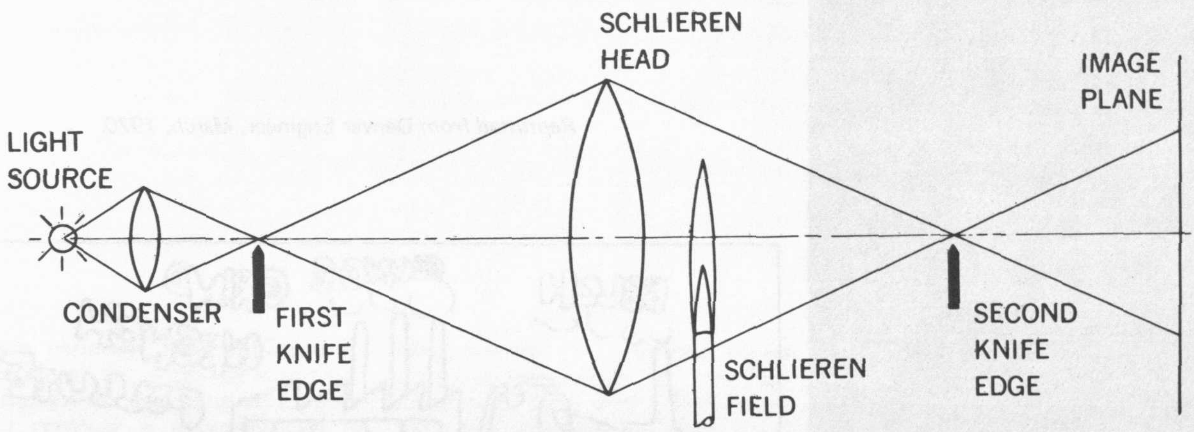


Figure 3. Basic Schlieren system.

through the system to be studied (Figure 3). If there is no gradient in refractive index within the schlieren field, the amount of light reaching the film is determined by the relative positions of the two knife edges. A gradient normal to the plane of the knife edges, however, causes the beam to be refracted so that it either adds to or subtracts from the light which would normally strike the film. Thus, a pattern of density gradients within the field is rendered by a pattern of light or dark tones on the film.

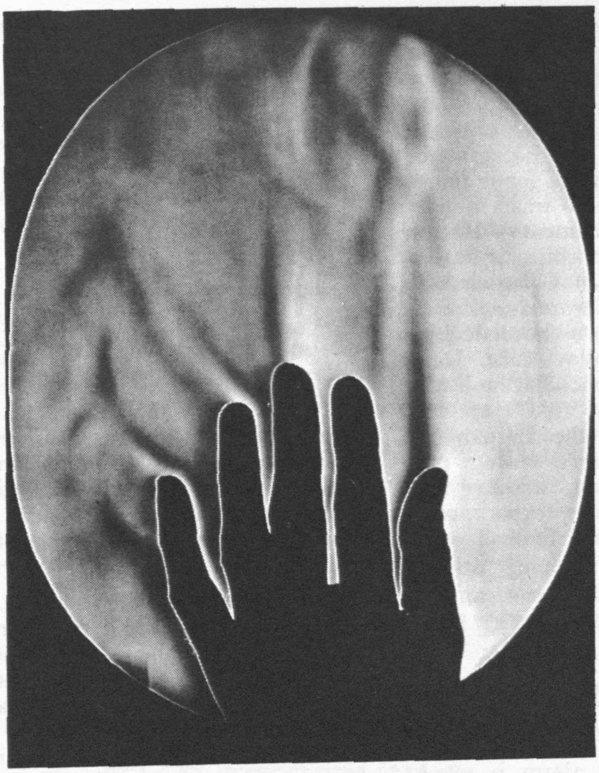


Figure 4. Convection current rising from a human hand.

As an indication of the sensitivity of this technique, it has been pointed out that this method is sufficiently sensitive to detect temperature differences as small as 5 degrees Celsius in a stream of moving air. This is sensitive enough to measure the convection currents rising from a man's hand (Figure 4)!

THE SYMBIONTS MERGE

Consideration of a few of the aforementioned subjects might lead the thoughtful reader to quickly defend the affirmative reply when considering the question "Is the *art* of photography also a science?" But another question may also be relevant: in light of the current popularity of such items as calendars bearing large, colorful, almost psychedelic reproductions of photomicrographs of crystallizing triphenylmethane, it might just be remotely possible that scientific photography is artistic.

BIBLIOGRAPHY

Schlieren Photograph. Eastman Kodak Co., Rochester, 1960.

Basic Principles of Organic Chemistry. Roberts, J. D. and Caserio, M. C. W. A. Benjamin, Inc., New York, 1965.

Photographic Exposure Guide. Photographic Standards Board. American Standards Association Inc., New York, 1966.

NOISE
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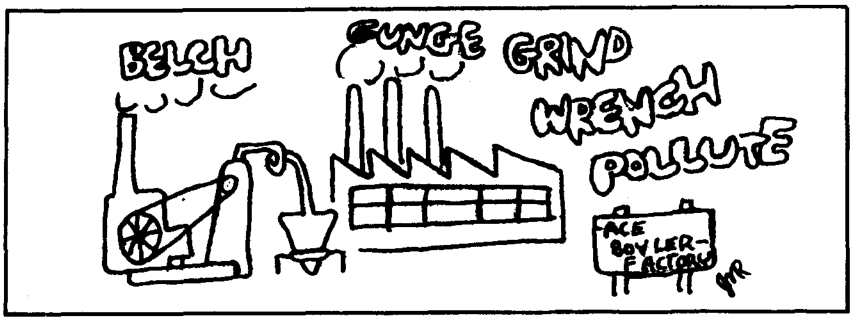
Reprinted from Denver Engineer, *March, 1970.*



by James M. Fiorillo

Indeed, almost every family man knows the enjoyment of relaxing in his favorite chair after a big dinner. In his lap is the evening paper and he scans the headlines as he unwraps a choice cigar. In the background, he is faintly aware of the gentle noises which have become so much a part of his leisure environment — Johnny munching on potato chips as he lies in a stupor in front of a blasting television, Sally using the mix-master as she tries her hand at a chocolate peanut butter-marshmallow cake, Dave talking on the hall phone as he listens to "In-A-Gadda-Da-Vida" at full blast, and finally the harmonious background of Mom's sewing machine, the dishwasher, washing machine, hot water heater, furnace, passing traffic, a backyard football game next door, Freddie tuning up his motorcycle across the street, an airplane passing overhead, a lawnmower . . .

Absurdly superfluous! you say, but the fact is, there is no escape. From the clatter of garbage cans fifteen minutes before the alarm is set to ring until the ambulance siren screams just as he drops off into slumber, man's ears are bombarded with the relentless fallout of bangs, clatters, roars, screams and whines.

By the year 2000, our population will exceed three hundred million, and over eighty per cent will reside in major metropolitan areas. The overall "loudness" of environmental noise is doubling every ten years, predominantly in metropolitan areas. From these two simply stated facts, it can easily be seen that unless there is drastic curtailment of our society's auditory infringements, few people will escape the impending noise explosion.

Technically speaking, "noise" refers to any disagreeable or unwanted sound. Although there is insufficient space in this article for technical discussion of noise, a brief description might be worthwhile.

When airborne, "sound is the result of pressure variation superimposed on the ambient atmospheric pressure."[1] It is composed of longitudinal waves with vibrational particle movement in the direction of the wave movement. Energy is required to create these waves and, with noise, this represents wasted energy. Frequency (expressed in cycles per second) refers to the rate of vibrational pressure variation, and amplitude is a measure of the degree of variation. The human ear functions as a transducer; response is dependent on a very complex combination of both frequency and amplitude. Attempted measurement (via some kind of meter) along these lines is usually based on a decibel scale. The human tolerance level is about 140 dB with normal conversation being in the neighborhood of 50 dB. As a quick reference scale: whisper (20 dB), electric blender (93 dB), discotheque (125 dB), jet take-off at close range (150 dB).[2] Representing, as can be seen from this list, such potential threats, it is worth while to more closely examine some of the higher decibel range "noise-makers."

Causes of Noise Pollution

One major contributor to noise pollution in the United States is our modern transportation system. Both aircraft and surface transports are receiving increased attention in the strife toward effective noise suppression.

In many urban locations, jet planes are the worst single noise source. The following complaints represent a cross-section of the content of a 1967 *Los Angeles Times* article entitled "36 Million Claims Filed Against City Over Airport Noise:" "Children have been deprived of the use of their schools for proper education activities . . . , subjected to loud noise . . . , complained of anxiety, loss of sleep, hearing . . . , suffered permanent hearing damage and emotional disturbance from jets!"[3] With supersonic transportation becoming a reality in the near future, the "sonic boom" looms as an even more serious noise disturbance. Not only does it exceed human tolerance levels at close range, but it is also destructive to buildings, causing plaster cracks, broken windows and tiles, and various other excessive pressure disturbances.

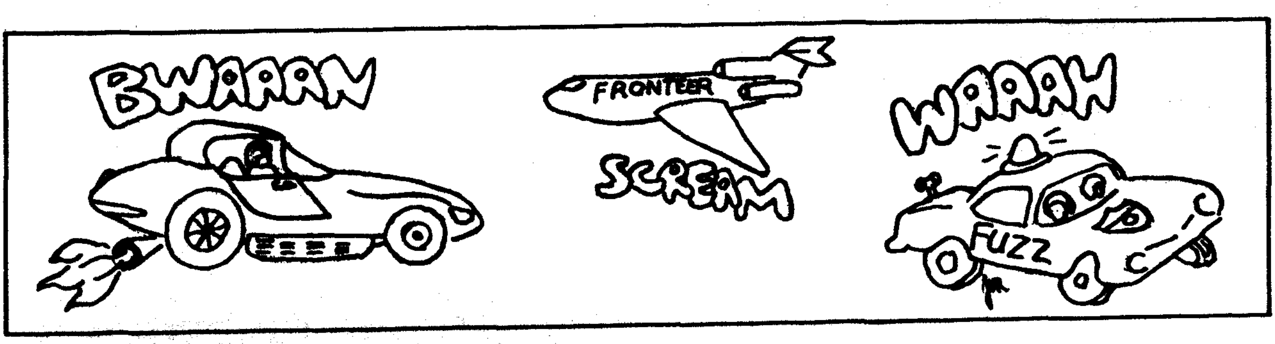
A second source of increasing noise pollution is surface transportation. Generally speaking, traffic noise disturbs more people than any other source of outdoor noise. Although less intense than aircraft noise, exposure time to highway noise is substantially greater—almost to a round-the-clock level. A single trailer truck at highway speeds generates a sound level of about 90 dB, with a line of truck traffic in excess of 100 dB. Following truck annoyance in a descending order of annoyances are buses, motorcycles, and passenger automobiles.

Indoor and outdoor noise present a third category of consideration. Some examples: (1) Automated clerical and computing equipment in the check tabulating room of one New York Bank is so noisy that the Bank is now hiring the deaf to reduce employee turnover.[4] (2) A study conducted by a team of McGill University epidemiologists revealed that the average rock music in Montreal produced a noise level of 120 dB (beyond the pain threshold for most people) with amplification systems operating at fifty per cent of maximum output due to "fear of burning out expensive electronic equipment."[5]

"Noise—Sound Without Value"

The following excerpt is taken from a Government Release entitled "Noise—Sound Without Value" and is illustrative of some of the harmful effects of noise pollution:

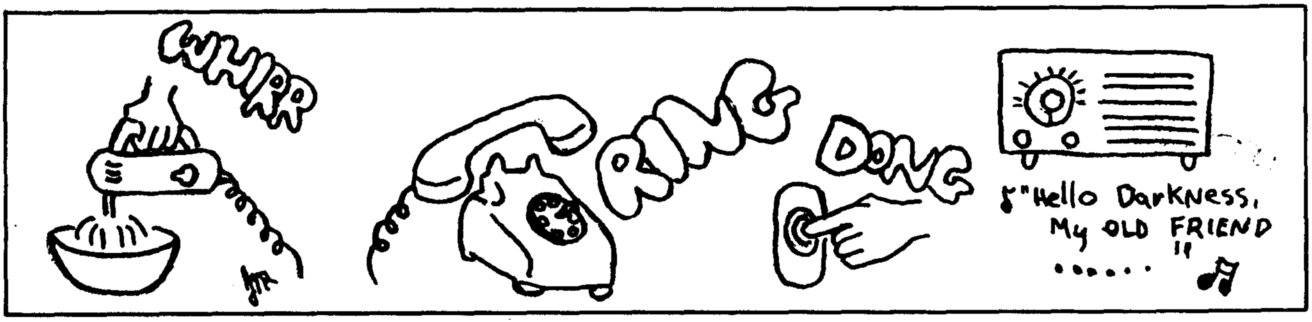
> Noise-induced hearing loss looms as a major health hazard in American industry. The number of United States workers experiencing noise conditions unsafe to hearing is estimated to be in excess of six million and may be as high as sixteen million . . . Aside from hearing loss, noise may cause cardiovascular, glandular, respiratory, and neurologic changes, all of which are suggestive of general stress reaction. These physiologic changes are produced typically by intense sounds of sudden onset, but also can occur under sustained high level, or even moderately strong, noise conditions. Whether such reactions have pathological consequences is not really known and may be unlikely in view of the body's capacity to adapt to prolonged or recurring forms of sound stimulation, including those of fairly high level. However, there are growing indications, mainly in the foreign scientific literature, that routine exposures to intense industrial noise may lead to chronic



physiologic disturbances. A German study, for example, has shown a high incidence of abnormal heart rhythms in steel workers exposed to high noise level in their work-places. Neurological examinations of Italian weavers, also exposed daily to intense noise, have shown their reflexes to be hyperactive, and, in a few cases, electroencephalography has revealed a pattern of desyncronization as seen in personality disorders. A study reported in the Russian literature shows that workers in noisy ball-bearing and steel plants have a high incidence of cardiovascular irregularities such as bradycardia. Subjective complaints of extreme fatigue, irratability, insomnia, impaired tactile function and sexual impotence also have been made by workers repeatedly exposed to high level industrial noise.[6]

Clearly, the effects of noise pollution go beyond the 300,000 complaints received in New York City last year.

"One of the most fascinating aspects of human behavior is the willingness, perhaps enthusiasm, of man to suggest that 'there ought to be a law' against nearly anything that disturbs him."[7] From the time the early Romans passed a law prohibiting chariot races at night, noise control has been the subject of many legislative efforts. However, when it comes to noise control, law and enforcement become rather distinct entities. For instance, in New York State, a law was passed in 1965 restricting truck noise to 88 dB at a distance of 50 feet. State police then proceeded to enforce a level of 92-94 dB (considering the measurements relatively imprecise) which is twice the sound pressure and one-and-one-half times the loudness of 88 dB. Further, this law was designed for single trucks on open highways, and when a line of trucks forms on a narrow city street, the sound level soars to over 100 dB.



Standards and Regulations

Presently, noise regulation is prevalent in the community governmental codes. There are two types of community laws that are designed for such regulation: (1) *nuisance laws* are developed primarily to restrict annoying sounds which are not readily measurable by physical methods. Examples include animal noises, loud parties, and power lawnmowers. (2) *performance standards* usually appear in zoning codes specifying the maximum permissable noise at a fixed point. These serve to preserve character in the community, promote general welfare, and provide guidance for design of facilities. Vagueness is inherent in both of these legal categories, for criterion reliability, however accurate it may be using physical instrumentation methods, becomes extremely complex when a person becomes the measuring device. This necessitates the creation of the "average person", implying that a fixed percentage of people an any given community will be particularly sensitive to noise and should be obliged to seek solace in quieter surroundings. This theory too, however, is complicated by the extreme variety of human reactions; "ringing church bells, which appeal to some people are noise to others."[8]

Community Codes

Noise codes should be formulated to provide sufficient standards and regulations for legal analysis of any noise situation within a community. Due to the ambiguous nature of community sounds, a working definition for community noise must be developed to serve as a basis for evaluation of complaints through these codes. Ron Donley of Hearing Conservation Inc. offers such a definition by saying: "Community noise is a statistical compendium of the all pervasive noises in a community upon which is superimposed transportation noise, industrial noise, and the noise of man."[9] Minimization of these three specific noises should result in effective control of noise pollution within the community.

There are, at present, numerous technical means available for achieving such minimization. First, concerning transportation noise, from the introduction of commercial, jet-powered aircraft until 1965, an estimated $150,000,000 was spent solely on installation of in-flight noise suppressors. Since then, suppressor-equipped jet engines have been replaced by newly developed turbofan engines (much quieter) at a cost of about $1,000,000 per aircraft.[10] Technical muffling is insufficient, however, in achieving maximum reduction conditions unless it is accompanied by developments in other areas. In aircraft noise reduction alone, for example, a quadrafold approach must be assumed: (1) the establishment of governmental noise criteria and standards for aircraft, (2) the full utilization of operational techniques for aircraft noise diminishment, (3) effective zoning ordinances and development of moderate cost soundproofing systems for communities surrounding air terminals. With regard to highway traffic, stricter enforcement of muffling requirements appears to be the major step in noise reduction. Truckers often remove the mufflers to gain horsepower, motorcycles often come stock without mufflers, and numerous means are provided to increase the sound emittance from passenger automobiles.

Industrial Noise

Industrial noise pollution is quite a different story, being both more complex in nature and more immediate in demand than the other forms of pollution. As an illustration of this demand, referral is once again made to the report published by the Federal Council for Science and Technology:

> The potential cost of compensation for industrial hearing loss is alarmingly large. One estimate is $450,000,000 which assumes that only ten per cent of those eligible for hearing loss compensation will file a claim and that the average award per claim is $1000. In actuality, hearing loss awards average $2000.

The Veteran's Administration spends $65,000,000 annually in rehabilitation programs for 90,000 war veterans with service-connected hearing disorders.[11]

Technical facilities are available for quieter industrial work (for instance "quiet" compressors and jackhammers are presently on the open market) but require additional investment on the part of contractors who are not being forced to consider noise. The critical question at this stage is: How soon will legislation be passed requiring industries and contractors to control industrial noise pollution?

Finally, in respect to the "noise of man", the term was interpreted as referring to man's careless use of the facilities which are accessible to him. Almost everyone has heard the screech of tires around a sharp corner, a stereo being played at peak capacity, or a child banging on a toy drum. Certain sounds are, by nature, enjoyable to man and, in this report, it must be resolved to assume a certain percentage of the community population will take pleasure, at one time or another, in the careless creation of noticeable sounds. It should be mentioned at this point that certain technically unnecessary sounds have been made socially necessary by their association with power. For instance, there is a strong belief among appliance manufacturers that consumers consider machines such as mix-masters and vacuum cleaners underpowered if they are quiet. When consulted, marketing experts expressed that only consumer education can make quietness a salable commodity.[12]

Ultimate Goal

The ultimate goal of this analysis is to achieve a desirable environment in which noise pollution makes relatively no adverse contribution to the health and well-being of man. In reaching this goal, it has been shown that specific changes must be initiated, propogated, and coordinated as to their technical, legal, social, economic, and prerogatory implications. The alternative to transacting such changes is a state of chaotic noise pollution and acceptance of a rapidly deteriorating situation. In the words of former President Lyndon B. Johnson:

> The crescendo of noise — whether it comes from truck or jackhammer, siren or airplane — is more than an irritating nuisance. It intrudes on privacy, shatters serenity, and can inflict pain. We dare not be complacent about this ever mounting volume of noise. In the years ahead, it can bring even more discomfort — and worse — to the lives of people.[13]

Bibliography

1 Bredin, Harold W., "City Noise: Designers can restore quiet at a price", *Product Engineering,* McGraw-Hill 39:24, Nov. 18, 1968, page 31.

2 *Ibid,* page 29.

3 *Noise-Sound Without Value,* Committee on Environmental Quality of the Federal Council for Science and Technology, U.S. Govt Printing Office, Sept. 1968, page 8.

4 Baron, Rovert Alex, "The Noise Receiver: The Citizen", *Sound and Vibration,* J. K. Mowry 2:5, May 1968, page 8.

5 Hersey, Irwin, "Our Hearing", *Engineering Opportunities,* Press Tech Inc., 7:9-c, Sept. 1969, page 36.

6 *Loc. cit., Noise-Sound Without Value,* pages 32-33.

7 Donley, Ray, "Community Noise Regulation", *Sound and Vibration,* J. K. Mowry 3:2, Feb. 1969, page 12.

8 *Op. cit., Noise-Sound Without Value,* page 19.

9 *Op. cit.,* Donley, page 16.

10 *Op. cit., Noise-Sound Without Value,* pages 10-11.

11 *Op. Cit., Noise-Sound Without Value,* pages 34-35.

12 *Op. Cit.,* Bredin, page 30.

13 *Op. Cit., Noise-Sound Without Value,* page 1.

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ENGRINEERS

An automobile dealer which doesn't enjoy a good reputation advertised that he would give away a blonde with each car. A delighted young wolf bought a car and rode with his newly-won blonde into the country and parked. He kissed her and then whispered in her ear. "No," she replied, "you got that when you bought the car."

"Doctor," said the young mother, "I'm always worried about my baby. I'm afraid to leave him alone for even a minute. For example, I'm even afraid to leave him in the bedroom for fear I won't hear him if he falls out of his crib!"

"Well, you can remedy that easily," said the doctor. "Just take the carpet off the floor."

A gentleman was dining in an exclusive restaurant and enjoying the chamber music as he ate. As the orchestra began a different selection, a waiter approached and set his dessert before him. "Is that Beethoven's Fifth Movement?" asked the diner. "No sir," replied the waiter, "that's chocolate pudding."

A young married couple who had just settled down in their new home got a pleasant surprise in their mail one morning–a couple of tickets to one of the best shows in town. But the donor had omitted to send his name and for the rest of the day the question was: "Wonder who it was?"

They enjoyed the show; but when they reached home, they found that all their wedding presents had been taken. A note from the burglar said: "Now you know."

A small boy's head bobbed up over the garden wall and a meek little voice said, "Please, Miss Brown, may I have my arrow?"

"Certainly, where is it?"

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

Strange, but true: Dogs in Slobbovia show a pronounced flattening of the nose. Scientists theorize that this phenomenon is due to their chasing of parked cars.

A grasshopper walked into a tavern and hopped up on the bar stool. He said to the bartender. "I'll have a Scotch and Soda." After carding him, the bartender said, "Do you know we have a drink named after you?"

"Really," said the grasshopper. "You mean to say you have a drink named Irving?"