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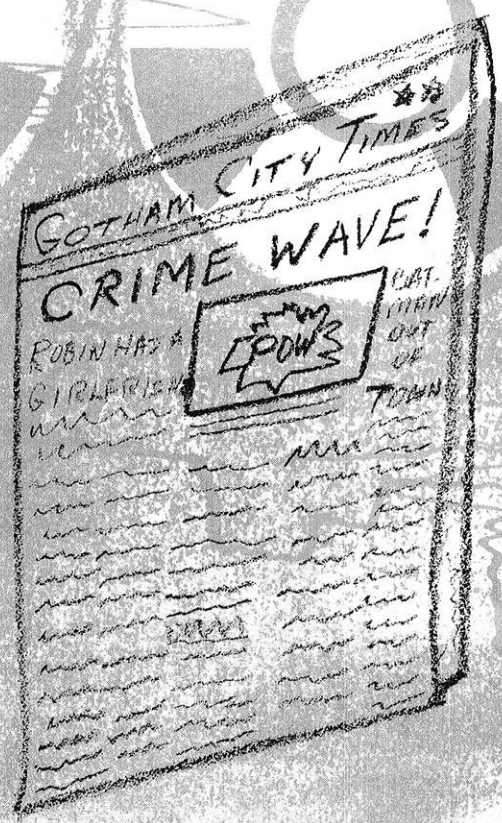
THE WISCONSIN ENGINEER

25¢
FEBRUARY 1966
Vol. 70, No. 5
MEMBER ECMA



—page 16

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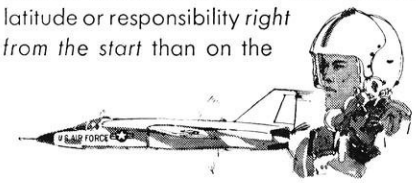

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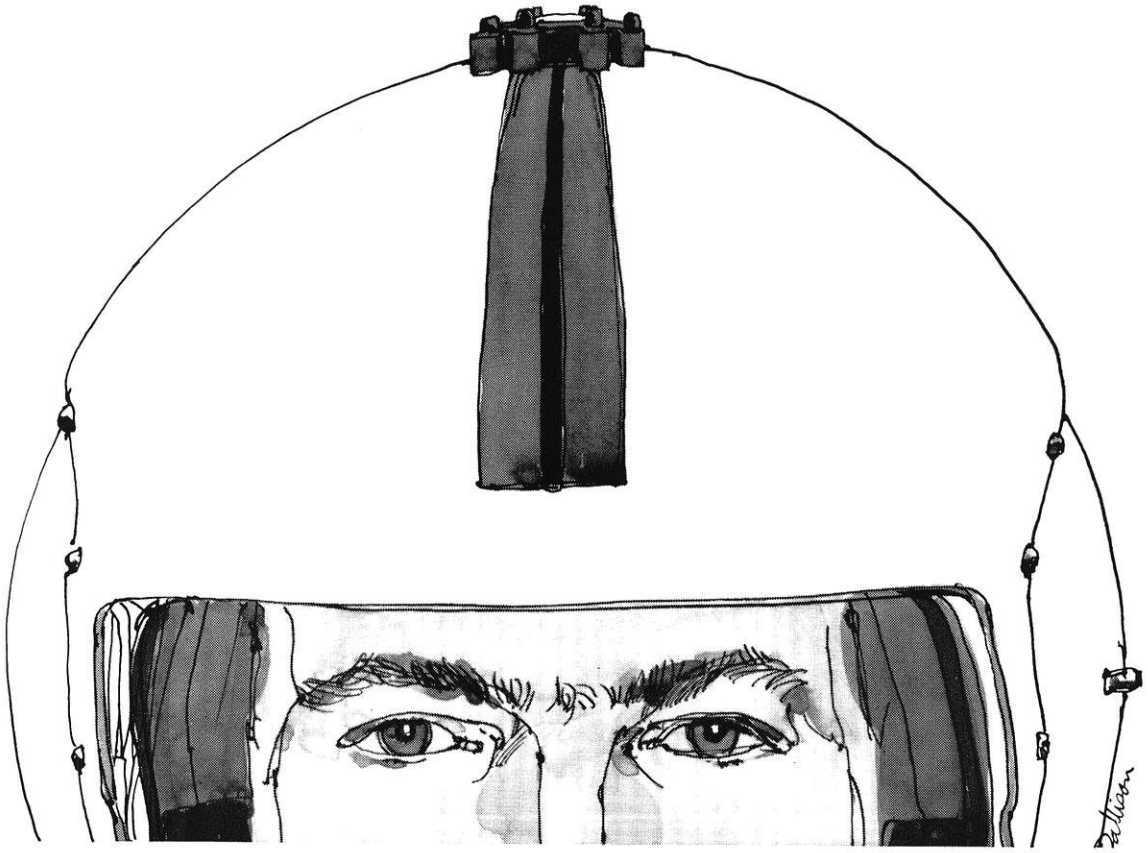

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PHILLIPS 66

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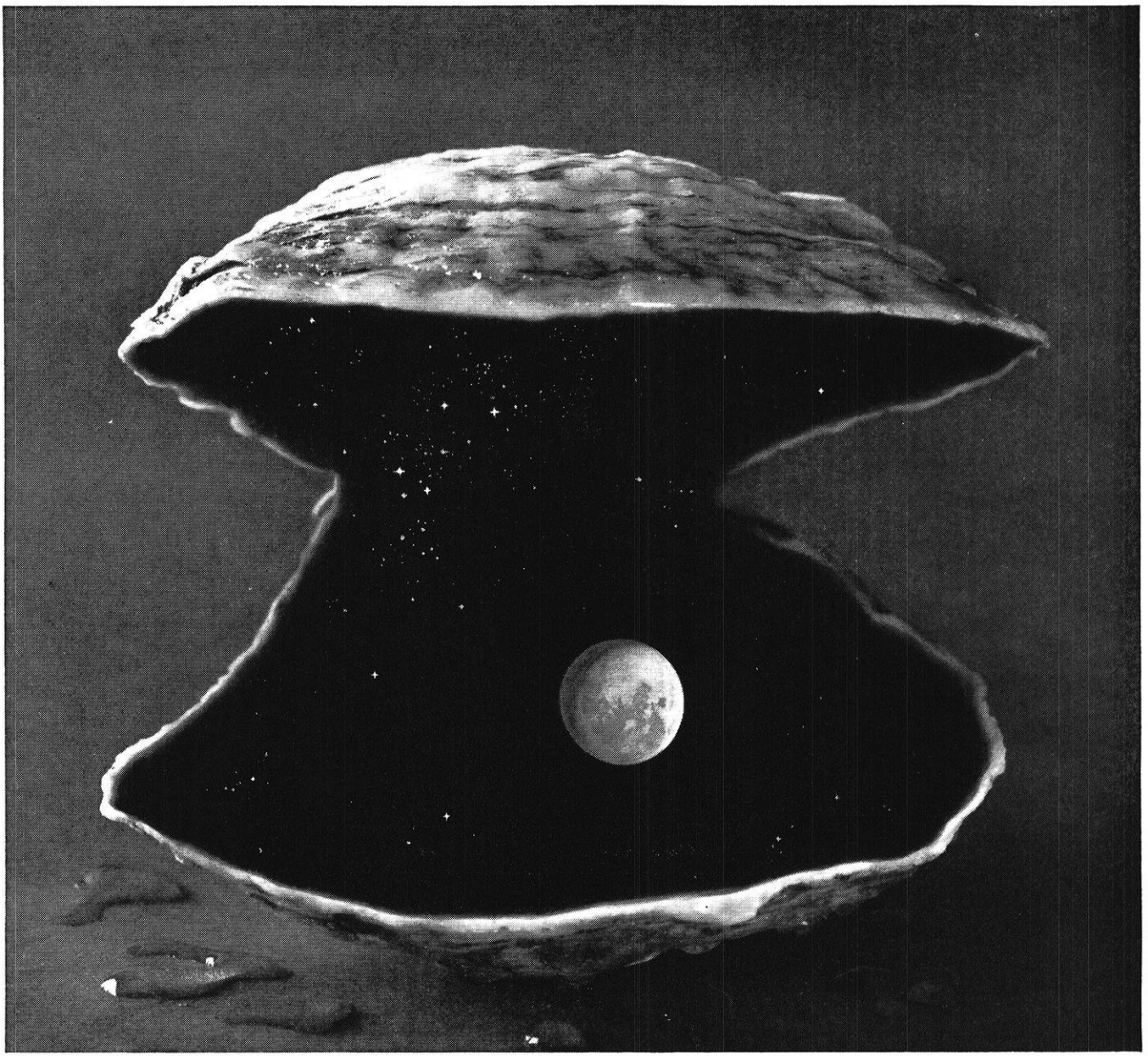

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ARTICLES

THE WISCONSIN ENGINEER

The Student Engineer's Magazine Founded in 1896

FEATURES

THIS MONTH'S COVER

Jim Lawton did the background work for our February Cover, while some unknown gremlin added the finishing touches. It's all tied in with our lead article on the utilization of computers in the newspaper industry, starting on page 16.

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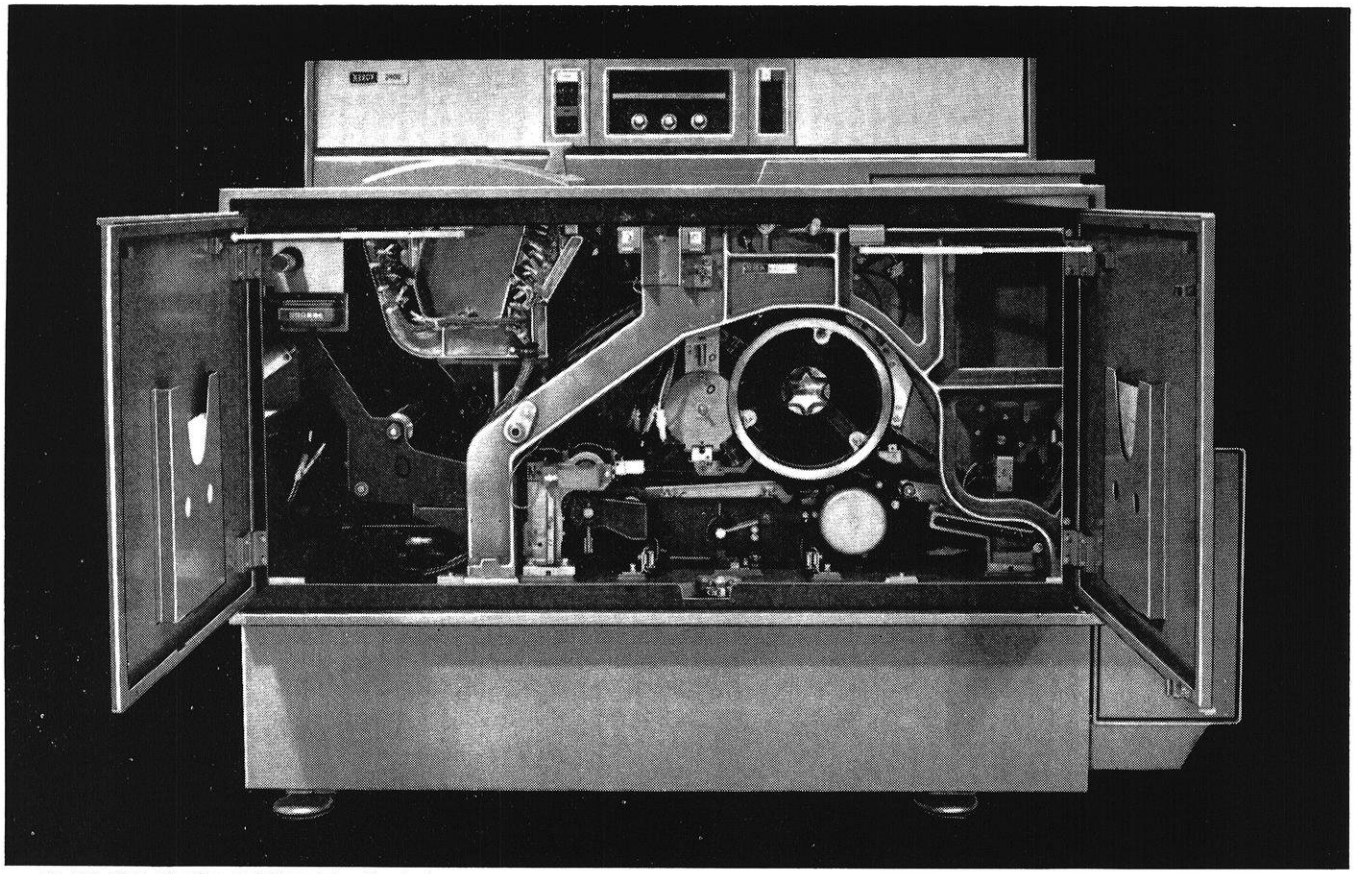

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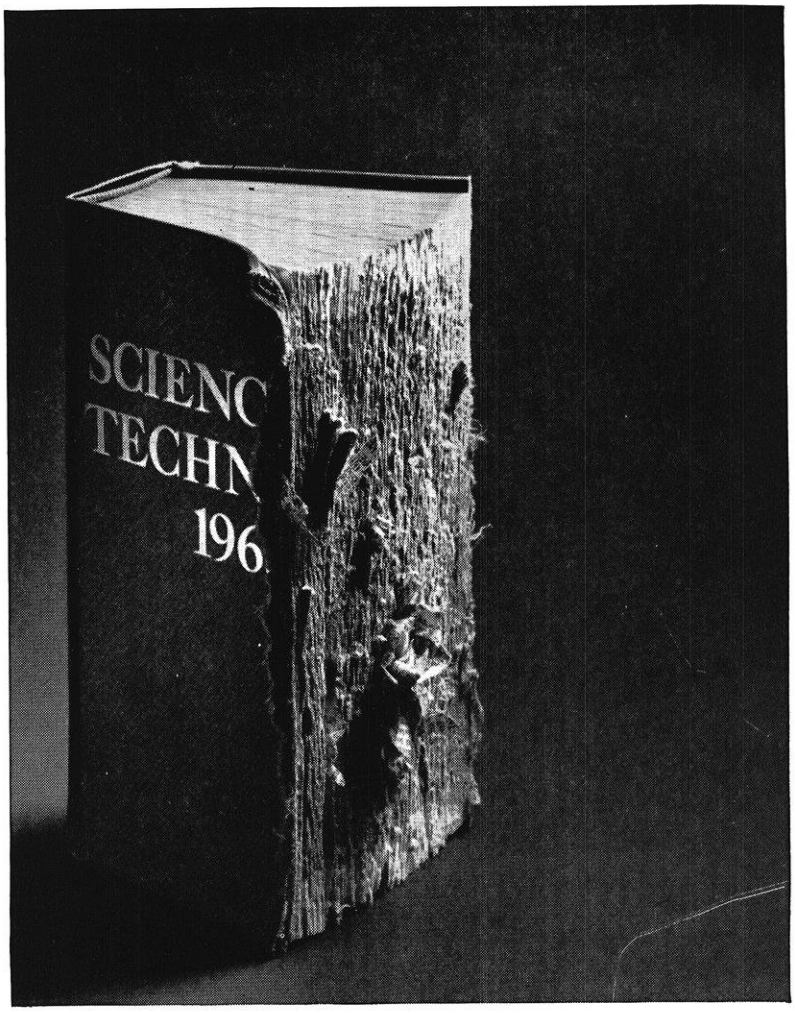

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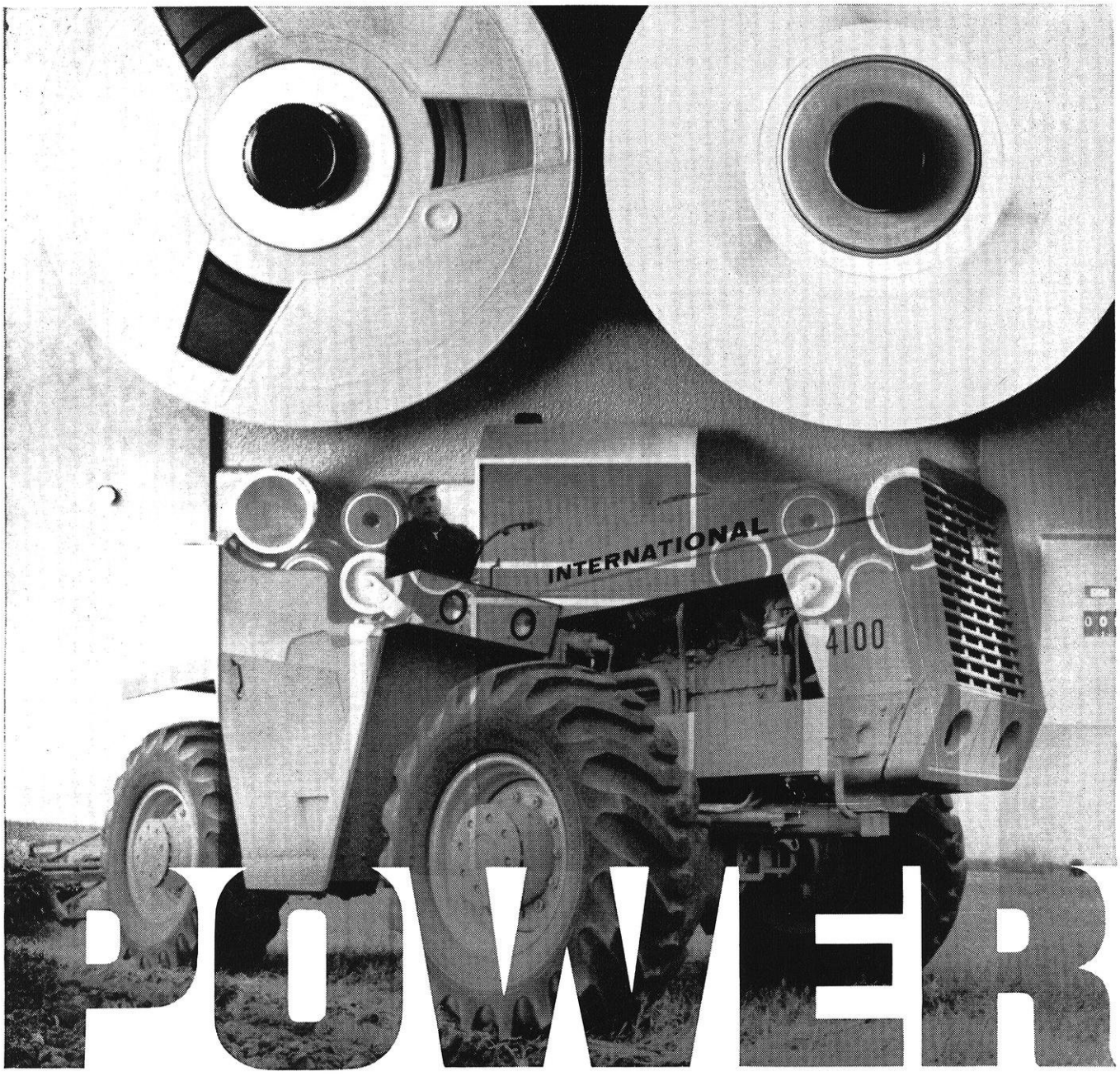

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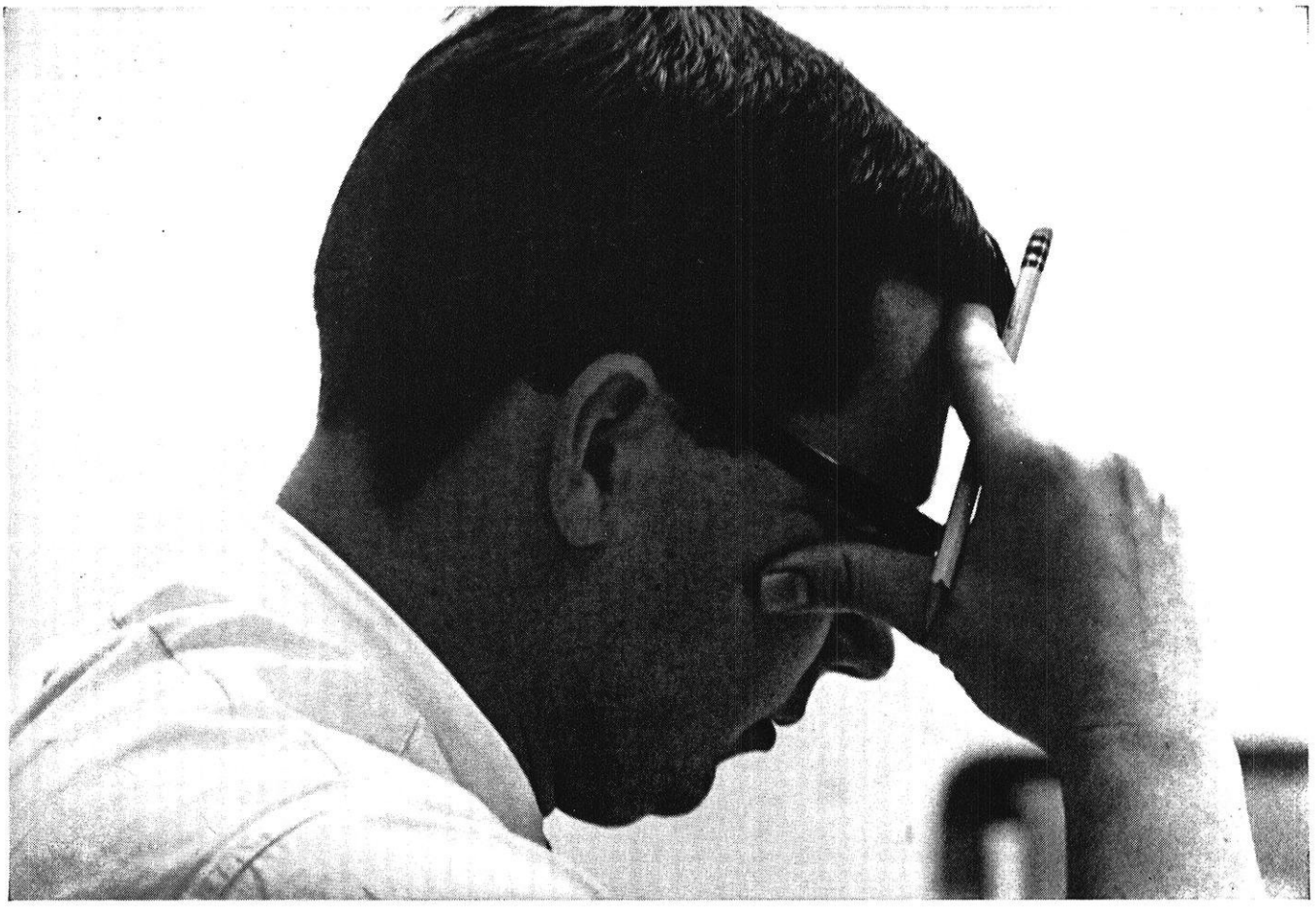

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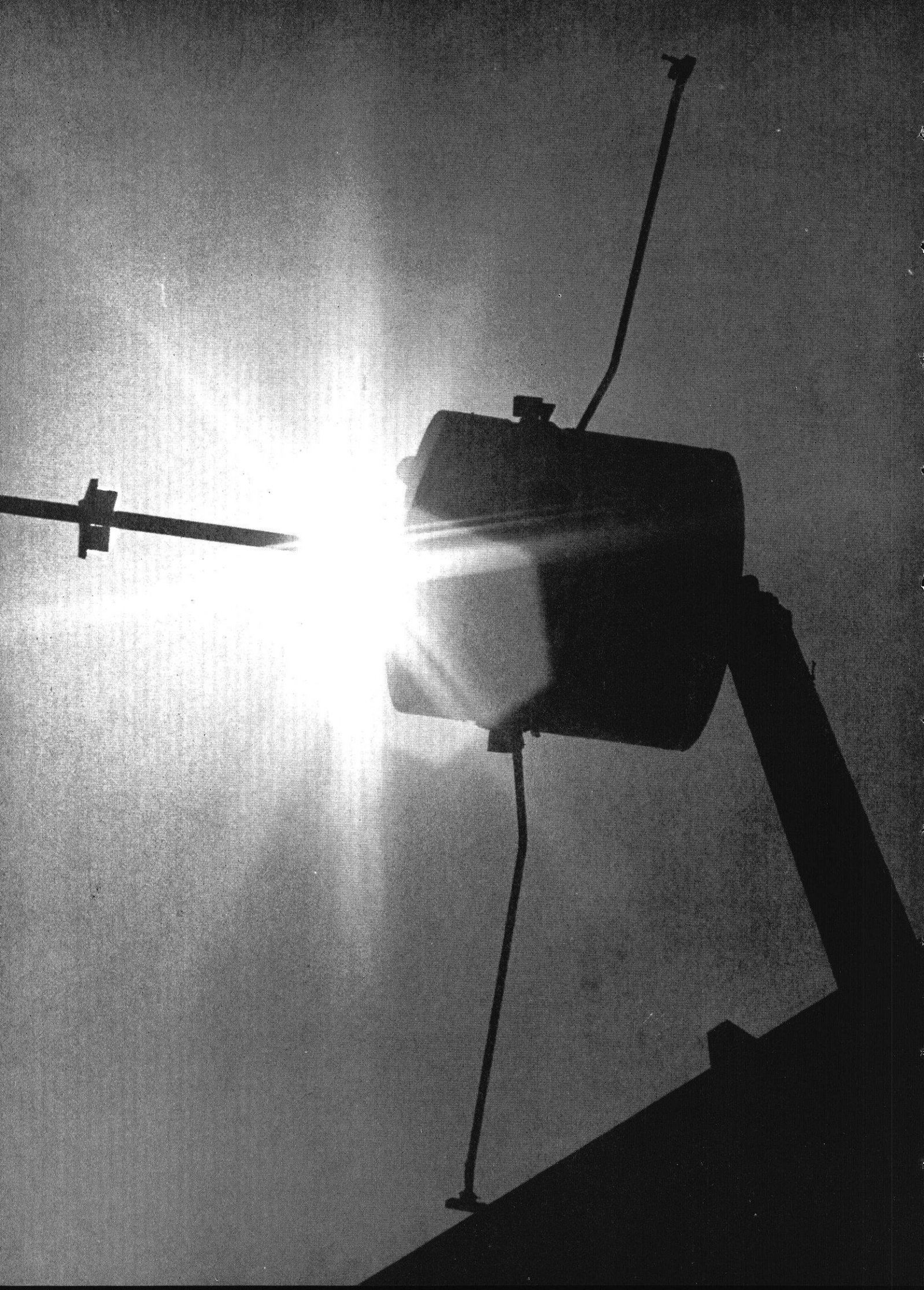

Rambling with the Editor

CLOUDS OVER CAMPUS

Among the multitude of new construction projects on our rapidly expanding campus is a structure rising in the block bounded by Dayton, Spring, Mills and Charter Streets—an addition to the main heating plant. Completion of the project will double the heating capacity of the present plant. While we grant that the project is necessary, it is our hope that it will not be designed and operated in a manner similar to the present plant.

All of us have walked through the region near Johnson and Mills on a quiet day and experienced a taste resembling soot and ashes. At times the three towering stacks send debris through the air over parts of the entire campus. Waste products from the combustion of literal mountains of coal gray the snow, cover cars with layers of dust, and make already dingy houses look dingier. The air looks, smells, and tastes like that of Gary, Indiana rather than Madison, Wisconsin.

Why should an institution spending thousands of dollars annually studying the causes and prevention of polluted air and water at the same time endanger plant and animal life and reduce property values. More efficient traps, filters, and precipitators are available and should be installed in the present system. And the addition now under construction should be equipped with the finest anti-smog devices available.

—R. J. Smith

FRONTISPIECE (Opposite)—The sun's rays glint off a Pioneer satellite.
Photo courtesy TRW Systems

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The Production Function in the Modern Newspaper

A Look at Computer Utilization

By JOSEPH J. VALITCHKA

THE future of American Newspapers is going to be determined to a large extent by their production methods. The technological developments being made in this field are striking in their scope, and their arrival on the newspaper scene is going to change the whole of the present production process. American newspapermen will have to become aware of these developments and their utilization capabilities or become as obsolete as their present composing room equipment. The time is now for management and policy makers of this nation's papers to prepare for automation and its impact on the journalism scene. Production is going to be the key to success tomorrow!

This article takes a look at the present methods of computerized production, the emerging systems, and finally the processes of the future. These systems are similar in one main respect—they all have the computer at their heart.

The general objective of a computer-orientated production system is to turn all copy and classified ad material into "hard" type as quickly and as efficiently as possible. Benefits from computerized typesetting are realized in both editorial and production areas. From an editorial viewpoint, benefits are derived because with the new production speed available, more coverage can be given to a late breaking story in the earliest possible edition. From the production angle, there is a savings in time and money utilized to compose type. Computer set type also results in an easier to read, better spaced newspaper.

John Diebold, president of the Diebold Group systems planners, has said that he feels the newspaper industry is one that will be changed extensively by automation in the next decade. Along with this fact he states that it is an industry that least realizes it! He feels automation will be the salvation of many papers because of the economies of production associated with automation, the improvement of one's editorial reach, the quality of the product, and the role of the newspaper in our society. The editor's firm should also be able to offer more services as a result of automation.

Modernization through automation will mean a better newspaper because with faster production later news can be included in each day's issue. These remarks and the following have been expressed by John Torinus, editor of the *Appleton Post-Crescent*. The automatically produced paper will be better also because readability will be improved due to mechanical accuracy and a decrease in typographical errors.

Research Director Bill Williams of the Oklahoma Publishing Company has said, "Any newspaper which hopes to remain competitive had better get into this field, and the health of the industry as a whole is at stake. All newspapers are involved whether they realize it or not, and the sooner we all come to this realization and work cooperatively together, the better for our profession."

Twenty-four newspapers in the United States are now utilizing computer-directed type-setting. This is according to the American Newspaper Publisher's Association Research Institute as of the September 12, 1964 edition of "Editor and Publisher". The breakdown according to computer system is:

IBM 1620	10
Mergenthaler's Linasec	6
RCA 301	5
Control Data 8080	1
NCR 315	1
Intertype	1
	24

Before delving into the body of this report, the writer would like to convey sincere gratitude to Mr. Warren G. Wheeler, Jr., General Manager of the *South Bend Tribune*, South Bend, Indiana. Mr. Wheeler was most helpful in supplying extensive material.

THE TYPE SETTING PROCESS, EQUIPMENT, AND THEIR FUNCTIONS

The equipment used in an automated typesetting process in its general order of use follows:

Joseph Valitchka wrote this informative article prior to graduating from UW. He was a Production Management student and is currently an Ensign in the USNR. Joe's home is Manitowoc, where his father is a newspaper editor.

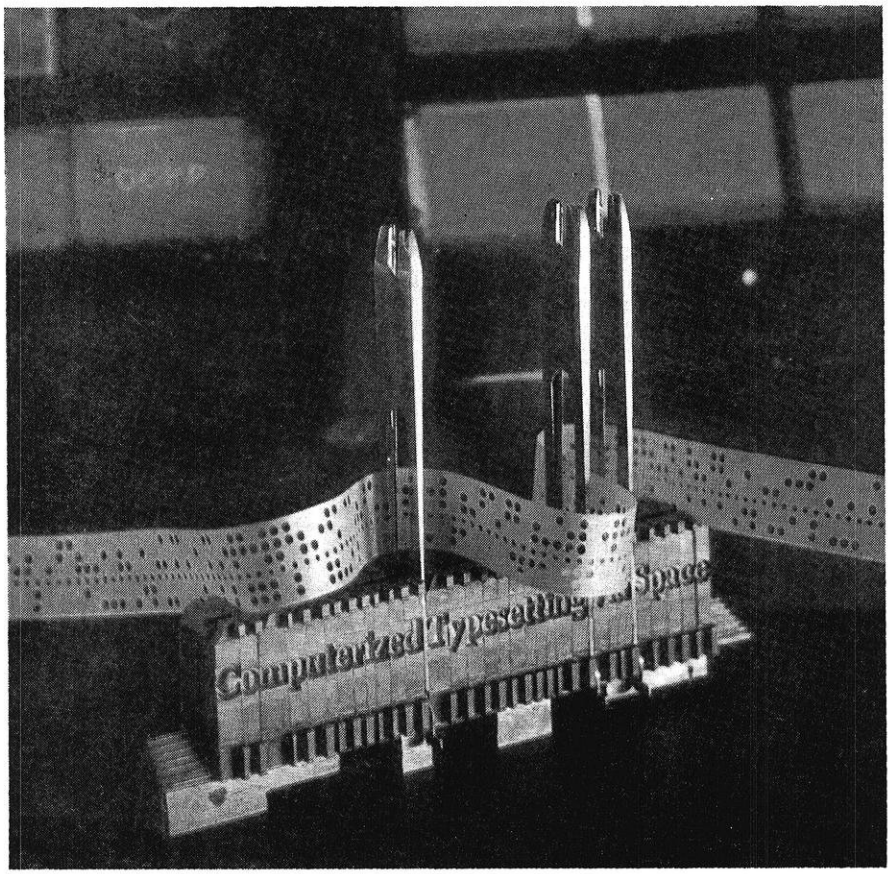

Figure 1.—Shown are three of the main elements of computer typesetting: the control panel of the RCA 301 computer console, the punched tape utilized by the computer, and assembled linotype matrices and space-bands. (Courtesy *RCA*)

1. Tape Perforator.
2. Tape Reader.
3. Buffer or Alloter.
4. Computer.
5. Reperforator.
6. Linecasting Machines.

The discussion of the computerized system in this section refers for the most part to the IBM 1620 system in use at the *South Bend Tribune*, South Bend, Indiana. The system is the first of its kind in the world.

Tape Perforator

The Fairchild Paper Tape Perforator is a typewriter-like machine which punches a continuous strip of six-channel paper tape, as shown in Fig. 2. In the Tribune's system there is an uninterrupted flow of information from the tape perforators to the linecasting machines. The perforator operators receive fully edited news and classified ad copy and reproduce this copy on perforated, unjustified tape. The tape is stored between the perforator and the Teletype Corporation CX Reader until the operator signals the buffer that the story or "take" is completed.

Tape Reader

The Teletype Corporation CX Paper Tape Reader accepts the take from the perforator through the medium of the buffer and relays the information received into the IBM 1620 Computer in the form of electronic impulses, again through the medium of the buffer.

The tape reader transforms the tape perforation pattern into electronic impulses at the rate of 110 characters per second.

Buffer

The *South Bend Tribune* uses an IBM 1906 Model II Buffer which:

1. Channels perforated tape from the Tribune's Fairchild Paper Tape Perforators into the computer. The tape perforation pattern represents unhyphenated, unjustified copy.
2. The buffer will also feed hyphenated, justified lines of copy in the form of electronic impulses to Teletype Reperforators which then feed directly into each of the Tribune's six Intertype Monarch Linecasters. The linecasters are geared to set the required type and column width.
3. The buffer continuously scans the tape perforators for an operator signal that a complete take is ready.
4. It then selects the tape to be read.
5. The information is then channeled into the computer by the buffer. (See Fig. 3).

After copy has been put on unjustified, perforated tape, "read", and then justified by the computer, the buffer, under computer guidance, seeks out an available reperforator at a waiting linecasting machine. The computer will seek out those linecasters geared to set the required column width, type style, and size required for any given story. If the desired type, style, size, and column width are not available immediately on a linecasting machine, the buffer will seek out a machine most nearly meeting these needs. That is, the buffer directs the computer signal to the reperforator at the linecasting machine which is most nearly set up to meet the desired type and column requirements. This will be a machine with at least the proper type size and style. When the incompatible copy on tape from the reperforator is about to enter the selected machine, the computer will halt the machine's typesetting operation so that required set up changes can be made manually. The computer will indicate the changes to be made. The economic advantages of having the computer select the machine with the least set-up requirements is obvious.

The link-up between the buffer and computer forms a completely automatic and extremely rapid transformation of copy to tape. The combination allows the Tribune system to set between 4050 and 4350 lines of nine point, 11 pica type per hour. The capability of the system is such that 20 linecasters could be utilized to produce up to 12,000 lines per hour. Twenty Teletype Setting Perforators could also be included in this expansion.

Alloter

The *Appleton Post-Crescent* is contemplating the addition of an Alloter System to their automated typesetting method. This equipment will route tape from the perforators through the computer and

to the linecasting machines automatically also. It will call for tape from the operators with the most set, and after justification will feed the tape to the linecasting machines most needing a fresh supply to maintain continuous operation. At the present time this tape transfer is hand carried by human monitors. This alloting system functions in much the same capacity as the IBM 1906 Model II Buffer in operation at the *South Bend Tribune*.

Computer

The IBM 1620 is a fully transistorized, desk-sized computer possessing many of the operating capabilities of much larger units. It prepares justified and hyphenated tape at an average rate of 10–12,000 lines per hour. The tape is the perforated representation of editorial and classified ad copy.

The RCA 301 Computer produces justified paper tape for typesetting at 300 characters per second. This performance is sufficient to keep 60 typesetting machines operating continuously around-the-clock. The computer justification process can handle over ten newspaper lines per second; this is equivilent to 36,000 lines an hour or thirty pages!

The IBM 1620 Computer accomplishes the hyphenation task by first avoiding past errors and then proceeding on to divide words correctly. This is how the computer functions:

1. When an end of line word must be divided, the computer first scans an exception word dictionary which contains from 100 to 125 frequently used words which the computer has been known to hyphenate incorrectly. If the word is not there the computer goes on to hyphenate.
2. The computer determines the number of syllables and vowel count of the word being divided. The machine then scans a special hyphenation probability table to determine the best dividing point. At the present time 95% of the words being divided in this manner are done so correctly. This level of accuracy can possibly be increased to 96.5% which the Tribune considers acceptable.

The *Appleton Post-Crescent* employs a Linasec Computer designed by the Compugraphic Company in its automated typesetting system. When a word must be divided at the end of a line, that word is displayed on a small television screen to a human monitor outside. Below the word displayed on the screen are a row of buttons, one between each letter. The monitor divides the word by pressing the button which is between the last two syllables. The computer inserts a hyphen at this point and goes on with its justification work. This method tends to indicate that a monitor must constantly survey the viewing screen, however Editor John Torinus says that all the tape punched by the tape perforators in a fifteen minute period can be fed through the computer in several minutes. Therefore one printer can monitor both the computer and several linecasting machines.

Torinus states that his paper expects 100% accuracy with this method of hyphenation. He admits that there are computers that can do the job automatically but mentioned that his company's research has indicated only a 75% to 90% accuracy level for this type of word division. The automatic process is accomplished through a logic system programmed into the computer. He added that the accuracy level of the automatic system can increase depending on the money spent on the computer.

At the Oklahoma Publishing Company the computer has been programmed so as to deliberately try to assemble one word too many into the 11 pica column of all its papers. This packs more news into the already narrow columns. Here is what the system does:

1. Tries to justify the extra word into the line by first attempting word spacing.
2. If this fails then letter spacing as a second preference is tried.
3. Hyphenation is the third choice if

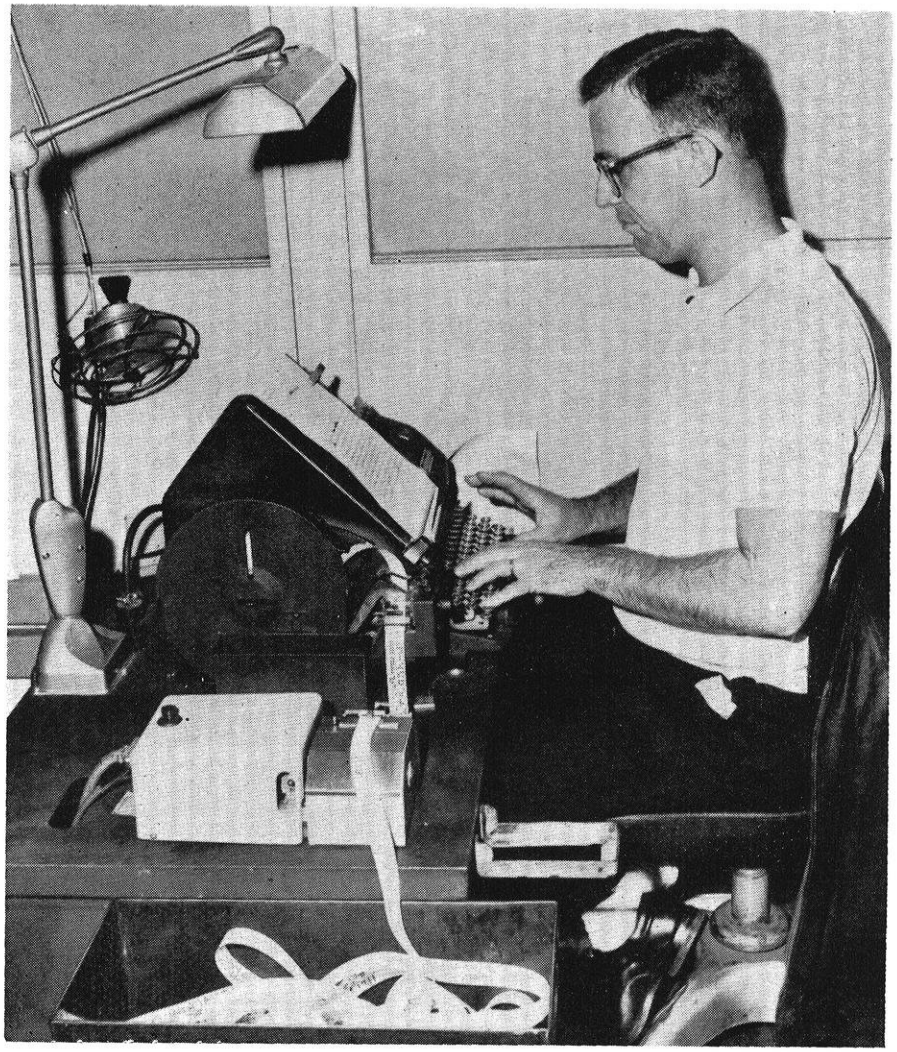

Figure 2.—TAPE PERFORATOR—First step in the Tribune's fully automatic high-speed computer typesetting operation is the conversion of reporters' edited copy to tape by perforator operators. (Courtesy *South Bend Tribune*)

neither of the first two methods work.
4. Only after steps one, two, and three fail is the extra word moved down to the next line.

This same computer can handle editing instructions which are put onto the input tape. These instructions will tell the computer:

1. When to indent, from one to nine spaces.
2. When to quad left, quad right, or center.
3. When to set a single word or an entire paragraph in boldface.
4. To indicate the end of a take, or a tape, and type out the traditional "30"—end line.
5. To specity the type line as to width, type size, or font. Lines within the same take can be set by the computer in varying widths to run around illustration cut, or for box scores, or tabular matter.

Reperforator

The Teletype Corporation BRPE Paper Tape Reperforators receive electronic impulses designating hyphenated, justified copy from the computer via the buffer. The reperforator then punches six-channel tape representing hyphenated, justified copy at a rate of 110 characters per second. The reperforators are attached directly to the linecasters and the tape feeds into these machines continuously. The time lapse in transmitting a single character from the tape perforator to the reperforator is about five to six milliseconds. The computer is capable of scanning information at a rate of about one million characters per second, but is limited by the speed of the reperforator which is 110 characters per second.

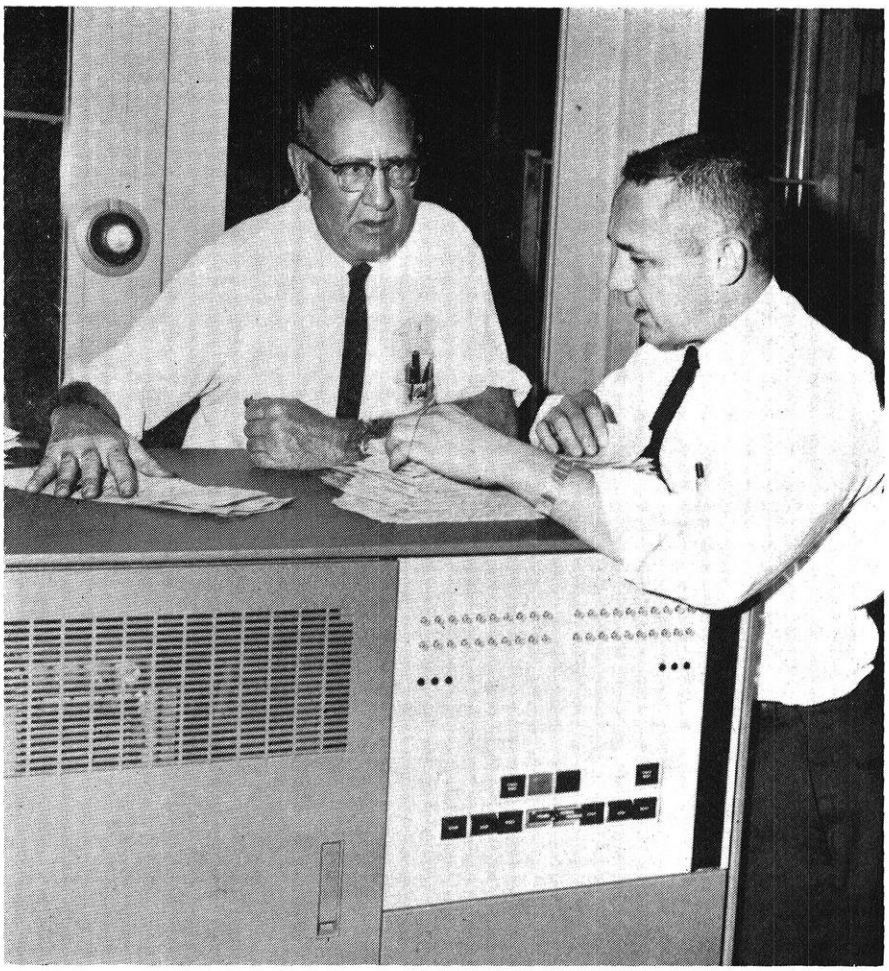

Figure 3.—BUFFER—*South Bend Tribune* composing room Superintendent Carl Wallace, left, and Robert W. Poland, IBM systems engineer, check the accuracy of proofs produced by the Tribune's fully automatic IBM computer typesetting system. The Buffer is an IBM 1906 Model II. (Courtesy *South Bend Tribune*)

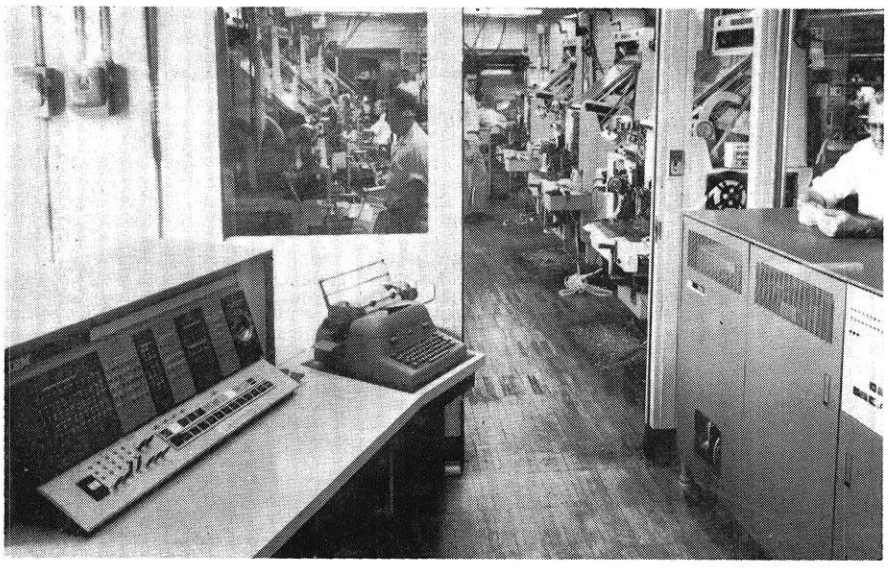

Figure 4.—COMPUTER—Shown at left is the IBM 1620 Computer. In the composing room are the Intertype Monarch Linecasters, at the right is the IBM Model II Buffer. (Courtesy *South Bend Tribune*)

Linecasting Machines

The Tribune uses six Harris Intertype Corporation Monarch Linecasting Machines, each of when operating at peak performance can produce from 675 to 725 lines of nine-point, 11-pica type per hour. Copy to be printed in odd or uncommon type size and style and column width is set early in the day. Classified agate, odd width editorials, and features are thus set all at once and earlier so that later in the day copy flow from the reperforators will be geared to copy setting capability of the machines. The later copy is usually set in nine point, 11 picas wide news type. This planning makes resetting of the linecasting machines during the deadline period a rather rare occurrence.

OTHER USES FOR THE COMPUTER SYSTEM

The RCA 301 Newspaper System has been programmed to do

the justification of editorial copy and classified "straight matter". Once installed within a newspaper plant the 301 System, besides cutting costs in the composing room and speeding typesetting can be further utilized to do:

1. General accounting work including payroll.
2. Subscription fulfillment, billing, and analysis.
3. Advertising scheduling.

The 301 can be integrated into existing communication systems to extend these uses to an entire chain of newspapers.

Production of Ad Scheduling

To simplify advertising detail and scheduling, the computer produces an ad manifest, listing by size the insertions for each section of the paper. The resulting benefits are:

1. A presentation of space breakdowns and totals to determine the number of sections and pages needed.
2. Speeds dummying. Large ads can be placed first.
3. Ad copy, type faces, plate numbers, etc., are compactly stored on magnetic tape, saving space and reducing dispatch errors.
4. Media records can be developed by classification and frequency for sales guidance.
5. Classified ads can be set, tabulated, inserted, and billed automatically.

Processing of Circulation

The computer can be used for major circulation paperwork operations. It will:

1. Maintain mailing lists.
2. Produce address and bundling labels, print hundreds of different addresses continuously.
3. Calculate the time of press run in advance.
4. Analyze subscriber and non-subscriber lists and records for editorial, publisher, and circulation guidance.

Management and Accounting

The RCA 301 Computer can be utilized to do billing, accounts payable, accounts receivable, payroll, payroll taxes, general ledger, balance sheets, and desired financial reports for management analysis. Programming in this area is simplified and speeded by use of RCA 301 COBOL for plain English programming in business terms.

These functions the computer will perform as well as its production function. In this way the installation of the automation system can be truly made to pay for itself as production, circulation, accounting, and management control all can gain efficiency, save time, and reduced costs from the same machine.

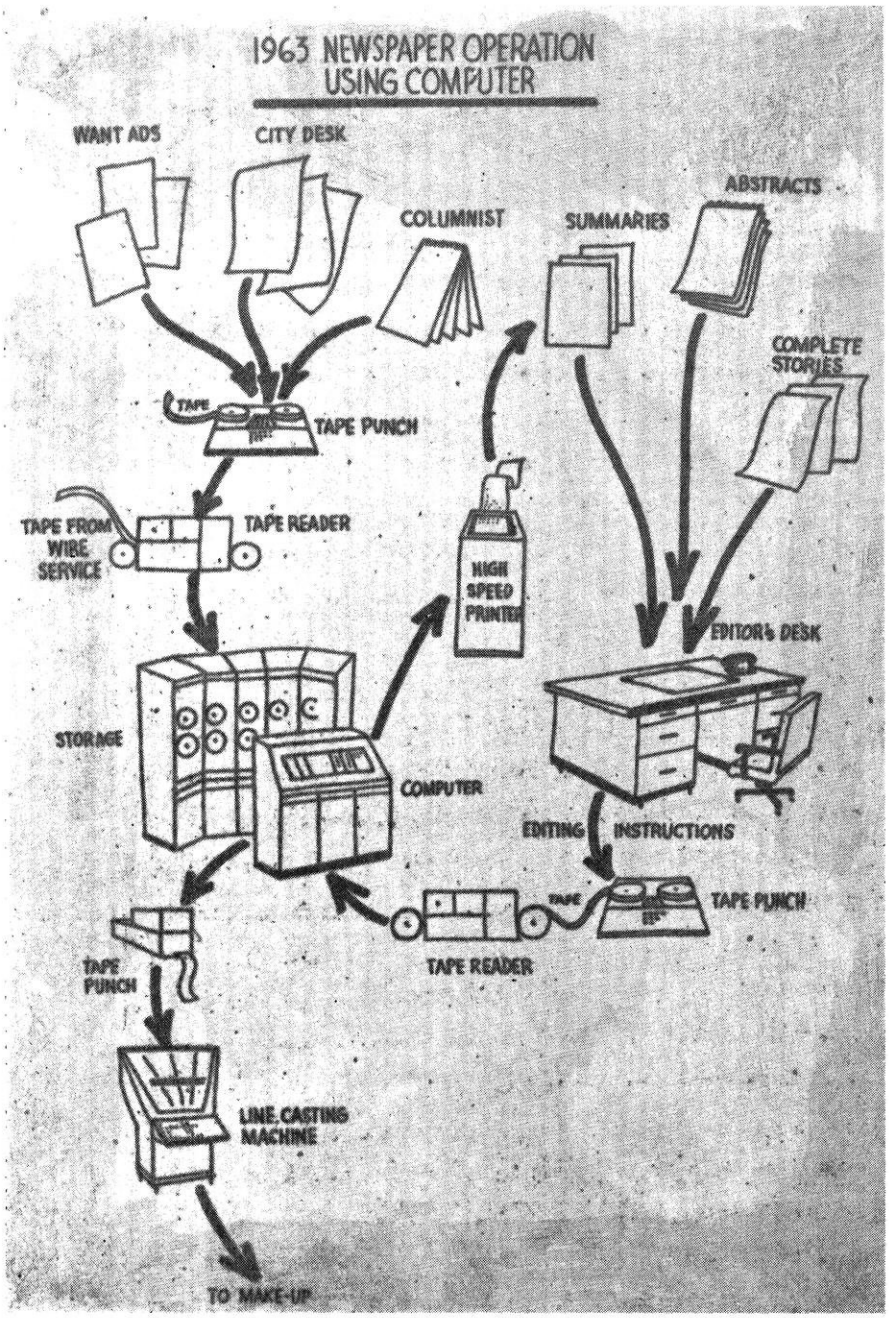

Figure 5.—Computerized Production Process used today. (Courtesy *Editor and Publisher*)

ADVANTAGES OF COMPUTER PRODUCTION

Makeup

Electronic typesetting is particularly efficient for box scores, sports tables, racing results, and stock market reports. The computer accommodates any column width, type font size, bold or light face, and indentations in its setup process. There are fewer typographical errors. The computer does not allow loose or tight lines. The justification by computer eliminates one full retyping of copy, thereby lessening possible errors.

Production

Storage space needed for galleys in the composing room is lessened because time copy is stored on magnetic tape. Later deadlines are possible to set and meet because

of faster tape preparation, type justification, and linecaster operation. Communications transmission of justified news and time copy to other plants and papers is facilitated. Simultaneous printing and perforating of justified straight matter permits proofreading at computer sight, speeds type to make-up men, and shrinks time lag for corrections. This is invaluable at deadline time.

Personnel

Paper tape perforators are easily trained; no skill in line justification is needed. Typeset production doubles the national average rate for paper tape justifying perforators. Requirements for machinists and monitors are lessened due to less linecaster down-time because of computer accuracy in line width determination.

Equipment

Because of automation, many advantages also accrue in the equipment area. Following are some of the major ones:

1. Linecasting machines operate at peak efficiency and speed. There is no pause for tape feed, rub outs, or waiting for transmission of re-perforated tape; fewer machines are needed because of increased output of existing hardware.
2. The consistency of computer justified tape results in substantial savings on linecaster mats, space bands, etc.
3. There is a positive reduction of linecaster down time.
4. Compared with a human operator, the computer does less hyphenation; this results in less chance of errors.
5. Computer hyphenation is exceedingly faster than manual hyphenation.
6. Tighter control and balanced use of composing room equipment and personnel are allowed because of computer speed.

Combination

The RCA 301 computerized type setting operation can be set up using any of the commonly used punched paper tape controlled linecasting machines. The system can also be used for paper-tape-controlled typesetting by photo composition machines for displaying advertising.

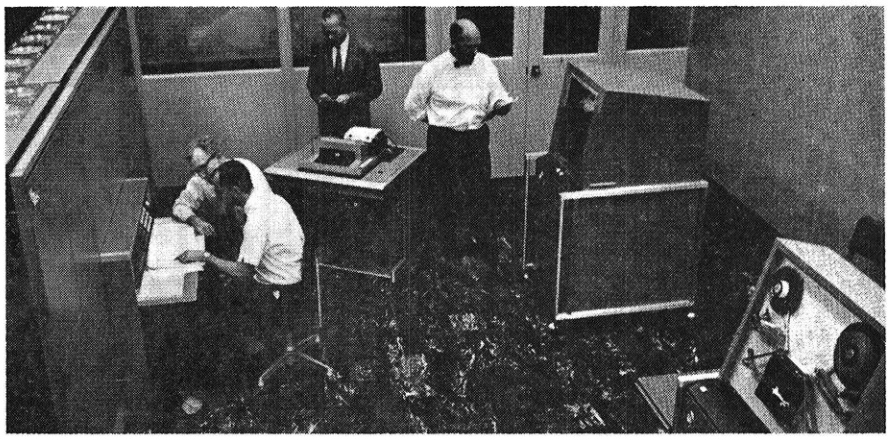

Figure 6.—*Los Angeles Times Layout*—This compact RCA 301 System includes (clockwise, from left) the computer, a monitor printer to tell the system operator what's going on in the computer.

COSTS AND SAVINGS

At the Oklahoma Publishing Company expense was heavy in initiating the operation of the computerized type system. But because the pioneering computer programming work has been done, other companies can now start out with considerably lower start-up costs. Oklahoma Publishing Company executives urge other professional newspaper and publishing groups to pool their research efforts; that is share their experience in computer utilization research to cut costs. Along this same line of thought, because both of RCA's automated type setting systems have been tested at the *Los Angeles Times* and at Perry Publications, Inc., *Palm Beach Post-Times*, other publishers can now integrate the RCA 301 System into their production system at substantial savings in programming costs and preparatory investment. The pioneering work has been done; setup knowledge is available and this cuts startup costs.

Because of cost savings associated with their computerized type setting system, very similar to that at the *South Bend Tribune*, Oklahoma Publishing Company expects their system to begin earning a profit within two years on the basis of daily operation. This expectation does not include the amortization of the ten man-years of research expended in developing the system, however.

An increased amount of classified advertising and editorial copy is now being set on fewer linecasting machines for the papers. They vary in size from twelve pages on Saturday afternoon to 70–80 during the week and 100–150 pages on Sundays. Eight Comet Linecasters are fed tape by the computer at a "forced" faster-than-rated speed of 12 lines a minute. One of the machines is a Linotype Elektron averaging 15 lines per minute. The papers are tighter in that the number of characters in a line has been increased about 20% because of computer controlled justification and hyphenation. Increased readability and appearance are results. The time previously required to punch tape manually for editorial and classified copy has been cut in half.

Payout will be speeded and cost savings increased as the yet untapped capabilities of the computer are utilized in the areas of editing, makeup, and production planning and control.

TWO OTHER SYSTEMS USING THE RCA 301

The RCA 301 utilization has two basic systems. The *Los Angeles Times* uses the primary-type justification system. It is based on logical word analysis by a powerful RCA 301 Computer. The Perry Electronic Composition System at the *Palm Beach Post-Times* employs a stored, compressed dictionary for type justification.

Los Angeles Times

At the *Los Angeles Times* copy from typewriters and other sources are handled automatically by the computer system, it doing editing changes and corrections, line justi-

fication, and hyphenation where necessary. The production steps at the *Los Angeles Times* are as follows:

1. The reporter writes his story on an electric typewriter with an attachment which also punches the copy on a paper tape. He pencils corrections on typewritten copy.
2. In the computer room a typist cuts a paper "correction" tape with the changes, deletions, insertions and subheads put into the typewritten copy by the reporter, and by subsequent editors at the copy desk.
3. The correction tape is fed with the original story into the computer at 1,000 characters a second. All the work is done in the computer's memory in multiples of 7-millionth second cycles!
4. During the interval between the continuous 1,000 c.p.s. input and 300 c.p.s. output on paper tape, the computer automatically incorporates all editing changes and performs logical type justification.
5. The computer counts each character and keeps track of the number of units in each line. When it decides to split a word, it scans key letter sequences to see if they follow the hyphenation rules for four basic types. If not, certain letter sequences are analyzed—up to 150 "questions asked" in 15-thousandths of a second to decide where the hyphen goes.
6. The justified paper tape is fed into a linecasting machine, which sets the type at a rate of up to 15 lines per minute. The type is proof read, corrections are made, and it is ready for lock-up.

Palm Beach Post–Times

The *Palm Beach Post-Times* has an automated production system utilizing the RCA 301 Computer, but differs from the previous system in that it uses a "dictionary" of some 30,000 words stored in the computer's memory for justification purposes. The operation sequence follows:

1. All copy is first edited at the rewrite desk. Edited and corrected copy is then "retyped" on fast paper tape perforators.
2. Paper tape with the clean copy is then fed into the computer at 1,000 characters per second. A seven-character parameter message specifies any of ten type sizes and column widths programmed for body text, cutlines, classified and legal ads.
3. Paragraphs up to 1,000 characters long are read into the computer's magnetic core memory, with each word checked at the spaceband to see if the line is in justification range. Thin spaces are tried before justification of the overflow word.

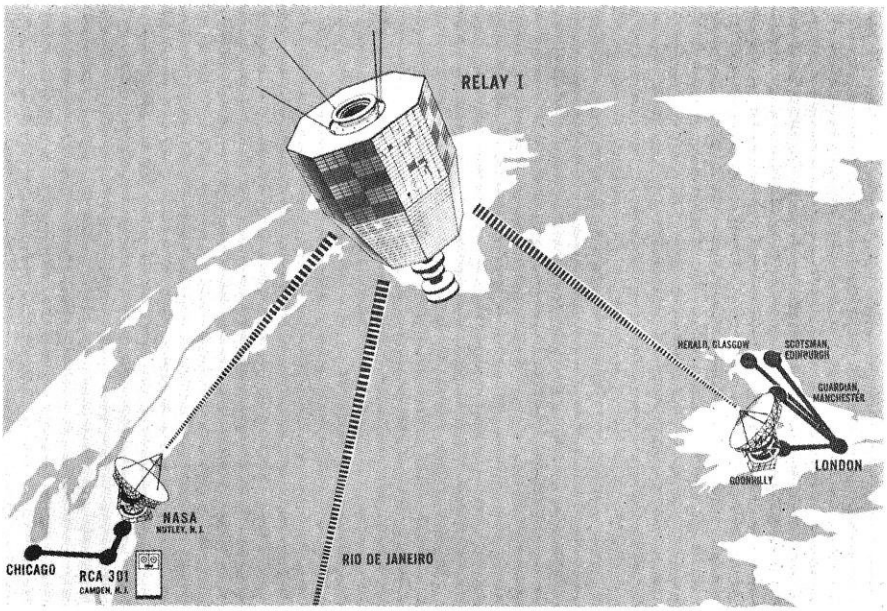

Figure 7.—Satellite Relay diagram shows how news copy was sent from the United States to Great Britain by Relay I Satellite. (Courtesy *RCA*)

4. The word to be hyphenated is looked up in a 30,000 word dictionary stored on magnetic tape. If it is not found it is broken after the 3rd, 5th, 7th, or 9th letter. The line is filled with thin or en spacers.
5. When the paragraph is justified, it is punched on paper tape at 100 characters per second and simultaneously printed on the high speed printer. Meanwhile the next paragraph of unjustified paper tape is read into the computer.
6. The justified paper tape is fed into the linecaster (continuously, if for the same type size and measure). Proofreading and corrections and conventional. If a change in type is needed, a 30-second change is inserted into the computer memory.

Electronic composition may also be used for justifying cold type for photographic composition systems. Sixteen photo typefaces in 12 sizes are being programmed for display ads.

EMERGING COMPUTER UTILIZATION

On June 10, 1963 Radio Corporation of America demonstrated for the first time in history how a computer based in one continent could give directions to a linecasting machine across the Atlantic Ocean. The entire operation from input of the news copy to set type in the second continent was completed without the use of any human activity. The demonstration was carried out at the 35th Annual Production Management Conference of the American Newspaper Publishers Association in Chicago, Illinois.

Conventional teleprinter circuits were utilized to transmit news copy originating at the ANPA convention to Camden, New Jersey. There the information was fed into an RCA 301 Computer. The Computer, in a matter of minutes, counted the words, spaced them, and hyphenated where necessary to achieve column width exactly as required. The RCA 301 then flashed electronic signals via a submarine cable to keyboardless Intertype linecasters at the *Manchester Guardian*, the *Glasgow Herald*, and the *Edinburgh Scotsman*. The linecasters then set the fully justified type ready for printing purposes.

In another demonstration, the RCA 301 was used in conjunction with Relay I satellite to send news copy from the Rio de Janeiro bureau of United Press International to Camden, New Jersey. processed the electronic transmis- (See Fig. 4.) At Camden, a 301 processed the electronic transmission signals and sent them on to Chicago, Illinois. Then hundreds of American newspapers received the copy from Chicago via UPI's national teletypesetter circuits. Another experiment saw news sent by cable from London-to-New York-to-Chicago again using the RCA 301 Computer at Camden, New Jersey.

Relay I satellite was again used on June 14, 1963 to send computerized news from the United States to papers in Great Britain. The National Aeronautics and Space Administration carried out this information transfer. Relay I satellite was designed and built for NASA by RCA. By utilizing all the available channels of the satellite, the contents of an entire newspaper, in electronic signals, could be relayed intercontinentally in five minutes.

RADIO CORPORATION OF AMERICA'S *TIES* SYSTEM

Radio Corporation of America's TIES System is a multipurpose method of joining computers no matter what the intervening distance and feeding data directly into the system from remote locations. TIES stands for Transmission and Information Exchange System. The TIES System accepts data in varying codes and different rates of speed from the many sources along the computer network. This data may come into the system on punched cards, paper tape, or by direct keyboard transmission. The system is an interpreter also in that terminal equipment in the linkup will change incoming information into computer information automatically.

The TIES System is composed of the RCA 301, the CMC or Communications Mode Control, the DEC or Data Exchange Control, and the Communications Control. The latter three units are fully transistorized and compose the scanning and control elements of the system. When these units are used in conjunction with associated buffers and data subsets where needed, the RCA 301 assisted by these auxilary units is enabled to move information at will. Data is moved from many locations to one or more information processing centers and at the same time finished data is transferred to a number of outlying locations automatically and at communication line speed.

Communications Mode Control

The Communications Mode Control surveys or scans constantly as many as 80 communication lines at once. The lines being "watched" by the unit can be telephone, telegraph, or both at once. The line circuits being used are for data communications. The data gathered by the CMC is relayed directly to the computer upon input from the transmission lines or directly out to the lines upon output for relay to other locations. The CMC is manufactured in two forms. The single-scan unit handles all communication lines at a common speed. The dual-scan model reads up to ten telephone lines at high speed while watching other circuits at proportionally slower speeds, depending on the transmission potential of the lines being employed.

Data Exchange Control

The Data Exchange Control is the second unit in the TIES system. This unit allows two computers at the same location to "talk to each other" or exchange data on a memory-to-memory basis at a rate of 285,000 data characters a second. This transfer is equivilent to an interchange of about 2,500,000 words an hour.

Communications Control

Separated computers in the TIES System can communicate on a memory-to-memory basis via the Communications Control unit, the third major component of the TIES System. A single voice grade circuit is utilized and the exchange takes place at a rate of 300 data characters per second.

Existing telephone or telegraph circuits, terminal equipment, and services are used by the TIES System for data interchange. The system can handle a maximum of 80 communication lines. A newspaper could start with a twenty line system and build up as needed in increments of 20 lines to the maximum capability.

FUTURE COMPUTER UTILIZATION—THE DIEBOLD SYSTEM

John Diebold, president of the Diebold Group, systems planners is developing and has described the newspaper production methods of the future. The debut date of this system is set for 1973.

At the center of the Diebold editing system is the main computer into which all copy from all sources is fed. The center of activity will be the editor's consoles containing viewing screens and will be linked to editorial desks, wire services, automation news library and morgue, and the composing room. (See Fig 8.) All news items and pictures gathered by the wire services, reporters, and the editors will be fed into the central com-

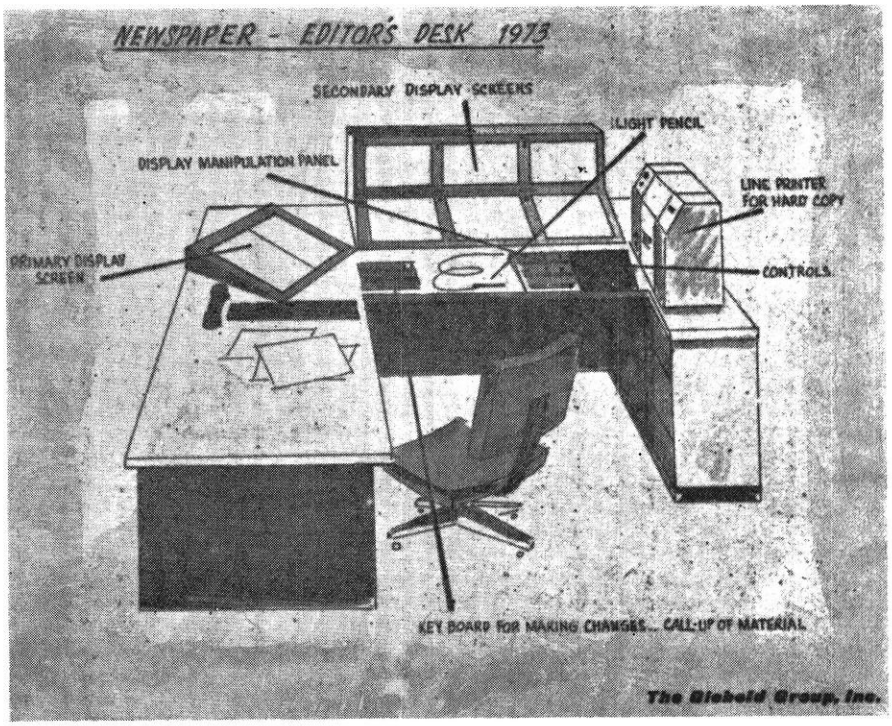

Figure 8.—Control center of the Diebold System. (Courtesy *Editor and Publisher*)

puter and the News Library will be the central repository for all this original copy. Some of the storage in the News Library will be accomplished by magnetic means but much will be done through optical methods. Copy stored optically can be recalled immediately for display or print at the central desk.

This optical method of storage will allow the editor to:

1. Refer instantly to any additional material one may need. A comparison of two wire service reports on the same story could be made, for instance.
2. Review all copy available on a given story at any time by letting it pass over the TV screen or by printing it out on paper.

The principal means of input will be typewriters and optical scanners that can read printed text or directly from the wires. There will be many control points though for communication with the system. Reporters and departmental editors will have viewing screens and access for adding more information to the system, and asking for information. They also will be able to make alterations of material already in the unit.

Some of the major parts of the system and their functions follow.

Primary Display Screens

Primary display screens at the central editor's desk will show what exists in the type font of a company's newspaper but will be only an electronic trace upon the screen, that is, a picture similar to that seen on a radar or television screen. What is seen will not be type that has been set. Also the image viewed will be temporary in that it won't be transferred onto a printing plate until minutes before final printing begins.

Because of this last minute feature, the size of photos or headlines can be changed at will and additions and deletions can be made anytime. Also extra copy not used originally and viewed on an auxiliary display screen can be added at will. Finally the break of a late news story will not upset the final makeup as the editor can easily cut out less important material and add in the more current copy.

Light Pencil

A light pencil which resembles a small flashlight will enable the editor at the display screen to make the following changes:

1. Allow deletions to be made by drawing a circle around unwanted copy with the pencil. The display will vanish but can be recalled later if desired.
2. Erase any part of the display at will.
3. Designate to those concerned items that should be expanded or eliminated. The results of these changes can then be viewed immediately on the screen.
4. Move, enlarge, reduce, eliminate or crop photos.

The combination of the viewing screen and the light pencil will allow an editor and his staff to dummy immediately and continuously. The final decision as to makeup needn't be made until the last moment before that decision is "frozen" into the metal for printing.

Input Keyboard

An input keyboard will also be part of this control console which will allow the editor to alter any display by pushing any one of the system of buttons which is linked up to a central control system. The keyboard looks much like a typewriter. This mechanism will allow the editor to:

(Continued on page 54)

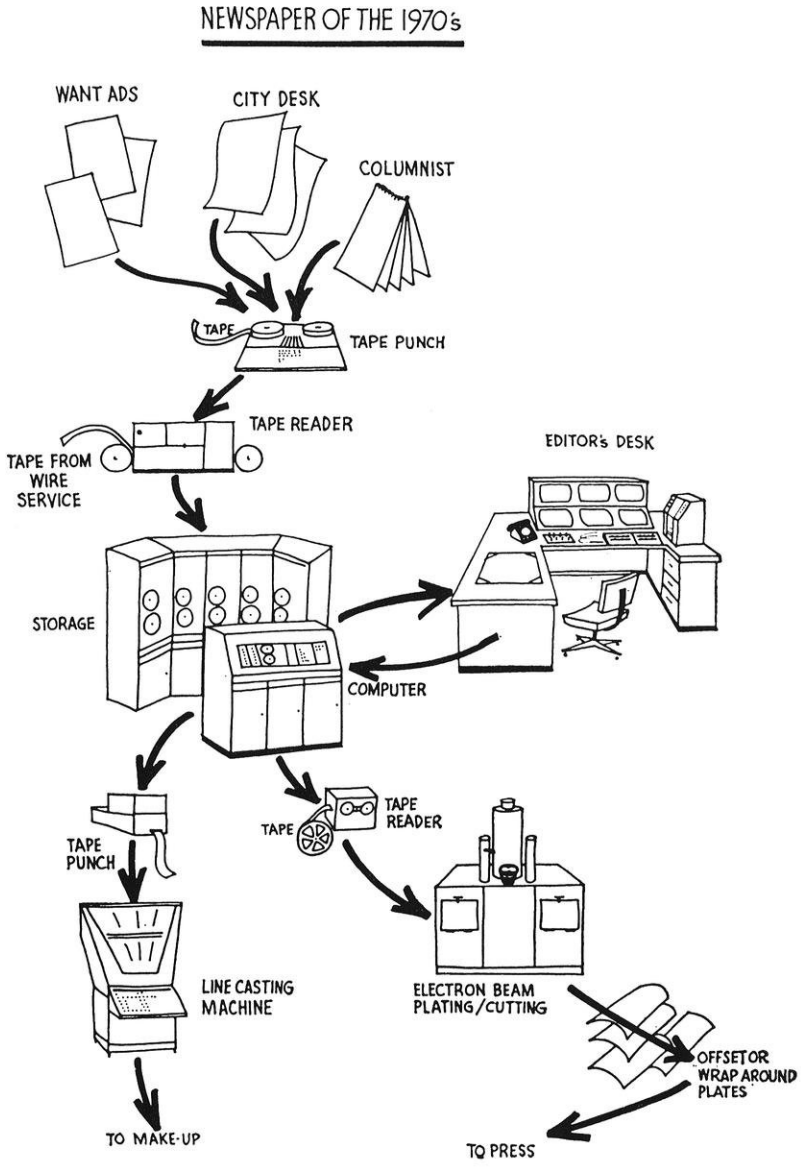

Figure 9.—Production process in the Diebold System. (Courtesy *Editor and Publisher*)

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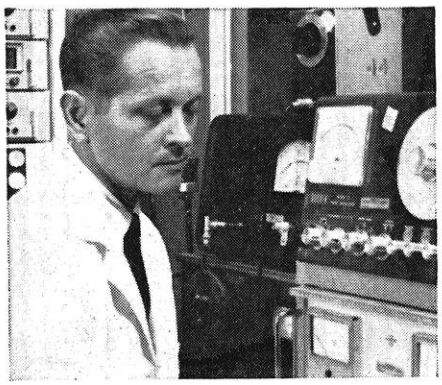


NSA is a scientific and technological community unique in the United States, perhaps in the world. Unique in its mission, its operation, its requirements . . . unique, too, in the scope of opportunity it affords a young scientist or engineer beginning his career.

A separate agency functioning within the Department of Defense, NSA is responsible for developing "secure" (i.e., invulnerable) communications systems to transmit and receive vital information. Within this area, which encompasses the whole field of cryptology—the science of codes and ciphers—NSA project teams pursue a broad spectrum of investigations taking them well beyond many known and accepted boundaries of knowledge. *Beginning with basic research, these investigations progress through applied research, development and design, prototype engineering, and on into various phases of applications engineering.*

At NSA you might specialize in any or several of these sectors, depending on your talents and special interests:

ENGINEERING. Antenna/transmitter/receiver design . . . high speed computers (digital and analog) . . . transistor circuitry . . . advanced radio communications techniques . . . microwave communications . . . audio and video recording devices . . . cryogenic studies and applications . . . integrated circuitry . . . microminiaturization.

PHYSICS. Solid state (basic and applied) . . . electromagnetic propagation . . . upper atmosphere phenomena . . . superconductivity and cryogenics (Ph. D. graduates only).

MATHEMATICS. Statistical mathematics . . . matrix algebra . . . finite fields . . . probability . . . combinatorial analysis . . . programming and symbolic logic.

Unequaled Facilities and Equipment

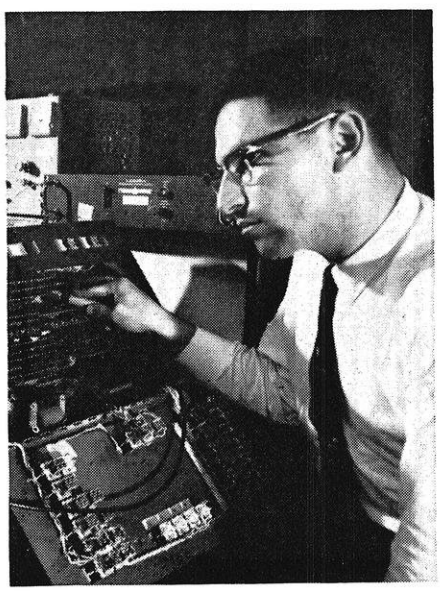
In a near-academic atmosphere, NSA scientists and engineers enjoy the most fully-instrumented laboratories and use of advanced computer and other equipment, some found nowhere else in the world.

Skilled clerical and technical support will free you to concentrate on the most challenging aspects of your projects, and thus help speed your professional growth.

Outstanding Colleagues

You will work alongside people of enormously varied backgrounds and intellectual interests, over 500 of whom hold advanced degrees.

Researchers at NSA also receive constant stimulus from outside the agency. To assist in certain program areas, NSA often calls on special boards of consultants—outstanding scientists and engineers from industry and



academic centers as well as from other government agencies.

Career Development Opportunities

Your professional growth and earning power expand from the day you join NSA, without having to accumulate years of "experience." NSA career development is orderly and swift; substantial salary increases follow as you assume more and more responsibility.

A number of NSA career development programs help shorten the time when you can contribute at your maximum potential. These programs include:

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IN-HOUSE TRAINING. The new NSA employee first attends a six-week general orientation program, followed by a period of specialized classroom study designed to broaden familiarity with an area or areas of heavy NSA concern (e.g., communications theory, cryptanalysis, computer logic and analysis, solid state physics). Formal study is complemented by on-the-job training, as you work and learn under the guidance and direction of highly experienced associates.

PROFESSIONAL ASSOCIATIONS, TRAVEL. The agency fosters a climate of recognition and advancement for its young professionals by encouraging participation in professional association affairs, and assisting you to attend national meetings, seminars and conferences as well as visit other research facilities where related work is underway—government, university and industrial—throughout the United States.

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INDUSTRIAL SAFETY PROGRAMS

A comprehensive review of values and techniques

By KENNETH W. KRASAVAGE

THE matter of industrial safety is of great importance because each year both management and labor suffer great personal tragedy and financial loss due to industrial accidents. It is hoped that this report will demonstrate to the general reader that both employer and employee can benefit from a well-organized and well-maintained industrial safety program.

Although this article is not intended to be a manual on industrial safety organization, it does contain primary safety organizational technique and National Safety Council accident facts which clearly demonstrate the need for organized industrial safety programs. A special mention is due the Aetna Casualty and Surety Company and Employers Mutuals of Wausau, who were kind enough to supply the most recent National Safety Council accident statistics and awaken the writer to the most important phases of basic industrial safety organization.

ACCIDENT FACTS

American industry must concern itself with the problem of industrial safety—the wealth of detailed information which follows clearly indicates that this is a problem of great importance for everyone! Eight workers will have been injured in industrial accidents in the short space of time that it takes to get this far in this report. By the time this report is thoroughly read through, about 200 more workers will have been injured and *one will have been killed!*

In 1963, over 14,000 workers lost their lives in industrial accidents and over two million were injured seriously. The total cost of these industrial accidents for that year was nearly *five billion dollars!* No measure can be put on the heart-

Table 1.—WORK ACCIDENTS, 1963[1]

Industry Group	Deaths			Death Rates**			Disabling Injuries*
	1963	1953	% Change	1963	1953	% Change	1963
ALL INDUSTRIES	14,200	15,000	— 5%	21	26	—19%	2,000,000
Trade	1,200	1,400	—14%	8	12	—33%	370,000
Manufacturing	1,800	2,400	—25%	11	14	—21%	400,000
Service, government	3,000	2,300	+30%	14	16	—13%	510,000
Transportation and public utilities	1,700	1,700	0%	43	37	+16%	190,000
Agriculture	3,300	3,800	—13%	67	59	+14%	280,000
Construction	2,500	2,500	0%	74	81	— 9%	210,000
Mining, quarrying	700	900	—22%	108	107	+ 1%	40,000

*Disabling beyond the day of the accident. Totals include deaths.
**Deaths per 100,000 workers in each group.

Ken Krasavage got his BSME in January and is currently employed in Minnesota. He is originally from Wisconsin Rapids, Wisconsin.

[1] Note: All Tables and Figures originally appeared in *Accident Facts 1964*, published by the National Safety Council.

break and sorrow that these preventable tragedies have caused.

Accidents in Recent Years

Each and every year, the American scene is decorated by parades of all types and for all reasons, but can you imagine a parade that took 85 days to pass? If all the people who were accidentally killed and injured (disabled one day or more) in 1962 were to form a parade, it would take them over 85 days to pass the reviewing stand at the rate of 5000 per hour! The total numbtr of accidental fatalities was 97,000 and, out of that huge total, nearly 14,000 were due to industrial accidents.

It is true that tht auto fatality rate is extremely high, but let's compare that well-known figure to the industrial accident rate. In 1963, car accidents claimed 40,600 lives. (This total does not include 3000 workers killed on the job by motor vehicle accident, i.e., truck drivers.) The total of all industrial fatalities was 14,200! Work accidents claimed 35 percent of the total of auto fatalities. In 1963 there were 1,900,000 non-motor vehicle industrial disabling (disabled beyond the day of the accident) injuries compared to 1,500,000 non-work motor vehicle disabling injuries! America seems to be so interested, and rightly so, about the total of auto fatalities and injuries, but in spite of the fact that there were more disabling injuries on the job than on the highway, how much has this shocking fact been made known??? Industrial accidents are among the nation's leading killers!

Accident Trends

What are the trends in industrial accidents? The percentage of deaths in 1963 is up four percent from the 1962 total and, thankfully, down five percent from the 1953 total of 15,000 as indicated by Table 1. The increase can be attributed to the total hours worked; employment rose about 1½ percent and the average hours worked per week increased slightly. The heartening aspect is that the death rate (deaths per 100,000 workers), as indicated in Figure 1, is seen to be dropping significantly. The amount of workers is steadily in-

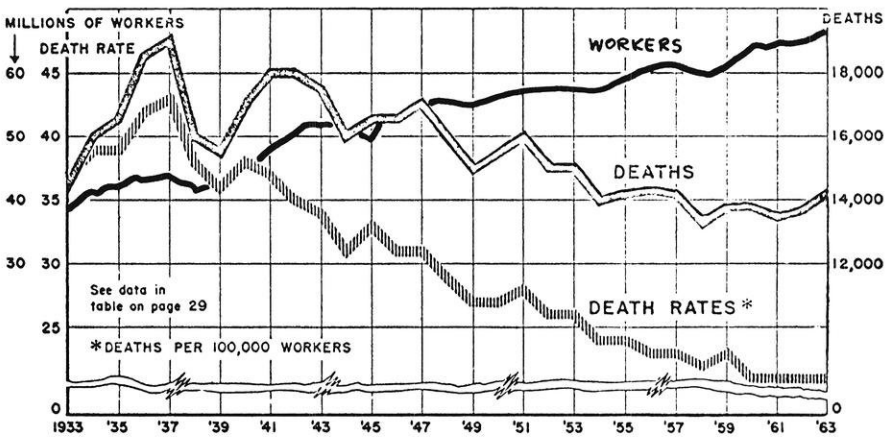


Figure 1.—Deaths and death rate trends.

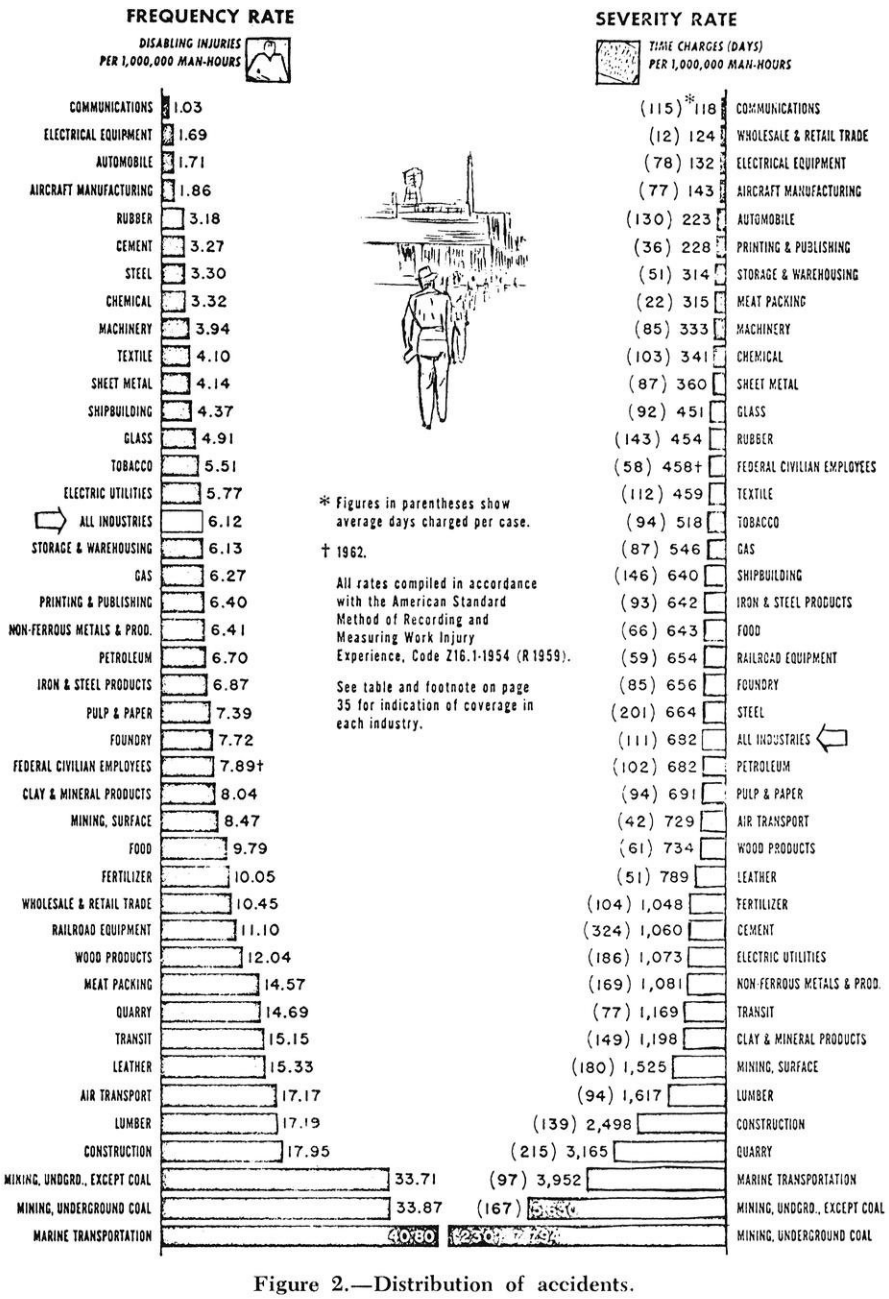


Figure 2.—Distribution of accidents.

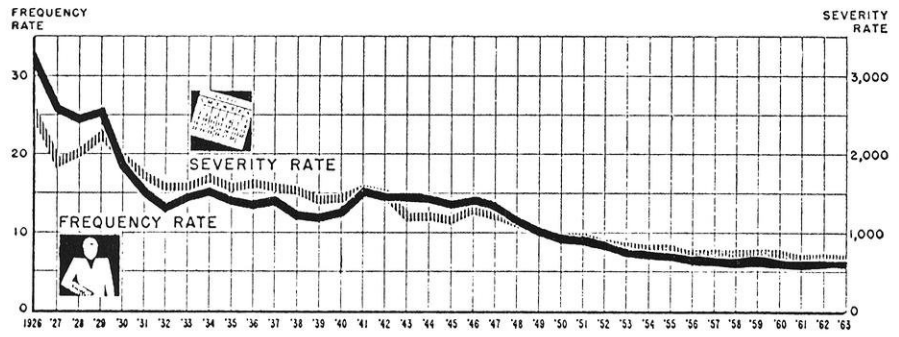


Figure 3.—Trends in severity and frequency of industrial accidents.

creasing but the death rate is on the decline! But yet, those lives need never be lost—for accidents are preventable!

How about industrial injuries? The 1963 total of nonfatal industrial injuries was close to two million. Out of this, 80,000 workers suffered permanent (including permanent-partial and permanent-total disability) and 1,900,000 suffered temporary total disability.

Figure 2 indicates that, for all industries, there were 6.12 disabling injuries per million man-hours worked and 111 days off per accident per million man-hours worked. Figure 3 shows that both of these rates are, thankfully, on the decline, but yet these injuries need never happen. Accidents are preventable!

Losses Due to Industrial Accidents

The total time lost in 1963 due to industrial accidents is 230,000,000 man-days—the equivalent of a force of 1000 men sitting idle for 63 years! The total cost of 1963 industrial accidents was an astounding $5 billion! This represents an average cost of $70 per worker to industry (see Table 4 for accident costs). The total amount of compensation paid out throughout the United States was nearly $1.5 billion. In Wisconsin alone, 122 fatalities and 22,194 compensable injuries caused nearly $25 million to be paid out in compensation by private carriers and self-insurers. All this because of accidents which could have been prevented.

Management Losses—Obvious Losses

Accidents are costing industry plenty. A plant of just 1000 employees would average an investment of $750 to test for possible prescription lenses; another $5000 for prescription glasses and $3000 for non-prescription eye wear—a total cost of $8750 for *full mandatory* eye protection. Some states have allowed awards up to $20,000 for the loss of a single eye! Business faces a potential $2 billion reduction of business each year through the yearly death of 10,000 males under 25 years of age. Between the ages of 25 and 70, the head of the average household controls about $200,000 of disposable income, and if he is killed off before the age of 25, he will not be able to use that purchasing power.

Thirty-six percent of all compensable injuries are to the arms, hands, and fingers; these injuries account for 29 percent of paid-out compensation costs. A study of 1500 hand injuries over a six month period by a steel mill employing 14,000 revealed these facts:

1. One out of every 138 hand injuries required hospitalization.
2. Each injury required an average of 33 dispensary visits.
3. The 1500 hand injuries resulted in a loss of 7,440 man-hours during the six month period.

All this waste of time, money, and resource need never be—accidents can be prevented!

Management Losses—Hidden Losses

Industrial mishaps are costing the employer more than he may realize at first glance. Let's consider the not-so-obvious losses of industrial accidents.

Table 2.—INJURY EXPERIENCE OF REPORTERS TO THE NATIONAL SAFETY COUNCIL, 1926–1963

Year	Number of Units	Frequency Rates				Severity Rates	% of All Disabilities			Average Days Lost per Temp. Total Disability
		Fatal, Perm. Total	Perm. Partial Disab.	Temp. Total Disab.	All Disabilities		Fatal, Perm. Total	Perm. Partial Disab.	Temp. Total Disab.	
1926	1,725	.23	.93	30.71	31.87	2,500	.7	2.9	96.4	17
1927	2,089	.17	.76	25.02	25.95	1,880	.7	2.9	96.4	15
1928	2,552	.19	.71	23.62	24.52	2,630	.8	2.9	96.3	17
1929	3,603	.22	.93	24.24	25.39	2,250	.9	3.7	95.4	16
1930	4,198	.19	.78	17.50	18.47	1,970	1.0	4.2	94.8	19
1931	4,383	.17	.64	14.31	15.12	1,720	1.1	4.2	94.7	21
1932	3,937	.16	.58	12.46	13.20	1,590	1.2	4.4	94.4	21
1933	3,776	.16	.63	13.77	14.56	1,590	1.1	4.3	94.6	20
1934	3,866	.17	.69	14.43	15.29	1,700	1.1	4.5	94.4	20
1935	3,796	.15	.73	13.14	14.02	1,580	1.1	5.6	93.3	21
1936	4,093	.16	.71	12.70	13.57	1,640	1.2	5.2	93.6	22
1937	4,032	.15	.76	13.14	14.05	1,580	1.1	5.4	93.5	20
1938	4,497	.15	.65	11.38	12.18	1,530	1.2	5.3	93.5	25
1939	4,734	.14	.65	11.04	11.83	1,420	1.2	5.5	93.3	23
1940	5,163	.14	.67	11.71	12.52	1,440	1.1	5.4	93.5	22
1941	5,325	.14	.70	14.55	15.39	1,530	.9	4.5	94.6	21
1942	5,537	.15	.59	13.94	14.68	1,490	1.0	4.0	95.0	20
1943	6,060	.10	.72	13.70	14.52	1,260	.7	5.0	94.3	20
1944	5,857	.10	.80	13.56	14.46	1,210	.7	5.5	93.8	20
1945	6,262	.09	.69	12.85	13.63	1,160	.7	5.1	94.2	23
1946	6,212	.11	.77	13.28	14.16	1,280	.8	5.4	93.8	22
1947	6,634	.10	.71	12.45	13.26	1,230	.8	5.4	93.8	24
1948	6,707	.10	.69	10.70	11.49	1,120	.9	6.0	93.1	21
1949	7,185	.08	.64	9.42	10.14	1,020	.8	6.3	92.9	23
1950	6,395	.08	.57	8.65	9.30	940	.9	6.2	92.9	22
1951	7,134	.09	.53	8.44	9.06	970	1.0	5.8	93.2	23
1952	7,920	.08	.52	7.80	8.40	880	.9	6.3	92.8	23
1953	8,139	.07	.50	6.87	7.44	830	1.0	6.8	92.2	23
1954	8,456	.07	.44	6.71	7.22	800	1.0	6.1	92.9	23
1955	9,315	.08	.46	6.42	6.96	815	1.2	6.6	92.2	22
1956	9,605	.07	.40	5.91	6.38	733	1.1	6.3	92.6	25
1957	10,403	.07	.42	5.78	6.27	740	1.2	6.6	92.2	24
1958	10,754	.07	.40	5.70	6.17	744	1.2	6.6	92.2	25
1959	11,545	.07	.41	5.99	6.47	754	1.1	6.4	92.5	25
1960	11,294	.07	.38	5.59	6.04	729	1.2	6.3	92.5	26
1961	11,921	.06	.38	5.55	5.99	666	1.1	6.3	92.6	26
1962	11,998	.07	.39	5.73	6.19	694	1.1	6.3	92.6	28
1963	12,539	.06	.34	5.72	6.12	682	1.0	5.6	93.4	29

Immediately following the accident, there results a loss of time not only because of the injured, but also because of those who must render first-aid and assistance. Aciident investigation on the scene will also eat up more of precious production time. Industrial accidents usually give the insurance rates a healthy boost; not to mention the fringe benefits which still usually accumulate.

An accident may result in overtime premiums being paid to other workers, and how about the downtime of machinery or the cost of training a new man for the job? Often, if a skilled employee is lost, there will be temporary, suboptimum performance on his job

Table 3.—TIME LOST BECAUSE OF WORK INJURIES

	Man-Days
Total time lost in 1963	230,000,000
(From accidents which occurred in 1963)	
By injured workers	40,000,000
By other workers	190,000,000
Time loss in future years from 1963 accidents ...	130,000,000

Table 4.—ACCIDENT COSTS

Total cost in 1963	$5,000,000,000
Visible costs	2,500,000,000
Other costs	2,500,000,000
Cost per worker to industry	70

until the new trainee can come up to par. The injured employee must often be placed on a "filler job" after returning to work until completely healed. Management would gladly pay for his skill, if only he could use it.

Plant dispensary visits after returning to work result in more lost time and more lost production. One large firm was shocked to discover that it was costing over $60-000 yearly just to have their employees sit in the dispensary waiting room. Industrial accidents are real thieves—they slowly take from the employer what is rightfully his. All this waste and loss, but yet industrial accidents are preventable!

Employee Losses

The individual employee is the greatest loser in an industrial accident. Immeasurable heartbreak and sorrow result to his family and friends at his sudden and unexpected death or injury. Hopelessly mangled bodies are often the product of an industrial accident.

The American worker lost nearly $1½ billion in wages in 1963. Most of those workers will never be able to recoup the losses resulting from their injury—they are just too staggering. Permanent disability can result in lower wages after returning to work. Again, more heartbreak and more loss, but yet, this need never be: industrial accidents are preventable!

THE SAFETY ENGINEER

The key man in organizing for safety is the safety engineer. His function is to assist in achieving maximum production by limiting the number of disabling injuries which result as the failure of some unit in the manufacturing process. The two basic problems which must be solved by the safety engineer are:

1. How to remove physical hazards from the plant.
2. How to substitute safe practices for unsafe practices of both employer and employee.

Duties and Obligations of the Safety Engineer

The safety engineer must be truly dedicated to protecting the men he serves; his obligation is a moral one—he must safeguard the lives and welfare of the employer and the employees. Because of this sacred obligation, the duties and obligations of the safety engineer are monumental. He has complete responsibility for seeing that an effective safety program is formulated and administered; he must see that necessary changes are made in the safety program. Cost-conscious management must be informed of the progress and status of the safety program—the safety engineer must see that management is kept well informed.

The safety engineer must maintain a plant safety inspection system and, in the event of accident, he is responsible for prompt and thorough accident investigation and analysis. All accidents must be properly recorded, hence it is his job to maintain an accurate, up-to-date accident record system. In his advisory capacity, he must cooperate in the proper training and placement of personnel in addition to initiating and holding their interest in safety.

He must approve the design of new plant equipment, set standards for safety equipment used by all personnel, and make sure that provisions for safety are made in any new building construction or remodeling programs. All local, state, and federal safety laws must be complied with and he must secure necessary help from state labor departments and insurance companies on matters pertaining to safety and health.

The safety engineer must be capable of organizing and directing his staff for quick action and efficiency. He has to maintain outside contact with insurance companies and other safety organizations to obtain fresh information and keep the plant safety program up to date. He knows what havoc results from industrial accidents and he firmly believes that industrial accidents are preventable!

OTHER ROLES IN SAFETY ORGANIZATION

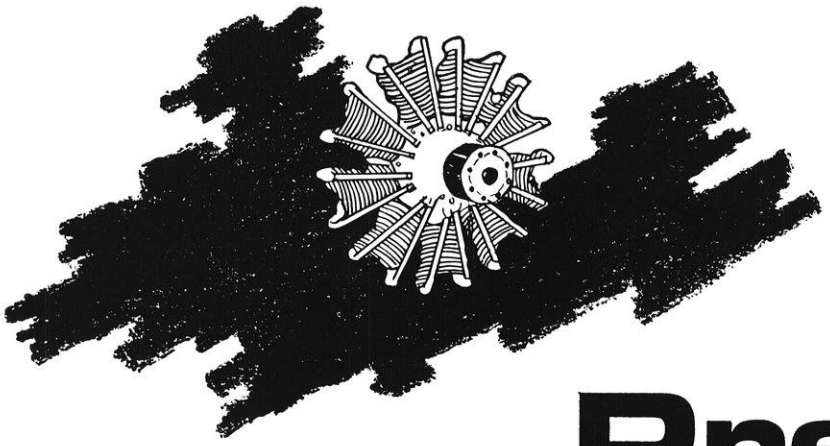
Organizing for overall safety is not up to one man, but rather, it is an integrated process involving top management and supervisors, the employees, and the plant medical staff as well as the safety engineer. Each of these components are essential parts of the entire safety program.

Role of Top Management

Top management that is "really on the ball" realizes that accidents are "poor business" and industrial safety is just "good business." They know that accident and injury represent un-needed loss of time, resource, and money.

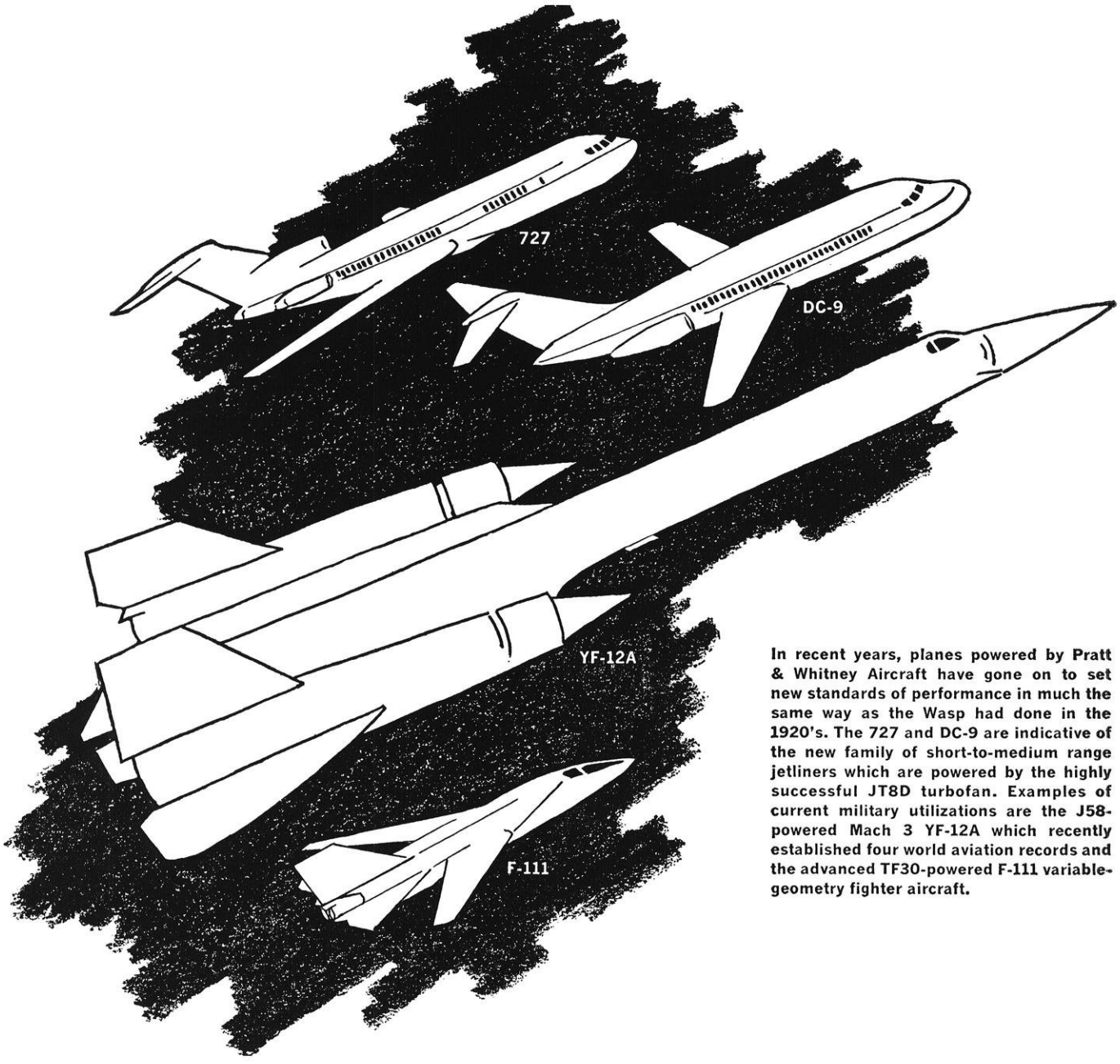
Accident prevention takes *good management*. The boss must realize that, as the leader, he must take the initiative and set the pace; the approach to safety is positive and constructive—safety, good business, and good management go hand-in-hand. If anything

Past



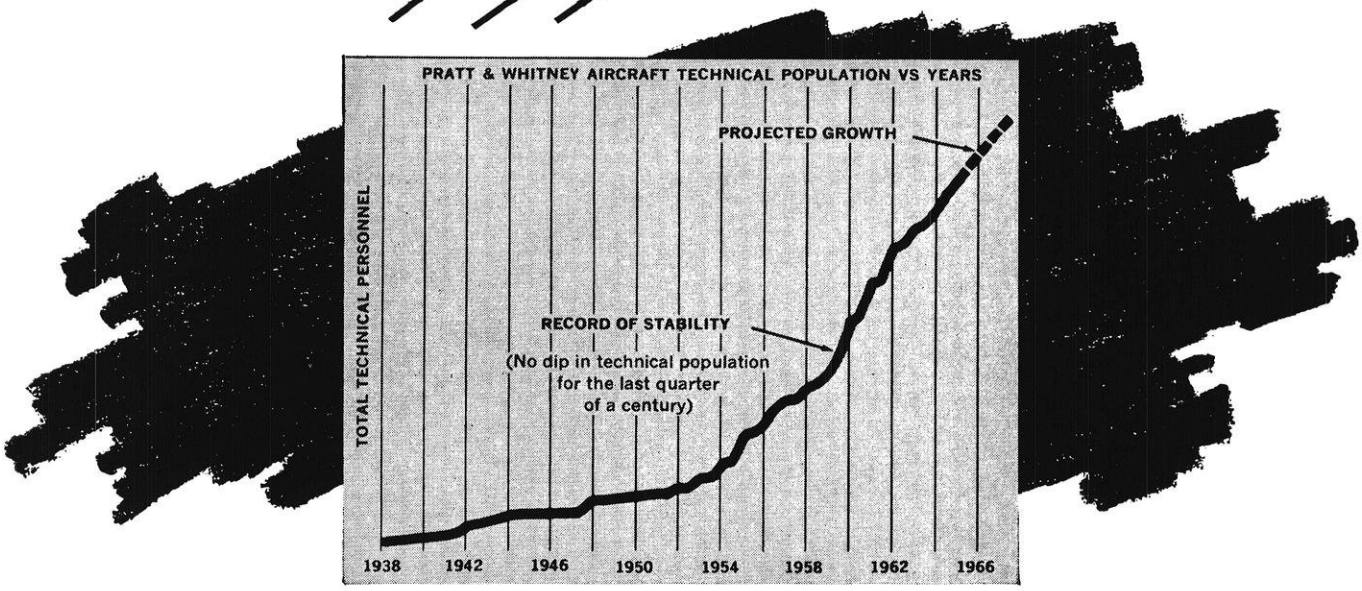
The Company's first engine, the Wasp, took to the air on May 5, 1926. Within a year the Wasp set its first world record and went on to smash existing records and set standards for both land and seaplanes for years to come, carrying airframes and pilots higher, farther, and faster than they had ever gone before.

Present



In recent years, planes powered by Pratt & Whitney Aircraft have gone on to set new standards of performance in much the same way as the Wasp had done in the 1920's. The 727 and DC-9 are indicative of the new family of short-to-medium range jetliners which are powered by the highly successful JT8D turbofan. Examples of current military utilizations are the J58-powered Mach 3 YF-12A which recently established four world aviation records and the advanced TF30-powered F-111 variable-geometry fighter aircraft.

Your and the Future



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is to be done about accidents, it must begin by management's firm declaration of safety policy and by tying safety in with production, maintenance, sales, and distribution.

Top management must put the emphasis on *action and prevention* and follow these important steps: First, management must demonstrate that it really wants to stop accidents by showing personal interest in their workers and business. Next, help on the details must be gotten. This may require extra work at first in gathering the details of safety principles, but the dividends will be worth the extra investment. Hazards must be located and jobs made safe. Most injuries are caused by little things such as exposed moving parts, slippery floors, defective tools, and cluttered-up work areas. Extra time and money might be needed to remove hazards, but eventually safety becomes a routine part of every job. Such action demonstrates to employees that their leaders are concerned for the welfare of all employed!

The management has just as much control over safe work habits as they do production. Teaching and training employees to work safely means showing them how to do their work safely with less spoilage and less damage to equipment and materials.

The Supervisor

The best person to decide what the "safe" standard operational procedure is for a particular job is the supervisor; he has probably seen more accidents and near misses than anyone else. He should know what the "safety operational procedure" is for the jobs responsible to him. An examination of operations in the ordinary industrial establishment clearly show that the supervisor has the best opportunity to correct unsafe actions. He has an excellent opportunity to observe and correct the unsafe conditions and practices which creep into the operation during the day as he makes his rounds. If he recognizes an unsafe condition beyond his control, he should quickly bring it to the attention of his immediate superior. It should be continually reported up the chain of command until it is placed in hands which can correct the situation.

If the supervisor truly believes that he is a busy man, he will be far too busy to have accidents which deprive him of personnel and valuable productive time. The supervisor must be sure that all new men assigned to him are familiar with safety policy and are physically capable of doing their job safely. He should not accept any machinery, paints, solvents, or materials into his department until they have been certified as safe by a responsible person.

All accidents in a department must be investigated and analysed; the supervisor must see to it that this is done promptly and thoroughly, even offer his assistance. Injured employees must be cared for. Minor injuries should not become major injuries because of a lack of medical attention—the supervisor must stress attention of even the slightest cut or nick.

Table 5A.—INJURY FREQUENCY RATES OF REPORTERS TO *NSC* AND *BLS*, 1963

Industry (NSC Classification)	NSC	BLS
Aircraft Manufacturing	1.9	2.9
Automobile	1.7	3.6
Chemical	3.3	8.2
Clay and Mineral Products	8.0	19.2
Electrical Equipment	1.7	5.1
Food	9.8	18.4
Foundry	7.7	23.9
Glass	4.9	7.3
Iron and Steel Products	6.9	14.1
Leather	15.3	12.8
Lumber	17.2	38.3
Machinery	3.9	10.5
Meat Packing	14.6	29.0
Non-ferrous Metals and Products	6.4	11.1
Printing and Publishing	6.4	11.7
Pulp and Paper	7.4	11.8
Railroad Equipment	11.1	7.9
Rubber	3.2	8.2
Sheet Metal Products	4.1	13.2
Shipbuilding	4.4	19.8
Steel	3.3	3.9
Textile	4.1	7.7
Wood Products	12.0	22.5

Source: NSC—reporters to National Safety Council; BLS—reporters to U. S. Bureau of Labor Statistics.

Table 5B.—INJURY RATES IN MANUFACTURING, *NSC* MEMBERS AND NON-MEMBERS.

Year	Injury Frequency Rate			Injury Severity Rate		
	NSC Members	Non-members	% NSC Rates Lower	NSC Members	Non-members	% NSC Rates Lower
1956	4.83	16.02	—70	552	784	—30
1957	4.72	14.56	—68	537	856	—37
1958	4.57	13.58	—66	522	865	—40
1959	4.84	14.87	—68	547	*	
1960	4.34	14.25	—70	529	*	
1961	4.33	13.79	—69	473	*	
1962	4.46	14.18	—69	490	*	
1963	4.58	14.14	—68	455	*	

Source: Nonmember—Total U.S. experience projected from BLS rates, less experience of reporters to NSC. *BLS rates not available.

The Industrial Nurse

In the course of her routine duties, the industrial nurse is often the first to pick up clues which indicate a lapse or breakdown in safety procedure. She has the opportunity to talk with the workers, giving them the reason for and importance of safety procedure. She can provide a valuable link between the man in the plant and the safety director.

The industrial nurse must concern herself with the overall health of an individual worker because any health problem he may have can make him a potential source of danger to himself and others. The nurse should have a clear and thorough knowledge of what her company manufactures and what services are rendered. She must be familiar with the physical requirements of the jobs in the plant and the physical, chemical, and biological hazards present. The problem of accident prevention can be best tackled if the nurse works hand-

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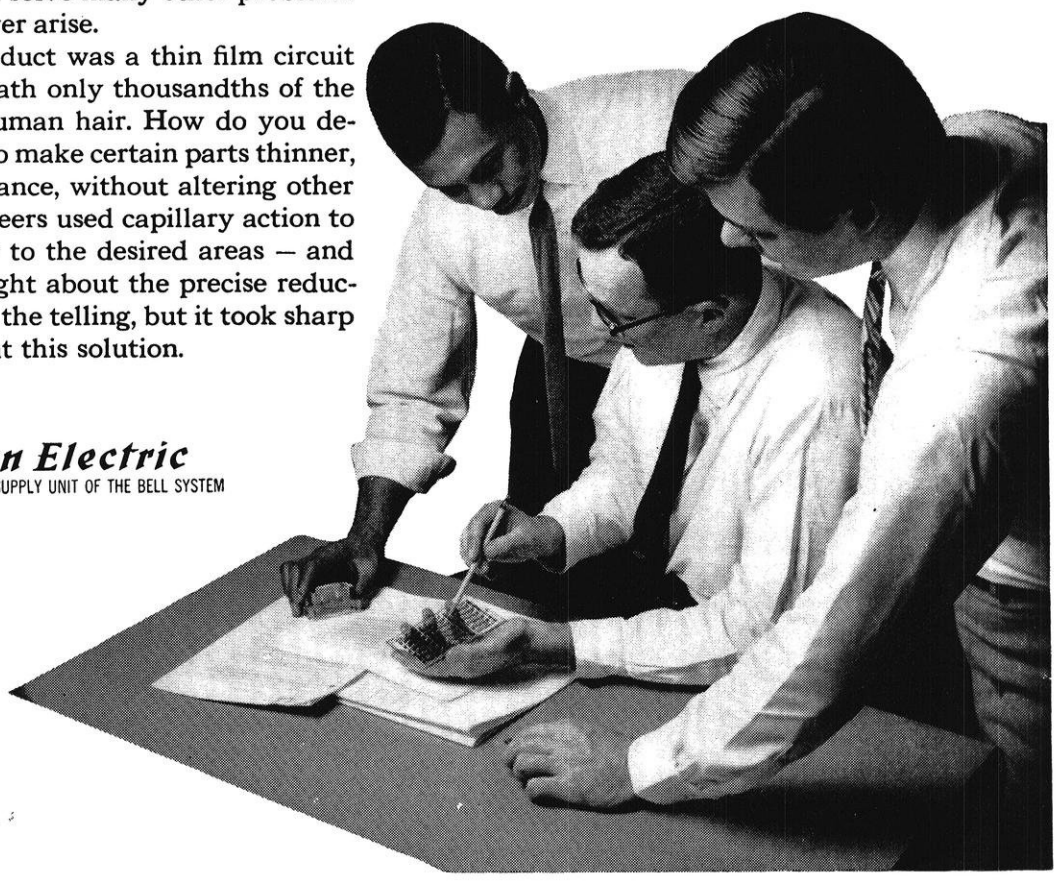

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in-hand with the safety department rather than separate as the "medical department."

Safety Inspectors

Another key link in the safety chain is a group composed of safety inspectors. They may be full-time inspectors under the direction of the safety engineer or they may be specially designated employees who spend part of their time on inspection. These men are "on the production floor" continuously and are well aware of the safety problems which often arise during a typical working day. It is their job to note these little lapses in safety routine and see that they are remedied. Maintenance employees and tool room attendants are a vital part of the inspection team because they are able to observe and repair or replace faulty equipment and tools which are potential accident causers.

The number of inspectors will depend on the size and type of the plant. They cannot and should not inspect equipment (boilers, autoclaves, digesters, elevators, etc.) for which they are not qualified.

FUNDAMENTAL OF SAFETY ORGANIZATION

The reasons for a safety program are now evident, and the safety team has been described. How can an effective, well-organized safety program be put into action? What are the essentials of this program? Grief and financial loss can be avoided by both employer and employee through a well-organized and well-maintained industrial safety program. Table 5 shows that member companies of the National Safety Council have injury frequency rates and accident severity rates which are significantly below those of non-member companies.

Selling Safety

Management must be sold on safety itself before it can effectually offer this worthwhile product to the employee. Management always insists upon the sacred three—production, cost, and quality—from their employees, so why not add a fourth—safety! Therefore, the first step in getting the "safety show" on the road is a firm declaration by management of a safety policy which is to be strictly adhered to by all without exception. Compelling workers to do their job safely should be held to a minimum, but instances will undoubtedly arise when strict and absolute enforcement of safety rules may be necessary. Again, the worker must not be allowed to be a menace to himself or to his co-workers.

Table 6.—SOURCE AND COST OF COMPENSABLE WORK INJURIES

Source of Injury	All Disabling Injuries		Fatal, Perm. Total Disability		Perm. Partial Disability		Temp. Total Disability	
	% of Cases	Ave.* Cost per Case	% of Cases	Ave.* Cost per Case	% of Cases	Ave.* Cost per Case	% of Cases	Ave.* Cost per Case
Total	**100.0**	**$ 730**	**100.0**	**$13,707**	**100.0**	**$1,583**	**100.0**	**$348**
Handling objects, manual	22.6	675	13.9	15,351	9.6	1,595	28.5	348
Falls	20.4	1,005	17.4	13,785	18.5	2,469	21.2	403
Same level	*10.4*	*845*	*4.8*	*14,466*	*9.2*	*1,950*	*11.0*	*331*
Different level	*10.0*	*1,193*	*12.6*	*13,394*	*9.3*	*3,118*	*10.2*	*493*
Struck by falling, moving objects	13.6	515	9.3	12,373	19.3	1,039	11.1	300
Machinery	10.2	755	3.1	18,538	19.2	1,353	6.3	230
Vehicles	7.1	1,072	20.7	14,289	7.1	2,196	6.9	392
Motor	*5.0*	*1,192*	*18.0*	*14,304*	*4.3*	*2,298*	*5.2*	*389*
Other	*2.1*	*839*	*2.7*	*14,441*	*2.8*	*1,885*	*1.7*	*411*
Stepping on, striking against objects	6.9	329	2.3	16,888	5.6	691	7.6	154
Hand tools	6.1	503	1.5	15,596	8.1	1,012	5.3	241
Elec., heat, explosives	2.5	778	7.7	12,766	2.2	1,474	2.6	241
Harmful substances	2.5	988	8.2	14,515	1.1	2,074	3.0	456
Elevators, hoists, conveyors	2.2	1,071	3.6	13,965	3.8	1,986	1.5	425
Engines, motors	.4	825	.7	11,889	.7	1,481	.2	428
Other	5.5	624	11.6	8,501	4.8	1,715	5.8	321

Source: Reports from state labor departments.

*Wage compensation only.

The Safety Salesman

Bad accidents are the best safety salesmen available, but who wants to hire them? Getting men to work safely is really a sales job because only interest in safety can bring about superior accomplishment.

Since the supervisor or foreman is in closest contact with the employee, he is best suited for the job of salesman—he is more aware of the individual employee and his needs and will be in the best position to make the sale.

Essentials of a Sound "Safety Sale"

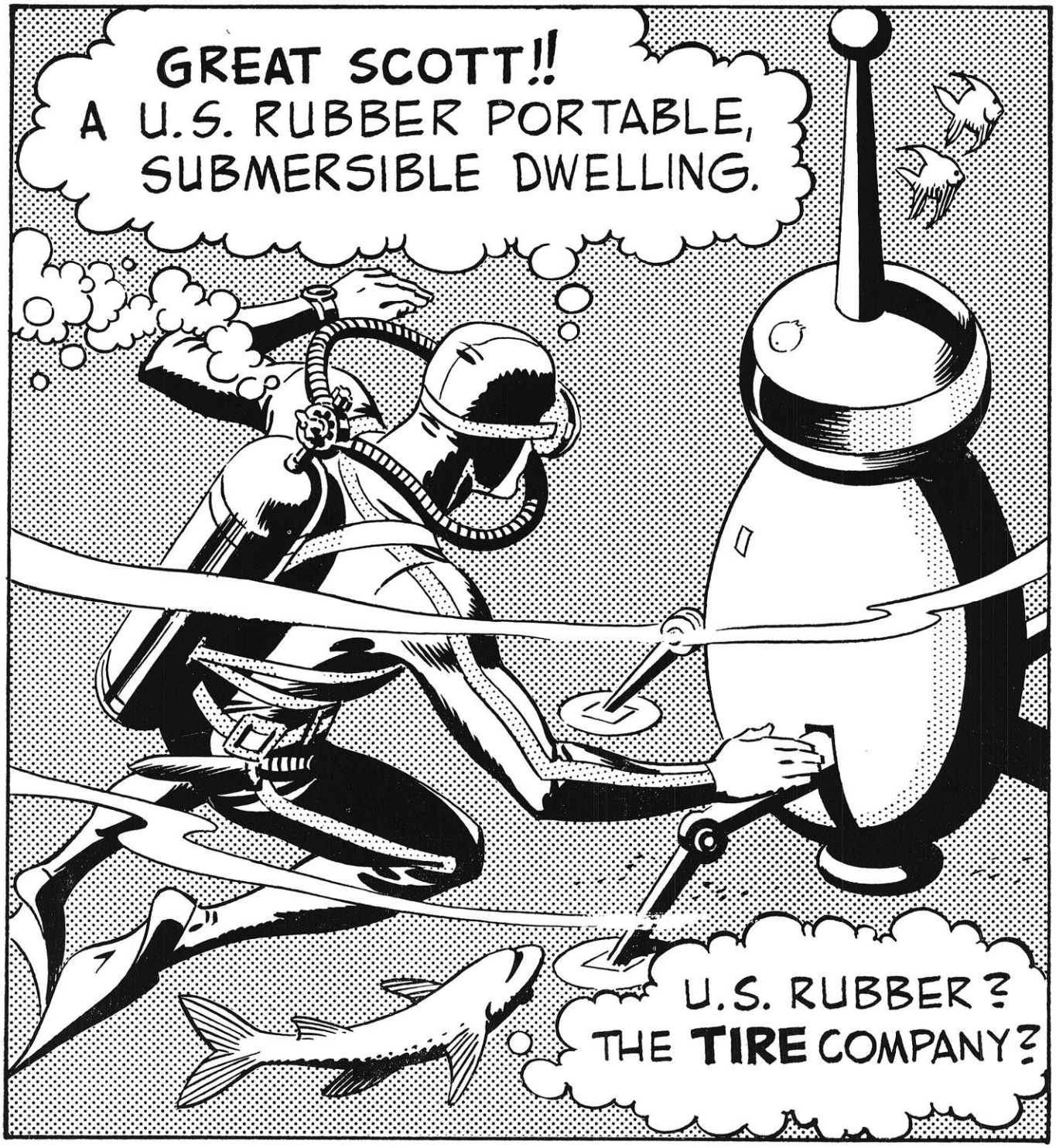
What are the essentials of a sound "safety sale"? How can the point be best put across? First of all, the safety salesman must know his product and have a good mastery of his subject—this is gotten by clear thinking, hard study, and attention to detail.

Secondly, the safety salesman must convince the potential "customer" that safety is worth buying. It is a good buy because it brings the employee freedom from injury, hardship, suffering, and bereavement; it saves loss to the community and to the nation.

Finally, the safety salesman should endeavor to watch his sales from the point of view of the prospect. Most safety sales are made on an individual basis by a salesman who is interested in his prospect and seeks to present his product in such a manner that the prospect sees his own wants and desires tied up in it.

In general, the entire safety sale should be directed to major motivating characteristics that most men share in common such as:

1. The instinct for self preservation—few people really realize just how good life is until they face the prospect of losing it.
2. Desire for gain—offer rewards to those who have demonstrated good safety performance or who have made a good safety suggestion.
3. Desire for praise or distinction—public mention, badges, engraved pins, letters of commendation from a company official, can mean a lot.
4. Fear of disapproval—careful workers do not want their safety record marred by a careless worker.



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5. Sense of humanity—nobody wants to see anyone crippled or maimed. Remember that "our brother's keeper" attitude.
6. Sense of loyalty to family, friends, and country.
7. Competitive instinct—safety contests and campaigns.
8. Desire for leadership or power—appointments to offices in safety organizations and presiding at safety meetings and rallies.

Again, the key to selling safety is motivating the buyer; make him see his likes, interests, needs, and desires tied up in the product.

Safety Promotion—Contests and Campaigns

A widespread technique for developing a spirit of rivalry in the interests of safety is the safety contest. The basic classifications of competition are interplant, interdepartmental, intergroup, intraplant, and intradepartmental. Various types of sweepstakes and raffles can be devised which base participation on individual safety practice.

Safety contests are run purely for their interest-creating value. Competition is taken on only after the basics of a safety program (record system, equipment safeguarded, first-aid department, etc.) have been installed. Contests are based on accident experience and are operated over a stated period such as six months or a year, with a prize for the group having the best record according to the rules. Contests *should not* be based on reduction of reported first-aid injuries because this will only keep some employees from seeking needed medical treatment.

One popular method of determining a safety contest winner is to base standings on percent improvement over past records. This equalizes the differences between departments which are inherently more hazardous than others.

Contest Publicity

The safety contest must get plenty of publicity if it is to get plenty of participation. Company newspapers, bulletin boards, posters and placards, displays of safety equipment, messages in pay envelopes, and the local news media are all effective means for spreading the word. Departmental and plant standings should be colorfully dramatized by auto or horse races, airplane heights, etc. which show who's in the lead by how much.

Safety Awards

Awards for winning a safety contest are important and do serve a purpose. They are an inducement to continue to work safely and a builder of good will. They serve as a continuing reminder and a basis for publicity to work safely.

Awards should be presented at a general meeting or at a dinner by a high company official. This indicates management's interest in the employees' safety and does much to create a favorable employee attitude.

Attractive awards greatly increase and maintain interest in a safety contest. These awards cost only a fraction of the medical compensation and related costs due to a single serious injury. Some suggested awards are:

1. Expense-paid vacations.
2. Cash and bonds.
3. Sports equipment—boats, guns, golf clubs, etc.
4. Household items—TV's, washers, dryers, power mowers, etc.
5. Cups, plaques, and trophies.
6. Engraved pins and medals.
7. Day off with pay.
8. Dinners.

Remember—awards that are really worthwhile will be worth working for; they will help maintain the employees' interest.

Safety Campaigns

A word about safety campaigns. Webster defines a campaign as ". . . a series of operations to bring about some result. . . ." Safety campaigns are out to achieve a specific result.

Safety campaigns are most effective when a special situation arises which necessitates a general quickening of safety interest, i.e., laxity in wearing safety goggles. Annual campaigns such as "Clean-Up Week" and "Fire Prevention Week" help to focus attention on a specific problem, but they should only supplement persistent accident prevention programs and not replace them. Campaigns must be more than a rehearsing of the same old stuff; it they are to be effective, they must have an element of freshness in them.

The "Safe Employee" and His Job

The man "in the shop" who is "on the job" is the one who usually gets hurt. What his attitude toward safety and his job is and just how accident-free his job is will all show up in the accident records. Employee "positive" attitudes and safe jobs are essential for a successful safety program.

Employee Attitude Appraisal

What is an attitude? Why are attitudes important in industrial safety? An attitude is a predisposition to respond in a given way; an individual will respond to an initiating cause in a predetermined manner each time. Attitudes are important!

Attitudes can be positive or negative. A worker with a positive safety attitude is usually management oriented and will comply with safety regulations and do everything in his power to make the safety program a big success. A negative attitude usually brings out just the reverse. A worker with a negative attitude may comply with safety regulations only to a minimal degree because he sees these regulations as a hardship imposed on him by this or that boss. Most likely, this hostile action will generalize over all of his actions at work and, if he can, he will try to breed this same kind of contempt in other workers.

Negative attitudes are unsafe—they must be changed. The first step in changing a negative attitude is to recognize that a person's attitude is a deep-seated conviction which he firmly believes is right and true, no matter what proof is offered to the contrary. After that, it is a process of building new attitudes favorable to safety through a special safety training and education program which helps the worker see his wants, needs, and desires tied up in safety.

Attitude Surveys

Before action on attitudes can be taken, they must be determined. Safety surveys help determine the reasons for attitudes so that a process of education through word

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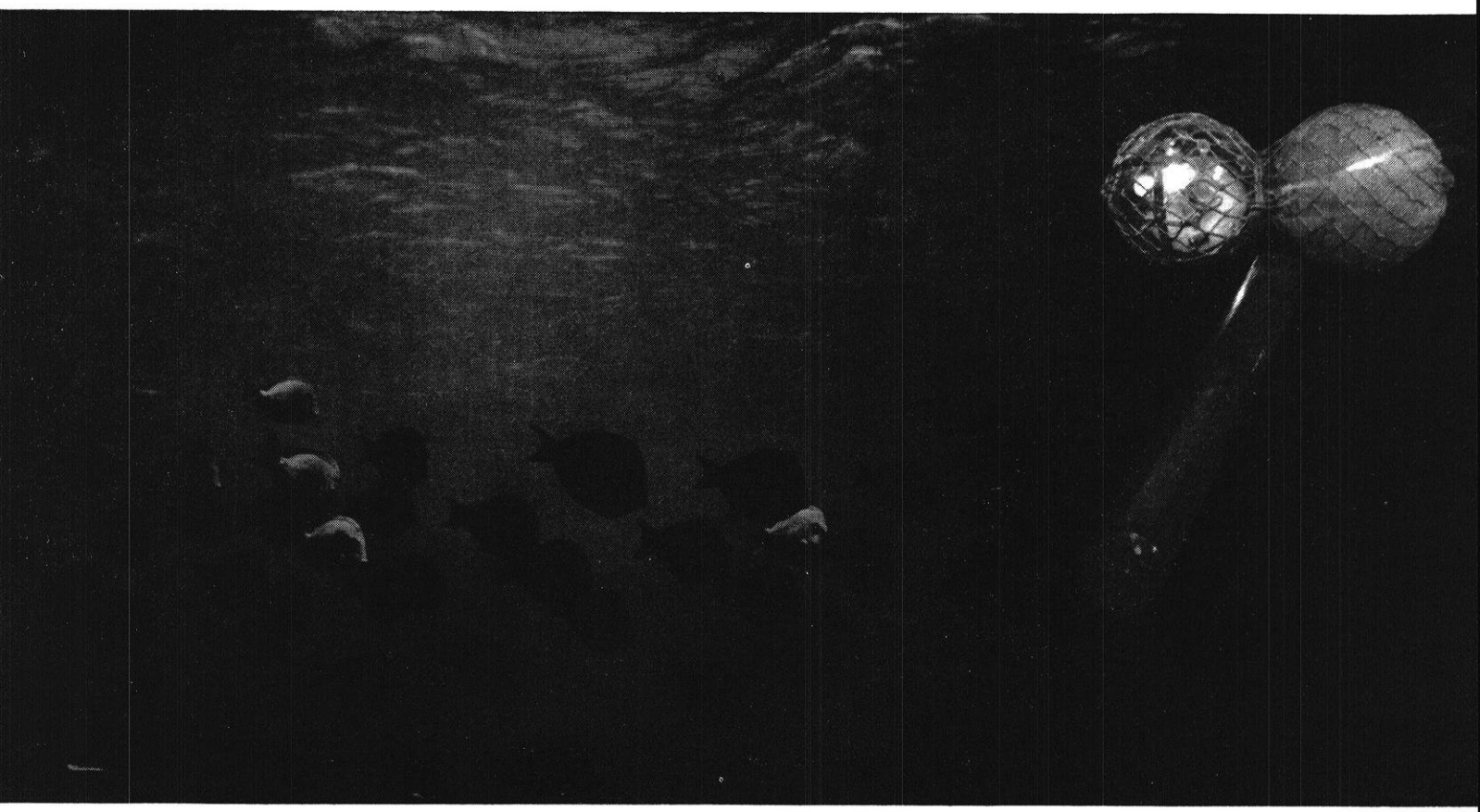

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Table 7.—PREVALENCE OF PERMANENT IMPAIRMENTS DUE TO INJURIES (Figures in Thousands)

Type of Impairment	Total	Place of Injury			
		Work	Home	Moving MV	Other
Total	10,670	3,516	2,989	1,646	2,519
Visual	570	160	231	55	124
Hearing	452	75	124	45	208
Absence of fingers, toes	1,492	833	395	39	225
Absence of major extremities	196	78	28	29	61
Upper extremities and shoulder	1,700	538	582	189	391
Lower extremities and hip	2,991	733	858	539	863
Back and spine	2,287	811	531	518	427
Multiple, back, trunk, limbs	540	171	130	143	96
Paralysis	138	32	28	36	42
Other	304	85	84	53	82

Source: National Health Survey, Series 10, Number 6, U. S. Department of Health, Education and Welfare. Survey period, July 1959-June 1961.

and action can be designed to attack the real problem, not what appears on the surface.

What type of surveys are to be run? How are they to be run? Full-time safety inspectors are able to observe and sound out the attitudes of the men they become so familiar with. Workmen usually talk freely with their fellow workers; the workers on safety committees should be able to pick out unsafe attitudes. The plant nurse can determine what the attitudes are of those she treats without obviously trying to do so, just by carefully listening to their gripes and groans about the shop.

Suggestion systems and questionaires are also effective sounding boards. Those who take the time and effort to fill out a questionaire are those who are usually safety conscious, hence their thoughts and observations should be carefully considered. A perfect example of an effective questionaire appraisal is the Westinghouse Safety Inventory. This inventory is carried out following the year-end stock inventory. Each workman is earnestly requested to take stock of his job, fill in the questionaire, sign it, and turn it in. The answers to many questions gives clues and solutions to much-needed reform and action.

Job Safety Appraisal

Safety appraisal of each job in the plant by trained safety personnel is an integral part of the entire safety program. The purpose of job safety appraisal is to eliminate or control unsafe actions and unsafe conditions.

The worker must not be exposed to any unnecessary risk and he must be fully aware of any hazards to which he is exposed. One worker was not aware of what would happen if he immersed his hand in the seemingly harmless fluid of an ultrasonic cleaner even for a few seconds. He did so. The result—a completely incapacitated hand which needed over four years to achieve only partial recovery.

Accident Investigation and Analysis

No accident is a total loss if it is thoroughly investigated and analysed, for after finding the real cause of a mishap, recurrence can be prevented.

Accident investigation should begin as soon after the accident as possible because the passing of time tends to erase and color the facts of an accident. The analyst on the case should be conpletely impartial, impersonal, and be willing to concentrate only on the facts. He should not try to hang the blame on anyone, this will only cover up the real facts of the case.

The cause of the accident must be specifically determined. Was it a failure of machine or man? Both? If machine, why? If man, why? Just plain carelessness? Never!!! Explaining away an accident as "just plain carelessness" is easy to do, but if a man was careless, he probably had a more definable weakness

He didn't:

1. Do what he should have done.
2. Use safe work methods.
3. Pay attention to what he or the equipment was doing.
4. Use tools or equipment properly.
5. Wear personal protective clothing.
6. Think ahead and plan his actions.
7. Know his own physical capabilities or limitations.
8. Have the skill necessary for the work.
9. Know the limits of strength of materials.
10. Know the properties or actions of chemicals with which he was working.
11. Use good, common sense.

Only if the real cause of an accident is actually and accurately determined can another accident of similar nature be prevented.

Organizing Against Accidents and Injury

Formal organization for safety and against accident and injury is positive thinking—don't give the accident a chance to happen. Positive thinking begins with proper safety training and education; it is carried on by effective safety inspection.

Safety Training Programs

Unsafe conditions and unsafe acts are the result of human failure. Since safety is a man-made condition, education in the techniques of safety is an essential. The principal tool for combatting unsafe conditions is the education of management people, they are responsible for their departments.

Training the Supervisor

Education and safety training of the all-important safety leader, the supervisor, is highly important and serves many objectives.[6] First of all, it acquaints him with the company's accident prevention policy and makes him aware that *he is responsible* for preventing accidents. It provides him with special information on accident causes and prevention and gives him an opportunity to consider current accident prevention problems. It helps him gain skill in safety instruction, accident investigation, and job safety analysis so that he can do the "safety job" in his department.

These objectives for supervisor training can be gotten through training by conferences, personal instruction, work projects, and selected reading material. It may take a little extra time and effort, but the smart supervisor knows that this little investment will pay him big dividends both conscience-wise and production-wise; his de-

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partment will be more productive because it is a safer place to work in.

Training the Employee

Training for the employee is aimed at influencing his behavior and thus eliminating unsafe acts. These training programs should be designed to develop an interest in eliminating accidents and an alertness to unsafe conditions. They should aid the employee in developing the ability to do a job safely without any departure from established safety practices.

Safety Induction Programs

Proper education of the employee begins at the time of employment, before the employee begins work. The new employee needs to learn that management insists upon safe procedure by each and every person employed. He must learn that accidents can be prevented if unsafe conditions are reported. He must learn not to undertake any job until he has learned its "safety operational procedure" and he must not undertake any job which appears to be unsafe. He must learn to report all injuries, however slight, because little injuries which are not cared for all too often become major injuries because of infection.

A proper safety induction program will usually get the employee off on the right foot safety-wise. Preplacement physicals are essential; both the company and the new employee must know what jobs he may or may not be suited for. Company policy can best be demonstrated in an introductory speech by an influential company executive. A half of a day, or a whole day, just devoted to introducing the employee to basic safety routine and safety equipment by means of movies, demonstrations, exhibits, and selected, limited safety reading will go a long way in impressing upon him the fact that this company *really means business!!!!*

In short, induction programs pay off! This is a form of positive thinking because it stops the accident before it has a chance to happen.

Accident Repeaters

Some people have ten to twenty times as many accidents as others. These people are usually victims of early discoverable faults which can be cured quickly with a little common sense. They usually are suffering from some physical condition such as a lack of stamina for the job or poor vision. Oftentimes, a social conflict such as a family problem is the cause. A few words with the plant nurse, safety engineer, or department supervisor usually brings any extenuating circumstances to light.

Often, just telling an employee that he has a greater tendency to accidents may help him realize shortcomings which he never thought he had. If this tendency persists, psychiatric treatment may be in order. A worker must never be allowed to be a hazard to himself or to those around him.

Table 8.—TYPES OF ACCIDENTS CAUSING IMPAIRMENTS OF LIMBS, BACK, TRUNK (All Figures in Thousands)

Type of Accident	Total	Back, Spine	Extremities		Other
			Lower	Upper	
Total**	2,253	811	733	538	171
Falls	633	231	241	105	35
From stairs, steps, heights	*394*	*143*	*155*	*61*	*35*
Other	*239*	*88*	*86*	*44*	*
One-time lifting, overexertion	370	292	34	*	*
Struck by moving object	279	65	120	73	*
Machinery in motion	279	31	61	172	*
Moving motor vehicle	226	89	87	*	*
Caught between objects	79	*	29	36	*
Twisted or stumbled	76	30	40	*	*
Other	213	*	82	67	*

Source: See footnote to table above.
*Figure indicated by the survey sample does not meet standards of reliability.
**Totals exceed sums of separate items due to estimating methods.

Safety Courses

Safety training courses are usually very popular with employer and employee alike. First-aid training has inherent interest for employees because they recognize this as something of real value; it also makes them less likely to have an accident. Trained first-aiders are a real asset in the plant because *they can save a life!!!*

Safety sessions which cover a variety of subjects will attract different segments of the working force. Some suggested session subjects are:[6]

1. Accidents are preventable.
2. Discovering accident causes.
3. Good housekeeping.
4. Safe materials handling.
5. Guarding danger points.
6. Preventing falls.
7. Personal protective equipment.
8. Care of injuries.
9. Preventing fire.
10. Safety off-the-job.

Remember! Accidents are preventable and safety training is a form of positive prevention because it stops accidents before they can happen.

Safety Inspection Systems

Just as inspection of parts is an important function in quality control, safety inspection is a vital tool in accident control. Inspections are not conducted primarily to determine how many things are wrong, but rather, they are conducted to determine if everything, including employee practices is satisfactory. Before any inspection is conducted, it is a wise practice to analyse and review accident records of previous years so that special attention can be given to those areas which are known to be accident-producers.

A safety inspection can be designed for a **specific need** much as a tool can be designed for a specific task. Hence, there are a variety of safety inspections which serve a variety of purposes.

Periodic inspections are those which are made at fairl yregular intervals. The periodic general inspection should cover the most remote corners of a plant in addition to those places where "nobody ever visits or gets hurt." Some periodic inspections are to be made at regular specified intervals. Equipment such as boilers, elevators, unfired pressure vessels, and fire-fighting equipment are *required by law* to have regular, periodic inspections.

Fire inspections should be made at regular, specified intervals; fire is one of the greatest hazards to an industrial plant. The inspections should include water tanks, sprin-

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kler systems, standpipes, hoses, extinguishers, and all other equipment used for fire protection. All means of egress from the building and all warning systems must be thoroughly inspected.

Every plant should have a **continuous inspection** system operating throughout the year. A good way of accomplishing this is to have selected employees spend all of their time observing and inspecting certain equipment and operations. This method makes men so familiar with a machine or process that they are able to point out potential hazards long before they can cause an accident.

Another good method of having continuous inspections is to select roving trouble-shooters from the employees at large at regular intervals. The job is rotated on the theory that each employee will make a definite contribution to the safety of the entire plant, especially to the safety education of employees.

Continuous inspection of all personal safety equipment such as goggles, respirators, safety shoes, gloves, and other safety clothing and protective devices is essential. Men *depend* on these items to keep free from serious injury and possible death.

Special inspections are intended to serve special purposes. They are required when new equipment or processes are installed; new facilities are constructed or old ones remodeled; for accident investigation; or during special campaigns such as fire prevention week, waste elimination campaigns, or other special programs. Whenever there is a suspected health hazard, a special inspection should be made to determine what it is. This may involve air sampling for toxic fumes in dust, testing of materials for toxic properties, or testing adequacy and efficiency of ventilation and exhaust systems. Special equipment for these tests is usually available through the state industrial hygiene division or from industrial hygienists employed by insurance companies.

Regular special inspections for conditions causing falls should be made. Statistics show (see Tables 6 and 8) that falls are one of the largest causes of accidental death. Slippery, wet, worn and oily floors, stumble hazards, loose materials, faulty steps, insecure scaffolds and faulty ladders, and unguarded openings are all hazards of great magnitude.

Another form of special inspection is the night inspection. Two or three-shift plants should have occasional night inspections because safety conditions vary considerably after dark, due to the use of artificial illumination. The inspector should be certain that all work areas have adequate illumination. Moving hazards which can be seen in daylight must be just as plainly seen at night. Accidents can happen at any time—day or night!

SAFETY COMMITTEES AND SAFETY MEETINGS

Formal organization of any sort for any reason usually involves committees and meetings for direction and effectiveness.

Safety Committees

The safety committee is an important member of the safety body. Its basic function is to create and maintain interest in safety and to reduce the number of accidents by inspecting, educating, formulating policy, and improving the cooperative spirit between management and labor. Committees usually provide an opportunity for free discussion to air out safety problems. The committee must be made up to have prestige; a governing committee should include key executives such as the production manager and master mechanic. The committee should not be so large as to become unwieldy, and each of its members should have definite, definable duties.

The **plant central** committee is the arm of the chief executive, it is designated as the executive or policy-making committee. It is the top safety policy-making group at the plant level in multiplant operations and the main governing body in single plant operations. It should be composed of such men as the general manager, safety director, company physician, supervisors, and a union representative. The duties of this committee are to form training and job procedure policy as well as supervise safety education. It acts mainly in a consulting and advisory capacity.

The **joint labor-management** committee, usually composed of equal numbers of labor and management, also acts mainly in an advisory capacity. A key point in this organization is that, in order to avoid controversy, nothing but safety may be discussed at their meetings.

The **foremen's** safety committee is usually found in small or medium-sized plants. This committee is generally made up of foremen from several or all departments with the superintendent or works manager at the head. This is a general purpose committee in some cases; in others, it supplements the activities of the plant central or executive committee.

The **departmental** safety committee transforms the company safety policy into action at the operating level. It originates and guides departmental safety activities, checks for compliance with safety rules, investigates accidents, and makes safety inspections. It is usually composed of the department head, his foremen, and some of the workers.

The **workmen's** committee is the last link in the chain of safety organization, and the final medium of distribution of plant safety activities. It is usually composed of the foreman and his workers; the workmen membership should be rotated so that all will gain experience on the committee. The function of this committee is chiefly accident investigation and elimination of hazards.

Safety Meetings

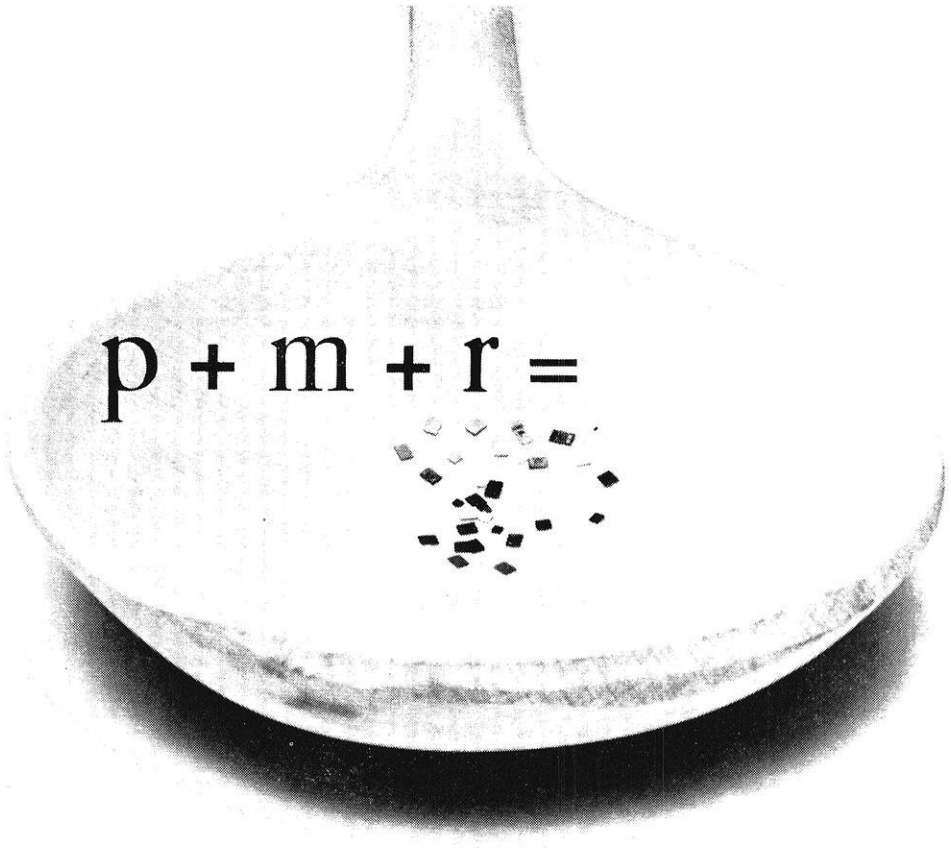
Safety meetings are held to create and hold the interest of the employees in safety as well as to consider group safety programs. The secret of successful safety meetings is that they must be planned, run, attended, and followed-up not by the safety engineer, *but by the man who gets hurt!* Worker involvement in safety meetings is a must for success. The meetings are of all types and sizes and they too, can be designed for a specific need.

Mass Meetings

A special occasion-special purpose meeting is the large **mass**

(Continued on page 56)

CONSUMER PRODUCTS * COMMUNICATIONS * SEMICONDUCTOR PRODUCTS * MILITARY ELECTRONICS * AUTOMOTIVE PRODUCTS * CONTROL SYSTEMS



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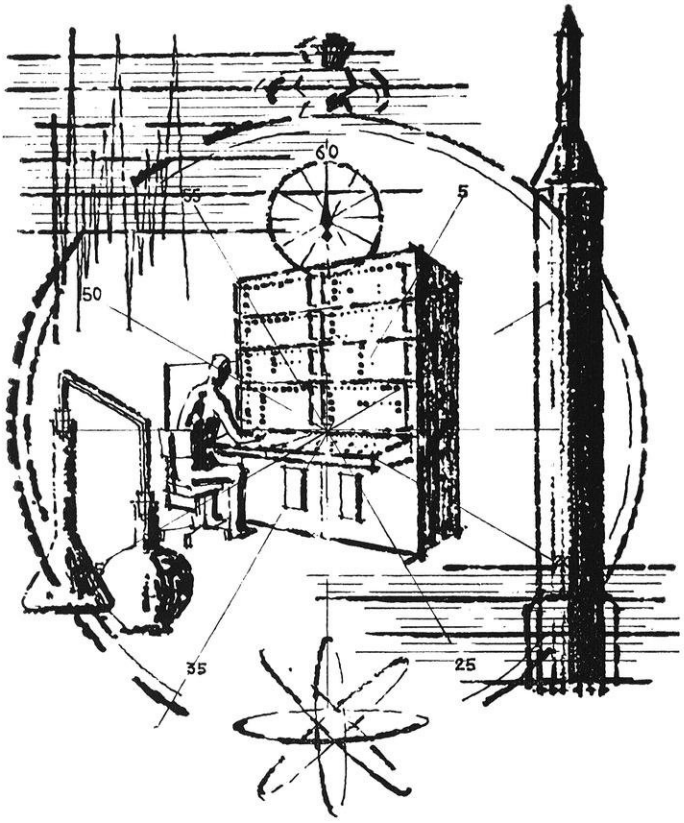


SCIENCE HIGHLIGHTS

A brief resume of new developments in government and industry, compiled by the *Wisconsin Engineer* staff

COMPUTERS STILL HAVE LOTS TO LEARN

Considerable research is required before computers will be capable of providing detailed answers to sophisticated questions, the annual meeting of the American Association for the Advancement of Science was told recently.

Dr. Robert Simmons, head of the Language Processing and Retrieval Staff at System Development Corporation, said that the eventual goal of language-processing research is the development of highly sophisticated question-answering systems.

These systems, said Dr. Simmons, would accept natural-language questions, search a multilingual library for pertinent factual text, translate and generate essays that answered the question at any desired level of detail.

Dr. Simmons showed that up to now, researchers have been able to produce simple question-answering programs, rudimentary language translations, and computerized essay writers. However, these systems are "highly-inventive linguistic gadgetry that is still far from practical usefulness."

Before this "gadgetry" can be applied to function as a useful system, "linguistic, semantic, and psychological problems, both of theory and practice, must be solved," he said.

Said Dr. Simmons: "Language processing researchers have a dream and a goal: the dream is that we can understand language well enough to instruct an inanimate computer just what to do in every linguistic situation; the goal is to make the recorded verbal product of millions of thinkers easily available via large computers to anyone who needs some portions of it."

Those computers, he said, must eventually be able to analyze questions and text from several languages into some basically meaningful structure. Furthermore, they must be able to synthesize from that structure answers, essays, translations, etc., in any of several natural languages.

Dr. Simmons cautioned that synthesis is required "lest we build a gigantic parrot, clever enough at reflecting precisely what has been recorded, but as frustrating as a tape recording in its mindless, indiscriminate unreeling of unrelated facts."

At present, the strongest existing machine capability for language processing is that of counting and indexing words of a text. This capability, Dr. Simmons reported, has already made the computer an indispensable partner in information retrieval, linguistic analysis, concordancing, and stylistic and content analysis.

"Although fascinating linguistic gadgetry is available on computers, the solid contribution so far lies in this well-developed capability of word counting and indexing.

"Linguistic gadgets and their descendents will eventually fit together into a complex system—perhaps beyond our present dream. But it won't happen tomorrow, nor next year, nor for at least some several or many years to come. More gadgetry is needed, and far more understanding is required," Dr. Simmons said.

SIX NUCLEAR DETECTION SATELLITES NOW IN ORBIT

A pair of Vela Nuclear Detection Satellites, successfully launched last July, provide the U.S. a total of six nuclear monitoring spacecraft. Velas 1 and 2, orbited in October 1963, are still functioning and remain the longest continuously operating spacecraft yet orbited by any nation. Velas 3 and 4 were launched in 1964 and also continue to watch for clandestine nuclear tests.

The Vela program took on in-

creased significance with the signing of the Nuclear Test Ban Treaty in 1963. With the Vela satellites the Department of Defense can maintain a space-based arms control system to detect and identify nuclear explosions at high altitude and in space. The program also marks the first use of an incentive contract for the development of satellites. Under this contract, TRW has been awarded added profits due to the performance of its satellites. This type of contract is seeing increasing use in defense and space programs to stimulate contractor cost, quality, and delivery performance.

The Vela satellite is a symmetrical icosahedron, 54 inches in diameter. Eighteen of the 20 surfaces are covered by solar cells, and X-ray detectors are mounted at the 12 corners. Other instrumentation, including gamma ray and neutron detectors, is carried inside the satellite. A central magnesium cylinder supports a solid propellant motor and the aluminum structure. Each spacecraft weighs about 500 pounds when launched and about 300 pounds after firing its orbit injection motor.

Two Vela satellites, connected by a spin-up interstage, are carried by the Atlas-Agena D launch vehicle. Each spacecraft is placed in an approximate 60,000-mile circular orbit, phased about 180 degrees apart. The most recent Vela launch also included a third payload, a 12-pound environmental research satellite developed to measure radiation and test materials in the space environment.

ASCE WATER CONFERENCE THIS SPRING

The eyes of a nation made abruptly water conscious will be on Denver next spring when Colorado is host to more than 1,000 water engineers whose job it is to assure an enduring supply of the precious resource.

The Fourth ASCE Water Resources Engineering Conference follows by a year the most critical water shortage in the nation's history.

The American Society of Civil Engineers organized the water resources conferences in 1962 in an effort to focus the combined talent of the nation's engineering leaders on a continually worsening problem:

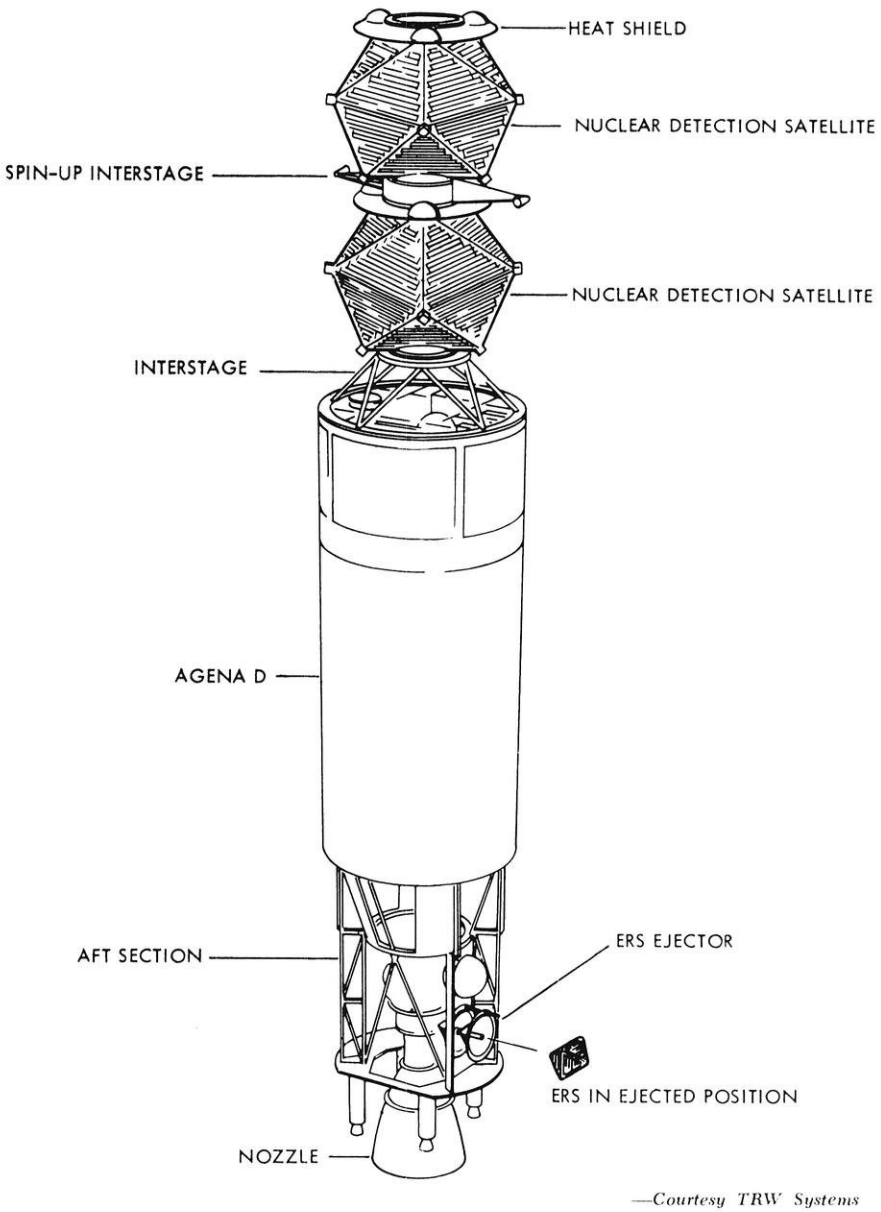
How to preserve our water supplies at a time when expanding business, industry and population demand ever more.

The 1966 conference will be held May 15–21, with Denver engineer David E. Fleming of Ketchum, Konkel, Ryan and Fleming as convention chairman. Olin Kalmbach of Tipton and Kalmbach, Inc., is program committee chairman.

Engineers active in water resources planning consider the problem to be one of transportation and distribution, rather than of a "shortage." The United States has sufficient water to serve its millions, but the most generous supplies are in areas of the least population.

Thus, they say, the problem is one of engineering and technology to economically collect, transport, treat and distribute the resource to those points where it is needed most—in the great urban areas where tens of millions of people congregate.

In various committee programs during the week, the engineers will study such issues as river basin planning; the East–West water conflict and how to solve it; inter-



—*Courtesy TRW Systems*

A pair of Vela Nuclear Detection Satellites is shown mounted atop the Agena second stage. A third spacecraft, an environmental research satellite, also was orbited.

state planning; power plants and multi-purpose projects; desalination of sea water; flood control and urban land use; earth, rockfill and concrete dam design; and new concepts in water treatment.

Frank C. DiLuzio, director of the Office of Saline Water in Washington, D.C., will preside at a May 17 session on progress in converting sea water to fresh.

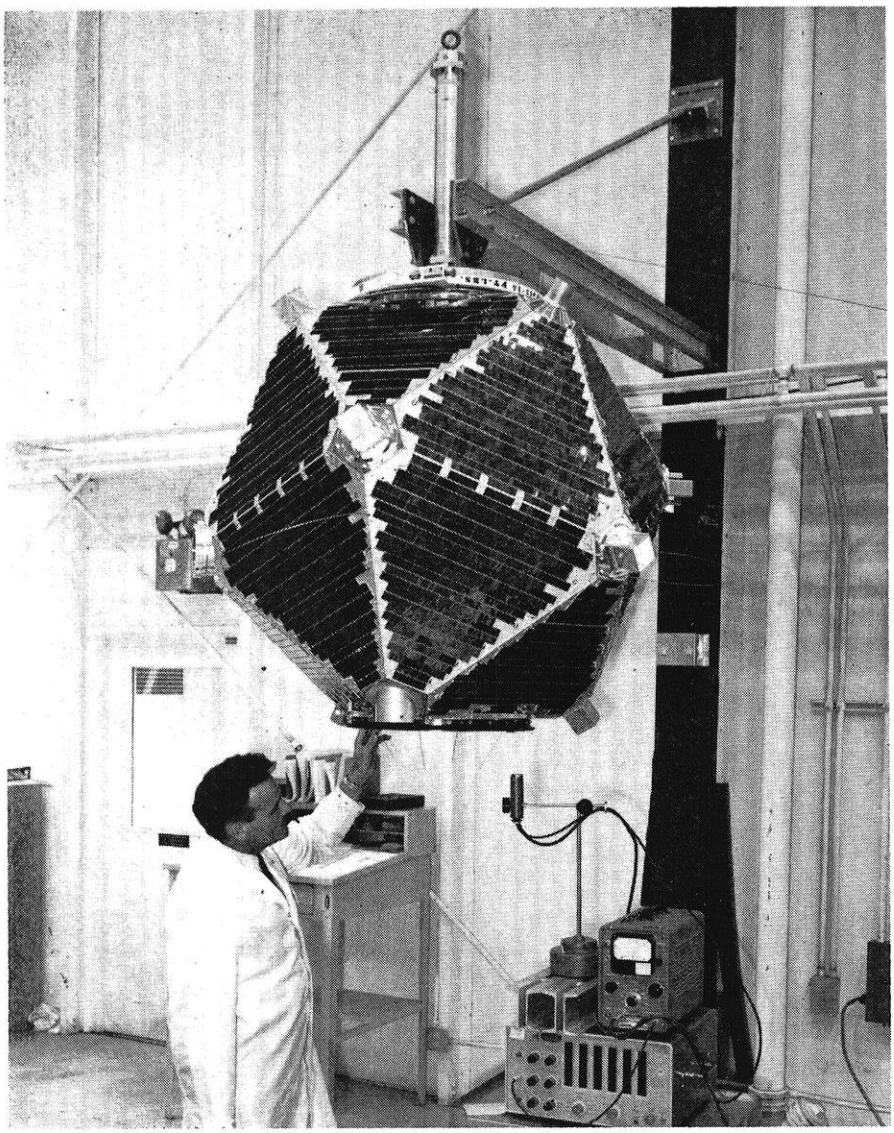
Papers will be presented the following day on the proposed construction of dual-purpose power and desalination plants, including one to be located in Israel. Emil V. Lindseth, assistant chief design engineer for the Bureau of Reclamation, will preside.

The East–West water dispute will be aired May 16 in presentations by Floyd E. Dominy, U.S. reclamation commissioner, and Dr. Maurice Goddard, commissioner of the Pennsylvania Department of Forest and Waters. Dominy will speak for the West, Dr. Goddard for the East, with the debate monitored and summarized by Ray Linsley, dean of engineering at Stanford University.

Other speakers and guests will include William J. Hedley of St. Louis, national president of ASCE; Lt. Gen. William F. Cassidy, chief of Army Engineers; Chief Engineer Bernard P. Bellport of the Bureau of Reclamation; Adm. (ret.) Joseph F. Jelley of Colorado Springs, former chief of the Navy's Civil Engineers and of the Bureau of Yards and Docks; and representatives of the Federal Power Commission and other government agencies, colleges and universities and private engineering firms.

Cooperating in the 1966 conference are nine engineering groups and allied organizations.

These include the American Geophysical Union, the American Meteorological Society, American Public Health Association, American Society of Agricultural Engineers, Geological Society of America, International Commission on Irrigation and Drainage, U.S. Committee on Large Dams, Society of American Military Engineers and the American Sanitary Engineering Inter-Society Board.



—Courtesy TRW Systems

An engineer examines the Vela Nuclear Detection Satellite. Six of these 500-pound icosahedrons have been orbited by the Air Force to monitor possible atomic tests in space.

BRIDGE CABLES PAINTED NO MORE

The awesome sight of sky-high maintenance men painting bridge cables may be a thing of the past with the introduction of a new color-fast plastic covering system for suspension-bridge cables.

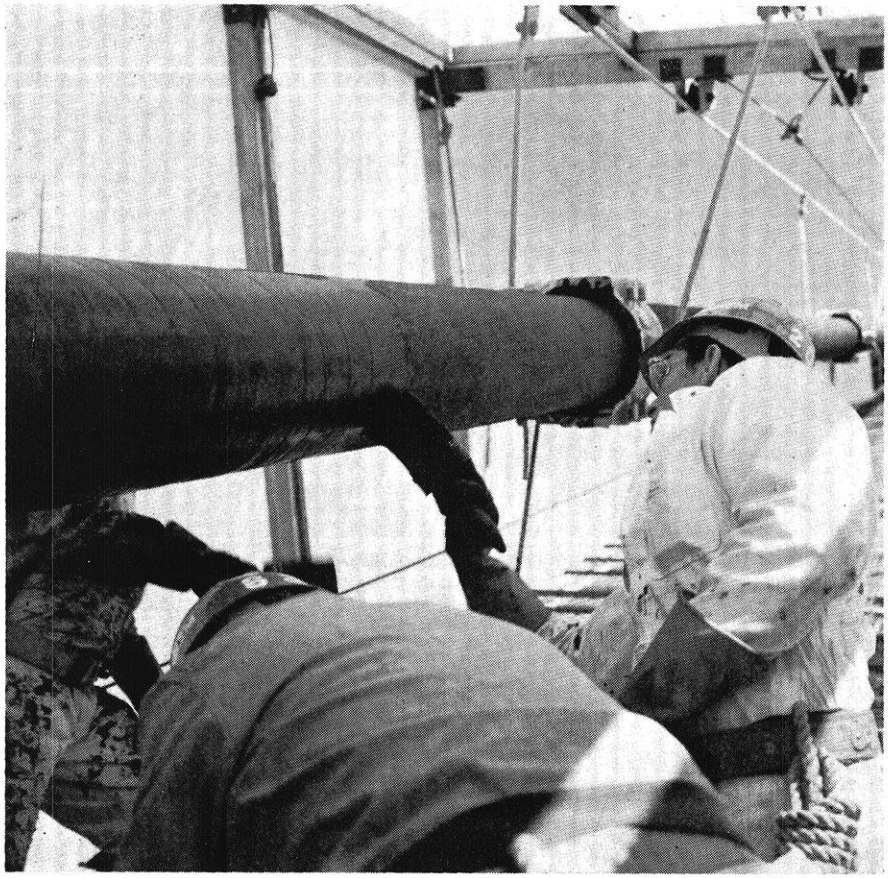
The new plastic system, the first change in bridge-cable protection since before the Civil War, has been installed on the just-completed Bidwell Bar Bridge in California. Approval for the installation was given by the State of California Department of Water Resources, owners and designers of the bridge.

A joint development by Bethlehem Steel and du Pont, the new plastic system consists of a protective covering made from "Lucite" acrylic sirup approximately 1/8-inch thick, heavily reinforced with glass fibers. For cables made of helical bridge strands, polyethylene cable filler pieces are used to round out the cable prior to application of the covering.

The most important advantage of the new covering is the assured watertight protection which it provides to bridge cables. Other advantages include speedy installation (16 working days for covering the two 11-inch-diameter Bidwell Bar Bridge cables), handsome appearance, gritty non-slip walking surface for inspection personnel, and minimum maintenance.

The Old System

Compare this to the standard system used for the last century and a quarter for protecting bridge cables. Cables made of helical



—*Courtesy Bethlehem Steel*

New plastic covering system for suspension-bridge cables has many advantages: speedy installation, handsome appearance, true watertight protection of the cables, and no maintenance.

bridge strands (the type used for the Bidwell Bar Bridge) were first rounded by means of metal filler pieces placed between the outer strands, then wrapped with galvanized steel wire laid in red-lead paste, and finally given four coats of paint.

The machine customarily employed to place the wire wrapping is complicated and expensive. The unit must be mounted on the cable, loaded with wire, and adjusted so that the wire will be wrapped under specified tension. At every cable band—usually every 25 feet or so—the unit must be disassembled, "jumped" over the cable band, reassembled, and started up again. The workmen are handling heavy equipment at high elevations.

The completed wire wrapping is not necessarily watertight, because of the strong tendency for cracks to occur between adjacent turns of wrapping wire as the bridge cable stretches under live load.

The New System

A look at the new plastic system shows its advantages clearly. The principal advantage lies in the dependable watertight weather protection that it will afford to suspension-bridge cables.

The covering can be tinted to match almost any color. Color fading of the covering proceeds extremely slowly. Should the covering be damaged, it can be readily repaired with no special tools or equipment. The granular outer surface of the covering provides sure footing for inspectors walking the cables, and also assures attractive appearance of the coating system. There is no need for any painting of the covering since the pigmented "Lucite" acrylic sirup has "built-in" color. Thus, cable maintenance costs are greatly reduced, if not eliminated.

The effective life of the covering is conservatively estimated as 50 years.

A flexible calking compound is used to seal water-access areas of the cable bands for watertightness of the cable between sections of covering. The plastic system is not harmed by temperature changes and deflections of the cables.

The plastic system is not only suitable for all new suspension bridges, but also can be applied to existing bridges where upgrading of cable protection is needed.

Application for patent has been filed.

POLYURETHANE KEEPS PIPES CLEAN

Water pipes usually are not run along the exterior of buildings in cold climates because of the danger of freezing, but special insulating techniques made this possible in Chicago's newest skyscraper.

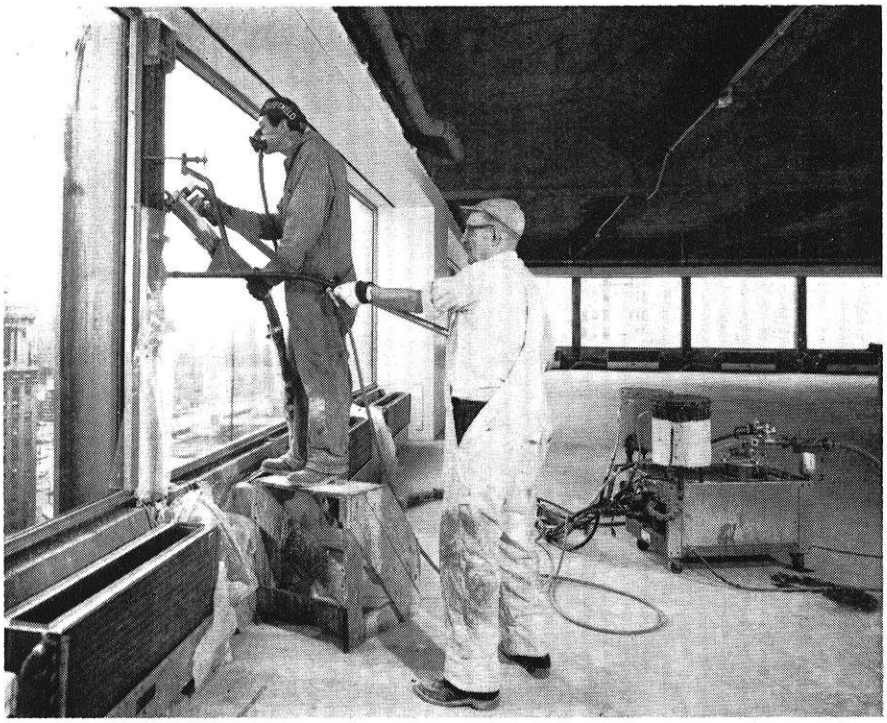
The 13,000 linear feet of water pipe in the Equitable Building now nearing completion at the intersection of North Michigan Avenue and the Chicago River are housed in exterior aluminum mullions or stiles that separate the windows.

Insulation is provided by polyurethane foam, a highly efficient insulating material. The foam has a k factor of 0.11 compared with 0.22 for glass fiber and polystyrene and 1.00 for cellular gypsum, other common insulating materials. K factor is a measure of heat transmittal and the lower it is, the better the insulating material.

The insulating techniques were developed especially for the new building and require the services of only two men. One applies the poured-in-place foam. The other uses a specially-designed levered pressure handle to hold a steel form in place. The mullion cavity serves as the rigid exterior wall of the mold. The steel form supports the expanding foam in the interior areas. A minimum depth of ¾-inches of foam exists between the pipe and the outer foam surface. The two-man crew is capable of applying the foam at the rate of two to two-and-a-half days per floor.

Exterior piping was specified because restrictions on the building's height made it necessary to minimize floor thickness for maximum interior space. Ordinarily the pipes are run from a central core riser to perimeter-installed air induction units in the floor. This system, however, would have added to floor thickness.

The problem of exterior piping



—*Courtesy Olin*

INSULATING EXTERIOR WATER PIPES: Utilizing unique methods developed by Vierling Steel Works, Chicago, these two workers insulate exterior water pipes in the new Equitable Building in Chicago with polyurethane foam. One foams the urethane in place with a gun-like device while the other holds a steel mold. The foam, providing superior insulating characteristics, enabled The Equitable Life Assurance Society of the United States to run water pipes through the exterior mullions of its 35-story building along the Chicago River and save floor space. Ordinarily, water pipes are run from a central core riser to perimeter-installed air induction units in the floor, adding to the thickness of the floor.

was complicated by the fact that the exterior mullions had to be kept as thin as possible for esthetic reasons. This resulted in a minimum of space for insulating.

Further, insulating was complicated because the pipes in the mullions ran through complicated configurations of anchorage devices and other intermediate supports and were hidden behind spandrel beams between floor and ceiling. The net result was that when insulation had to be applied the pipes were virtually inaccessible once they had been connected and tested against leakage.

With water temperatures in the pipes ranging from 43 degrees F. to 156 degrees F. and with outside temperatures often ranging from over 100 degrees F. to minus 15 degrees F., properties other than insulation were required from the insulating material. It had to completely fill the open spaces between the pipe and outside the walls to prevent condensation. Further, moisture accumulation that might build up in the mullions had to be forestalled. Polyurethane provided these properties.

NAVY PILOTS TAKE A SPIN

Tests to aid in determining how much rotation a man can stand and still perform tasks as he would be required to do in a whirling spacecraft are under way today at the Convair division of General Dynamics.

Twenty-four test subjects, all Navy flight instructors, will be whirled for four hours at 12.4 revolutions per minute in an experiment being conducted for the Manned Spacecraft Center, National Aeronautics and Space Administration, Houston, Tex.

A simulated spacecraft, called the Manned Revolving Simulated Space Station (MRSSS) has been put on the arm of a giant centrifuge which revolves so that the "floor" of the simulator spins out to 45 degrees.

NASA is undertaking the experiment as part of a program to gain information on man's ability to adapt to being whirled as he might be in space if it is found that astronauts require artificial gravity to overcome the problems of prolonged weightlessness. One means of providing artificial gravity is by applying centrifugal force to the astronaut.

Part of a continuing study on the effects of rotation on man, the current experiment centers around a specially designed tilt seat mechanism that permits putting the test subject at various angles.

Subjects are required to make various head movements from side-to-side and up and down to determine which type of head rotation is the least disturbing to the astronaut's performance. Such information is necessary in the design of a revolving space station to determine the optimum location of instrumentation.

The experiment and final report will require 10 months to complete.

The 24 test subjects are flight instructors at the Miramar Naval Air Station at San Diego.

The MRSSS is a box-like structure 14 feet long by 8 feet wide by 7 feet high. It is suspended on the arm of the centrifuge with an 18-foot radius.

Previous tests have been conducted with deaf subjects as well as a test in which four engineers were subjected to continuous spinning at 6 RPM for five days. In all tests the subjects are under constant observation by a medical officer by means of closed circuit television and bioinstrumentation.

NEW COMMUNICATIONS SYSTEM HAS CAPACITY TO TRANSMIT CONTENTS OF 10,000 BOOKS IN 15 MINUTES

All the information contained in a 10,000 volume library can be transmitted in 15 minutes over a new experimental communications system.

The system can send 3456 telephone calls or two television programs over the same transmission path using a technique called Pulse Code Modulation (PCM).

PCM is already being used commercially for transmitting 24 telephone calls, or comparable amounts of data, over distances of up to 50 miles on a pair of wires.

The new, high-speed PCM system, when fully developed, will be able to transmit voice, television, and data signals of the highest quality from coast to coast over coaxial cable.

In PCM, the varying electrical

signals that represent sound or picture information are not sent in their entirety but, instead, are sampled many times a second and encoded into groups of nine electrical pulses. These pulses are sent over the cable at a rate of 224 million pulses per second.

Because electrical signals grow weaker and become distorted as they travel, devices called "repeaters", spaced about a mile apart along the route, are provided to regenerate the pulses to full strength and send them to the next repeater.

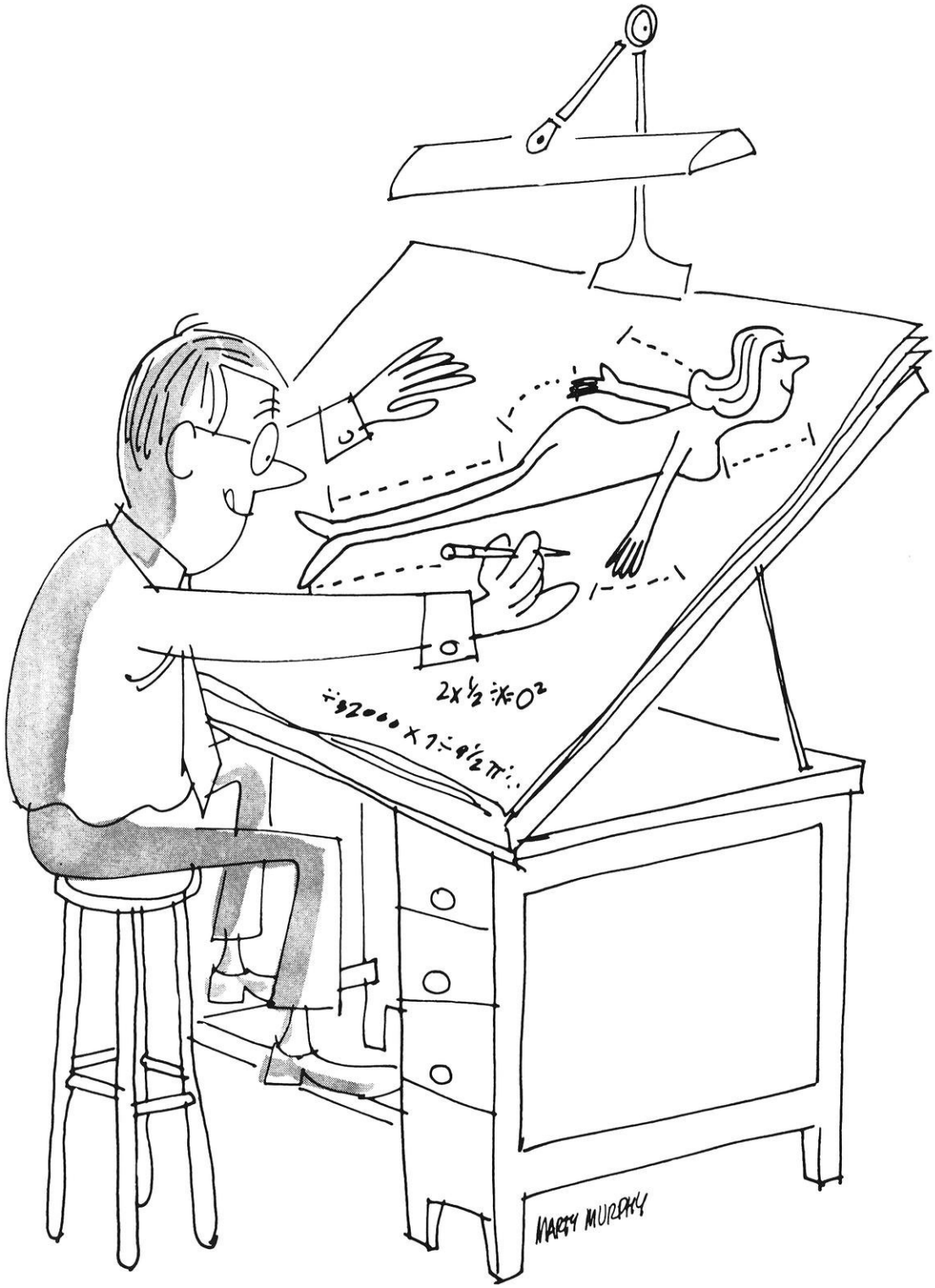
Because pulses are sent, the codes of many different signals—voices, data, and pictures—can be easily interleaved on the same transmission path.

At the far end of the line the pulses are sorted out and converted back into voice and television signals, and then into sound and pictures with no loss in quality.

Along the route signals can be added or taken off the main stream of pulses as desired. The performance of this experimental high-speed PCM system indicates that even higher speed systems—with greater information capacity—are possible.

—Courtesy Bell Telephone Laboratories

This equipment simulates the jitter (the smearing out of pulses in time) that would accumulate in a 4000 mile long pulse code modulation system. John Mayo of Bell Laboratories observes the effect of this jitter as it is automatically compensated for in the experimental high speed PCM system. The television picture on the screen is transmitted without distortion because of the "de-jitterizing" circuit.



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Computerized Newspapers

(Continued from page 24)

1. Specify material to be displayed on the screen.
2. Designate column width, page layout, type font, and size.
3. Type in additions of his own or additions he may wish to incorporate from the secondary display screens.

Secondary Display Screens

The secondary display screens around the editor's desk will allow him easy and efficient access to alternative sources of editorial copy. The screens will enable the editor to:

1. Review material that spills over onto other pages.
2. Study original copy before changes and unused portions of a story.
3. Display background materials from the morgue.

Electronic Morgue

The electronic morgue will replace the morgue of the present; the new one will be an electronic library. The new morgue will store information by both electro-mechanical and optical means. It will allow the editor to:

1. See displays on his screen of actual documents, clippings, and stories which have been stored and indexed by the computer.
2. Obtain prints from earlier editions which have been stored photographically.
3. Indicate to the computer the category or kind of information which he desires and have the computer select that information for him.

Magnetic Tape File

The magnetic tape file will hold on tape all the copy for a single edition or a series of editions. It is a part of the central information system. This file in conjunction with the keyboard and screen will enable the editor to:

1. Print out 'hard copy' of any material in the system by using an office copier type of device at the desk.
2. Call up for review upon the display screen the makeup of any page.

Printing

When an editor is satisfied with a page display he can cause it to be printed by pressing a print button. This will transmit an electron beam to an area where a metal plate will be etched out to print the same page viewed on the T. V. type viewing screen.

The electronic impulse in the etching beam is the same as the electron beam causing the image on the viewing screen, but is at much higher energy levels so that metal is actually removed from the plates. An alternate process would be a photo-composition method with similar electron actuation and much greater speed.

Results of Diebold System

The results of the Diebold System will have many effects on tomorrow's newspaper:

1. Many newspapers will print simultaneously at a number of locations on light presses.
2. Time of copy from desk to printed page will be a few minutes.
3. Edition to edition changes will be easier and less costly.
4. There will be no more typesetting; page images on the screen will be transmitted directly to printing plate when the final approval button is touched. This will make economical and possible editorial up to the moment one prints.
5. Publishers will be able to sell special local and regional news material. This material will be stored in the electronic morgue and transmitted to papers requesting the information by sending the electronic impulses stored in the morgue via data transmission facilities of the telephone system. It will be a machine-to-machine conversation!
6. Partly because of electronic and mechanical ability to transmit very rapidly and print at several locations, more regional and local editions of individual papers will exist.

CONCLUSIONS

Diebold has told the American Society of Newspaper Editors that they "should establish a study group to identify developments in information technology, to familiarize its members with what it is that this new technology makes possible, and to provide a mechanism whereby editorial imagination is exercised in determining just what it is that the editor wants to do with the technology." The time to start realizing the capabilities of computer technology is now so that the development of these systems will be guided in the directions of best service to the newspaper industry.

The utilization of the RCA TIES System for news transfer and interchange is obvious. A newspaper network on a TIES System could have news from any part of the world at fingertip control. Not only would this system bring in copy, but it could set that copy into type for printing as fast as the information could flow into the editor's office. A combination of the TIES System and the Diebold System would be even more rapid and all encompassing in its editorial reach.

Possibly remote seeming at the present, but not at all improbable, is the concept of sending copy material from outer space. Should we begin colonization of that expanse, copy material from our space pioneers could be relayed as fast as terrestrial transmissions. Our manned flights to the Moon, Mars, and beyond can be covered first hand by U.S. newspapers when the time comes, if the proper data transmission equipment is planned for and installed ahead of time.

In the sense that communication diminishes distance and uncertainty, the newspaper industry, with the latest production equipment, more than ever before, can play a leading role in shrinking the world and even the universe!

In reference to American Newspapers and their final selection of material for presentation, Max Lerner, a commentator on American culture and personality has said: ". . . what they gather at the big end of the funnel is often hardly recognizable when it emerges at the narrow end in a typical small city newspaper. A double process of selection takes place: first by the wire service editors when they decide what news to get, to hold out, to send out; by the publishers and editors when they decide what to print, given their readers and the available space."

With computerized production methods there can be less discrimination in news selection. All the facts can be presented and the reader can choose for himself. The decision will be to read or not to read, instead of to print or not to print!

The adaptation of this new information technology will also have an important role in international

(Continued on page 56)

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Other responsible assignments include: ATS (advanced technological satellites), TOW (wire-guided, anti-tank missile system), VATE (automatic checkout equipment), advanced infrared systems, electronic signal processing, space communications, parametric amplifiers, airborne radar systems, reconnaissance systems, aerospace vehicle development, missile/spacecraft power & propulsion systems...and others.

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CAMPUS INTERVIEWS

February 28, 1966

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Computerized Newspapers

(Continued from page 54)

relations. The cause of truth can truly be served by American Journalism. Propaganda lies can be better dispelled. A combination of computers, relay satellites, and imagination can bring the facts to the whole world. The distribution of truth through automation and electronics can help contain and abate inflamed misconception. Automation, taking continued high editorial quality for granted, can get the truth to the masses fast and accurately. Computerized production will encourage a much better understanding of people because a true and current picture of our democratic society can be presented untainted to other nations presently receiving lies and half-truths.

Looking in the direction of world trade and economic interdependence, United States Journalism can tap foreign markets heretofore untouched. American consumer goods could be advertised nightly in other newspapers in Rome, Itay! Barring legislation and tariff restrictions, there is no reason why the Rome paper could not reciprocate.

The function of today's newspaper is one of interpretation—to provide the "essential" truth as L. S. Fannin, Executive Editor of the *Chicago Daily News* has said. Our papers today are to give the background and the depth of stories as well as the straight facts. To give the background, to provide the depth, requires information—information when and where it is needed. Technology will provide the conveyance, the speed, and the accuracy. Will your paper be using it?

END

Industrial Safety

(Continued from page 42)

meeting. It should be used to launch safety contests, present safety awards, introduce new equipment, announce changes in company safety policy, and announce new safety records. This type of meeting should be held at least once a year. They can be held in conjunction with other companies in the area so that the cost of hall rental, entertainment, and prizes can be shared.

This type of meeting has its advantages. The family can be brought into the act and employees can be made to participate by having a few as speakers; entertainment can often be provided by talented employees—remember, the secret of successful safety meetings is *worker involvement.*

The **departmental** safety meeting passes information to the departmental — operational — level. These meetings, which are held periodically, must not become dull and routine; they should not be an occasion for complaining and scolding, but rather, they should help maintain a positive safety program. A demonstration called "Let's Pretend", which was initiated by the Industrial Accident Prevention Association makes for an interesting meeting with comical aspects which still drives home the importance of eye protection. A blindfolded member of the audience tries to perform simple, everyday tasks as:

1. Putting toothpaste on a toothbrush.
2. Replacing a broken shoe lace.
3. Lighting a cigarette.
4. *Reading a newspaper!!!*

Get the point of the demonstration??? Others as this can be devised which are interesting and amusing but yet, *dead serious.*

Production huddles are comparatively recent developments in accident prevention work. Small group conferences are held at or near the workplace. These small, informal meetings are most useful because the individual worker is most directly involved and specific topics of immediate importance can be directly dealt with. The production huddle is very useful for maintenance crews just before a particularly unusual job is begun.

CONCLUSION

A single thread has been very carefully woven into this report throughout its entire length. The thread is that *industrial accidents are preventable!* How? By effective safety organization! Why? Because every single year, America is suffering a needless loss of life and resource due to industrial accidents, fatalities, and injuries!

Everybody loses and nobody wins when an industrial accident occurs. In addition to the attendant heartbreak and sorrow, in 1963, industrial accidents cost the American employer $70 for each worker employed by him; the man hurt will probably never recover the wages he lost while off the job. Nobody comes out ahead in an industrial accident!

Effective safety organization will stop this needless loss. Accidents are preventable! Companies must formulate a good, practical, working safety policy and provide the means to carry it through. Effective safety organization requires involvement—involvement of every single person in industry; from the president of the largest company down to the newest employee of the smallest shop! Involvement is important.

Involvement is brought about by organization and group function. Safety campaigns and contests wage effective battles against the foe. Safety inspections reconnoiter the enemy's strongholds; safety committees and safety meetings plan and provide direction for the attack; trained individuals put up the fight.

Vigilance and persistence are needed. Remember. The loss of life and resource can be prevented because *industrial accidents are preventable!*

END

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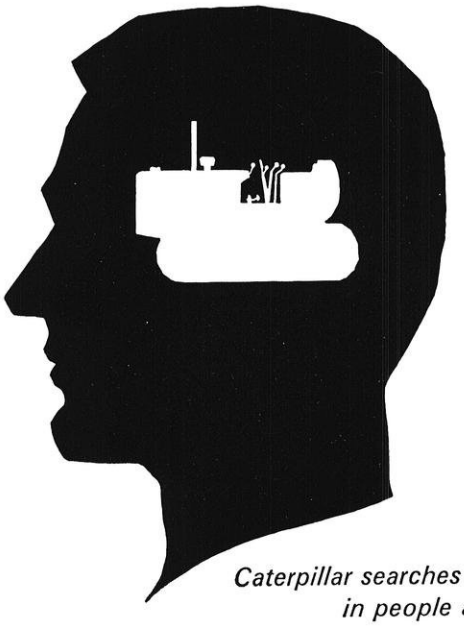

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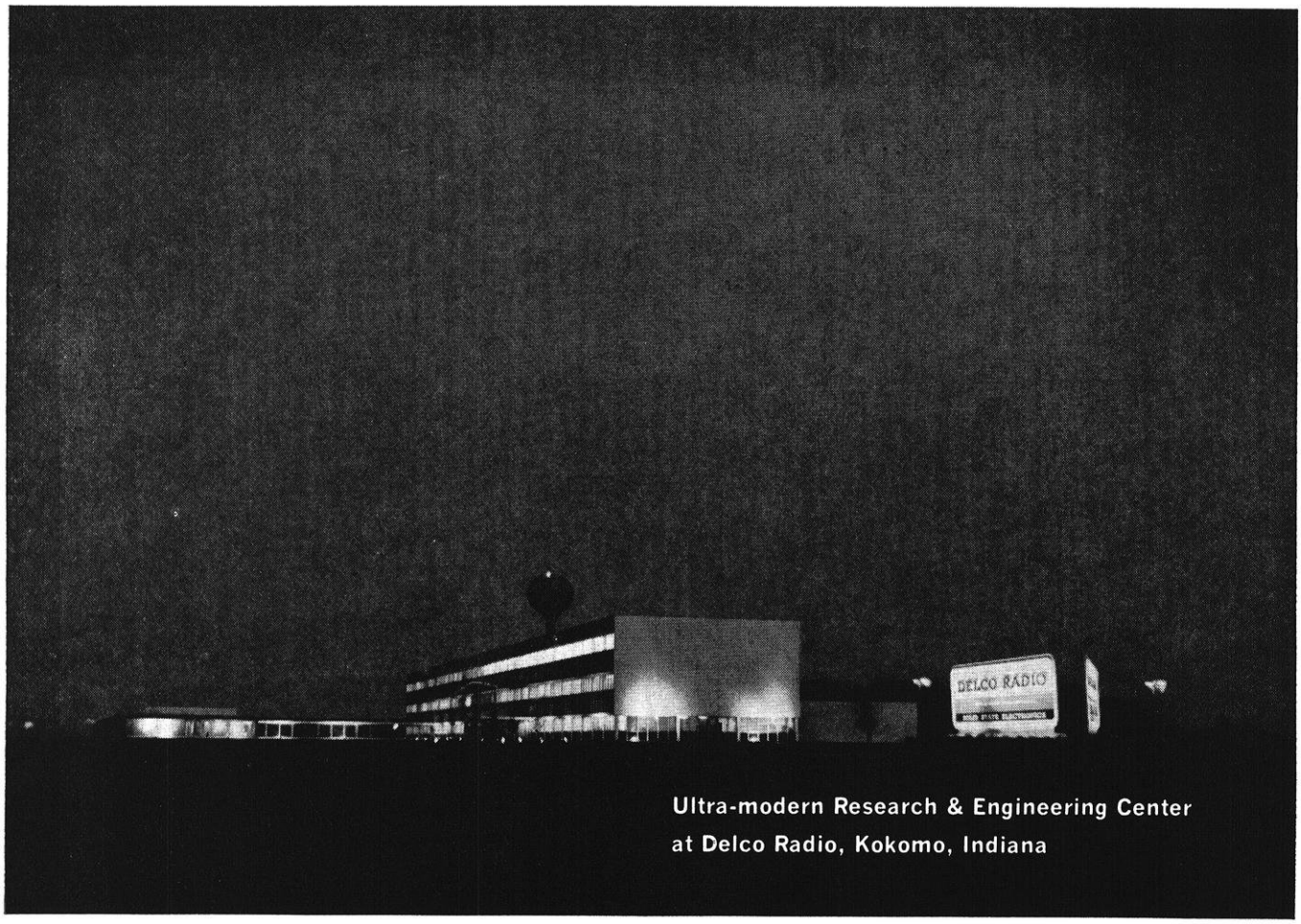

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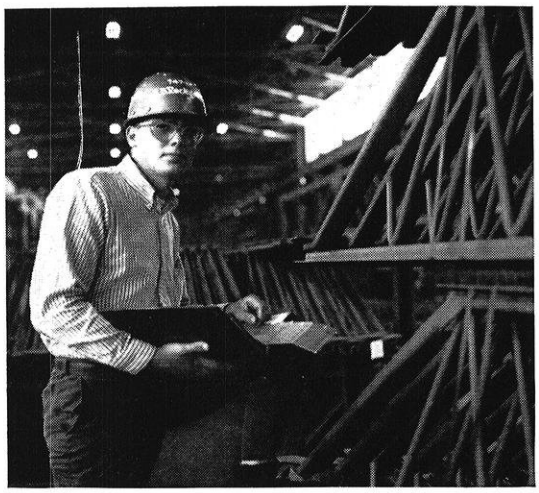

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Ch.E., '62, Villanova University

DAVE SPARKS, ASSISTANT TO SUPERINTENDENT, COAL MINE
Min.E., '60, Ohio State University

BARREL OF BOTTOM

There was this professor of genetics in Europe who tried to breed the perfect, peace-loving race. He crossed a German with a Frenchman and got a tall, blond machine-gunner who likes wine. Not discouraged, he crossed a gypsy with a Jew and got the owner of a chain of empty stores. Better luck next time, Doc.

* * *

A guy called his girl one night and asked "Got anything on for tonight "

"Yes," replied the chick, "and it's staying on."

* * *

The meek little bank clerk had his suspicions. One day he left work early and, sure enough, at home he found a strange hat and umbrella in the hallway and his wife was on the couch in the living room in the arms of another man. Wild for revenge, the husband picked up the man's umbrella and snapped it in two across his knee.

"There!" he exclaimed. "Now I hope it rains!"

* * *

Judge: "Did you say this man stole your money out of your stocking?"

Gal: "Yes, your honor."

Judge: "Well why didn't you put up a fight?"

Gal: "I didn't know he was after my money."

An EE we know spent $200 on a cure for halitosis and then found out that nobody liked him.

* * *

Some years ago when the Wisconsin football team was playing Minnesota at Madison, the game was hard fought and a number of penalties were called, most of them against the Badgers. Sitting directly back of us were four coeds, who did not take kindly to these Wisconsin setbacks. After one 15-yard penalty, a coed demanded, "What's it for this time?"

"Illegal use of hands," we told her.

"Wouldn't you know it?" she cried. "That's Wisconsin for you everytime."

* * *

It's hard to keep a good girl down—but fun trying.

* * *

Nice Old Thing: "Don't you know you shouldn't play strip poker?"

Sweet Young Thing: "Oh, it's all right really. It's not gambling. You see, we get our clothes back."

* * *

Papa Stork: "I surely had a busy day. I delivered 152 babies."

Mama Stork: "Yeah, me too. I delivered 145 babies."

Kid Stork: "Well, I can't deliver babies like you grownups can, but I did have fun today scaring the hell out of a couple of college kids."

Ch. E. "What is the most beautiful thing in the world?"

M. E. "I say a beautiful woman is the most beautiful thing in the world."

E. E. "I claim that sleep is the most beautiful thing in the world."

C. E. "Yes, next to a beautiful woman, sleep is."

* * *

Mary had a little calf—
It was a shame to hide,
So Mary bought a little skirt
With a slit up on the side.

* * *

E.E.: "Doc, I'm really in a bad way. I'm nervous all the time."

Doctor: "How much do you smoke?"

E.E.: "Oh, about a pack a day."

Doctor: "Hm—Do you stay up late?"

E.E.: "No, I'm usually in bed by ten."

Doctor: "Well, how much do you drink?"

E.E.: "Oh, I don't know."

Doctor: "A half pint—a pint?"

E.E.: " Heck Doc, I spill that much."

* * *

What is purple and Hums?
A transistorized Grape.
What is purple and doesn't hum?
A transistorized grape built for an E.E. lab.

* * *

Limbo dancing was invented by a Scotsman trying to enter a pay toilet.

Kodak

wants two kinds of mechanical engineers:

1. burning with ambition to reach manager's status as soon as possible

- **College grade-point average on the high side in technical subjects**

Secretly admitted to self at certain point in undergraduate career that the scholar's way of life is for other people *but smart enough to have kept secret from the professors who are, after all, scholars.* Diploma in, secret out.

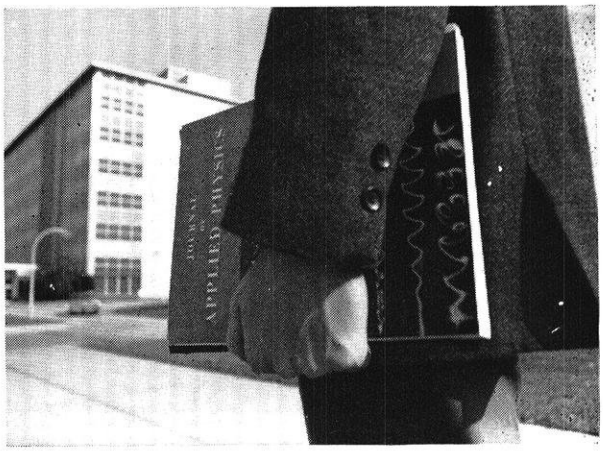
- **Seeks prosperous, highly diversified employer**

Competitive personality who wants to play on a strong, long-lasting team in the big leagues.

- **Unafraid of choices and changes**

With a mechanical engineering background, we might find him adept at keeping a troupe of welders happy on a new petrochemical project, or designing a new type of machine for the lithographic industry, or organizing a small laser-manufacturing department, or operating a large magnetic tape plant, or profitably piloting one of the world's major industrial corporations.

2. able to hold a manager's job in time but sure he wouldn't like it



- **College grade-point average on the high side in technical subjects**

Why not? The subjects were intrinsically interesting, and most of the professors proved to have a clear understanding of them.

- **Seeks prosperous, highly diversified employer**

To practice modern mechanical engineering—this is not 1936—one needs scope, contacts, and resources.

- **Unafraid of choices and changes**

With a mechanical engineering background, he might choose to take a high leap over the interdisciplinary wall into solid state physics, pull some excessively generalized equations out of a journal that others on the circulation list quickly glance at and pass along. Six months later he may have a new composition of matter on board a ship bucking the solar wind to Mars.

What is said here about mechanical engineers is equally applicable to chemical engineers and electrical engineers. Our expansion rate now demands technical people who, at the one extreme, are still fresh from the classroom with its benefits and, at the other, have had ten years of practice in their professions and are now ready to select a lifetime employer. We offer a choice of three communities: Rochester, N. Y., Kingsport, Tenn., and Longview, Tex. We earnestly solicit serious and honest self-descriptions addressed to:

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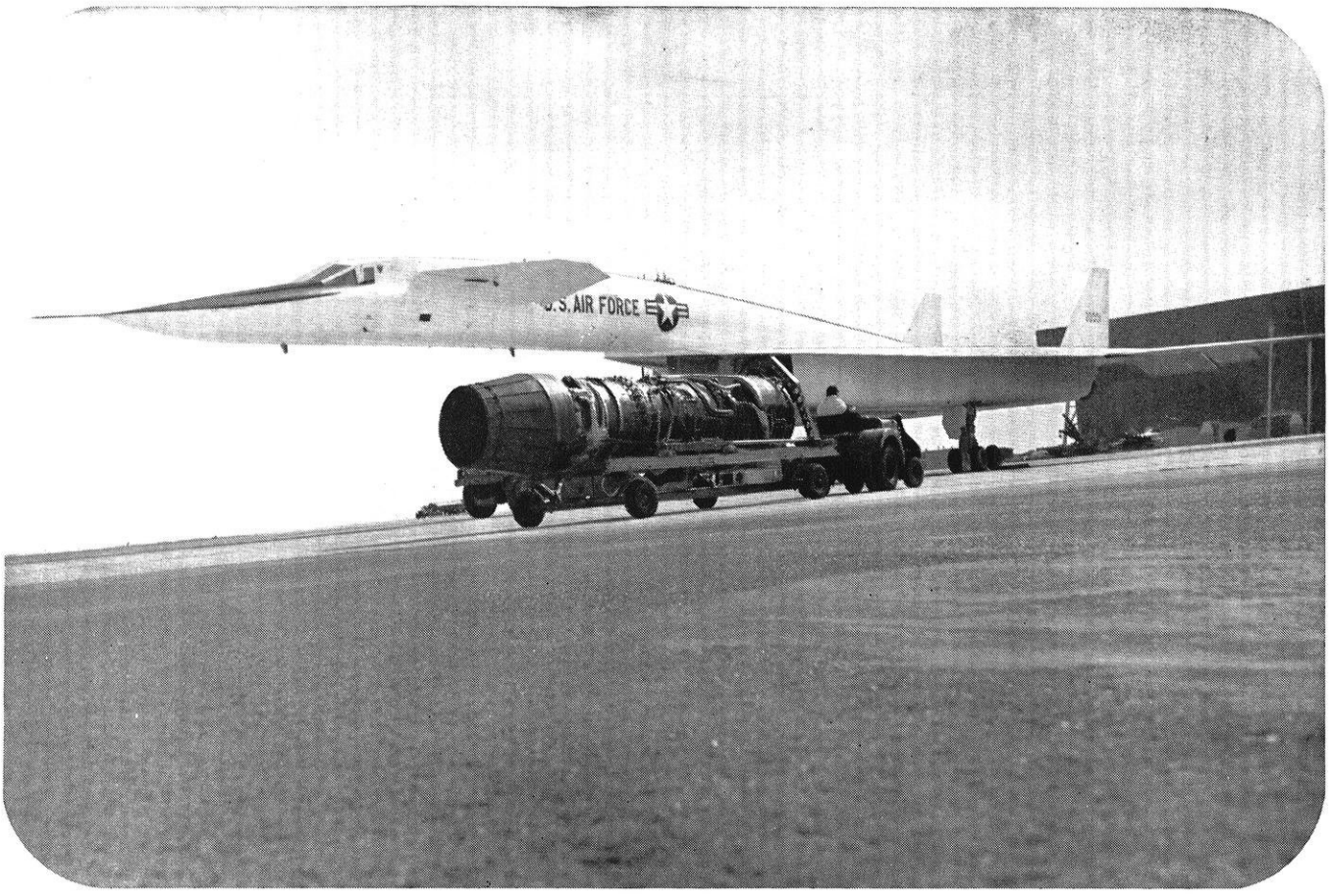
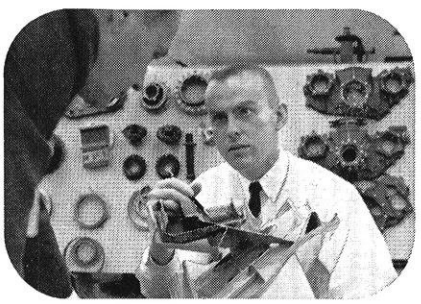
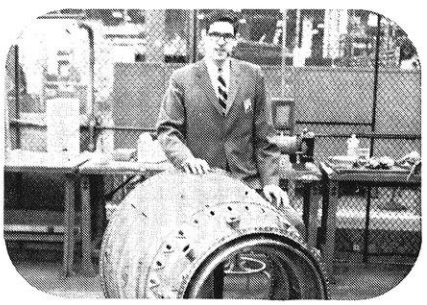


SIX G-E J93 ENGINES push USAF XB-70 to MACH 3.

JACK WADDEY, Auburn U., 1965, translates customer requirements into aircraft electrical systems on a Technical Marketing Program assignment at Specialty Control Dept.



PAUL HENRY is assigned to design and analysis of compressor components for G.E.'s Large Jet Engine Dept. He holds a BSME from the University of Cincinnati, 1964.



ANDY O'KEEFE, Villanova U., BSEE, 1965, Manufacturing Training Program, works on fabrications for large jet engines at LJED, Evendale, Ohio.

A PREVIEW OF YOUR CAREER AT GENERAL ELECTRIC

Achieving Thrust for Mach 3

When the North American Aviation XB-70 established a milestone by achieving Mach 3 flight, it was powered by six General Electric J93 jet engines. That flight was the high point of two decades of G-E leadership in jet power that began when America's first jet plane was flown in 1942. In addition to the 30,000-pound thrust J93's, the XB-70 carries a unique, 240-kva electrical system that supplies all on-board power needs—designed by G-E engineers. The challenge of advanced flight propulsion promises even more opportunity at G.E. GETF39 engines will help the new USAF C-5A fly more payload than any other aircraft in the world; the Mach 3 GE4/J5 is designed to deliver 50,000-pound thrust for a U.S. Supersonic Transport (SST). General Electric's involvement in jet power since the beginning of propellerless flight has made us one of the world's leading suppliers of these prime movers. This is typical of the fast-paced technical challenge you'll find in any of G.E.'s 120 decentralized product operations. To define your career interest at General Electric, talk with your placement officer, or write us now. Section 699-16, Schenectady, N.Y. 12305. An Equal Opportunity Employer.

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