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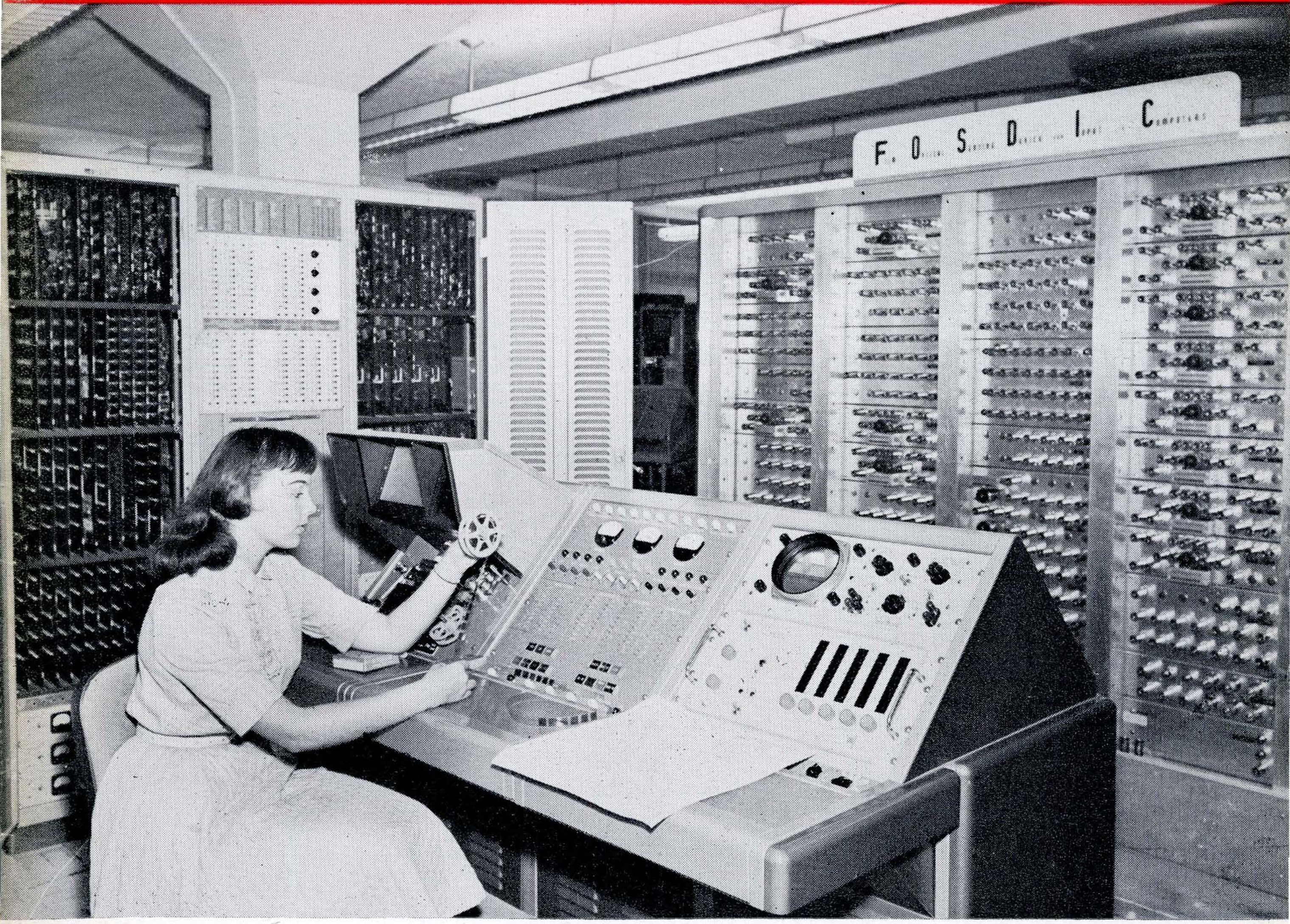
DATA PROCESSING • CYBERNETICS • ROBOTS



MARCH
1960
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VOL. 9 - NO. 3 & 3B

Ten Years of Computer Experience and the 1960 Census

Distribution and Electronic Data Processing: "Marriage" With Problems

News of Computers and Data Processors: ACROSS THE EDITOR'S DESK

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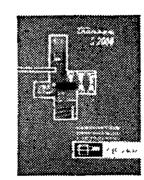

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COMPUTERS

and AUTOMATION

DATA PROCESSING • CYBERNETICS • ROBOTS

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Vol. 9, No. 3 B

News of Computers and Data Processors: ACROSS THE EDITOR'S DESK

. . . . inserted between pages 8 and 9, and between pages 24 and 25

THE COMPUTER DIRECTORY AND BUYERS' GUIDE 1960

6th Annual Issue,

the only directory in the computer field,

the June 1960 issue of Computers and Automation

CONTENTS:

Part 1, ROSTER OF ORGANIZATIONS. Each entry will give:

Name of organization / Address / Telephone number / Types of computers, data processors, accessories, components, services, etc., produced or offered / Approximate number of employees / Year organization was established

(740 organization entries last year)

Part 2, BUYERS' GUIDE: ROSTER OF PRODUCTS AND SERVICES. Each expanded boldface entry will give:

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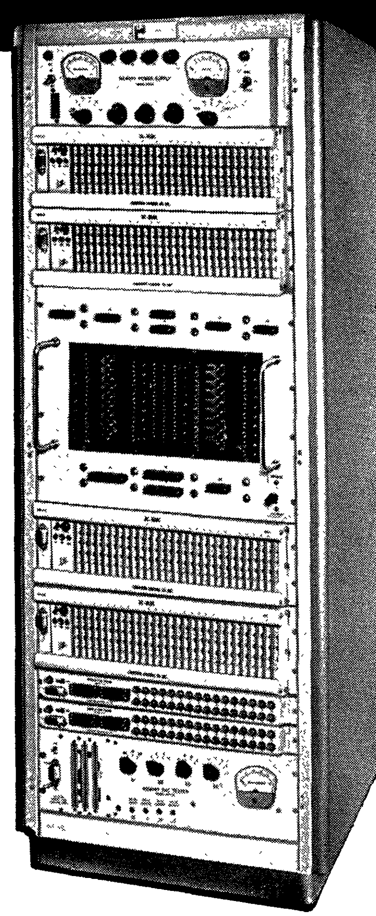

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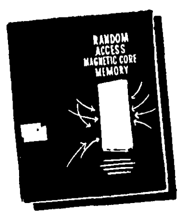

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Ten Years Of Computer Experience And The 1960 Census

by

E. D. Morgan
Chief, Engineering Branch

and

Mrs. D. P. Armstrong
Chief, Programming Branch

Electronic Systems Division
Bureau of the Census
Washington 25, D. C.

The Bureau of the Census will soon conclude its first decade of active electronic computing. It will scarcely pause to note this milestone, however, for it will be in the midst of its toughest assignment to date — the processing of the 1960 Censuses of Population and Housing.

These ten years have been marked by one development following rapidly upon another. The computer industry is now speaking of "second generation" computers while the tasks and opportunities already undertaken have had a penetrating effect upon business data processing and statistical methods.

The Early Years

It is difficult to consider Census activity in the data processing field without starting with Hollerith's invention of the punch card method and the first use of his equipment during the 1890 Census. Its profound effect was multiplied so that by 1950 practically all data processing was planned for the use of punch card tabulating equipment.

However, as early as 1946 Census supported an electronic computer study with our sister agency, the Bureau of Standards, acting as advisors. This start culminated on March 30, 1951, when the Bureau of the Census accepted delivery in Philadelphia of Univac I, Serial 1, from the Remington Rand Corporation.

This was the first large-scale non-defense electronic computer and was specifically designed to enhance its use for business data processing. At about the same time we accepted delivery on a punch card-to-magnetic tape converter and a 12 character per second Uniprinter. With these auxiliaries and 4 Uniservo tape handlers on the Univac I we found ourselves in the electronic data processing business.

The early exasperations were many; but, slowly, progress was assured. The first assignment was a tabulation run using data from the 1950 Census of Population which was then being processed principally through the use of both conventional and Census-built special punch card equipment.

The intervening years saw our data processing expand. The workload imposed by the 1954 Economic Censuses led to the purchase of a second Univac I, this time Serial 13. Meanwhile our plea for better input-output equipment had been joined by others. As a result we have been using 10 line per second printers, higher efficiency card-to-magnetic tape converters and high-speed magnetic tape transports for many years.

In 1958, Remington Rand installed at Census two Univac Scientific 1105 computers, each with 18 Uniservo tape transports and two completely buffered input-output channels. The computers can simultaneously read, write, and compute and they form the backbone of our present system.

FRONT COVER: FOSDIC, READY TO WORK FOR THE BUREAU OF THE CENSUS

The front cover shows FOSDIC, Film Optical Sensing Device for Input to Computers. This extraordinary input device "reads" microfilm copies of the forms which will be filled in by the census enumerators of the U. S. Bureau of the Census in April 1960, and produces magnetic tape for the computers of the Bureau. The operator is examining a reel of microfilm before inserting it into the machine. A sample document of the type to be used in the 1960 Census is lying on the console.

System Organization

Early in our experience we learned to talk not in terms of machines, but of a data processing system. This included in addition to the hardware all the persons associated with the undertaking — programmers, operators, maintenance engineers, etc. We learned to judge ourselves only by the results produced by this complex of men and machines.

It is the resultant organizational system which now faces its toughest test, the complete processing of the 1960 Decennial Census, the largest single processing task so far attempted.

Census activity has advanced far beyond the mere periodic enumeration of population data and now encompasses a significant amount of monthly, quarterly and annual statistical programs. These include the Foreign Trade Statistics program, Current Business Surveys, Current Population Survey, Annual Survey of Manufacturers and many other continuing or special projects from which the Nation draws a significant proportion of its statistical facts.

Distributed in time and superimposed on this fairly constant work-load are the larger undertakings, such as the Censuses of Business and Manufactures, the Agriculture Census, and the Censuses of Population and Housing.

We have a need, then, for ample computing facilities to enable us to provide for our year-in, year-out work as well as for an ability to expand our facilities and capacity to meet the periodic increases represented by the major censuses.

We have found several ways this expansion can be accomplished. For instance, during the 1954 Economic Censuses, we operated not only on our own electronic equipment but at Gary, Indiana, on the U.S. Steel computer and at Los Angeles, California, on the Pacific Mutual Life Insurance Company computer. This taught us the significant lesson that such remote operation was feasible and practical.

The shared use of computers was tried early in our electronic history when our second Univac I was purchased jointly with the Internal Revenue Service. They provide their own programs; they manage their own magnetic tape library; in short they have complete control of their own operation except for actual operator and maintenance functions.

These two successful ventures, shared use and remote operation, led us to the unique arrangement which has provided for our peak loads from 1959-62. Once it was established that Univac Scientific 1105 computers would form the heart of our system, a cooperative arrangement between industry, education, and government was reached. Two educational and research institutions, the Armour Research Foundation of the Illinois Institute of Technology and the University of North Carolina have purchased and installed 1105 computing systems compatible with those at our headquarters. Prepayments by our Bureau for time on their equipment combined with Remington Rand's generous discount to educational institutions enabled the universities to acquire powerful equipment for comparatively small expenditures. Large amounts of the available computer time will be utilized to handle the peak Census processing. These computers have already contributed to the processing of the 1958 Economic Censuses and we feel the cooperative use of the facilities will prove advantageous to all parties.

Computer Administration

Our present Computer System philosophy has evolved from our several years of experience. Briefly, we operate with what we call an "Open-Closed Shop" computer system. Our equipment is assigned to an operating division which has the responsibility to provide computer equipment, operators, maintenance, training, and certain programming services to those divisions charged with the successful completion of statistical tasks. The "subject-matter" divisions, in turn, plan their own work, do the bulk of their own programming, control the flow and progress of their work and are responsible for its successful completion.

Only in the area of programming is there an apparent contradiction in this scheme of things. Even in this area cooperation has worked out well. It has been demonstrated to be easier for us to train a person to program who already is experienced in the direction and processing of a statistical task, than it is to train a programmer the subtleties of handling large masses of detailed, complex, subject matter. Our programming effort utilizes a Compiler-Generator-Framework type of structure through which our computer division can concentrate on providing this type of service programming while easing the task of the subject-matter programmer so he can concentrate primarily on the completion of his mission rather than on the details of machine coding.

Development of Auxiliary Equipment

To this overall system must be added one more important tool before we can adequately describe our future plans. That tool is FOSDIC III, which will be our prime preparer of computer input for the 1960 Censuses.

Prior to the invention of FOSDIC the bulk input medium has generally been punch cards; but a few figures showing our experience in 1950 points out certain of their limitations. At that time we used a force of nearly 2000 key punch operators at the peak of operations, and over 14 months was needed at a cost of almost six million dollars just to record the enumerated population and housing data on cards.

These facts led Census back to the Bureau of Standards for additional study and review of the input problem. Out of this interchange grew FOSDIC I. The name is an abbreviation of Film Optical Sensing Device for Input to Computers. Designed and built for Census by the Bureau of Standards, it promised a breakthrough in the input problem area.

The principle was based on field documents being position coded (by checking the proper box), microfilming the documents, and scanning the microfilm with an electronic beam. The detected position codes are written on the magnetic tape which is our computer input medium.

This early model FOSDIC served Census well. Several special tasks were successfully processed through its use. Its chief contribution, however, was in showing the way to a more versatile, faster, less restrictive system. Subsequently, Bureau of Standards and Census engineers collaborated on a successor, FOSDIC III. In the meantime, the Bureau of Standards had produced FOSDIC II which is used by the Weather Bureau to do a high-speed search on large punch card files which have been reduced to microfilm.

FOSDIC III captured our imagination. It features a completely programmable scan, permits tremendous flexibility in schedule and questionnaire design, and has such features as automatic calibration on each microfilm frame measuring dark level, light level; compensation for tilt or non-parallelism due to photography or printing; compensation for size variation in the filming reduction process; blank line elimination (conditional jumps over partially-filled out documents); and dominant mark, an ability to choose the darkest of several competing marks, thus eliminating the problem of erasures. It is plugboard programmed and has about 45 instructions and program loops. Iterations are possible as with internally-stored program computers. Documents are limited only to be 20″ x 14″ or less, and their microfilm counterparts will be translated to programmer-chosen codes on magnetic tape at about 100 frames or documents per minute. This works out to an average character rate of about 19,000-24,000 characters per minute. A tough rate for a key punch operator to match.

The 1960 Decennial Census

Our lineup of equipment as the big job builds to a peak is as follows:

- 4 — Univac Scientific 1105 Computers with 18 tape units each
- 2 — Univac I Computers with 10 tape units each
- 2 — 600 lines per minute High-Speed Printers, equipped with Block Buffers
- 5 — FOSDIC III units
- 1 — Card-to-Magnetic Tape Converter

A host of miscellaneous auxiliary equipment of a minor nature.

In early spring, 1960, the Census which touches every person in the Nation gets underway. Each household in the country will receive a simple form asking such questions as the occupants' names, relationship, age, sex, etc. Enumerators will visit every household to pick up the completed forms. They will quickly transcribe the information to a FOSDIC document and give any help needed to complete the questionnaire. At one household in four they will leave another form requesting information about additional housing and population characteristics. The form will be returned by mail and later transcribed to separate sample FOSDIC documents. A follow-up procedure will obtain information for incompletely filled forms or for householders that did not return this form.

At Field Offices all over the country, these FOSDIC documents will be assembled and sent to Jeffersonville, Indiana, for microfilming. Some 20 to 25 cameras will work full-time preparing microfilm reels covering each enumeration district.

The exposed film will be sent to Washington where our FOSDIC staff will work around-the-clock for several months reducing the data to magnetic tape. As each tape is completed, our electronic computers will take on the task of producing meaningful numbers from the data.

The computers' speed and capacity will enable them to produce complete tabulations for each enumeration district on the first pass of the estimated 14,000 FOSDIC-produced magnetic tapes for the 100 percent phase of the work. Consistency checks and complex editing rules will be applied by the computers to insure that they process only good data and reject those portions which require clerical review.

The final output of a Census, is of course, bound volumes of tabulated statistics. For this our High-Speed Printers will produce from computer prepared magnetic tapes, suitable tables which can be used directly for offset printing in the final publications. Complex cross-tabulations of the population and housing data will continue into 1962 on a large scale.

We can hardly call the process "untouched-by-human-hands" but a large bulk of the data is expected to require no intervening human editing or correction before its appearance in the final tables.

Statistics are a very perishable commodity. They are worthless unless produced when needed. Census hopes that the strides made so far in statistical processing will give way to even greater advances. The time scale for 1960 far exceeds any prior demands.

For instance, the State totals of population on which Congressional apportionments are based are required by law to be reported not later than eight months after the enumeration date. While the strides in automatic business processing for the last 50 years or so have been great, this requirement has never been met by any means other than counting by hand. No machine method for obtaining this count within the required time schedule has existed. The goal in 1960 is for the first apportionment count produced by machine in Census history. And the hope is that our combination of equipment, systems organization, remote operation, around-the-clock performance and 100,000 hours of computer experience will produce the result desired.

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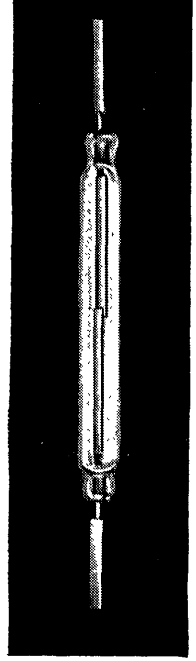
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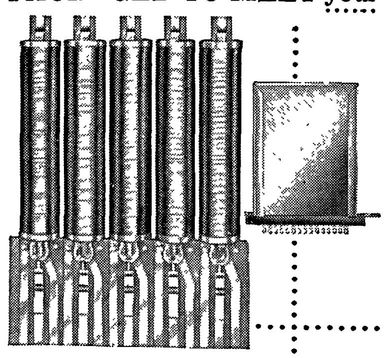
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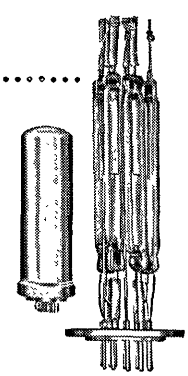
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NEWS of Computers and Data Processors

"ACROSS THE EDITOR'S DESK"

COMPUTERS AND AUTOMATION

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MAGNETIC-INK CHECK-PROCESSING COMPUTER APPLICATION

First National Bank of Arizona, Phoenix, Arizona, and General Electric Computer Department, Phoenix, Arizona.

— An intensive four-week course in computer programming and operation has been held by the General Electric Company's Computer Department in Phoenix for personnel of the First National Bank of Arizona.

Fifteen employees of the Bank, who represent all phases of bank operation, attended the course to learn such things as computer programming, operation, application of computers to banking procedures, and magnetic character recognition. The course, under direction of General Electric application engineers, was designed to familiarize Bank personnel with the new computer-controlled bank bookkeeping system to be inaugurated by First National Bank of Arizona "sometime this Spring."

Classroom instruction was held at the First National Bank headquarters here. Field trips for actual computer operation were held at General Electric's Deer Valley plant where bank personnel operated a data-processing system similar to that scheduled for installation at the Bank.

The First National Bank of Arizona is expected to be the nation's second bank to install a completely-automated demand-deposit accounting system using magnetic character reading. California's Bank of America began initial operation of such an installation last September.

The new system, developed by General Electric computer engineers, features magnetic character reading, and permits direct reading of checks and deposit slips. Thus, much costly and time-comsuming human translation will be avoided in transfering the information into the computer.

The computer system will do all daily check-bookkeeping tasks for First National Bank of Arizona at electronic speeds. General Electric computer engineers estimate the system will process 550 accounts per minute or 33,000 per hour. By comparison, an efficient bookkeeper -- with a year's experience -- can sort and post a mere 245 accounts per hour.

The First National Bank of Arizona has been preparing for the new system over the past several months. Bank customers are already being issued personal checks and deposit slips imprinted in magnetic ink across the lower edge. The checks are similar in appearance to conventional checks, with exception of the magnetic-ink characters.

The magnetic characters are printed in stylized Arabic numbers, running from 0 through 9, and can be read both by the eye and by the machine. They are imprinted in a special type font -- E 13-B -- developed by General Electric and approved by the American Banking Association. The figures, or code numbers, indicate the depositor's name, account number, bank branch, amount of check, and other accounting information.

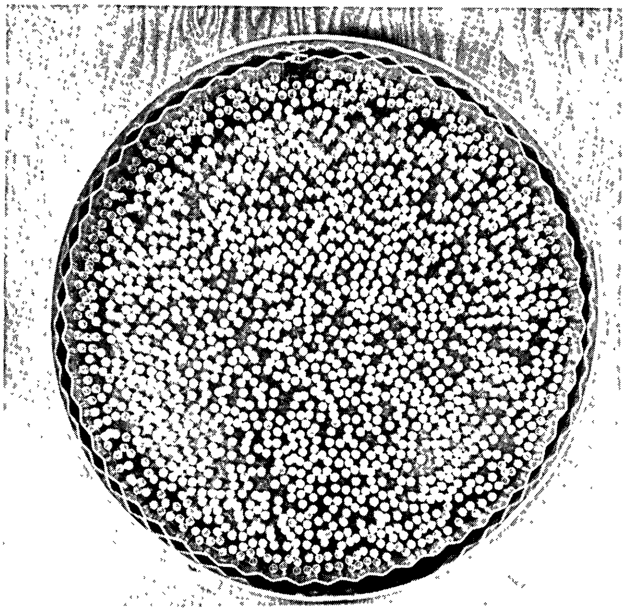
Bank officials expect the new computer-controlled system to permit faster, improved service to customers, with new standards of accuracy and reliability. When the new system is installed, it will initially serve all of the Bank's 25 branches in the Phoenix area.

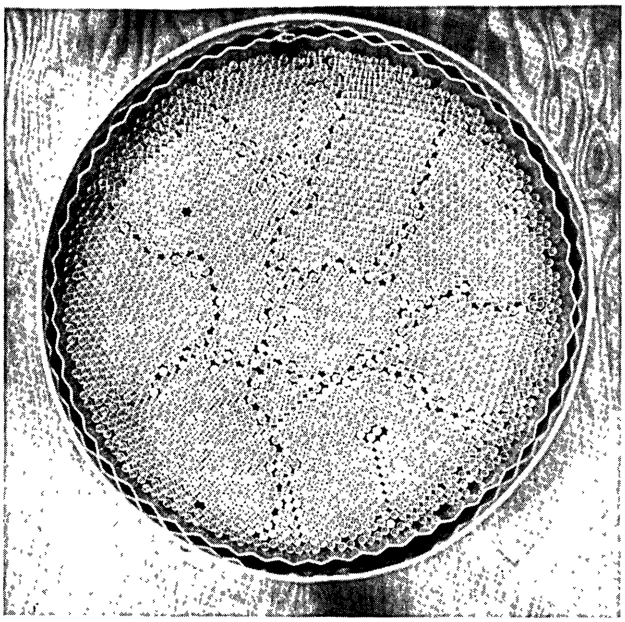
CALCULATION OF ATOM ARRANGEMENTS BY A MODEL

General Electric Research Laboratory, Schenectady, N.Y.

A mechanical model that demonstrates how atoms move in gases, liquids, and solids has been developed here. The new device, in which several hundred glass beads jostle each other on a vibrating platform, is helping researchers move toward solutions of an important scientific problem: how atoms move in liquids.

In the model, developed by David Turnbull and Robert Cormia, the glass beads are substitutes for atoms. They are poured onto a round glass plate with a "fence" around the outside to keep them from rolling off. The plate, suspended from springs, is vibrated constantly by a motor mounted beneath it. The constant motion leads the beads to behave as atoms are believed to. This behavior, in the model, can then be photographed and studied.





FENCED IN on a jiggling plate, hundreds of glass beads act out the role of atoms at the General Electric Research Laboratory. In this device, the beads are kept in constant random motion, similar to the motion of actual atoms. Above, the beads illustrate atomic behavior in a liquid: they are loosely packed, and no pattern is visible in their arrangement. Below, a "solid" has formed, and the "grain boundaries" between adjacent groups of atoms are clearly visible. The circular plate, approximately 9 inches in diameter, is kept in motion by a motor mounted beneath it.

"The properties of matter result from the interaction of many atoms," says Turnbull. "The long range objective of material science is to calculate these interactions and thereby predict the behavior of matter. However, precise calculations are extremely difficult and models can be of use by suggesting how such calculations may be simplified.

"Most models developed heretofore have had the shortcoming of not illustrating atomic motion. The unique feature of the present model is that the glass beads, representing atoms, are kept in the ceaseless random motion that atoms are believed to be in at all times. A remarkable number of the atomic interactions that are believed to occur in actual matter are illustrated by the model."

When only a few beads are poured onto the moving plate, the "atoms" behave as they do in a gas -- moving rapidly over relatively long distances between collisions with other atoms, and arranging themselves in no particular pattern. As more beads are added, the atoms travel shorter and shorter distances, although they are still moving rapidly and are showing no pattern. This condition represents atomic behavior in a liquid. As the number of atoms continues to increase, they eventually "freeze" into a solid -- becoming confined most of the time to a particular position, and forming a distinct pattern of several large areas separated by lines known as "grain boundaries."

By means of movies taken of the model, many aspects of atomic behavior are being studied, including the question of how the large areas of close-packed atoms enlarge themselves, pushing their grain boundaries out until neighboring small areas disappear. One drawback to the model is that the glass beads do not attract one another, as real atoms are supposed to do. Inside a solid material, however, such atomic attractions largely cancel each other out.

REMOTE CONTROL OF AN INDUSTRIAL SWITCHING LOCOMOTIVE

Union Switch and Signal Co., Division of Westinghouse Air Brake Co., Swissvale, Pa.

The Plymouth Locomotive Works at Plymouth, Ohio, has placed an order with Union Switch & Signal for remote control equipment to be installed in an office and on a locomotive, for in-plant demonstrations for customers of the practicability of operating industrial switching locomotives without the need for an operating crew. The equipment will make remote controlled operation possible. It will be offered by the Plymouth Works as an optional feature to buyers of industrial switching locomotives.

With this equipment an operator located at a point where the locomotive can be seen while working in its operating area can, just by turning miniature switches, release brakes, start the the locomotive, control its speed, apply brakes, stop the locomotive, and stop the engine. In addition, provision is made for reversing the running direction, sanding, and blowing a whistle.

Switches for initiating control functions are on a panel in a console-type cabinet. Twelve panel-mounted buttons are provided to remotely control the unmanned locomotive operation.

The locomotive apparatus consists of an equipment box 30" wide, 20" high and 15" deep, which houses a carrier receiver, a tone amplifier including a demodulating unit, and control relays. A receiving antenna is included. This equipment will operate from the 24-volt battery on the locomotive.

One set of office remote control equipment consists of a carrier transmitter, a tone oscillator, and a d-c power supply. The equipment will require 110-volts a-c power.

DEVICE PROVIDING HIGH-SPEED REPETITIVE OPERATION FOR ANALOG COMPUTERS

Electronic Associates, Long Branch, N.J.

A new device, which adds another important dimension to the art of analog computation, and which has been named High Speed Repetitive Operation, is now being produced as an accessory for all PACE 231R Analog Computers. This new device provides the operator of an analog computer with a highly accurate, extremely versatile means of solving a variety of engineering problems that would be difficult through "real-time" techniques alone.

For example, to obtain an optimum design in a problem with several variables, a great many problem runs are required. These are normally drawn on automatic recorders where speeds are limited by the mechanical characteristics of the recorders. With repetitive operation, the solution appears as a continuous plot on the 17 inch display screen. The effect of a change in the problem variables can be observed immediately on the display screen, without the necessity of resetting the equipment and drawing additional plots. When the optimum design is reached, the computer may be switched back to real time operation so permanent plots can be made of the final and more detailed solution.

High Speed Repetitive Operation is well suited to problems involving the simulation of servomechanisms, optimization of chemical, petrochemical and physical systems, and the solution of boundary-value and eigenvalue problems.

A computer equipped with High Speed Repetitive Operation can be operated either repetitively or as a real time simulator at the throw of a switch without loss of its real-time accuracy. Pre-patch panel arrangements remain the same in either repetitive or real-time operation and do not require the use of more amplifiers than on real-time studies.

Computing times of from 10 to 80 milliseconds are available, and may be controlled from either the Repetitive Operation Control Unit or the Display Unit. Both stepped and continuously variable control of computer time are provided to permit the operator to obtain maximum length of solution and avoid overloads.

The display unit consists of four chassis units in a single bay EAI rack and allows simultaneous viewing of eight problem variables plotted against time or seven variables plotted against an eighth on the 17 inch screen. In the Display Unit, 21 voltage calibration lines are references to computer voltage within 0.1%. Time lines are generated by a crystal oscillator accurate to 0.05%.

THE COMPUTER REVOLUTION IN NEW YORK STATE'S DIVISION OF EMPLOYMENT

Surrounded by a wall of punchcard boxes, Alfred L. Green, executive director of New York State Labor Department's Division of Employment, points to a model of an electronic computer system which will operate at the speed of light in dealing with the mountain of paperwork handled by the agency. Within 60 seconds, the computer will be able to absorb and memorize information equivalent to that contained on 30,000 punchcards. The single reel of magnetic tape he holds will contain the information now carried in a stack of punchcards 100 feet high. The computer will work on the records of the 400,000 employers in the State covered by the unemployment insurance law.

A completely transistorized data-processing system including computer and auxiliary machines is to be installed at the agency's Albany headquarters by January of 1961.

An eight-month study by a group of Division technicians indicates that the new system should result in a saving of $750,000 a year after it is in full operation.

Prior to 1960 the Division handled the unemployment insurance accounts of more than 300,000 employers; but during January 1960 100,000 more employers became subject to the unemployment insurance law, making a total of over 400,000 employers.

The computer and its auxiliary machines will automate a large part of the operations of the Unemployment Insurance Accounts Bureau of the Division. It will operate at very high speed in solving complex arithmetical problems and making

logical decisions. It will eliminate machine operations that now require at least a billion card-handlings a year.

About 40 per cent of the saving is expected to be realized through reduced rental costs for space and for machines that will no longer be required. The rest of the saving is expected from reduced personnel costs, mainly reduced use of temporary employees at seasonal peaks and elimination of overtime.

Not more than a dozen employees are expected to be needed to operate the new data-processing system. As a result, the Division expects that 130 permanent employees, including 20 supervisors, will be offered training and transfer to other jobs without loss in pay. "We hope and expect," Mr. Green has said, "that satisfactory reassignment of all permanent employees will be possible."

EXPERIMENTS FOR ULTRA-HIGH-SPEED COMPUTER REPORTED SUCCESSFUL

Ubon Kamata, Tokyo, Japan

The Telecommunications Society of Japan has announced that the Ultra-High Speed Computer Research Institute of Tokyo University -- which consists of three laboratories, Takahashi Research Laboratory, Amamiya Research Laboratory, and Motooka Research Laboratory, all of Tokyo University -- has successfully completed experiments for an ultra-high speed electronic computer. The speed of this machine would be 40 times faster than the present fastest computer in the United States.

The major element of the computer consists of the Esaki "tunnel" Diodes invented by Dr. Reona Esaki, Chief Physicist of the Semiconductor Laboratories of Sony Corporation of Japan.

Electronic switches in the computer are opened and closed at ultra-high speed and the speed of electronic computer is determined by the speed of switch opening and closing. The average speed of switching in electronic computers made in Japan up to now is about 200,000 a second. The average speed of switching in electronic computers made in the U.S.A. is as high as 700,000 a second. The test-produced basic circuit made at Tokyo University has a speed of 30,000,000 switchings a second, and it is reported to be both accurate and reliable.

By further improvements, the speed is expected to be increased to 100,000,000 switchings a second.

COMPUTER FOR THE PACIFIC MISSILE RANGE

Comdr. R. A. Barracks, Pacific Missile Range Headquarters, U.S. Navy, Pt. Mugu, California

A large electronic computer for military "space age" use in the United States, an IBM type 709, was "commissioned" on January 20 at this Headquarters.

The computer will enable the range safety officer to observe the position of a missile from the time it is launched until it impacts. The missile can be destroyed in flight within a second and a half if the computer reveals that it is off course. The computer will monitor flight paths ranging from short-range to an ICBM's impact more than 5,000 miles away in the Western Pacific.

Chief job of the new computer is to give missilemen an immediate answer to the question, "How are we doing?", while the test vehicle is in the air and after it lands.

A stream of information from telemetry radio sets in the missile, from radar on land and ships at sea, and from visual sightings flow into the data processing center. There in rooms at Point Mugu and the Naval Missile Facility Point Arguello, the 709's electronic equipment digests the information and "thinks ahead" of the missile in flight.

If the stylus tracing a line on the impact prediction chart shows that the bird is going out of control and threatens a populated area, the range safety officer immediately pushes a button and destroys it in mid-air.

SHELL OIL FIRST NEW YORK CITY CUSTOMER FOR IBM COMPUTERS-BY-THE-HOUR

International Business Machines Corporation, Data Processing Division, 112 East Post Road, White Plains, N.Y.

Shell Oil Company on February 9 became the first "do-it-yourself" data processing customer at IBM's recently opened Data-center in the midtown Manhattan Time and Life Building.

Shell inaugurated the new approach to data processing by renting time by the hour on the Datacenter's powerful IBM 709 computer to calculate the economics of petroleum distillation methods. At the same time, Shell is using the Datacenter facilities to ready programs and operators for next year, when Shell will take delivery of a solid-state IBM 7090 data processing system, one of the most powerful computers commercially available.

On February 9, IBM Datacenter personnel turned over the entire $2,500,000 system to Shell. The oil firm's data processing staff fed into the machine punched cards containing raw data on a distillation study and magnetic tapes telling the computer what to do with the data. In the processing, the 709, calculating at the rate of up to 42,000 calculations a second, produced a complete breakdown of all fractionation products and heat requirements of a large distillation column.

The basic results came off the 709 in six minutes, 800 times faster than they could have been obtained by a Shell engineer using manual computational techniques.

Shell, long a pioneer in advanced computing, has one of the largest installations of data processing equipment in its industry, with 19 medium sized IBM 650 computer systems located in Shell facilities about the country.

NEW POST OFFICE SYSTEM REDUCES SORTING TIME UP TO 58%

Automation Management, Inc., Westboro 95, Mass., and Broadview Research Corporation, Burlingame, Calif.

Sorting time reductions up to 58% have been achieved in a project conducted at the main sorting post office in Detroit, Michigan.

Results were measured by making before and after comparisons of the time it took first class letters bound for twenty typical destinations to pass through the office. The average time needed for the passage of a letter through the office, from dumping on the receiving platform to departure by train was cut by percentages of 9.3% (Erie, Pa.) to 58.9% (Chattanooga, Tenn.). More than half the delay reductions were by 25% or more, and one quarter were by 40% or more.

The delay reductions were achieved at the cost of one additional clerk. No new machines were installed, and the number of hours of labor required for the processing of a given amount of mail remained unchanged.

These seemingly extraordinary results were achieved by means of an operations research study which led to an improved understanding of what goes on in a sorting office and by means of better data reporting and interpretation.

The Post Office Department's Office of Research and Engineering assigned the prime contract to Automation Management Incorporated, who first made a detailed six-week study of all outgoing letters passing through the office. This information provided the basis for the operations research study conducted by Broadview Research Corporation as subcontractor through the agency of Bruce Payne & Associates, Inc.

The operations research study centered on a better understanding of the mail sorting process and the factors leading to delays. When mail reaches the sorting office after being collected from the mailbox, it is first dumped, and packages, large envelopes, etc., are removed. Stamped mail is faced (turned so that all letters have the same orientation) and cancelled; bundles of metered mail are slit open and stacked. Local metered mail can be isolated and removed at this stage. Other mail moves to a primary sorting area where it is sorted into about fifty categories by destination. The categories correspond roughly to states; but distant states are lumped together, while nearby states are split, so that the categories may be more nearly equal in mail volume. Mail from the primary destination categories is then further sorted into secondary categories in another region of the floor. Here the typical destination categories are cities and towns. Just before train times, mail addressed to cities along the route is tied into bundles, sacked, and conveyed to the train.

This is a greatly simplified picture of the flow of mail. In practice, the situation is complicated by special destinations (e.g., mail order houses), letter sizes, and classes of mail (e.g., air mail). The floor of the sorting office in Detroit may contain as many as 600 workers at peak hours.

Delays in the processing of mail result from the uneven nature of its arrival in the post office. More than half the day's mail arrives at the sorting office in two hours in the early evening. It is uneconomical to match the labor force to the input during the peak hours because this results in idle labor at other times. Therefore, unprocessed mail accumulates at the different processing stages.

A letter may spend 4 to 5 hours in the sorting office. Of this, about 1 to 2 minutes is the actual processing time. Another 10 minutes is the time needed to transport the letter between stages. The rest is waiting time.

The object of the operations research study was to minimize waiting time subject to existing manpower and facility limitation. For this purpose, a general theory of mail processing was developed. It is a special form of the theory of queues (waiting lines) developed in recent years by operations research workers. In general, it shows how to match manpower to mail input at all stages so as to achieve minimum waiting lines.

Special attention is required for minimization of delays at the secondary sorting stage, because use of manpower must be matched to letter priorities. At this stage some letters have greater processing priorities than others because they must catch earlier trains. A special formula embodying these priorities was derived and a simple graphical method of determining manpower assignments was developed.

To more fully exploit the operations research findings Automation Management Inc. has devised a data assembly method which will enable the shift superintendent to control and optimize the use of manpower on the sorting office floor. Using commercially available machinery and some special equipment, the reporting system will bring to a central console the current and cumulative data on labor used and mail processed and waiting at each station on the office floor. To this information decision rules developed by the operations research analysis will be applied to determine the best changes in manpower arrangements.

The improved manpower scheduling system was introduced in Detroit as it was developed, with the time savings indicated at the beginning of this story. Absolute savings in average letter processing time ranged from 22 minutes to 2 hours and 41 minutes; 12 of 20 destinations showed reductions of more than one hour.

Superintendents and supervisors at the Detroit Post Office have expressed their satisfaction with the scheduling system, and it remains in force.

All mathematical results have been expressed in simple form and optimization methods have been taught to general foremen and supervisors. With the assistance of Post Office Department personnel, a manual has been prepared which will permit any post office in the country to apply the same methods at no additional cost to the taxpayer.

It is noteworthy that this low-cost project (cost $85,000, of which $55,000 was for Broadview Research Corporation's operations research study) has achieved reductions of the time required for processing mail through a facility comparable to those achieved from some installations of more expensive automatic machinery. Results of this project are quickly available to all major sorting offices. Naturally the Post Office Department would like to reduce both the time required for mail to go through a sorting system and the hours of labor required for its processing. A major program for mechanization and modernization does involve problems of development and procurement which normally will require several years to complete.

The procedures developed in the Detroit Post Office have important implications for all processing industries where it is desired to minimize delay times of items undergoing processing. These include business where the working material is perishable (e.g., fruit canning) or has priority value (e.g., parcel services) and those which have high inventory costs (e.g., automobile assembly plants).

ORGANIZATION & MANAGEMENT OF THE DATA PROCESSING FUNCTION --

Announcement of Seminar, March 7-9, 1960

American Management Assoc'n.
New York, N.Y.

Chairman:
STEVENS L. SHEA, Vice-President, Data Processing, American Insurance Co., Newark, N.J.

Co-Chairman:
LIONEL E. GRIFFITH, Assistant Controller, International Latex Corp., Dover, Del.

Speakers:
ALBERT J. EISENBERG, Manager, Data Processing Dept., Bache & Co., New York, N.Y.
DONALD V. BIERWERT, Manager, Data Processing, Plastics Division, Monsanto Chemical Co., Springfield, Mass.
JOSEPH M. SAVAGE, Executive Director of Planning & Research, Planning & Development Dept., Prudential Insurance Co. of America, Newark, N.J.
LEO SYNNESTVEDT, Project Group Leader, Planning & Control, International Latex Corp., Dover, Del.
JAMES JUMP, Manager, Machine Data Processing, International Latex Corp., Dover, Del.

I. ORGANIZATION
Objectives and goals. Company needs. Organization charts. Responsibility and authority. Staff and line relationships. Level of reporting. Staffing and developing personnel. Policies. Systems and Procedures. Relationship with other functions.

II. PLANNING DEPARTMENTAL OPERATIONS
Long- and short-range planning. Manpower requirements. Salary structure. Cost and budgetary requirements. Data processing equipment needs. Scheduling workloads. Setting standards of performance. Analyzing existing operations. Planning an information retrieval program. Preparing work distribution charts. Determining degree of mechanization and equipment types.

III. DIRECTING OPERATIONS
Developing programs, projects, activities -- communications systems, manual, mechanical, and electronic data processing. Punched-card equipment, computers, other data processing equipment. Supporting programs and projects. Systems analysis and flow charting. Equipment operation, evaluation and practices. Programming. Machine coding. Forms design. Procedures and methods. Job realignment and employee training. Machine operation, supervision and maintenance. Program maintenance and development. Applications -- Sales, accounting, production and inventory control, payroll and cost control, personnel, engineering, others.

IV. CONTROLLING AND APPRAISING OPERATIONS
Performance measurement. Actual vs. goals. Variances from departmental plans. Performance appraisal. Setting performance standards. Establishing budgetary controls. Workload and production control. Evaluating systems, programming, and operator effectiveness.

V. IMPROVING DEPARTMENTAL OPERATIONS
Correcting and modifying operations. Research and Development of new methods and systems. Prevention of problems and pitfalls. Operations research. New equipment analysis.

VI. PROBLEMS OF ATTENDEES

INTERNATIONAL COMPUTER FEDERATION FORMED BY TWELVE NATIONS

I. L. Auerbach, Auerbach Electronics Corp., Narberth, Pa.

Twelve nations have ratified the statutes of the International Federation of Information Processing Societies, which will provide a regular common meeting ground for computer experts from all over the world. Although many countries, including the United States, have had their own professional computer societies, until now these groups have not had permanent, formal means of meeting and exchanging ideas.

The movement to form the new Federation was a direct result of the first International Conference on Information Processing, sponsored by UNESCO and held in Paris June, 1959. A provisional bureau for the International Federation was then established.

The countries whose national computer technical societies have ratified the statutes include Canada, Denmark, Finland, France, Germany, the Netherlands, Spain, Sweden, Switzerland, the Union of Soviet Socialist Republics, the United Kingdom, and the United States. In addition, Belgium, Israel, and Japan are in process of forming national computer societies to qualify for membership.

It is expected that the first meeting of the IFIPS council later this year will result in plans for a second International Conference on Information Processing with an associated technical exhibit in 1963.

Distribution and Electronic Data Processing: "Marriage" With Problems

Jerome P. Shuchter

Director, Market Research
Federal Pacific Electric Company
Newark, N.J.

(Based on a talk before an American Management Association Conference, New York, N.Y., October 28, 1959.)

In Newark, New Jersey, Federal Pacific Electric Company operates a complex of modern plants producing specialized electrical equipment for construction and industry. From its assembly lines pour assorted packaged products for the distribution and control of electric power — circuit breakers, load centers, switches, motor controls, instruments — more than 2000 catalog items, ranging in price from one to several hundreds of dollars. (Federal Pacific also operates an international network of other plants producing engineered electrical equipment approaching in bulk the size of a house, but these are not warehouse items and, as such, are not relevant to this present discussion.)

From Newark, 40,000,000 pounds of freight, packaged in our distinctive yellow and red cartons, enters our national distribution system each year. The bulk moves first to a strategically placed group of 17 warehouses. These provide a local pool of stock for a thousand authorized distributors. They in turn service many thousands of electrical and building contractors, and industrial and utility accounts.

Federal Pacific is a growth company. This year's forty million pounds of freight is 7 times the volume of a decade ago. As many people certainly know, the rapid growth process inevitably creates backward areas in corporate development. In the case of our company, particular attention has gone into product design, manufacturing, and selling. The distribution process itself — unglamorous and heavy with detail — took a back seat.

Finally, the sheer weight of the distribution system forced us to turn real attention to it. In 1959 we installed a RAMAC 305, I.B.M.'s small-scale computer, which features a gigantic memory and quick access to an extensive file of data. Our studies showed beyond question that the machine had the capacity and know-how to handle our supply system.

Nonetheless, for the past six months we have been "spinning our wheels on the track" with annoying lack of progress. Our first efforts proved disappointing. The system now is being re-built on a more substantial basis; this time we think we have hit the right "combination."

In this case history study, with its frank exposition of what happened, I hope you will find lessons applicable to your own business.

An article in a recent issue of **Fortune** has taken much of the stigma off of our initial lack of success. It shows that in this, as in other areas, there are no unique experiences; we shared ours with a good cross-section of American business.

The Distribution Function

I have indicated that distribution was an important, but relatively less scrutinized phase of Federal's operations for many years. Oh, we expended a normal amount of planning on the activity, but our seven-fold expansion in volume just left our plans behind.

We had no director of distribution nor any really consistent concept of the distribution function. We had a traffic man in there, someone scheduled shipments, someone backed the process up with production schedules, someone modernized and laid out new warehouses, someone bird-dogged the activity as an arm of marketing, policed warehouse expenses and counted inventories. But these were separated in different departments, with insufficient common direction and policy.

Warehouse Policy

We backed into our general warehouse policy some 10 years ago. There was a meeting in the chief accountant's office attended by the production manager, the sales manager, and the market research director. With sales expanding rapidly and freight costs mounting, we had to reach an understanding about the function of warehouses. Two different concepts were under consideration:

(a) **The emergency stock theory:** were warehouses to be used only to provide local emergency stocks to our distributors? Under this theory bulk shipments would normally be made directly from our central warehouse at Newark.

Or: (b) **The bottomless cup theory:** were warehouses to be a full-dress distribution channel with large stocks available locally? Under this theory our distributors could stock lightly and be assured of an unlimited secondary source of supply.

On the table were surveys backing the emergency stock viewpoint. They showed the tremendous inventory saving that could be achieved through this concept. They showed conclusively that direct less than carload shipments to customers were more economical freight-wise than through use of the warehouse as a way station.

Change of Decision

We reached an easy decision that day — and had to toss it out the next month! The pace of industrial and corporate growth almost passed us by. There was no way in the world we could hold to the emergency standby concept if even one of our major competitors took the road to all-out customer service through large local back-up stocks. And many of our competitors did take that road.

The bottomless cup theory carried the day. It proved to be an expensive alternative. Seventeen bottomless cups take a lot of inventory, and Federal Pacific Electric was ready, had to be ready, to join the game. Comparing sales-to-inventory ratios with other members of our industry we found we were being very generous to our far-flung customers. We were, as a company, willing — had to be willing — to make the monetary investment in inventory. But in the many tasks confronting each of us in a period of extraordinary growth we neglected the further investment in brains, manpower and equipment adequate to cope with the total problem.

Checks and Balances

I guess there never was a marketing manager who thought he had too much inventory — or a finance manager who figured he had too little. There never was a production manager who thought production runs long enough — or a marketing manager who didn't prefer more frequent and smaller runs. These differences set the checks and balances to total inventory position within a company.

The push and pull of these and other factors bring the distribution system sharply into the limelight from time to time. Yet the distribution process itself is strangely unresponsive to internal company pressures. The needs of the vast market form a shifting kaleidoscope of demand which requires more than part-time attention.

Record-Keeping a Livelihood

By-and-by each department finds more rewarding activities than slotting 2,000 kinds of merchandise into seventeen warehouses and supporting the flow with adequate production plans. The details of operation shift back to a secondary staff of lieutenants for whom record-keeping is a livelihood rather than a means to an end. The activity turns from a concept of reorganization and correction to one of filling holes, plugging gaps — improvisation and doing one's best.

Sam O'Toole

Let me describe the distribution system of the early growth days of Federal Pacific Electric in terms of Sam O'Toole — a familiar figure in any company.

Sam was the 1949 version of RAMAC. He guided the destiny of our stock from its source for many years. Orders and memos tucked in every pocket like a buccaneer's guns and knives he charged through each day as though it were the decisive moment of human history. Rightly trusting no records, his first daily act was to march through the central warehouse taking mental stock. Then up to the production line where half-finished devices lay awaiting the touch of the final assembler's hand.

Emergency! ABC Distributor had placed an order for 12 400-amp three-pole solid neutral switch devices three months ago. The order had been misplaced and there was the salesman, Sam's buddy, on the phone crying his heart out, facing cancellation of the $600 order and other reprisals too terrible to mention. The card inventory shows "zero."

Enter Sam O'Toole! From the dark recesses of the stock room he drags three of the devices. His friend, Jake the foreman, will convert two more from similar units. Up in the factory Sam has spotted five almost complete assemblies coming down the line. He drags the plant manager — no lesser mortal will do — to the spot and stands panting as the foreman is ordered to stop all work until the devices are complete. That's ten down and two to go. In a flash Sam has wired the St. Louis warehouse that the switch they will receive today is to be airfreighted back to Newark. And finally Sam calls a Paterson distributor who's sure to help him out by returning a switch he has in stock. His task complete, Sam calls the salesman to promise shipment of eight switches today and four tomorrow and knows in his heart that this was a job well done. Sam, by the way, was also the best pitcher our softball team ever had.

The Feasible Control System

The amount of effort and manpower — and finally the expenses — thrown into the solution of this problem have been one of the greatest variables in company operation. I've called attention to the Sam O'Toole approach, but this was only an early version of a tug-o'-war that has occupied us throughout the years. The re-enactment of the drama of over-controlling and under-controlling warehouse inventories recurred over and over.

What I would like to suggest here is that this process is not the chaos which some of my earlier comments might imply. In each historical setting internal company pressures tend to create a control system which is feasible, profitable and applicable to the period. As in your companies, we follow the squeaking axle theory of greasing.

For example, many of you, I am sure, maintain records at your central warehouse which paralellel each warehouse's records. You show each item's inventory status at each warehouse location and post the ins and outs which affect the total. You doubtless require periodic reports from each warehouse for proper balancing.

We eliminated the parallel records for several years, threw in a few elementary reports and auditing controls, and found that we had lost little in the process. The step was keyed to our stage of development at the time.

Another push-pull affair was the responsibility for stock replenishment orders. Sometimes the task was placed in the warehouse's lap, sometimes it was under home office control; sometimes we used a min-max system for selected items, sometimes not.

In some of this effort we were probing for permanent solutions, in some we were simply accomplishing a necessary task in the most efficient, most expedient, most economical way.

At the end, when we determined that the time was right for RAMAC, for a fully controlled warehouse inventory system, backed up by appropriate production schedules, this was the picture:

(1) Our total inventory was unbalanced in vital respects.
(2) The dollar value of our inventory was excessive by industry standards.
(3) There were numerous instances of poorly placed inventories.
(4) The company was operating a vast distribution network on a scale that demanded improved controls.

The Installation of RAMAC

The mistakes that can be made with a computer, the frustrations of mis-use of a splendid piece of equipment, and the early marriage problems between a mechanical system and reality have been amply publicized.

The elements of the approach we used were deceptively simple. As items are shipped from any warehouse, RAMAC is notified and renders an invoice. As the invoice is typed, a series of inventory records are up-dated to new balances. If stock runs low, warehouse replenishment orders are issued to re-stock the warehouse. And finally the whole ebb and flow of stock is evaluated continuously to determine production requirements.

Thus if our Dallas warehouse has sold enough units of Product X to decrease its stock below its minimum, RAMAC issues the replenishment order to ship enough stock to restore its maximum. As a result of the shipment, central warehouse stock may be reduced below its minimum and RAMAC will write up a production order to restock.

Initial studies showed that if the process could be efficiently accomplished, inventories could be reduced by a fourth (several millions of dollars), every item would be constantly in stock where needed and a new era would prevail in relation to inventories and production planning problems.

Ideal Requirements

The ideal concepts which guided us were the following:

In our view, first and foremost is the ideal of never losing a sale for lack of inventory. Stock must be constantly available in adequate supply at the point of sale. Our studies showed that disposition of inventory was all-important, that we could handle more sales with less inventory, if only we could solve the problems of correct allocation.

Another part of perfection is minimization of freight costs through economical shipments. We at Federal Pacific rate this factor as important, but not crucial. The solution of the primary distribution problem, even if it involves some additional initial freight expense, would lead to fewer emergency shipments, more efficient handling, better space utilization, etc. In the long run, our studies indicated, we would minimize freight rates as a matter of course.

A third element of perfection is a synchronized flow of stock. The perfect system requires that the new stock reach the warehouse the day the old stock is exhausted. This goal can of course only be approached within reasonable margins.

A fourth element of perfection is to have the process of control pay its way. To us in Marketing — any expense would be justified to achieve the primary ideal. Other management inclines to the harder view that the economic justification has to be in some cold figures rather than in subjective expectations.

To finance each million dollars of inventory costs us some $50,000 annually, to pick a rough figure. To pay for itself a system must fit into that framework. Since this is approximately the plus-cost of RAMAC we set as our first objective the reduction of inventories by $1 million. The plus features we expect to get in terms of increased sales, better space utilization and efficient administration are extra benefits. And of course we visualize an inventory reduction bigger than this first million.

Going on to RAMAC

We can't say we weren't warned. The first advice we received from the computer industry five years ago was: don't rush in! Bring in specialists, set up a committee, assign an executive to concentrate on the problems and applications for one year, two years. Soak up know-how; then go in with your applications.

We followed an expedient version of this approach. We obtained a procedures man and a specialist well in advance. Some of us dutifully attended briefing courses, but when it came to the installation-date — we remained inadequate to the task. Willy-nilly we joined the two out of three outfits whose first applications have had to be described as false starts.

In the process, as I now see it, we made the following errors:

(1) **The pedestal error.** This marvelous equipment is set up on a pedestal and expected to perform magical maneuvers far above the common range of past company experience.

(2) **The "leave-it-to-experts" error.** The terms and potentials of the equipment are so far outside past management experience that the working-out of problems is left to the experts. Usually these experts have limited ranges and solve problems expediently rather than in depth.

(3) **The remote control error.** In the press of other duties, executive administration of the system deteriorates into passing on procedures rather than shirt-sleeve participation.

In short the know-how of a going organization from executive to clerical levels is somehow ignored and rendered ineffectual while the abracadabra of the computer jargon grows with a life of its own.

The results in the case of Federal Pacific were: (1) The procedures established were much too elaborate, much too sophisticated, for the stage of development of the company's distribution system; (2) The voluminous reports were fraught with error and inadequate for action; (3) The installation failed to enlist the cooperation and support of the people who had to work with it.

Corrective Steps

We were faced with a stern alternative. Make it work or toss it out!

These are the steps we have taken to date:

(1) **Tightening internal paperwork.** RAMAC demands near-perfection in its input. We learned that clerical processing makes thousands of unnoticed and trivial corrections, interpretations and adjustments — something like the tiny corrections you make while driving — which RAMAC can only partially duplicate. It cannot improvise like Sam O'Toole. The paperwork must be organized and shaped for machine use.

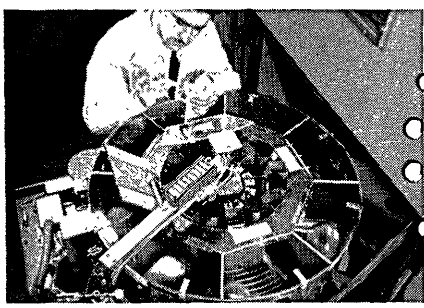
In our case this has meant an upgrading of personnel at the source of records, as well as improved formal methods.

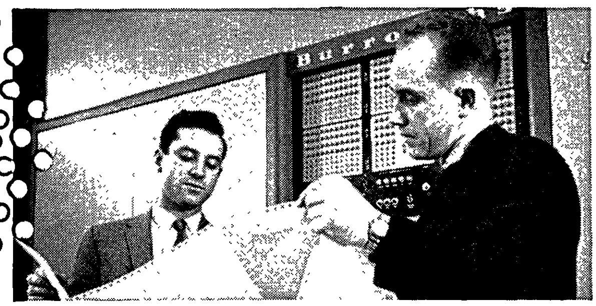
(2) **Knee-deep administration.** Responsibility has ben firmly assigned to a corporate officer. Not only must he make the process work, but must involve all administrative personnel whose task involves use of the results. There are no more on-lookers.

(3) **Simplified methods.** The initial formulation we threw into RAMAC was of the womb-to-tomb variety.

A Statement from Francis C. Brown, Chairman of the Board and President, Schering Corporation:

"In behavioral research alone, our Burroughs computer has multiplied our productivity by 100 times!"





Dr. Francis Mechner checks computer's daily results with Ronald Ray.

"We, at Schering Corporation, have grown accustomed to miraculous developments in our industry. So many advancements have been made in pharmaceutical research in the last two decades, we are convinced that we may indeed be on the brink of a pharmacological revolution.

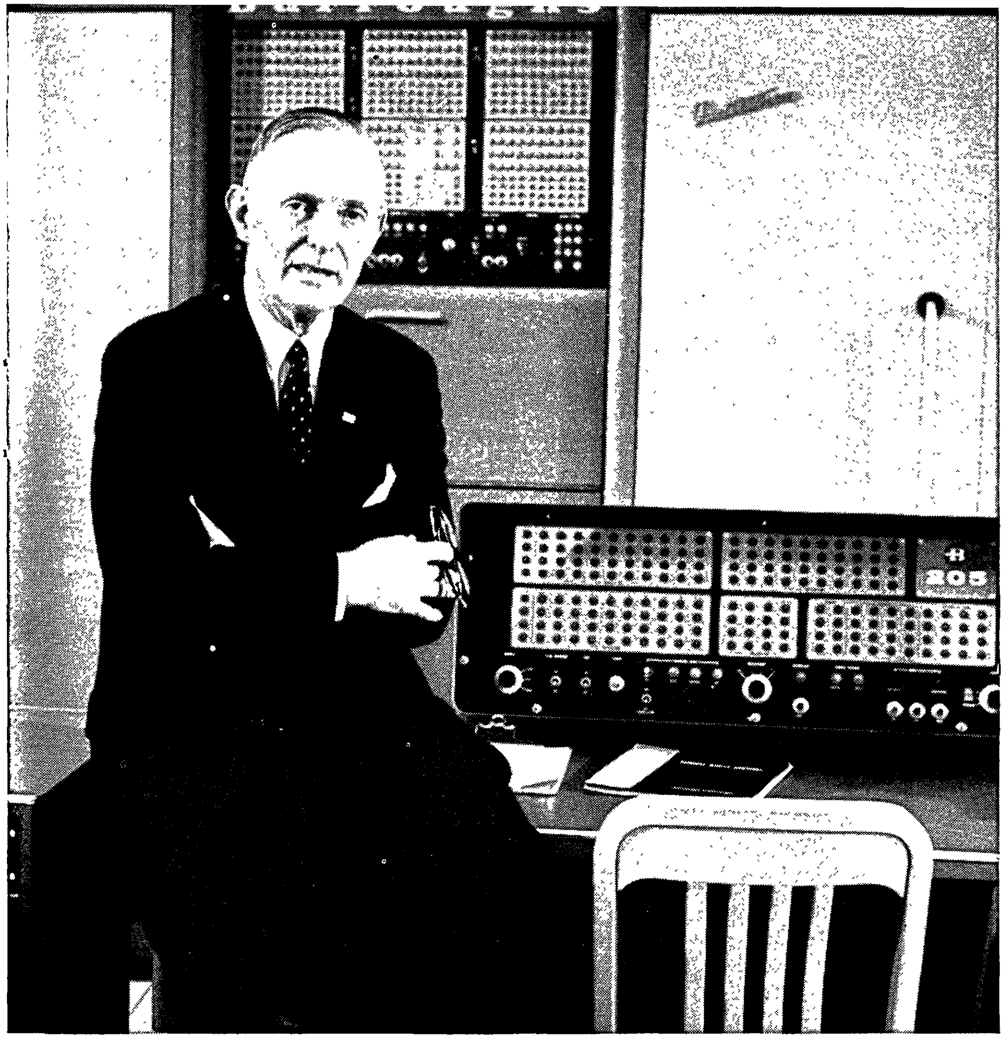
"Yet, there is so much more to be done, so many new avenues to explore, that we recognize the only real source of continued development is through expanded research efforts. Through research, Schering has already created several of the world's leading ethical drugs... major emphasis has been on cortical hormones and antahistamines. Some, like Coricidin, have become household words.

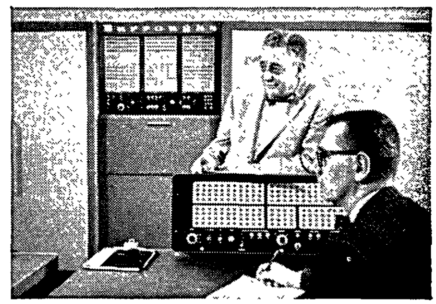
"While the results of research are sometimes dramatic, there is little of the miraculous in the day-to-day explorations made by pharmaceutical scientists. For one thing, pharmaceutical research is expensive... costs are over three times more per sales dollar than all other industries and rising substantially each year. Findings are often inconclusive and only a small portion ever reach fruition in a marketable product. And with a diversified line of products such as ours, we must maintain research projects in many different areas simultaneously. Even with the newest and most successful discovery, a competitor may enter the market with a better product that puts yesterday's 'miracle' out of favor.

"Yet, a relentless search for new products is a necessity. It is the only reasonable assurance of the continuing health of our own business enterprise. Today we are conducting extensive experimentation with chemical molecules of known pharmacological properties. The object is to achieve radically new pharmacological results by means of various alterations in chemical structure. Once achieved, these new compounds must be evaluated in laboratory animals. The methodology of this program is exemplified by an experiment carried out in Schering's Behavorial Research Laboratory. Here, eight highly trained rats take their turn in succession night and day, at a testing station where their behavior is recorded and then analyzed by computer. This is the type of experimentation in which the behavorial effects of drugs are tested in animals. The results of these experiments permit predictions concerning the effects these drugs will have on man.

"With thirteen experiments of this type proceeding on a continuous basis, the volume of data generated could never be handled without the aid of a computer. The Burroughs 205 performs computations every day which the staff

PHOTOGRAPHS BY J. ALEX LANGLEY





Dr. Bradley Whitman, Director of Research Services, confers with Gordon B. Thomas, Biometrics Manager.

of Schering's Behavorial Laboratory would require years to complete. The computer's final output is in the form of tables and graphs which are then studied and interpreted by psychopharmacologists.

"The decision to install a Burroughs 205 computer was upheld by a need to provide rapid, complete and economic analysis of the data which is produced by the research division at great cost. We investigated the computer field thoroughly, and after careful study and professional consultation, our technical people believed no other computer met our requirements so well. One of our scientific programmers, Biometrics Manager Gordon B. Thomas, was particularly impressed with the 205's ability to handle large masses of data with the power of a large scale computer... and at less than half the cost. Mr. Thomas felt the 4000-word memory of the 205 greatly facilitated the execution of research programs, many of which exceed 10,000 steps.

"In our research projects alone, the 205 has earned its keep. Dr. Bradley Whitman, head of Research Services, reports our 205 computer is turning out fast, accurate results at a cost we could never have realized by any other method. Research scientists are freed from time-consuming data collecting and may now spend more time on creative work.

"In addition to serving as a research aid, our 205 has provided us with other benefits as well.

"Our Procedures Department Manager, William B. Spencer, points out that the 205 is completely compatible with our commercial needs as well as research. In fact, our recent purchase of additional Burroughs peripheral equipment will allow us much greater capacity for commercial applications.

"As we expand and broaden our search for new products, we expect commensurate growth in other areas of our company as well, and we are confident that our 205 computer, with its modular expansion features, will keep pace with our computing needs."

FRANCIS C. BROWN
Chairman of the Board and President
Schering Corporation

Hundreds of other scientific and commercial users of Burroughs computers are confirming the same experience. Burroughs complete line of electronic data processing equipment is backed by a coast-to-coast team of computer specialists, all eager to tell you how Burroughs can help in your business. For additional information, write ElectroData Division, Pasadena, California.

Burroughs Corporation *"NEW DIMENSIONS/in electronics and data processing systems"*

Every step was organized into a beautiful model. The machine internally calculated a minimum-maximum level for each product, the relationship of field stock levels to central warehouse levels was cleverly spelled out, and the production orders were created with ingenious attention to the needs of our farflung distribution system.

Unfortunately, we planned to install this formula not by leaping successive hurdles over a period of years, but in one gigantic pole vault.

We found this would not work. We needed an evolutionary, organizationally-directed approach rather than the **deus ex machina** devices which soar with the wings of imagination, but fall to the ground in the trial spin.

We have therefore reverted to methods which duplicate clerical methods commonly used. Some later day, when stock rotation aproaches efficiency, we will introduce more sophisticated concepts for machine handling.

(4) **Human intervention.** One of the problems of mecanical methods is that raw-material for human judgement moves out of sight — into holes in punched cards or magnetic charges on spinning disks. The machine renders a series of judgements, as instructed, and man, at the end, is confronted with a wide array of end results. Somewhere in the process the conditions for evaluating the results have gotten lost. Sometime, maybe tomorrow, we may again have to resort to Sam O'Toole's methods to handle a problem.

In initial stages, human intervention must be frequent. The machine process must include significant read-outs of background factors. In short, at this stage, the machine is developing — with more speed and accuracy — into a reasonable facsimile of a crew of efficient clerks.

(5) **Evaluation and planning:** We are focussing a continuous spotlight on the method itself. Further uses of the equipment will have the widest and deepest scrutiny so that the first naive errors in application are not compounded. False starts are extremely expensive in equipment and manpower — not to mention morale.

On the Second Stretch

Without question, the system is starting to roll and we are well on the way toward balancing out our stocks; the new gears are starting to mesh.

We believe the marriage of RAMAC to reality will be happy and fruitful.

In pulling in our horns, in backing off from a highly imaginative to a more practical approach to the distribution problem, Federal Pacific is, I believe, facing the realities of the moment. But there is a higher reality which is also within our field of vision. Beyond the prosaic use of RAMAC as a substitute for a dozen clerks, there is a potential for lines of development far beyond the capabilities of a clerical staff. The use of e.d.p. equipment as a mere substitute for a dozen pencils is as unschooled in its way as the attempt to turn it into a master-mind overnight. My point is not that perspective should be eliminated, but that it should be programmed.

It is wholly possible that our abandoned program may now become precisely our program for 1963. We can take advantage of the machine's voracious appetite for facts to introduce indices of market conditions or seasonal factors as a thermostat for inventory levels; we may take advantage of the capacious memory system to store rates of sales at levels we never found expedient in clerical activity; we may use the machine's capacity for integrating a vast assortment of factors to shape a unique forecasting method. We may gear the system to the size of economical production runs and economic shipping weights and freight time. As we achieve some or all of these goals we close in on our objective picture of perfection.

Distributor Stocks

Beyond these concepts lies yet another fertile field of exploration. When we have solved and automated our warehouse supply problems, what of the step beyond? Distributor stocks are nothing but miniature warehouses. If we can control our own warehouse inventories with economy and precision, what of the next step, introducing similar controls on distributor inventories? The RAMAC or other brain would, under this concept, constantly evaluate the distributor's stock in terms of his sales rates, market and seasonal factors and, when necessary, speed a shipment to the distributor's shelves.

The Best Concept of Warehousing Function

We would at last find a better answer to our theoretical debate on the warehousing function. Neither the "emergency stock" theory of warehouse replenishment nor the "bottomless cup" theory is correct. Both are inverted; the best system is the one which most efficiently and economically delivers the product from factory to the user, minimizing costs and prices and maximizing profit. We might call this the "lean and hungry" approach, which benefits both manufacturer and distributor.

The central control of distributor inventories, a problem of control on a truly massive scale, would be a qualitative change which a computer makes feasible. It will be feasible, of course, only when the machine proves its ability to make decisions as good or better than the distributor himself.

It is at this later stage that the continually mounting costs of distribution can be halted. The science of distribution can then pass upward into more creative and selective channels than the basically mechanical problem of getting stock to the right place at the right time.

DIVISION OF LABOR

"I'd say the machines do 90% of the thinking around here . . ."

THE "SPACE RACE"?

Dr. Eberhardt Rechtin

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, Calif.

(Note by Neil Macdonald: This article is based on a talk given before the Electric Club of Los Angeles, November 16, 1959. It points out some factors which will certainly affect the market for computers in missiles and space vehicles.)

Over the past two years there has been a great deal of discussion about a situation called the "space race." There have been statements that the United States is involved in such a space race. There have also been statements that the United States is **not** in a space race at all, but is pursuing an unhurried, but scientific, exploration of the space environment.

It would seem that the first question to be answered is whether or not there really is a race.

Is There Really a Space Race?

A race has certain required elements. There must be a reward or a prize. There must be a significant achievement which must be accomplished in order to acquire this reward. There must be an interested audience. And there must be at least one participant. It is worth noting that it is not necessary to have two participants in order to produce a race. We can all think of examples of a single participant who is racing against time, or racing to beat his own previous record, or racing as a sheer and often beautiful exhibition of skill and strength.

If the ingredients of a reward, a significant achievement, an interested audience, and at least one participant are taken as the criteria for a race, then there most certainly is a space race, since we have at least one highly demonstrative participant, the Russians, and we have ample evidence of the achievements, rewards, and interest to the audience.

Let us then consider the race from the point of view of the Communist government and society of the USSR. The Russian Communists have certain over-all objectives. They want a strong Russian Communist society. They want to expand their sphere of influence. And they want an increasingly favorable economic situation for Russia; i.e., they wish a higher standard of living, greater productivity, and a favorable world market, which will permit them, in capitalistic terms, to make a profit.

The Russian Communist government must therefore decide if these over-all objectives would be met by putting money and energy into space activity. There is not much question that the original Soviet missile program was a direct consequence of a military need to counter our Strategic Air Command. In the simplest terms, it was necessary for the Soviets to be able to fire at and over the SAC bases and to be able to fire accurately and swiftly. The Soviets therefore had considerable incentive for a missile program. At about the same time, the United States recognized this Soviet move and consequently also embarked on a missile program with considerable incentive. However, this missile program, although it has been essential in producing large boosters, is not the same thing as a space program. This difference is evident even in the Russian program. According to the Soviet scientists, it was no simple task for them to get their space program started. As a matter of fact, it apparently took several years. According to one possibly apocryphal story, a very serious question was raised in the upper Soviet government circles as to whether or not the Soviets should launch space vehicles at all. Evidently, so the story goes, certain members of the Soviet government were very seriously concerned that such space activity might trigger the United States into engaging in this race of missiles and space before the Russians had a sufficient advantage. In other words, these Soviet officials felt that they would like to have the United States sleep on a bit longer. However, the decision was made to fire satellites and so the space age began. Judging from the results, it appears to me that neither the Russians nor the Americans remotely guessed the prizes which the Russians would pick up as a result of their success. The Russians probably guessed a bit better than we did, but there is ample evidence that even they did not understand the full implications. I base my opinion on the fact that the Russians are evidently still going around picking up prizes which, had they foreseen the situation, they would have been prepared to pick up a long time ago.

The Prizes

What are the prizes which the Russians have picked up in these early laps of the space race? They are well worth looking at in a little detail. Some of the prizes can be valued in cold cash. The Russians probably spent on the order of 500 million dollars in order to launch the first several Sputniks. As a direct result of these launchings, Russian technical prestige took a large discrete jump upwards in the world market. Making a highly conservative guess of the cash value of this jump, based upon the size of the world market and the size of various governmental expenditures, the first several Sputniks meant a return on the world market on the order of five billion dollars. Therefore, by spending five hundred million dollars the Russians got back about

[Please turn to page 18]

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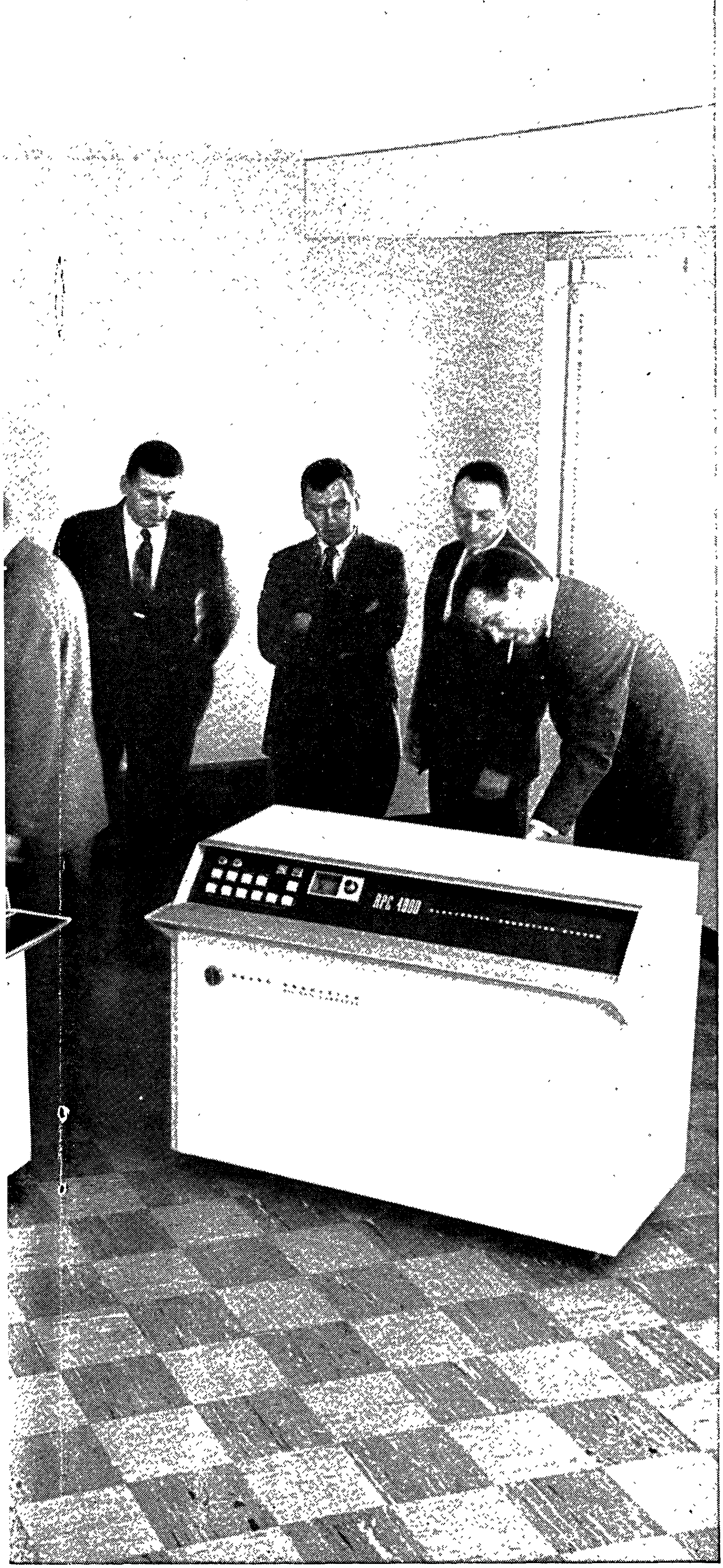

The RPC-4000 is a new, fully-transistorized electronic computing system with the largest memory, greatest problem-solving capacity and flexibility in the low- or medium-priced field. It is the latest member of a growing family from the people whose LGP-30 has become the world's leading small-scale computer.

Wide range of applications: the RPC-4000 has been designed for engineering, scientific, business data processing and management control functions. Such jobs as product and process design, statistical analysis, research, inventory control, payroll and sales analysis are all well within its capabilities.

Easy to use: the RPC-4000 is simple to program and operate. Royal McBee compiling and translating routines allow even non-technical personnel to obtain maximum results. Versatile command structure gives programming speed and flexibility.

Available at low cost: high capacity, flexibility and ease of operation make the RPC-4000 the outstanding computer value on the market today.

Minimum operating costs: the RPC-4000 requires no site preparation or special maintenance. It is powered from any ordinary wall outlet.

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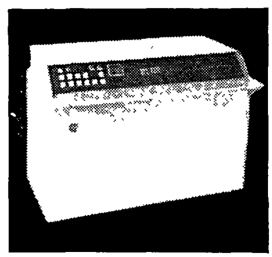
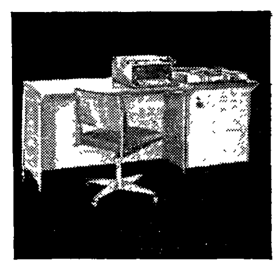
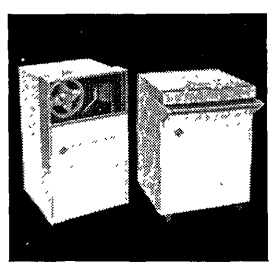


Heart of the RPC-4000 system is a new transistorized computer with advanced design concepts that provide substantial computing speed and capacity in a low-cost unit. Magnetic memory drum stores *8008 words.* Operating speeds are as high as 230,000/minute.



Standard input-output is a tape typewriter system which includes a Royal electric encoding-decoding typewriter complete with desk and chair, plus a tape punch-read console. Read speed is 60 characters/sec., punch speed 30 characters/sec. Typewriter, punch and reader may be interconnected in any combination for both on-line and off-line operations.



A new 500 character/sec. photoelectric tape reader and a 300 character/sec. punch are available as optional input-output equipment. A magnetic tape unit and a line printer will be available soon. As many as 17 input-output devices (60 with minor modification) may be connected on-line to the basic system. All peripheral equipment is under automatic program control of the computer.

Royal Precision Corporation

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. RPC-4000 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing Offices. For full, detailed specifications on the new, transistorized RPC-4000, write

ROYAL McBEE data processing division, Port Chester, N. Y.

ten times that amount. Let me illustrate the economic effect with a story: Suppose that you were a civil servant in South America or in Asia and you were responsible for choosing a contractor to build a bridge. Because your own country has no bridge-building contractors, you must look to other countries of the world. We will consider two cases. First, consider the case when you are trying to decide on this contractor in about 1954. You would probably consider obtaining your bridge from the United States, the United Kingdom, or perhaps, West Germany. It is unlikely that you would consider a Russian contractor too seriously. For the second case, let's change the date to 1958. The countries which immediately come to mind to perform this technical task of building a bridge are now Russia and the United States.

Well, the prize of technical prestige in obtaining more of the world market is relatively obvious. Another prize, very easily overlooked by us, is an advantage which is probably of even greater value to the Russian Communist leaders. The Russian Communists have clearly identified themselves in the minds of the Russian people with the success in the space race. The Russian people understandably and justifiably are quite proud of this remarkable technical achievement. Such an achievement is an enormous boost to nationalism and patriotism, and the Russian Communists have succeeded in adding this asset of patriotism to support for Russian Communism. The Russian Communist government is now in far better standing with the Russian people: this is evidenced by at least two facts. The first fact is that the absolute dictator of Russia could afford to be out of his country for a period of three months. Secondly, we no longer hear the assertion that "if we could only reach the Russian people directly, they would overthrow the Communist yoke." Such talk no longer seems realistic.

The Sputniks also greatly changed the world picture of the average Russian. I was talking to a Norwegian the other day; he remarked that the stereotyped picture of the Russian used to be something between an ape and a Tartar on a frothing horse. The massive, violent, not too intelligent, Russian bear is no longer a very good caricature of the country that can launch space vehicles: It would have to be a pretty intelligent bear that would take pictures of the far side of the moon. This re-evaluation of the Russians has also shown up in such things as very well attended classes in Russian at the Jet Propulsion Laboratory. The attendees recognize that it is going to be altogether worthwhile to be able to listen to what the Russians say **in Russian.** Not too many years ago, the attendees would have been investigated by Senator McCarthy.

Continuing on our list of prizes: we find that the Russians have managed to demonstrate to the world the detailed characteristics of their ICBM technology in a way which is perhaps even more effective than going to war. Not too many years ago, it was a question whether the Russians had any rockets at all. Then the question changed to whether they had very much thrust to their rockets. Until very recently there was then the question of whether or not, given a large thrust, the Russians could hit anything with their rockets. The only remaining question, now, is whether the Russians can recover a device from a long ballistic flight outside the atmosphere. It is reasonable to expect that demonstration within about three months. The Russian demonstration of ICBM technology has been almost oriental in the air of mystery which has been given to it. The Russians have yet to show the U.S. a picture of their ICBM, perhaps because a picture tends to dispel some of the mystery. And yet, the Russians have essentially told our military people that they have rockets which are more than capable of landing sufficient payload anywhere on the earth with an accuracy of five miles or better. They have shown us the threat without telling us how to build the club.

It is probably no coincidence that the Russians began mentioning (and we began considering) coequal summit meetings just after the launchings of the Sputniks. It is now no longer Russia, Great Britain, and the United States as the three great powers; it is now Russia versus the West, even up. That particular prize Mr. Khrushchev probably appreciated very quickly after the first Sputniks.

However, there was another prize which he evidently did not see (or choose to exploit) until very recently. This prize was the direct association of the space successes with "the results of forty years of communist society" as a compelling argument in the Communist conversion campaigns. We often disposed of the earlier claims of the Communists that their political society was better than our political society by a simple comparison of our standards of living. Now, however, Mr| Khrushchev has made it quite clear that he wishes to compare not present status but rather rate of progress when considering the two societies. The Soviets have recently added another element to this particular line by announcing that they were now going to make loans on the world market quite comparable to those made by the United States but with the exception that there would be fewer visible strings. We can expect to hear of the remarkable achievement of the Russian Communists in evidencing such a complete recovery of a country by its own efforts within fifteen years of an obliterating war.

The real surprise is that the **expected** prize of all this space activity was supposed to be science and discovery and yet this prize seems to come last on the list. Until very recently, the Russians had not made any astonishing scientific discoveries and it almost appeared as if the United States held the monopoly. Unfortunately, that U.S. monopoly no longer exists and the Russians have made important scientific discoveries which are recognized as such throughout the world. The Russians have told us that the moon has no magnetic field nor does it have any Van Allen belt. It is unlikely that anyone will question this discovery. The Russians have taken a picture of the other side of the moon and have named the various topological features. It is doubtful if there will be any argument as to whether the Russian names will be adopted.

What Will the Russians Do Next?

The Russians will most certainly continue in the space race since this race very well meets the over-all objectives of the Russian Communist society. The race, to them, is economically, politically, and psychologically a sound program to direct against the principal competitor of the USSR, the United States. The Russians have succeeded in putting us in a position of "acute embarrassment" which they can certainly exploit ruthlessly. In the long run, the Russians probably realize, as we do, that exploration has always paid for itself, if you have the time to wait for the final returns. From the economic standpoint, it can be shown that certain types of space vehicles will more than pay for themselves. Both communication and weather satellites can be used to make money. The Russians, could, for example, set up a world-wide communication system which would be considerably better and more reliable than our high frequency radio system in use today. The Russians could then rent and control this communication system.

The Russians, of course, long ago told us that they intended to stay in the space race. Recently, two well-known Russian scientists, Federov and Blagonravov, reportedly outlined a Russian space program which might very well be underway. These two scientists are recognized professionals who help direct the USSR program and who are not given to idle comment or spectacular proposals in the public press. They were reported as stating that a Soviet satellite bearing two men will orbit the earth for fourteen days by the end of this year. Four weeks after that firing, two men with a TV camera will make a roundtrip flight to the moon, circling it twice. In March or April of next year, two men and two women are predicted to make a trip around the moon for more than half a year. The program intends to send rockets to Mars and Venus during 1961, to Mercury and Jupiter shortly thereafter, and to send manned ships carrying from two to six men to Mars and Venus. If this sounds fantastic to us, we should remember that from their advanced position, the view of the immediate future might well be clearer than what we see from further back. In some ways, this difference in what we see is one of the more dramatic illustrations of the relative positions of Russia and the U.S.

Based on this kind of evidence, I think it is fair to conclude that we are in a race. What we may not have realized is that the Russians are in it whether we are in it or not. In a sense, we are so far behind that the Russian competition does not even look back to find out where we are.

Should the United States Enter the Race?

Fortunately, or otherwise if you prefer, the United States at the moment is neither in nor out of the space race. We have made no declaration to accept the Russian challenge. We have no programs whose avowed intent is to close the gap between ourselves and the Russians. We have one or two programs whose hopeful intent is to try to keep the gap from getting wider. At the present time, one of the most remarkable features of the U.S. position is the almost complete lack of urgency to the space program. This lack of urgency is justified, presumably, by a statement that we are in a scientific program and not a race. I have not yet figured out why coming in second in science is any different or better than coming in second anywhere else. The remaining indication that we are neither in nor out of the space race is the present funding level. The National Aeronautics and Space Administration budget is now somewhat less than what the United States pays to ship and store surplus wheat. Our space program is less than two percent of our defense budget. The space program costs less than ten dollars per year per U.S. adult or roughly one evening's entertainment per year.

On the other hand, we have not declared ourselves **out**, either, and unless we do, the rest of the world probably assumes we are in. The results of continuing at our present level are not particularly encouraging. In the last two years we have dropped six months to a year further behind in the process of organizing, re-evaluating, carving out paper empires, and fighting over who is going to be the boss to tell the professional what to do. The results of continuing as we are were illustrated the other day in a meeting at Jet Propulsion Laboratory in which we were attempting to plan the missions for a set of space vehicles in 1961 and 1962. We went through the process of setting up a logical and technically sound program, only to be shocked at the end of our efforts to find that the first half of our fine program had already been done by the Russians. The frustration of the few professionals in the space business was well illustrated by the comment made by a colleague of mine just last week. He stated that the closer you get to the space program, the more of a sinking feeling you get.

Putting it in somewhat different words, continuing at the present level is largely a waste of money. At the moment, we are paying for the privilege of being the perfect straight man for the Russians. As Dr. Glennan has stated, "we cannot run second very long and still talk of leadership."

In a perfectly objective way, we should therefore consider the results of declaring ourselves out of this game. We might well save ourselves a great deal of embarrassment. We would have to yield the field to the Russians and admit that they are highly successful. What would hurt is that we would have to admit by inference that their reason for success, namely the Communist Society, might also be true. If we declared ourselves out of this race, we would definitely need a different race as a substitute. This other race must have drama and interest and must have exportable advantages. Unfortunately, neither our standard of living nor our foreign aid can be used as a satisfactory substitute. The statement that "we went military" is not a particularly good counter-argument to the Russians' space activity. On the other hand, we would at least quit being the straight man, quit wasting our money, and stop some of the endless frustrations.

We should also consider the results of declaring ourselves **in** the space race. It will certainly cost us more money than we are presently spending. We should probably spend the amount of money which Dr. Killian initially estimated, about $1.5 billions per year, or approximately something less than five percent of our defense budget. We are going to need clearly defined goals; one of them is specifically whether or not we intend to accept the Russian challenge. We will need facilities and priorities. We need a very hard-boiled look at the past performance of groups in the United States and a willingness to let the finally chosen professionals run their own race. As I see it, one of the most effective ways is to give both support and authority to the NASA to do its legally assigned job. A major step in this direction was taken by President Eisenhower in making his decision that von Braun and his team should join NASA.

Even if we declared ourselves in the race tomorrow morning, there will be some years of not being first. That will take a great deal of patience from the American public.

On the asset side, there is very little question that we would get the free world approval. We have often been an underdog but so far we have never yet refused a fight. The Russians have picked up a lot of prizes. There is no reason why we should not pick up similar prizes, including such things as national pride, sales in the world market, and world communications systems. The space business is a fair and dramatic field in which we can display our own talents. We too can acquire some of the benefits of new discovery.

After all, there is undoubtedly some truth in the story that the Russians were doubtful as to the desirability of launching the space age. The United States is no insignificant competitor in any field in which it accepts the challenge.

CALENDAR OF COMING EVENTS

March 21-24, 1960: IRE National Convention, Coliseum and Waldorf Astoria Hotel, New York, N.Y.

March 24-25, 1960: 1960 Northeastern Divisional Data Processing and Computer Conference and Business Show, sponsored by the National Machine Accountants Association, Statler-Hilton Hotel, New York, N.Y.

March 26, 1960: Fourth Annual Symposium on Recent Advances in Programming Methods, conducted by the Central Ohio Association for Computing Machinery, Ohio State University, Columbus, Ohio.

April 7-8, 1960: Annual Joint West Coast Regional Meeting of the Institute of Management Sciences and the Operations Research Society of America, U.S. Naval Postgraduate School, Monterey, Calif.

April 14-16, 1960: Symposium on Basic Questions in the Structure of Languages, sponsored by American Mathematical Society and Association for Symbolic Logic, Hotel New Yorker, New York, N.Y.

April 18-19, 1960: Third Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, Ohio.

April 20-22, 1960: 12th Annual Southwestern I.R.E. Conference and Electronics Show including the National Medical Electronics Conference, Shamrock-Hilton Hotel, Houston, Tex.

April 21-22, 1960: Seminar on Analog Methods in Nuclear Energy Problems, sponsored by The International Association for Analog Computation, Brussels, Belgium / Contact: Seminar-Secretariat, c/o Electronic Associates, Inc., 43, rue de la Science, Brussels 4, Belgium

May 2-6, 1960: Western Joint Computer Conference, San Francisco, Calif.

May 9-12, 1960: 2nd ISA Instrument-Automation Conference and Exhibit of 1960, Civic Auditorium and Brooks Hall, San Francisco, Calif.

May 17-18, 1960: Symposium on Superconductive Techniques for Computing Systems, sponsored by Information Systems Branch, Office of Naval Research, at Dept. of Interior Auditorium, Washington, D.C.

May 18-20, 1960: Operations Research Society of America Seventeenth National Meeting (Eighth Annual Meeting), Statler-Hilton Hotel, New York, N.Y.

May 19, 1960: Conference on Parallel Programming, sponsored by Cleveland-Akron Chapter of Association for Computing Machinery, Cleveland, Ohio / Contact: L. R. Turner, NASA, Lewis Research Ctr., 21000 Brookpark Rd., Cleveland 35, Ohio

May 23-25, 1960: 9th Annual Telemetering Conference (West Coast), sponsored by ISA with ARS, AIEE and ISA cooperating, Miramar Hotel, Santa Barbara, Calif.

June 1-3, 1960: 6th Annual ISA Instrumental Methods of Analysis Symposium, Montreal, Canada

June 6-7, 1960: Second Conference of The Computing and Data Processing Society of Canada, University of Toronto.

June 15-29, 1960: 7th Rassegna International Electronics, Nuclear Energy, and Cinematography Scientific Congresses and Exhibition (included in the program: Electronic computers — collation and processing of data for research operation), Palazzo dei Congressi, Rome, Italy.

June 22-24, 1960: 1960 National Conference and Business Show, National Machine Accountants Association, Mark Hopkins and Fairmont Hotels, and Calif. Masonic Memorial Temple, San Francisco, Calif.

June 25 - July 5, 1960: 1st International Congress for Automatic Control, AACC sponsored, with ISA, ASME, IRE and AICE cooperating, Moscow, U.S.S.R.

August 23-25, 1960: Annual Meeting of the Association for Computing Machinery, Marquette Univ., Milwaukee, Wisc.

Sept. 19-21, 1960: 5th Annual Symposium on Space Electronics and Telemetry, sponsored by The Institute of Radio Engineers, Inc., Shoreham Hotel, Washington, D.C.

Sept. 26-30, 1960: 3rd ISA Instrument-Automation Conference and Exhibit of 1960, and ISA's 15th Annual Meeting, New York Coliseum, New York, N.Y.

Nov. ?, 1960: 13th Annual Conference on Electronic Techniques in Medicine & Biology, sponsored by ISA, with IRE and AIEE cooperating, Washington, D.C.

If You Can Call the Shots For New Computers Designed to do New Jobs, You'll Like it at Sylvania's Data Systems Operations

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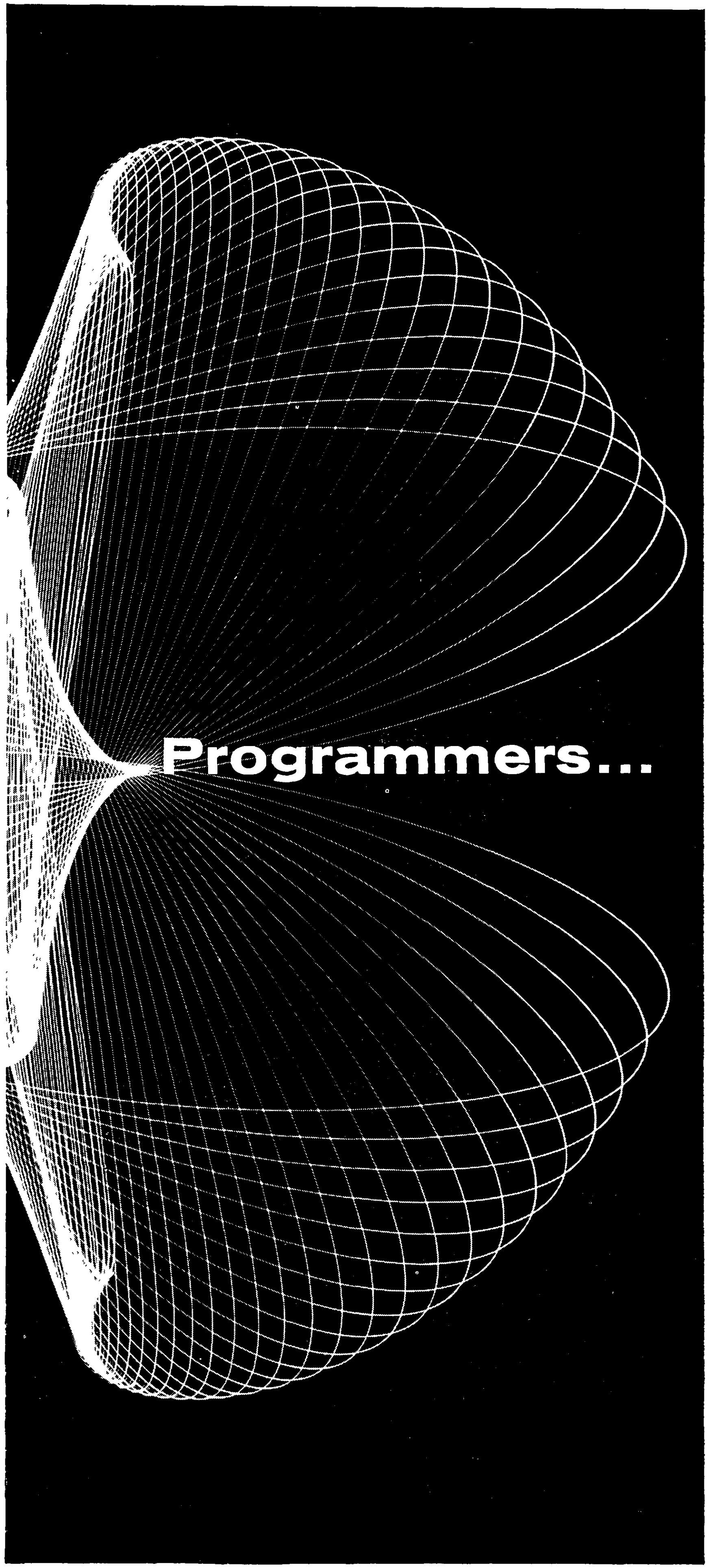
There are both administrative and technical openings at every level with opportunities for advancement at our Needham, Massachusetts research and development center. This new facility is located on Boston's suburban Route 128 in the midst of the nation's largest research complex, and close to the cultural, recreational and educational facilities of Boston.

If you'd like to program your future with Sylvania, write Mr. Ed N. Parry at Sylvania's DSO, Needham, Massachusetts, or telephone collect, HIllcrest 4-3940.



Data Systems Operations/SYLVANIA ELECTRONIC SYSTEMS
A Division of
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Subsidiary of
GENERAL TELEPHONE & ELECTRONICS
New England Industrial Center on Route 128, Needham, Mass.

Readers' and Editor's Forum

LOCATIONS WHERE COMPUTERS ARE INSTALLED

I. From the Editor to Mr. Frank R. Hartman

Thank you for your article "The Demand for College Training in Digital Computing" [published in the November 1959 issue of **Computers and Automation**]. I take pleasure in enclosing some sets of tearsheets.

As you may know, we try to maintain a file of the names and addresses of locations where computers have been installed. Would you be willing to send us a copy of your list? If there are any costs, we shall be glad to pay them. If we can give you any corresponding help, we shall be glad to.

II. From Mr. Frank R. Hartman

Pennsylvania State University
University Park, Pa.

I am sorry that we are unable to fulfill your request for aid in expanding your list of computer locations. The survey letter stated that the identities of individual respondents would be kept confidential, and we do not feel we can release information without writing to the respondents for permission.

I am very sympathetic with any project which will increase the communication among computer users since I believe that the present state of such communication is a very poor one. Perhaps you might editorialize about this problem in some future issue of **Computers and Automation.** Someone needs to bring home to private enterprises that competitive secrecy in regard to computing is damaging to both the builders and the users of machines in the long run. Any improvement you could bring about in the sharing of information would be a real contribution to the advancement of computing.

III. From the Editor

There is already a fair amount of communication among many computer people, particularly through membership in the Association for Computing Machinery (address: 2 East 63rd St., New York 21, N.Y.), which now has over 5500 members. But the number of people in the computer field is now probably over 25000; and there is need for more communication still.

If the locations where computers are installed could be reported to a central point, and the list published from time to time for the benefit of everybody in the computer field, considerably more communication would result.

We should like to ask the computer manufacturers to cooperate in sending us systematically the names and addresses of new computer installations (unless the organization receiving the computer desires to remain unnoticed). We will gladly undertake to publish the list of computer locations from time to time, as one of the score of varieties of reference information which **Computers and Automation** publishes.

COMPUTER APPLICATIONS LIST — FOUR MORE APPLICATIONS

Richard M. Greene, Jr.
System Dev't Corp.
Santa Monica, Calif.

In regard to your reference report "Over 300 Areas of Application of Computers" in the January issue of **Computers and Automation,** I should like to suggest two areas with which I am familiar and two other areas, which appear not to have been covered.

First, the Federal Civil Defense Administration has been using for some three years a computer-based national damage assessment program which makes analyses of predicted damage to facilities and installations of a wide variety of types based upon most recent information about weapons. In 24 hours this program can produce estimates of predicted damage patterns to such installations as hospitals, policemen, oil refineries, communication centers, etc. The system has been given trial operations and is working at this time.

A second application is in the field of space and educational scheduling. The work done at several universities in scheduling of student registrations is a forerunner of systems which will permit simplification of student registration procedures for universities. In connection with this, some study has been done of a computer-based space analysis program which will permit large organizations to run studies of space requirements for future corporate planning on a computer. This last, however, has been programmed and has been used in one application.

Finally, in Puerto Rico, the IBM 705, which belongs to the Government there, is carrying, in addition to the routine Treasury programs and other government programs, an automobile and vehicle license registration, which I do not believe is included on your list.

I believe the damage assessment work, the Puerto Rican license application, the space analysis, and the student scheduling programs are unique and, as such, do not appear in your list.

It might also be noted, however, that the comment you have about traffic simulation under Civil Engineering and Highway Engineering hardly does justice to the large-scale evacuation studies which have been run on computers upon which have been based actual evacuation drills of several cities in the United States using all modes of transportation, including cars.

You have produced an excellent list; we all look forward to the development of more detail in this field.

COMPUTING AND DATA PROCESSING SOCIETY OF CANADA — CONFERENCE, JUNE 6 AND 7, 1960, TORONTO

A. P. Macfarlane
620 University Ave.
Toronto 2, Ont.

The Second Conference of The Computing and Data Processing Society of Canada will take place at the University of Toronto on the 6th and 7th of June, 1960, and is expected to attract several hundred delegates from across Canada.

Technical Sessions will be held on a wide range of topics related to the following categories; Business and Commercial Data Processing Applications; Engineering and Scientific Computing; Operational Research and Management Science Techniques; Computer Administrative Problems and Operational Procedures.

The Society has invited the submission of papers for this conference.

Presentation of papers will be limited to 30 minutes and will be followed by a brief discussion period.

Papers will be carefully reviewed with regard to obtaining a balanced program, and those whose papers are accepted will be advised promptly.

SOLVING OF "NUMBLES" BY COMPUTER

I. From the Editor:

In the December issue we posed the following challenge to computers:

FOR CHRISTMAS, WE wish our subscribers, our readers, and all computer people:

```
             M E R R Y
     ×           M A S  and a
     ------------------
           A T  A W W Y
         E Y B  S S T
       S N E S  A S
     ------------------
     = N Y B M M B W Y ,
  + S A S N A R T E Y S B
  -----------------------
  = S A N E N E W Y E A R ,
```

24619 59956 65743 85219 60145 65743 2453000. (Solve for the digits; each letter stands for just one digit 0 to 9, although one digit may be represented by more than one letter.)

This is a Numble, a number puzzle for nimble minds. For hints for solution if needed, write us.

We repeat our annual challenge to automatic computers — to solve this kind of problem by an automatic program. The challenge, offered now for the sixth December, remains unanswered so far as we know.

II. From N. J. Williams

Liverpool, England

Although we have not yet got around to programming our National-Elliott 405 to solve multiplication "numbles," we have programmed it to solve problems like:

```
      C R O S S
  +   R O A D S
  -------------
  = D A N G E R
```

Here each letter represents one digit, and vice versa. The principle used could be extended to more complicated "numbles," if anyone has the time.

The letters are taken in the order they are dealt with in a normal sum and treated as a decimal fraction, i.e.:

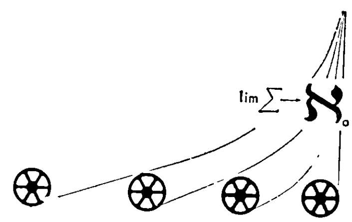
.SRDEOAGNC

Then, instead of working through every possibility from .012345678 to .987654321, the validity of each partial solution is tested as it is being formed from the left. When an inconsistency is found, the last letter to be given a value is increased to the next higher available digit, or if this is not possible it is cleared and the last but one increased, and so on. Formation and testing then continues, working to the right in the fraction and to the left in the problem.

As inconsistencies usually rule out the great majority of possibilities at the third or fourth letter, the number of tests is reduced from millions to a few thousands. To produce the answer or answers to problems, the computer requires only one or two minutes.

III. From the Editor

So it seems that this kind of problem also will fall before the advance of the computer, and the left-over programming time of human beings!



BE AMONG FIRST TO WORK WITH NEW SOLID STATE IBM 7070 COMPUTER:

TEXAS INSTRUMENTS DALLAS HEADQUARTERS OPPORTUNITY FOR COMPUTER PROGRAMMERS

Working at Central Staff level in Dallas, the men we select will be responsible for analyzing and programming data processing systems on our soon-to-be-installed IBM 7070. You must have a background with IBM 650 or 700 series computers, at least one year's experience in computer programming, and a college degree in Accounting, Math or related fields. Numerous personnel benefits including profit sharing are enjoyed at Texas Instruments, one of America's fastest growing companies.

Contact MARVIN BERKELEY
Personnel Director, Dept 1003

TEXAS INSTRUMENTS
INCORPORATED
100 EXCHANGE PARK NORTH
DALLAS 35, TEXAS

WHO'S WHO IN THE COMPUTER FIELD

(Supplement)

A full entry in the "Who's Who in the Computer Field" consists of: name / title, organization, address / interests (the capital letters of the abbreviations are the initial letters of Applications, Business, Construction, Design, Electronics, Logic, Mathematics, Programming, Sales) / year of birth, college or last school (background), year of entering the computer field, occupation / other information such as distinctions, publications, etc. An absence of information is indicated by - (hyphen). Other abbreviations are used which may be easily guessed like those in the telephone book.

Every now and then a group of completed Who's Who entry forms come in to us together from a single organization. This is a considerable help to a compiler, and we thank the people who are kind enough to arrange this. In such cases, the organization and the address are represented by . . . (three dots).

Following are several sets of such Who's Who entries.

Sandia Corp., Sandia Base, Albuquerque, New Mexico

Bell, Stoughton / Staff Member, . . . / ALMP / '23, Univ of Calif, '56, mathn

Bledsoe, Woodrow W / Mgr, Systems Analysis Dept, . . . / AMP / '21, Univ of Calif, Berkeley, '54, mathn, systems analyst

Jungmeyer, Wallace E / Staff Member, . . . / AMP / '27, Colo State Univ, Univ of New Mex, '52, prgmr, mathn

Lindsay, Bert W / Staff Member, . . . / AMP / '17, Univ of Tex, '52, physicist

Morrison, Donald R / Supv, Computing & Numerical Analysis Div, . . . / AM / '22, U of Wisc, '55, mathn

Weston, M. Katherine / Staff Member, . . . / P / '25, Miss State Coll for Women, '56, prgmr

Wicke, Howard H / Staff Member, . . . / AMP / '24, Univ of Iowa, '56, mathn

Williams, Charles M / Staff Member, . . . / LMP / '31, Va Mil Inst, '56, physicist-prgmr

Young, Dale A / Staff Member, . . . / AMP / '29, Colo State Univ, N.M.U., '52, prgmr-mathn

US Army, Data Processing Department, The Adjutant General's School, Fort Benjamin Harrison, Indiana

Bruner, Victor S / Analyst, . . . / ABP / '20, U of Ky, '55, prgmr instr

Evans, 1st Lt. William G / Instr, . . . / ABP / '34, Marshall Coll, N.C. State Col, '57, instr / member of APA

Hurley, 1st Lt. John R / Instr, . . . / ABP / '33, U of Ill, '57, prgmr inst / member of Psychometric Society

Konieczny, 2nd Lt. Raymond J / Instr, . . . / ABP / '35, De Paul Univ, '59, inst / Alpha Delta Sigma

Lipinski, CWO W-4 James B / Instr, . . . / ABP / '22, W. Va. Bus. Col., '59, inst

Melbourne, Capt. Clarence J / Prin Instr, . . . / ABP / '20, Ind S. Teacher's Col, '58, instr

Norton, 1st Lt. James A / Instr, . . . / ABP / '29, — , '56, analyst

Rembijas, Major Michael F / ADPS Crs. Dir, . . . / ABP / '20, — , '46 Customer Engineer, '57, analyst

Richards, Lt. Col. John P / Dept Dir, . . . / ABP / '18, '36, '57, Dept. Dir / developed ADP Systems Analysis Course

Smithe, 2nd Lt. Walter E / Instr, . . . / ABP / '36, U of Notre Dame, '59, instr, / Blue Circle Honor Society

US Army, Computational Center, Inst. for Exploratory Res., Signal Corps. Res. and Devt. Lab., Ft. Monmouth, N.J.

Armstrong, James A / Mathn, . . . / AMP / '08, Columbia Univ, '53, mathn

Herder, James B / Mathn, . . . / AMP / '32, Rutgers Univ, '58, mathn

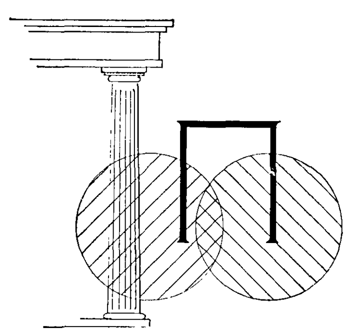
Leskowitz, Leon / Chief, Comp Ctr, . . . / AMP / '21, City Coll NY, '53, mathn

Perlman, Mrs. Hope S / Mathn, . . . / PM / '20, Hunter Coll, '55, mathn

Roper, Ivan J / Mathn, . . . / MP / '26, Clark Coll, '58, mathn

Tate, Mrs. Mary A / Mathn, . . . / MP / '24, North Carolina Coll, '57, mathn

Ulrich, Miss Eileen D / Mathn, . . . / MP / '25, Univ of Dubuque, '57, mathn



Univ. of Michigan, Willow Run Laboratory, Ann Arbor, Mich.

Aitchison, Robert T / Res Asst, . . . / LMP / '32, U of Mich, '58, prgmr

Otterman, Joseph / Assoc Res Engr, . . . / A / '25, U of Mich, '52, engr / PhD in EE; Sigma Xi; publns in: Control Engrg, IRE Procgs, IRE Trans on Elecnc Comprs, etc.

Teng, Lincoln / Res Assoc, . . . / AMP, compr methods / '24, — , '58, res

WHO'S WHO IN THE COMPUTER FIELD

From time to time we bring up to date our "Who's Who in the Computer Field." We are currently asking all computer people to fill in the following Who's Who Entry Form, and send it to us for their free listing in the Who's Who that we publish from time to time in **Computers and Automation.** We are often asked questions about computer people — and if we have up to date information in our file, we can answer those questions.

If you are interested in the computer field, please fill in and send us the following Who's Who Entry Form (to avoid tearing the magazine, the form may be copied on any piece of paper).

Name? (please print) ....

Your Address? ....

Your Organization? ....

Its Address? ....

Your Title? ....

Your Main Computer Interests?

( ) Applications
( ) Business
( ) Construction
( ) Design
( ) Electronics
( ) Logic
( ) Mathematics
( ) Programming
( ) Sales
( ) Other (specify):

....

....

Year of birth? ....

College or last school? ....

Year entered the computer field? ....

Occupation? ....

Anything else? (publications, distinctions, etc.) ....

....

....

....

....

....

....

....

When you have filled in this entry form please send it to: Who's Who Editor, **Computers and Automation,** 815 Washington Street, Newtonville 60, Mass.

NUMERICAL CONTROL SYSTEM USES COMPUTER-TYPE LOGIC TO CONTROL HIGH-SPEED PUNCH PRESS

Auerbach Electronics Corporation, Narberth, Pa.

A new numerical control system has been developed for a high-speed punch press. The system features a high degree of flexibility with simplified programming and operator control, made possible by building into the system logical decision-making elements such as are found in modern electronic computers.

The press punches holes of various sizes and shapes in linear bar stock and cuts finished pieces to the desired length. Information entered on a punched paper tape tells the system the size of the desired piece and the number, type and location of the holes. The system, through internal logic, determines the sequence of operations. Thus only the part specifications are entered on the tape, as compared to other systems where complicated logical instructions must also be programmed.

Under control of the Auerbach system, a hydraulic positioning system on the press advances the stock a prescribed distance. The stock is then clamped and the punches operated, while the positioning carriage moves out for the next feed stroke. All operations are fully interlocked for operator safety. Feed rates of up to 80 inches per second are accommodated with high accuracy by a digital servo loop; special circuits automatically correct slight positioning errors to prevent error accumulation.

Isaac L. Auerbach, President of Auerbach Electronics, cited the unit as the first in a family of custom numerical controls for machine tools. The company, staffed with computer designers and system engineers, is seeking to apply the proved techniques of modern digital computation to all types of machine tool control applications.

NON-LINEAR MAGNETICS CONFERENCE IN OCTOBER, 1960 -- CALL FOR PAPERS

Carl W. Green, Bell Telephone Laboratories, Whippany, N.J.

The fifth annual Conference on Non-Linear Magnetics and Magnetic Amplifiers will be held on October 26th, 27th and 28th, 1960. The Conference is sponsored by the AIEE Committee on Magnetic Amplifiers and the IRE Professional Group on Industrial Electronics with cooperation from the Professional Group on Electronic Computers.

The technical program will consist of sessions devoted to:

1. Computer Magnetics
   - A. Magnetic memory components, devices and systems.
   - B. Magnetic logic elements and circuits.
2. Combined Semiconductor & Non-Linear Magnetic Devices
3. Theory Design & Application of Magnetic Amplifiers

   This includes such topics as low level amplifiers, high frequency operation of magnetic amplifiers, ferroresonant circuitry, and magnetic devices for extreme environments.

Authors are invited to submit abstracts of papers to the Technical Program Chiarman,

Mr. David Katz
Bell Telephone Laboratories, Inc.
Whippany, New Jersey

by March 15, 1960. Abstracts should be two to four hundred words in length. Final manuscripts must be submitted by July 15, 1960. Papers may be submitted for the Conference only or for AIEE Transactions status as well. All papers will be published in the Conference Proceedings which will be available at the meeting.

An additional feature of the Conference will be exhibits by leading manufacturers of cores, semiconductor devices, magnetic amplifiers, and associated apparatus.

JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS, STARTING 1960

Academic Press, 111 Fifth Ave., New York 3, N.Y.

A new "JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS" will be published by Academic Press. The Editor of the periodical will be Dr. Richard Bellman, The RAND Corporation, Santa Monica, California. The Associate Editors are: F. V. Atkinson, Canberra, Australia; Garrett Birkoff, Harvard University; R. P. Boas, Jr., Northwestern University; S. Chandrasekhar, University of Chicago; C. L. Dolph, University of Michigan; R. J. Duffin, Duke University; K. Fan, University of Notre Dame; M. Juncosa, The RAND Corporation, Santa Monica, California; S. Karlin, Stanford Univeristy; J. G. Kemeny, Dartmouth College; P. D. Lax, New York University; N. Levinson, Mass. Inst. of Tech.; J. Richardson, Hughes Aircraft Corp., Culver City, California; P. C. Rosenbloom, University of Minnesota; H. N. Shapiro, New York University; S. M. Ulam, Los Alamos Scientific Laboratory; H. S. Vandiver, University of Texas; J. W. T. Youngs, University of Indiana; L. Zadeh, University of California, Berkeley.

The new journal will provide a medium for the rapid publication of carefully selected mathematical papers treating classical analysis and its manifold applications.

In recognition of the fact that other disciplines contribute new concepts and problems to the continuing growth of mathematics, papers devoted to the mathematical treatment of questions arising in physics, chemistry, biology, and engineering will be encouraged; in these papers the emphasis will be upon the analytical aspects and the novelty of problem and solution.

One novel feature of the journal will be that the refereeing system used in most journals is replaced by a board of Associate Editors, each of whom may accept manuscripts, thus greatly reducing the delay between receipt and publication.

Queries concerning editorial policy may be sent to either the Editor or to any one of the Associate Editors.

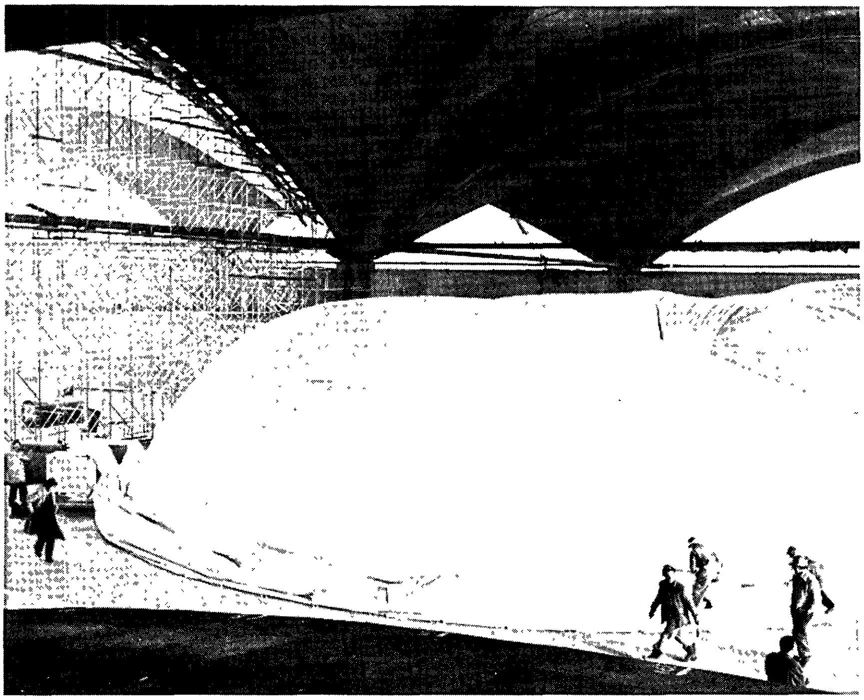


Figure 1.

— A giant vinyl-covered nylon balloon being inflated at Providence, R. I., by technicians of Intelex Systems Incorporated, subsidiary of International Telephone & Telegraph Corp. The balloon, 200 feet long, 80 feet wide and 40 feet high, will permit installation of ITT automatic sorting and mail handling equipment in a new automatic post office while the walls of the building are being erected. The balloon protects equipment and workmen from winter weather and the dust of construction.

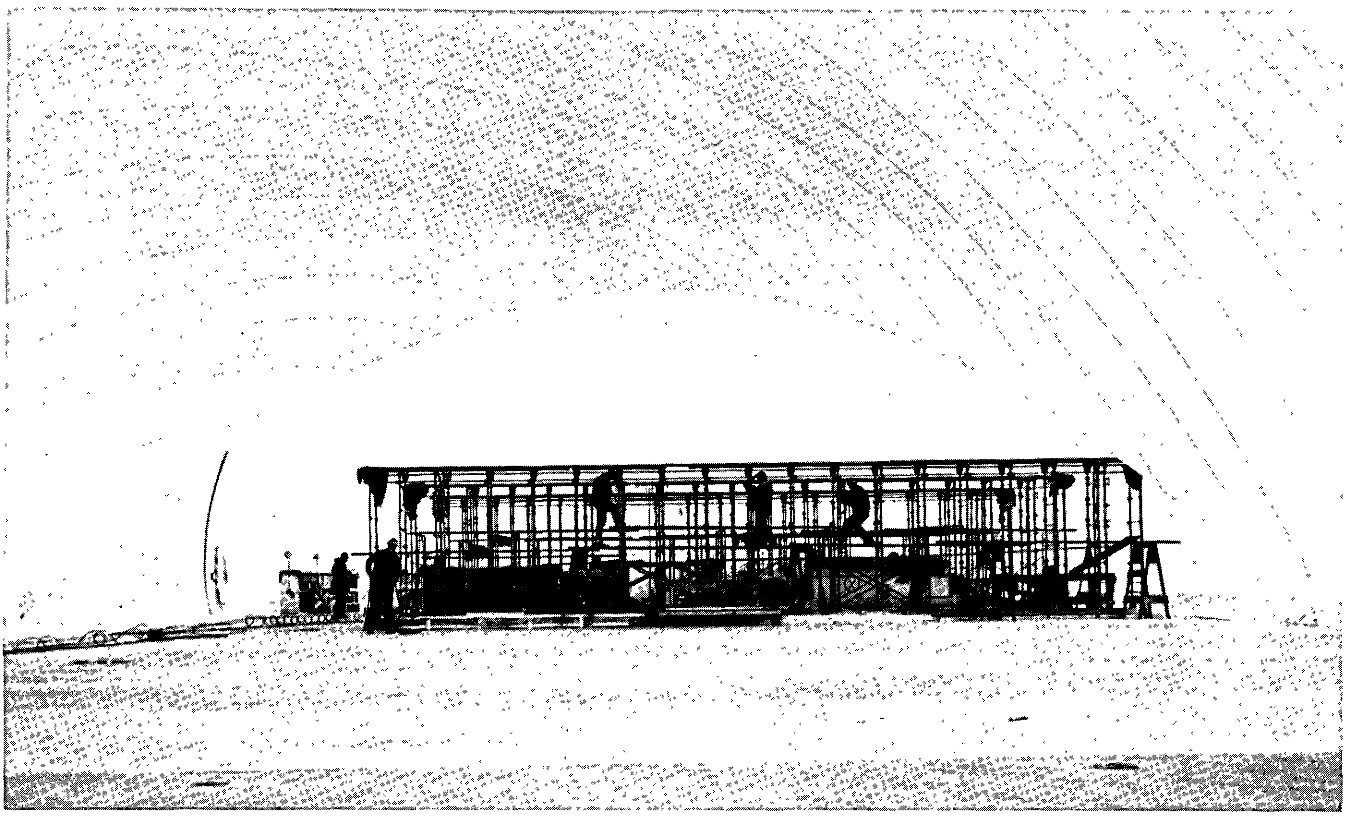


Figure 2. — Automatic sorting and mail handling equipment being installed by technicians of Intelex Systems Incorporated, subsidiary of International Telephone and Telegraph Corporation, inside the giant inflated balloon.

STARTING AN AUTOMATIC POST OFFICE WITHIN A BALLOON

International Telephone and Telegraph Corporation, New York 4, N.Y.

A huge balloon fastened to the ground is helping speed completion of a new $20,000,000 fully mechanized post office in Providence, R.I.

Actually a giant floating building within a building, the balloon is designed to enable workmen to begin installation of sensitive electromechanical equipment while the bustle of construction of the new post office building continues around it.

The inflated structure is the largest of its type in the world, measuring 200 feet long, 80 feet wide and 40 feet high.

The complex building plans for the post office called for roofing the structure before the walls were erected. The roof, which is about the size of three football fields, is nearing completion, but the builders were faced with the problem of how to install some delicate machinery even before the walls were up.

Engineers of International Telephone and Telegraph Corporation's Intelex Systems, Inc., decided to use a vinyl-covered nylon building, supported only by air and enclosing 12,500 square feet of space.

The balloon building is designed as a hyperbolic paraboloid, and holds approximately a half million cubic feet of air. Pressure within the balloon is a half-pound more per square inch than the normal pressure at sea-level of nearly 15 pounds.

Much like a submarine, the balloon building has two air locks at either end to permit trucks and machinery to enter. A truck moves into the lock, the door is closed behind it, and then the second door into the interior is opened, thus preventing the air from escaping and destroying the lifting power.

Workmen enter through two smaller doors, each resembling the type found aboard naval vessels, and the doors snap-seal themselves once a person has moved past them.

Within the balloon, workmen began in February to install the first of 11 semi-automatic letter sorters, each more than 64 feet long and 11 feet high. The sorters will be a part of the electronic equipment that will make up the automatic post office.

Although the weather outside is below freezing, the men inside the balloon work at room temperature in an atmosphere carefully controlled to provide freedom from dust and moisture changes.

The automatic post office is scheduled for completion in the autumn of 1960.

HONEYWELL 800 COMPUTER HAS NOW AN ORDER BACKLOG OF $35,000,000

Datamatic Div., Minneapolis-Honeywell, Wellesley, Mass.

On Feb. 4, the Datamatic Division of Minneapolis-Honeywell issued its first progress report on the status of orders for the Honeywell 800 computer. The occasion was the opening of a third Datamatic plant in the Boston area, a new building in Wellesley, Mass., in addition to the plants at Newton and Brighton.

Walter W. Finke, Datamatic president, spoke to a group of businessmen and educators at the dedication and said that Honeywell now has an order backlog for the high-speed computer in excess of $35 million. He said this is in addition to some $12 million worth of Datamatic 1000 systems that were produced before plans to build the Honeywell 800 were disclosed just a year ago.

Finke said the new Wellesley office building will be the headquarters for Datamatic's nationwide marketing operations, including: sales and service bureau administration; applied programming; advertising; sales promotion; and training of the Division's own people and customer personnel in electronic data-processing. This building also will contain the Division's executive and Boston area sales offices. These activities, together with the firm's engineering, research and development operations, had previously been located in Newton. Henceforth the Newton plant will function entirely as Datamatic's Engineering and Research Center.

Manufacturing operations will continue at the Division's Brighton plant. The Division also has sales offices in New York, Atlanta, Chicago, Cleveland, Detroit, Pittsburgh, Philadelphia, San Francisco, Houston and Washington. The number of employees of the Datamatic division has now gone over 1000.

The first Honeywell 800 prototype models are now nearing completion at the Engineering and Research Center; deliveries of commercial models will begin in October of this year. The expected rate of production by the end of 1961 will be 2 to 4 per month. Among those who have ordered the new, high-speed, solid-state computer are defense and other government agencies and companies in the insurance, manufacturing, public utilities and scientific fields, he added.

The Honeywell 800 is designed for both business and scientific applications. It can handle up to eight different jobs simultaneously; its system for error detection enables it to find and correct any mistakes by the computer without human intervention. The system is capable of handling over one million decimal digits (numerals) per second in the sorting of records, merging, or file maintenance. It can average 30,000 separate additions or subtractions a second, or 4,500 multiplications.

"Development and manufacture of electronic data-processing equipment is one of America's fastest growing industries," Finke said. "We estimate that it is already a billion-dollar-a-year business. By 1965 it may well achieve five times the present volume. One trade source* recently listed more than 300 different applications for computers in business, industry, government, science, engineering and other fields."

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*Computers and Automation, January, 1960, pp 13-15

SEMICONDUCTORS AND WHERE THEY ARE GOING

General Electric Research Laboratory, Schenectady, N.Y.

Sales of semiconductor products in the United States by all manufacturers have doubled every year for the past decade, and will be over $500 million in 1960, according to Dr. Guy Suits, General Electric vice president and director of research.

Suits cited the phenomenal growth of semiconductor products -- such as transistors -- during his opening address on February 10 at the 1960 Solid State Circuits Conference in Philadelphia. His $500 million sales estimate did not include products that semiconductor devices make possible, such as miniature portable radios.

Suits explained that the study of solids is peculiarly important to industry because it has provided the foundation science from which have come new materials, devices and products of great economic significance.

In his speech entitled "The Impact of Solid State Research on U. S. Industry and Technology," Suits pointed out that "solid state physics research has grown by 2½ times in the last seven years. About 10,000 scientists throughout the world are engaged in this research today: Russia (24%); the United States (21%); the United Kingdom (11%); and Japan (10%) do in aggregate 66% of world research on the solid state," he added.

"As exciting as the present time is in solid state science," Suits said, "the future will be even more so, particularly for the industrial and economic potential of this branch of science." He pointed to several areas of solid state research that show "great promise of things to come. The semiconductor high power field," Suits predicted, "may grow to major industrial dimensions, and the silicon power rectifier and the silicon controller-power rectifier have already added new dimensions to industrial power technology."

"Semiconductor thermojunctions for power generation and for refrigeration also show significant promise," Suits added. As more and more semiconductors are investigated, according to Suits, semiconductor thermojunctions for the direct conversion of heat to electricity and for refrigeration may reach efficiencies that are competitive with conventional systems.

"Moreover, we have barely scratched the surface in our progress with semiconductor compounds," Suits said. "Tunnel diodes made with gallium arsenide have already extended the performance of the new semiconductor, and the General Electric Research Laboratory has recently made progress with at least six other compounds. We have recently achieved peak-to-valley ratios of 60 to 1 and oscillation frequencies of 10,000 megacycles with various tunnel diodes."

Suits also called attention to the great progress that cross fertilization in science may make possible in the area of the solid state. "Many organic chemists have hoped for a polymeric semiconductor from which transistors might be made. The newest polymers are more and more crystalline in structure, and much that we know about inorganic crystals should have application to organic ones. It ought to be possible to produce polymeric semiconductors and they ought to have interesting possibilities," Suits stated.

"Moreover," according to Suits, "once organic semiconductors are understood, their new knowledge should prove useful in unraveling various biological phenomena; for example, those involving energy storage and energy transport in living systems."

"Ahead lie exciting prospects for still further major developments in solid state capabilities," Suits concluded, "and many promising new domains to explore and conquer in the science of the solid state".

USING NUMERICAL CONTROL IN AN OVERALL APPROACH

Rocketdyne Division, North American Aviation Corp., Canoga Park, Calif.

"Taking a 'leap frog' approach instead of doing things by conventional methods, is the only way we can beat Russia," according to William B. Johnson, chairman, Numerical Control Coordinating Committee of the Rocketdyne Division.

Mr. Johnson spoke at the American Society of Tool and Manufacturing Engineers' seminar on automation in Detroit February 4.

He suggested that the use of numerical control at the design intent level would enable industry to go into fast production of parts without a tooling build-up in case of national emergency, or to maintain industrial leadership.

Tapes could be telegraphed to plants in other parts of the country and production could begin almost immediately.

"This procedure -- the use of numerical control in the overall approach, from the research and development stage -- saves time and money without exception," Mr. Johnson said.

It is also the most flexible type of operation possible. It substantially reduces cost in peacetime production and is a necessity to save time in defense operations, he stated.

HIGH-SPEED PRINTING EQUIPMENT -- CONTRACT

Potter Instrument Co., Plainview, L.I., N.Y.

A production contract valued at more than $440,000 has been awarded the Potter Instrument Company of Plainview, N.Y. by the Welex Electronics Corporation of Washington, D.C., for high-speed printing equipment to be used in connection with a world-wide Air Force contract. It is believed to be the largest single contract ever placed for this type of equipment.

Welex is a wholly owned subsidiary of Halliburton Oil Well Cementing Company. Potter Instrument Company was the recipient three months ago of $1,000,000 of long term capital from Electronics Capital Corporation of San Diego, California.

SURVEY OF RECENT ARTICLES

Moses M. Berlin
Cambridge, Mass.

We publish here a survey of articles related to computers and data processors, and their applications and implications, occurring in certain magazines. We seek to cover at least the following magazines:

- Automatic Control
- Automation
- Automation and Automatic Equipment News (British)
- Business Week
- Control Engineering
- Datamation
- Electronic Design
- Electronics
- Harvard Business Review
- Industrial Research
- Instruments and Control Systems
- ISA Journal
- Proceedings of the IRE
- The Office
- Scientific American

The purpose of this type of reference information is to help anybody interested in computers find articles of particular relation to this field in these magazines.

For each article, we shall publish: the title of the article / the name of the author(s) / the magazine and issue where it appears / the publisher's name and address / two or three sentences telling what the article is about.

The War of the Computers / F. Bello / Fortune, vol. 60, no. 4, Oct., 1959, p 128 / Time, Inc., 540 N. Michigan Ave., Chicago 11, Ill.

The market for electronic computers, presently at approximately $1.5 billion, is expected to grow fivefold in the next ten years. Computer manufacturers believe that a part of the market will consist of small and middle-size firms which will find it beneficial to use electronic data processing. This article discusses the business war between the nine major computer companies, their competitive aims to sell their product to industry, government and research organizations; and predicts that one outcome will be fewer major companies.

USSR Improves Computers / Electronics, vol. 32, no. 49, Dec. 4, 1959, p 43 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

A report by eight computer people on Soviet progress in the field, is given. The information is mainly of a general nature, with the memory units of various computers described briefly.

Automatic Language Translation / W. G. Cass / Automation & Automatic Equipment News, vol. 5, no. 3, Nov. 1959, p 148 / A. &. A. E. N., 9 Gough Sq., Fleet St., London, E. C. 4

This article traces the development of machine translation, mentions some recent developments, and discusses linguistic and engineering studies in the field.

Natural-Gas-Dispatching Computer / Bill Karcher and Hugh Jacobson / Instruments and Control Systems, vol. 32, no. 12, Dec. 1959, p 1824 / Instruments Publg. Co., Inc., 845 Ridge Ave., Pittsburgh 12, Penna.

A computer system will be applied to the natural-gas-dispatching system, to optimize the system by controlling certain aspects of the metering system, and by recording total gas flow. The on-line and off-line functions of the computer are discussed.

Digital Control Computers / Gerhard L. Hollander / Instruments and Control Systems, vol. 32, no. 12, Dec. 1959, p 1828 / Instruments Publg. Co., Inc., 845 Ridge Ave., Pittsburgh 12, Penna.

This article reviews the fundamental requirements of an on-line real-time computer for control applications, and describes the airborne TRANSAC C-1100 computer made by Philco.

Automatic Failure Recovery in a Digital Data Processing System / R. H. Doyle, R. A. Meyer, R. P. Pedowitz, IBM Corp. / IBM Journal of Research, Jan. 1959, p 2 / IBM Journal of Research and Development, 590 Madison Ave., New York 22, N.Y.

Using a "standby" computer, the FIX program makes it possible to find and correct errors as they occur in the SAGE system. This article describes the check system and tells its performance in tests.

How to Conduct the Computer Feasibility Study / Richard M. Paget / The Office, vol 51, no. 1, Jan. 1960, p 95 / Office Publications, Inc., 232 Madison Ave., New York 16, N.Y.

Certain key elements require consideration, when the decision is made to investigate the role of computers in a specific business. This article discusses those elements, and advises management on an approach which may save time and money.

A Study of the Immediate and Future Needs of the Pennsylvania State University for Electronic Digital Computer Facilities / J. B. Bartoo and F. R. Hartman / The Division of Academic Researches and Services, Penn. State U., Penna.

This is a report on a study of the university's research and teaching needs for computer facilities. The report has three sections: the sources of information utilized; the information found out; estimates of the present and future needs, based on the information gathered. The appendix contains copies of questionnaires and tables which are relevant to the report.

The Computer is Just One of Many Managerial Tools / D. L. Bibby / The Office, vol. 51, no. 1, Jan. 1960, p 81 / Office Publications, Inc., 232 Madison Ave., New York 16, N.Y.

The present generation is the first to apply data processing to the control of industry, and the first to use computers as the center of production. This article discusses a reasonable approach toward computer use, and a good way to deal with computer personnel.

Digital Computer Runs Hot Plate Mill / Cliff Burdick / Control Engineering, vol. 7, no. 1, Jan. 1960, p 126 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

This article describes the control of a slabbing mill by a transistorized digital computer. The process is discussed and the functions performed by the computer are explained.

Deliver First Polaris Checkout Gear / Kemp Anderson / Control Engineering, vol. 7, no. 1, Jan. 1960, p 25 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

A brief description of the Navy's missile is presented. The Polaris will have computer-controlled automatic checkout equipment, which will enable engineers to test it from "factory to countdown". The eight step checkout is described.

Data Processing for Numerical Positioning Systems / Robert A. Bennett / Control Engineering, vol. 7, no. 1, Jan. 1960, p 142 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

This article discusses the application of a computer to "point-to-point" systems, for example, to determine the optimum sequence of drilling or punched holes. The problems inherent in such applications are described, and a sample problem is solved.

How Canada is Applying Automation / Anthony Kirby / Automation & Automatic Equipment News, vol. 5, no. 4, Dec. 1959, p 180 / A. & A. E. N., 9 Gough Sq., Fleet St., London, E.C. 4, Eng.

This article traces the history of Canadian industry's change to automation. The application of computers in the electric power industry is described, and other applications are discussed. The effect on Canada's industry is also discussed.

Subsidies for Automation? / J. W. Murray / Automation & Automatic Equipment News, vol. 5, no. 4, Dec. 1959, p 191 / A. & A. E. N., 9 Gough Sq., Fleet St., London, E. C. 4, Eng.

Parliament in England discusses a suggestion to subsidize industry's change to automation, and this article reports on the debate. In the 1960's, the topic will be subject to even greater -- and more heated -- debate, as automation becomes more widespread.

Georgetown University Machine Translation Research / Monthly Summary Report, vol. I, no. 2, Nov. 1959 / Georgetown Univ., Machine Translation Research, 1715 Massachusetts Ave., N. W., Washington, D.C.

This report appears monthly from October through June. This issue reports on a seminar of Nov. 13, 1959, and presents a summary of a paper on improvement of the "General Analysis Technique" dictionary.

The Electronics Market -- Looking Into the 60's / Edward De Jongh, Thomas Emma, and Howard K. Janis / Electronics, vol. 33, no. 1, Jan. 1, 1960, pp 49-66 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

A comprehensive report on the electronics industry's performance in 1959 is given, with a prediction for 1960. Increased sales are predicted in every major category. Electronic data processing is covered in the report, which also discusses manpower, buying and selling abroad, and marketing. Charts, facts, and figures are in abundance.

Career -- For the Experienced Engineer and Scientist / Careers Inc., 15 West 45 St., New York, N.Y. / Winter, 1960, printed, 114 pp, cost: inquire of publisher

This volume presents: an area report on the Northern New Jersey Industrial Area; an article on composing a résumé; 80 brief articles by employers on their career opportunities; an employers' directory; an industrial and geographic index; information on the Carrier Résumé Service, etc.

ARGUS -- Automatic Routine Generating and Updating System / Minneapolis-Honeywell Regulator Co., DATAmatic Div., 151 Needham St., Newton Highlands 61, Mass. / 1960, offset, 76 pp, free on request

This is a manual of automatic programming assembly language for the Honeywell 800 computer. The manual also gives an introduction to the methods of programming for the Honeywell 800 computer. Every aspect of coding is covered, followed by a description of machine instructions. Control instructions, constants, library routines, masking, and output, are described.

Digital Computer Newsletter / Office of Naval Research, Mathematical Sciences Div., Washington 25, D. C. / Vol. 12, no. 1, Jan. 1960, offset, 33 pp, distribution limited to government agencies and contractors, reprinted in "Communication of the ACM" and this distributed to members of the Assoc'n for Computing Machinery

This newsletter is continuing to provide a medium for the interchange of information on recent developments in digital computer projects. This edition mentions a dozen computing centers in the U. S. and sixteen overseas, reports on their experience and operations, and furnishes information on four recently developed computer systems -- the Control Data 1604, IBM 1401, IBM 1620 and Philco Transac S-2000.

A Survey of European Digital Computers

Part 2

Joseph L. F. De Kerf
Research Laboratories
Gevaert Photo-Producten N.V.
Mortsel, Belgium

(Continued from Computers and Automation, February, 1960, p. 26)

— **Intertechnique: RW-300 (cont.)**

Input/output (standard): through Flexowriter with punched tape (10 char. per sec) and 18 one bit digital input switches. The number of input switches may be expanded to a maximum of 540 bits and up to 540 one bit digital output switches are available. Multiple typewriters, punched tape readers (50 char. per sec), tape punches (25 char. per sec), magnetic tape units and an analog input/output conversion system are optional. The analog-to-digital and digital-to-analog conversion system works with dc electric signals. Transducers from mechanical, pneumatic and ac electric signals are available. Numbeı of analog inputs: up to 2,048. Number of analog outputs: up to 128. Conversion accuracy: 0.1%. Conversion rate: up to 1,000 per sec.

Operation speeds (optimum storage location): 1.09 ms for addition and subtraction, 3.59 ms for multiplication and 3.74 ms for division.

Power consumption (basic computer): 0.5 kVA. Floor area occupied (basic computer): 12 sq. ft. Technical data: 128 kc/s prf, vacuum tubes (12), germanium diodes (4,500), transistors (700) and printed circuits on plug-in boards (175). Price: $98,000 and up. Leased.

GERMANY (EAST)

The construction of a stored program computer was started at the Institute of Applied Mathematics at the Technological University of Dresden in 1953. Completion of the computer, called D 1, was announced at the Int. Comp. Conf. (Darmstadt, 1955) for 1956. It is used to get experience for the construction of a more advanced machine operating ten times faster.

Operation mode: serial. Number base: binary. Word length: 72 bits. Point working: fixed. Instructions: 1 address type (1/3 word). Store: magnetic drum. Capacity: 2,048 words. Speed: 6,000 rpm. Input/output: punched tape and electric typewriters. Multiplication time: 22 ms.

Another magnetic drum computer, but with magnetic core logical units, is under construction at the Carl Zeiss optical works (Jena). A relay calculator (OPREMA: Optische Rechenmaschine) is in operation at Carl Zeiss since 1955. The new machine, called ZRA 1 (Zeiss-Rechenautomat), is intended as its successor. Later on it will be manufactured in series.

Operation mode: serial. Number base: binary. Word length: 48 bits. Point working: fixed and floating. Instructions: 1 address type (1 word). Store: magnetic drum. Capacity: 4,096 words. Speed: 12,000 rpm. Input: punched cards. Output: line printer. Multiplication time: 7 ms (fixed) and 8 ms (floating).

A more detailed description has been given by N. M. Blachman in the Comm. of the ACM (Vol. 2, No. 9, p. 14).

GERMANY (WEST)

Private design and construction of program controlled calculators was started by K. Zuse several years before the war. Z 1, a mechanical store calculator, was completed in 1938. Z 2 and Z 3, both relay calculators, were completed during the war. Z 3 was constructed for the German Aeronautical Proving Centre. It was destroyed but a more advanced type, Z 4, completed in the beginning of 1945, could be saved. Afterwards Z 4 was installed at the Swish Federal Institute of Technology (Zürich).

In 1949, the firm Zuse KG was created (now at Bad Hersfeld, Wehneberger Strasze 4). The company has manufactured several types of analog computers. A punched tape controlled relay calculator, Z 5, was installed in 1953 at the Leitz Optical Works (Wetzlar). An improved type, Z 11, was manufactured in series. About thirty Z 11's have been delivered. A stored program magnetic drum computer, Z 22, was marketed in 1957. Thirty-eight Z 22's have been installed or are on order (Oct. 1959).

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ELECTRONIC DATA PROCESSING DIVISION

—Zuse KG: Z 22

Operation mode: serial. Number base: binary. Word length: 38 bits (sign included). Point working: fixed and floating. Floating representation: 29 bit mantissa + 7 bit exponent (+ 2 sign bits). Instructions: 2 address type (1 word). The arithmetic is controlled by fixed subroutines.

Quick access store: magnetic cores. Capacity: 14 to 25 words. May be used as index registers (and from 1960 on as accumulators). Main store: magnetic drum. Capacity: 8,192 words (256 tracks of 32 words). 1,024 words are used for the fixed subroutines (arithmetic operations, input and output). Speed: 6,000 rpm. Average access time: 5 ms. A magnetic tape unit with a capacity of 3.3 million words is optional.

Input: 5 hole punched tape reader (15-200 char. per sec). Output: 5 hole tape punch (25 char. per sec) and teleprinter (10 char. per sec). A curve plotter (Z 60) is optional.

Operation speeds (fixed point): 0.6 ms for addition and subtraction, 20 ms for multiplication and 50 ms for division. Access time to the magnetic drum is not included.

Power consumption: 5 kVA. Floor area occupied: about 50 sq. ft. Technical data: 140 kc/s prf, vacuum tubes (700), germanium diodes (2,400), plug-in units and magnetic cores. Price (basic machine): $64,000. Not leased.

In the meantime, several experimental machines were designed and constructed at the universities of Göttingen, Darmstadt and München. Descriptions of these machines may be found in the Proc. of the Int. Comp. Conf. (Darmstadt, 1955). The subjoined survey is mainly compiled from these proceedings and, as a consequence it may be incomplete now.

Several machines are in use at the University of Göttingen. The G 1 is a small magnetic drum calculator (26 words), constructed in 1951 and in operation since 1952. An improved version (2,048 words), with floating instead of fixed point working, the G 1A, was completed in 1956. Both are serial machines, controlled by punched tape. The design of a stored program computer was started in 1950. The computer, G 2, was completed in 1954.

Operation mode: serial. Number base: binary. Word length: 50 bits. Point working: fixed. Instructions: 1 address type (1 halfword). Store: magnetic drum. Capacity: 2,048 words. Speed: 3,000 rpm. Input: punched tape. Output: teletype writer. Operation time: 40 to 50 ms.

A parallel operating computer, the G 3, is under construction. Point working is floating. Magnetic cores are used for the main store. A magnetic drum and a magnetic tape unit are added. The operation speed is about 2,000 operations per second.

Another stored program computer, with a magnetic core computing store, has been constructed at the Technical University of Darmstadt. The computer, called DERA (Darmstädter Elektronische Rechenautomat), is used at the University for their scientific and technical calculations.

Operation mode: serial. Number base: binary decimal. Word length: 14 decimals. Point working: fixed. Instructions: 1 address type (1 half-word). Quick access store: magnetic cores. Capacity: 100 words. Main store: magnetic drum. Capacity: 3,000 words. Speed: 3,000 rpm. Input/output: punched cards, punched tape, teletype writer and curve plotter. Multiplication time: 12 to 16 ms.

A parallel operating computer, PERM (Programmgesteuerte Elektronische Rechenanlage München), has been constructed at the Munich Technical University. About 2,400 vacuum tubes and 3,000 germanium diodes were used. The high speed of the drum is exceptional. Extension of the capacity by a magnetic core store is developed.

Operation mode: parallel. Number base: binary. Word length: 50 bits. Point working: fixed and floating. Instructions: 1 address type (1 word). Store: magnetic drum. Capacity: 8,192 words. Speed: 15,000 rpm. Input/output: punched tape and teletype writers. Multiplication time (access time not included): 170 to 330 microsec (fixed) and 180 to 340 microsec (floating).

Besides the previously described small scale scientific computer, Z 22, manufactured by Zuse KG, several large scale commercial data processing systems have been announced in 1957.

The Siemens 2002 is a transistorized magnetic core computer, manufactured in series by Siemens & Halske AG (Hofmannstrasze 51, München 25). Seventeen machines have been installed or are on order (Sept. 1959). Logic circuits on plug-in boards, magnetic drums and magnetic core store units may be purchased as separate units.

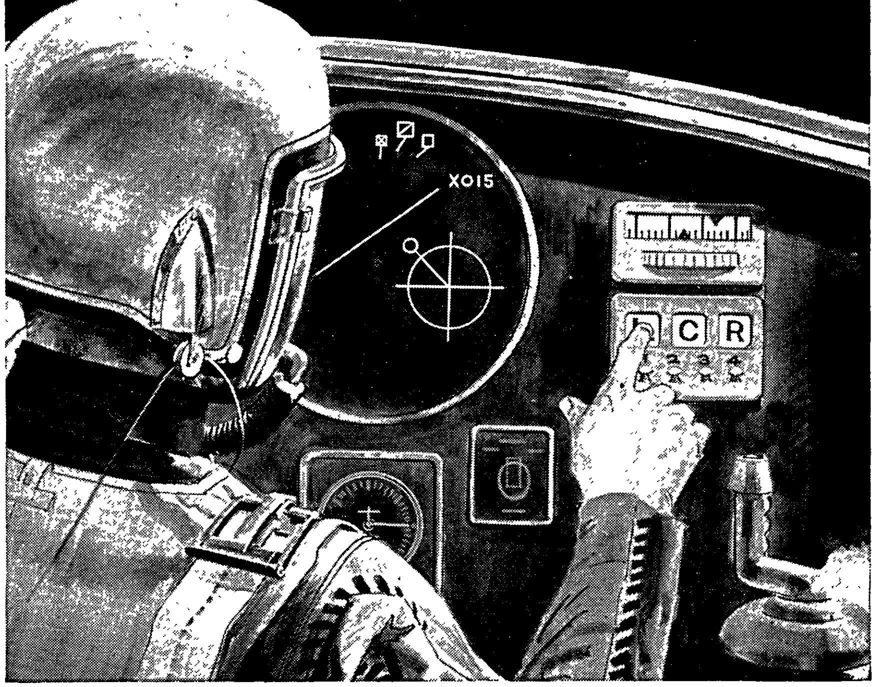
— Siemens & Halske AG: Siemens 2002

Operation mode: serial parallel. Number base: binary decimal (excess three code). Word length: 12 decimals plus sign or 6 alphanumeric characters. Point working: fixed and floating. Floating point representation: 10 digit mantissa + 2 digit exponent. Instructions: 1 address type (1 word). Number of operations: 87. Number of registers: 12 (3 index registers).

Store: magnetic cores. Capacity: units of 1,000, 5,000 and 10,000 words (maximum capacity: 100,000 words). Cycle time: 14 microsec. Access time: 5 microsec. Auxiliary store: magnetic drums. Capacity: 10,000 words. Speed: 3,000 rpm. Average access time: 19 + n. 0.09 ms (transfer to and from main store in blocks of variable length). Up to 50 magnetic tape units may be connected (e.g. IBM 727 or 729 or other types of magnetic tape units). They are connected with the computer by a magnetic tape control unit, with magnetic core buffer store. This permits simultaneous processing of several tape units, while computing proceeds. Further high capacity magnetic drum store can be connected with the computer.

Input: punched tape (200 or 400 char. per sec). Output: punched tape (20 or 50 char. per sec) and electric typewriter (10 char. per sec). 80-column punched card equipment (e.g. IBM 077, 088, 514 and 544), line printers (IBM 407 and 421)

AIRBORNE DATA PROCESSING



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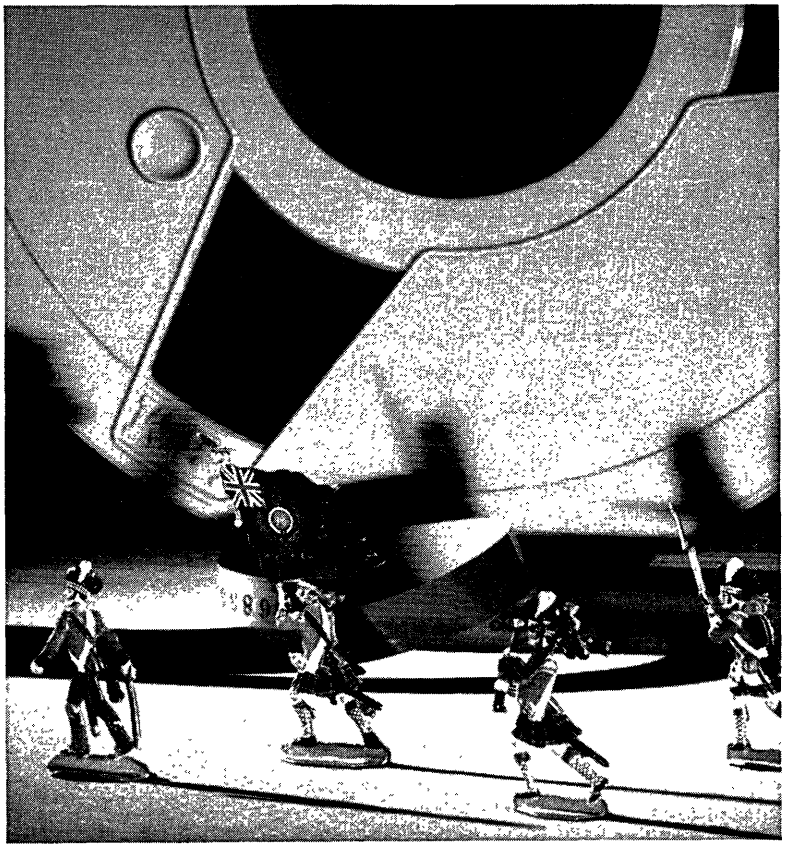

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and a cathode ray tube curve plotter may be conected. The possibility to connect high speed printers (e.g. IBM 720 and 730) is under development. Magnetic core buffers permit input/output while computing.

Fixed point operation speeds: 0.090 ms for addition and subtraction, 1.260 ms for multiplication and 3.510 ms for division. Foating point operation speeds: 0.450 ms for addition and subtraction, 1.350 ms for multiplication and 3.240 ms for division. Access time to the quick access store is included.

Power consumption (basic machine): less than 4 kVA. Room accommodation required: about 500 sq. ft. Technical data: 200 kc/s prf, vacuum tubes for power requirements (25), germanium diodes (ca. 30,000), transistors (ca. 15,000), printed circuits on plug-in boards and magnetic cores. Price (basic machine): $240,000 Leased.

Another transistorized magnetic core computer, ER 56, is manufactured in series by Standard Elektrik Lorenz AG (Hellmuth-Hirth-Strasze 42, Stuttgart-Zuffenhausen), an associate of ITT (International Telephone and Telegraph Corp.). Twenty ER 56's have bee installed or are on order (Oct. 1959). Several special purpose installations have been built, e.g. for permanent stock control and bookkeeping in a large mail order house, for airplane seat reservation, for car transport reservation on a ferry boat service, etc.

— Stand. El. Lorenz AG: ER 56

Operation mode: serial parallel. Number base: binary decimal (1 out of 10 code for computing, 2 out of 5 code for storing and transferring). Word length: 6 decimals plus sign (short) and 13 decimals plus sign (long). Alphanumeric representation: 2 digits per character. Point working. fixed. Floating point built-in if desired. Floating point representation: 11 digit mantissa + 2 digit exponent. Instructions: 1 address type (1 short word). Number of operations: 100, some in different versions (20 operations for computations with the index registers). Several operations are performed simultaneously through a traffic pilot (an electronic crossbar switch) between the different main store partial units and the arithmetic, magnetic drum store, magnetic tape units, input/output units, etc. 10 index registers.

Store: magnetic cores. Capacity: indedendant partial units of 200 and 1,000 short words (maximum capacity: 10,000 words). Auxiliary store: magnetic drums. Capacity: 12,000 short words (blocks of 20 words). Transfer: up to 10 blocks. Speed: 3,000 rpm. Average access time: 10 ms. Magnetic tape units may be connected (Type SEL-K, SEL-S and FR-300). Tape width: 1 inch. Tape length: 350, 3,600 and 3,600 ft. Capacity: 150,000, 1,500,000 and 2,000,000 short words. Speed: 4,000, 4,000 and 9,000 words per sec.

Input: punched tape (400 char. per sec) and 80-column punched cards (400 cards per min). Output: punched tape (50 char. per sec), 80-column punched cards (100 cards per min), mosaic printer (100 char. per sec, up to 150 char. per line), high speed printer (900 lines of up to 190 char. per min) and teleprinters (7 char. per sec). The punched card equipment is in mechanical parts from Elliott and IBM. Fixed point operation speeds (short): 0.20 ms for addition and subtraction, 0.32 to 0.67 ms for multiplication and 2.96 ms for division. Fixed point operation speeds (long): 0.30 ms for addition and subtraction, 0.62 to 2.30 ms for multiplication and 9.75 ms for division. Foating point operation speeds: 0.96 to 1.10 ms for addition and subtraction, 0.82 to 2.26 ms for multiplication and 7.98 ms for division. Access time to the quick access store is included.

Power consumption: 4 kVA (average). Room accommodation required: 400 sq. ft. and up. Technical data: 100 kc/s prf, germanium diodes (30,000), transistors (12,000), plug-in units and magnetic cores. Price (basic machine): $140,000. Leased.

Operation mode of Siemens 2002 and ER 56 is serial parallel. A transistorized parallel computer, TR 4, is under development at Telefunken GmbH (Gerberstrasze 34, Backnang/Württ.). The prototype will be completed in the course of 1960.

— Telefunken GmbH: TR 4

Operation mode: parallel. Number base: binary. Word length: 48 bits or 8 alphanumeric char. Point working: fixed and floating. Floating point representation: 37 bit mantissa + 8 bit exponent. Instructions: 1 address type (1 halfword). Number of operations: 250 and up. 5 registers.

Store: magnetic cores. Capacity: 2 units of 4,096 words or more (maximum capacity: 28,672 words). Access time: 6 microsec. A passive store for input/output routines and fixed subroutines, with a capacity of 1,024 (expandable to 4,096 words), and an index store, with a capacity of 256 indexes, complete the main store. Up to 32 twin magnetic tape decks may be connected. Tape width: ½ inch. Tape length: 250 m. Block length: variable. Capacity: 3 million char. Read/write speed: 7,500 or 37,500 char. per sec.

Input/output: punched tape units, punched card units, high speed line printers, analog-to-digital and digital-to-analog converters, and type-writers. Input/output units are connected to the computer or through the magnetic tape units. Four external units plus one typewriter may be handled in parallel. Computing may proceed in the meantime.

Fixed point operation speeds: 4.5 microsec for addition and subtraction, 30 microsec for multiplication and 105 microsec for division (decimal working: 25 microsec for addition and subtraction, 500 microsec for multiplication and division). Floating point speeds: 20 microsec for addition and subtraction, 30 microsec for multiplication and 90 microsec for division. Access time is not included.

Power consumption: 1.5 kVA. Room accommodation required: about 400 sq. ft. Technical data: 2,000 kc/s, germanium diodes (50,000), transistors (8,000), punched circuits on plug-in boards and magnetic cores. Price (basic machine): about $520,000.

Finally, a copy of the small scale scientific computer LGP-30 is manufactured under license by Schoppe & Faeser GmbH (Minden/Westf.). It is marketed in Germany by Royal McBee GmbH (Brockenheimer-Landstrasze 72-74, Frankfurt/Main). Export to other European coun tries is organized by Royal McBee International. About 9 machines have been constructed (Oct. 1959).

— Royal McBee GmbH: LGP-30

Operation mode: serial. Number base: binary. Word length: 32 bits (sign and spacer bit included). Point working: fixed. Instructions: 1 address type (1 word). Number of operations: 16. Number of registers: 3.

Store: magnetic drum. Capacity: 4,096 words (64 tracks of 64 words). Speed: 4,000 rpm. Average access time: 7.5 ms.

Input/output: through Flexowriter with punched tape (10 char. per sec). A punched tape console, with photoelectric reader (200 char. per sec) and motorized punch (20 char. per sec), is optional.

Operation speeds (including access time): 2 to 15 ms for addition and subtraction, 17 to 30 ms for multiplication and division.

Power consumption: 1.5 kVA (standby 35 VA). Floor area occupied: 8 sq. ft. (Flexowriter and shelf not included). Technical data: 136 kc/s, tubes (113), germanium diodes (1350) and printed circuits on plug-in boards (34). Price: $43,500 (Flexowriter included). Maintenance service contracts are available. Not leased.

NETHERLANDS

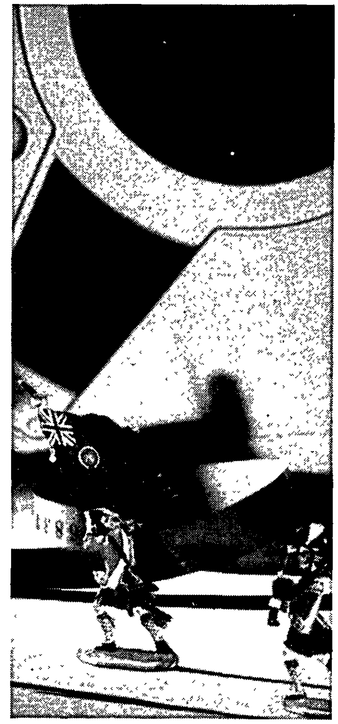
A magnetic drum computer has been built by the Dr. Neher Laboratory of the Postal and Telecommunications Services at The Hague for their own use. The computer, PTERA (Postal Telecommunications Electronic Automatic Calculator), was completed in 1953.

Operation mode: serial. Number base: binary. Word length: 30 bits plus sign. Point working: fixed. Instructions: 1 address type (1 word). Store: magnetic drum. Capacity: 1,024 words. Speed: 2,400 rpm. Input/output: punched tape and electric typewriter. Operation time (average): 50 ms.

PTERA was dismantled in 1958 but in the meantime a more advanced computer was designed at the Dr. Neher Laboratory. It has been engineered and constructed by the Standard Telephones and Cables Ltd (United Kingdom). The computer is marketed by this firm under the name Stantec-Zebra (cf. "A Survey of British Digital Computers").

Another magnetic drum computer, called ARRA (Automatische Relais Rekenmachine Amsterdam), was constructed by the Mathematics Centre at Amsterdam in 1953 and completed in 1954. A copy of this machine, FERTA (Fokker's Electronische Rekenmachine Type ARRA), was built by the Centre for the Fokker aircraft works and is still in use there.

[To be continued in the April issue of Computers and Automation]



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Research Office, in California, an unusual opportunity exists for a mathematician-programmer to expand his horizons in mathematical analysis and computer programming, in an operations research environment. A B.S. degree and one to two years' programming experience are required, plus the desire and ability to contribute to pre-programming analysis. The over-all Company policies in areas of fringe benefits and profit-sharing plans are unique. Write or wire collect:

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NEW PATENTS

RAYMOND R. SKOLNICK
Reg. Patent Agent

Ford Inst. Co., Div. of Sperry Rand Corp.
Long Island City 1, New York

THE following is a compilation of patents pertaining to computers and associated equipment from the "Official Gazette of the United States Patent Office," dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U.S. Commissioner of Patents, Washington 25, D.C., at a cost of 25 cents each.

October 6, 1959 (continued):

2,907,987 / Louis A. Russell, Poughkeepsie, N.Y. / International Business Machines Corp., New York, N.Y. / A magnetic core transfer circuit.

2,907,988 / Simon Duinker, Eindhoven, Netherlands / North American Philips Co., New York, N.Y. / A magnetic memory device.

2,907,989 / Howard P. Guerber, Barrington, N.J. / R.C.S., a corp. of Del. / A system for transmitting information represented by successive sets of nominally simultaneous character signals in parallel channels.

October 13, 1959: 2,908,828 / Eugene C. Thompson, Livingston, N.J. / Bell Telephone Lab., Inc., New York, N.Y. / A transistor binary adder.

2,908,830 / Harry L. Mason, Noroton, and David L. Noble, Rowayton, Conn. / Sperry Rand Corp., a corp. of Del. / An electronic computing circuit utilizing enhancement amplifiers.

2,908,857 / Kenneth G. King and Arnold W. Tucker, London, Eng. / Westinghouse Brake and Signal Co., Lim., London, Eng. / A trigger circuit with memory action.

October 20, 1959: 2,909,658 / Richard G. Goldman, Schenectady, N.Y. / General Electric Co., a corp. of New York / An electronic function generator.

2,909,659 / Way Dong Woo, Newton Center, Mass. / Raytheon Company, a corp. of Del. / A pulse shaping circuit.

2,909,676 / Lewis C. Thomas, North Plainfield, N.J. / Bell Telephone Lab., Inc., New York, N.Y. / A transistor comparator circuit for analog-to-digital code conversion.

2,909,680 / J. K. Moore, Downington, and Stanley Schneider, Newtown Sq., Pa. / Burroughs Corp., Detroit, Mich. / A conditional steering gate for a complementing flip-flop.

2,909,768 / William H. Kautz, Palo Alto, Calif. / General Electric Co., New York, N.Y. / A circuit for checking the validity of a binary-excess-three code number having a parity digit.

2,909,769 / Carl P. Spaulding, San Marino, Calif. / Datex Corp., Monrovia, Calif. / A code comparison and control system.

October 27, 1959: 2,910,229 / Wallis D. Bolton, Vestal, N.Y. / International Business Machines Corp., New York, N.Y. / A data storage device.

2,910,234 / Orville B. Shafer, Owego, N.Y., and Andrew C. Reynolds, Jr., Waterbury, Conn. / International Business Machines Corp., New York, N.Y. / A bit count checking circuit.

2,910,235 / Carl D. Southard, Endicott, N.Y. / International Business Machines Corp., New York, N.Y. / A drive and bit count control means for data handling matrix.

2,910,237 / Maurice A. Meyer, Natick, and Bernard M. Gordon, Concord, Mass. / Laboratory For Electronics, Inc., Boston, Mass. / A pulse rate multiplier.

2,910,238 / James G. Miles and Robert M. Kalb, Minneapolis, Minn. / Sperry Rand Corp., a corp. of Del. / An inventory digital storage and computation apparatus.

2,910,239 / Byron L. Havens, Closter, N.J. / International Business Machines Corp., New York, N.Y. / A serial type binary-coded decimal adder.

2,910,241 / John T. Bangert, Summit, N.J. / Bell Telephone Lab., Inc., New York, N.Y. / A computer for network synthesis.

2,910,595 / Louis A. Russell, Poughkeepsie, N.Y. / International Business Machines Corp., New York, N.Y. / A magnetic core logical circuit.

2,910,667 / Samuel Lubkin, Brooklyn, N.Y. / Underwood Corp., New York, N.Y. / A serial binary coded decimal pulse train comparator.

2,910,668 / Robert F. Shaw, New York, N.Y. / Underwood Corp., New York, N.Y. / An information processing system.

2,910,671 / Donald T. Best, Phila., Pa. / Burroughs Corp., Detroit, Mich. / A data storage memory system.

2,910,674 / Wilford M. Wittenberg, Poughkeepsie, N.Y. / International Business Machines Corp., New York, N.Y. / A magnetic core memory device.

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

November 3, 1959: 2,911,146 / Keith P. Lanneau and Lindsay I. Griffin, Jr., Baton Rouge, La. / Esso Research and Engineering Co., a corp. of Del. / An analogue computer for solving simultaneous equations.

2,911,277 / John C. Bellamy, Barrington, Ill. / Cook Electric Co., Chicago, Ill. / A system and apparatus for data processing.

2,911,622 / William R. Ayres, Wichita, Kans., and Joel N. Smith, Westmont, N.J. / R.C.A., a corp. of Del. / A static serial memory.

2,911,624 / Grant W. Booth, Collingswood, and Linder C. Hobbs, Haddonfield, N.J., and Stephen M. Fillebrown, Waterford, Maine / An information handling system.

2,911,625 / Kun Li Chien, Erlton, N.J. / R.C.A., a corp. of Del. / An information translating system.

2,911,626 / John P. Jones, Pottstown, and Albert J. Meyerhoff, Wynnewood, Pa. / Burroughs Corp., Detroit, Mich. / One core per bit shift register.

2,911,627 / Tom Kilburn, Urmston, and George R. Hoffman, Manchester, Eng. / National Research Development Corp., London, Eng. / A magnetic core storage system.

2,911,628 / George R. Briggs, Princeton, and Arthur W. Lo, Fords, N.J. / R.C.A., a corp. of Del. / A magnetic shift register.

2,911,629 / Hanns J. Wetzstein, Cochituate, and Zenard K. Kawecki, Brighton, Mass. / R.C.A., a corp. of Del. / An analog storage system.

2,911,630 / Edward E. Dinowitz, Needham, Mass. / R.C.A., a corp. of Del. / A magnetic storage system.

2,911,631 / Charles S. Warren, Haddon Heights, N.J. / R.C.A., a corp. of Del. / A magnetic memory system.

November 10, 1959: 2,912,596 / Chaang Huang, Ipswich, Mass. / Sylvania Electric Products, Inc., Wilmington, Del. / A transistor shift register.

2,912,598 / W. Shockley, Los Altos, Calif. / Shockley Transistor Corp., Palo Alto, Calif. / A shifting register.

November 17, 1959: 2,913,174 / Wilhelm Bilz, Schwaig-Nuremberg, Germany / Siemens-Schuckertwerke Aktiengesellschaft, Erlangen, Germany / A maximum value determining device.

2,913,175 / Frederic C. Williams, Romily, and Tom Kilburn, Davyhulme, Manchester, Eng., and David B. G. Edwards, Tonteg, near Pontypridd, and Gordon E. Thomas, Port Talbot, Wales / International Business Machines Corp., New York, N.Y. / A computer storage data handling control apparatus.

2,913,176 / Evelyn Berezin, New York, N.Y. / Underwood Corp., New York, N.Y. / A data processing system.

2,913,177 / Edward J. Petherick, Rowledge, near Farnham, and Geoffrey C. Rowley, Sutton, Eng. / International Business Machines Corp., New York, N.Y. / A digital multiplying arrangement for an electronic computer.

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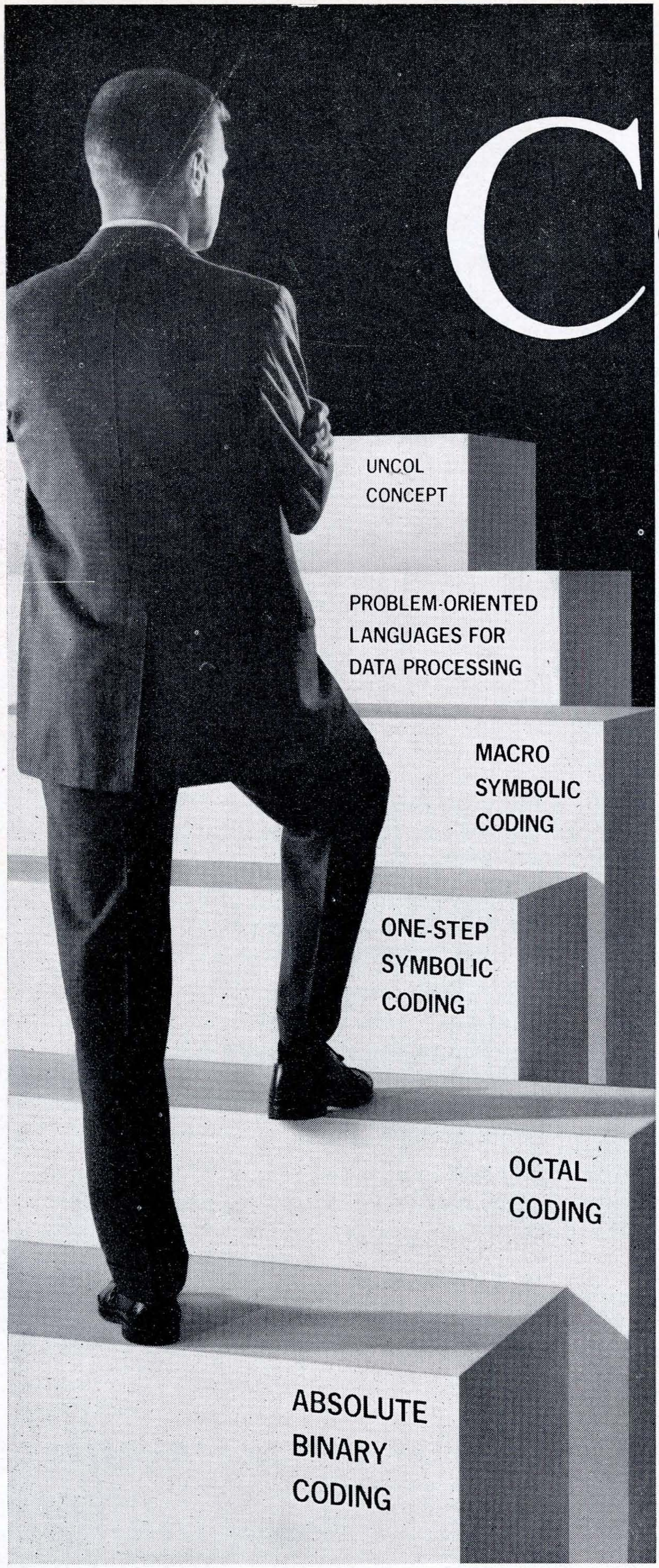

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Computer Programmers:

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"SP-127 ANCHOR An Algorithm for Analysis of Algebraic and Logical Expressions," a paper by Howard Manelowitz of SDC's staff is available upon request. Send request to Mr. Price at SDC.

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