COMPUTERS *and* AUTOMATION

COMPUTERS AND DATA PROCESSORS, AND THEIR CONSTRUCTION, APPLICATIONS, AND IMPLICATIONS, INCLUDING AUTOMATION

NOVEL APPLICATIONS OF COMPUTERS AND DATA PROCESSORS

Automated Material Control

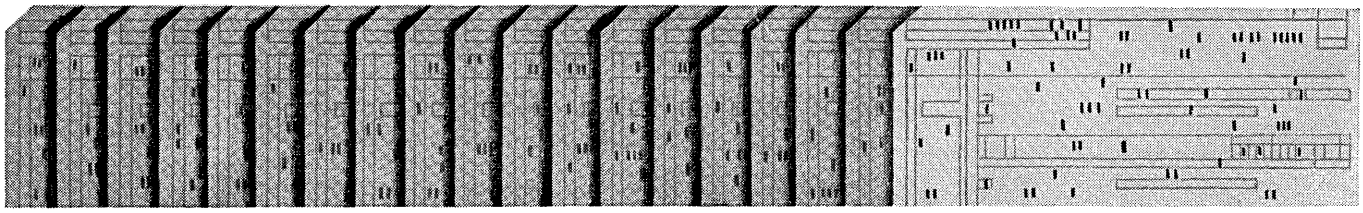
The Advantages of Numerically Controlled Machine Tools

MARCH
1961

VOL. 10 - NO. 3 & 3B

a DATA-PHONE case history

Biggest DATA-PHONE *system*



in the United States today!

A midwestern insurance company sets a dramatic example for users of data-processing equipment

The Hardware Mutuals - Sentry Life insurance group is using a new data-communications system to speed data handling by 500 per cent and reduce operating costs by over a million dollars a year.

The new system makes use of the nationwide Long Distance telephone network. It combines the Bell System's new *Data-Phone* service with data processing equipment to send business records from 32 branches to the company's centralized computer center at Stevens Point, Wisconsin.

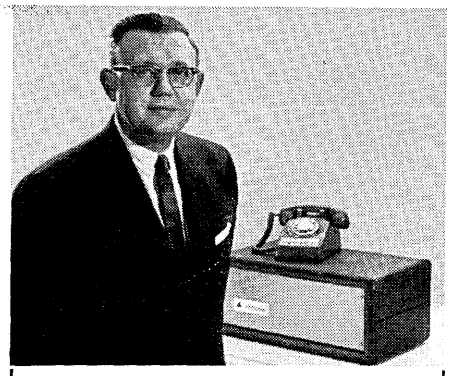
Machines "talk" to machines

All kinds of daily operating data, from widely scattered points, are handled efficiently and accurately at speeds up to 200 words per minute. The data is keyed into punch cards. A Data-Phone unit is connected to business machines at both the sending and receiving locations. A phone call is put through—and the machines immediately start "talking" data. It's that simple.

The system is as flexible as the telephone network itself. The insurance company pays for telephone circuits only when using them, as for any branch-to-headquarters call. And Data-Phone takes up little more space than a standard typewriter.

• • •

Learn how high-speed, low-cost Data-Phone service can streamline your company's data processing. Just call your Bell Telephone Business Office and ask for a Communications Consultant. He'll bring you the complete story.



James P. Jacobs, President, Hardware Mutuals - Sentry Life insurance group, says:

"Our new data-processing technique—with the rapid communication of data made possible by Data-Phone—is benefiting our business in many important ways.

"It lets us collect the mass of information we need for management decisions almost instantly. It has cut the time needed for certain policy-handling functions from three days to three minutes. It is reducing our operating costs by over $1,000,000 a year and is helping us give our policyholders better service than ever before.

"Naturally, we're enthusiastic about it."

The one source for all business communications

BELL TELEPHONE SYSTEM

COMPUTERS *and* AUTOMATION

COMPUTERS AND DATA PROCESSORS, AND THEIR CONSTRUCTION, APPLICATIONS, AND IMPLICATIONS, INCLUDING AUTOMATION

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Vol. 10, No. 3B

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

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

NOVEL APPLICATIONS OF COMPUTERS AND DATA PROCESSORS

Design changes double power of Honeywell 400

Internal speed increased to 10,000 three-address operations a second; new independent console, FACT business compiler, optional off-line printing, more optional tape drives.

Honeywell's EDP Division has greatly broadened the application of Honeywell 400 — and extended the benefits of electronic data processing to more companies — by incorporating into this System a number of outstanding new features. These new developments, a result of Honeywell's continuous research, have further enhanced the pre-eminence of Honeywell 400 in its class. And, except for the new optional features, *there has been no increase in cost.*

Internal speed jumps — The internal speed of the Honeywell 400 is now approximately 10,000 three-address operations per second — the equivalent of 20,000 one-address operations. Multiplication is about twice as fast as before, and division about four times as fast. Multiply time for a six non-zero digit multiplier is 1.9 milliseconds. Division times range from 1.6 to 8.6 milliseconds.

FACT business compiler available — Now, in addition to the EASY assembly program, the FACT compiler is available with Honeywell 400. FACT, a widely acclaimed, highly efficient automatic programming system, is unique in that it can be applied to *all* typical functions of business data processing with ease and uniformity. This includes input editing, sorting, processing of variable-length records, and report writing.

New independent console — Included in the basic system price of $8,660 a month is a new independent console equipped with a keyboard, printer, and breakpoint switches. This new console enables Honeywell 400 operators to communicate more easily with the System.

Optional off-line printing — Now organizations such as public utilities and insurance companies can print bills or premium notices in huge volume without attenuating the important processing work going on inside their Honeywell 400.

An off-line printing configuration consisting of a printer, high-speed magnetic tape unit, and electronic control equipment is now available at a rental of $3,500 per month.

More tape drives may be connected — The maximum number of magnetic tape units which may be used with the Honeywell 400 has been increased from six to eight. (Basic system includes four tape units.)

Expansion now easy, economical — By vastly increasing the processing power *without increasing the price,* and by making new optional equipment available, the new Honeywell 400 gives users power to spare for the years of growth ahead. It also makes easy and economical the possible future jump to Honeywell 800, the most powerful of all computers in the Honeywell family.

The outstanding performance of Honeywell 400 in the areas of storage and high-speed manipulation of large volumes of data make it exceptionally efficient at sorting and file maintenance.

SUMMARY OF KEY FEATURES

Basic package: Includes central processor, four high-speed magnetic tape units, console and console printer, high-speed printer and card reader.

Price of basic package: Monthly rental — $8,660 per month. Price — $390,000.

Options: Various input-output devices including off-line printing, up to four additional tape units, card punch (100 or 250 cards per minute), paper tape input and output units.

EQUIPMENT SPECIFICATIONS

CENTRAL PROCESSOR:	
Speed	10,000 (approx.) 3-address operations per second.
Memory	1,024 words of core memory (approx. 10,000 characters).
Checking	Internal parity checking.
Features	Simultaneous read-write, special automatic editing provisions, high-speed sorting ability.
Options	Multiply-divide, print storage for simultaneity with other operations, additional memory.
MAGNETIC TAPES:	
Speed	96,000 decimal digits per second.
Features	Identical to Honeywell 800 tape units. Orthotronic Control (automatic error detection and correction).
PRINTER:	
Speed	900 lines per minute.
Horizontal span	120 columnar positions.
Features	Up to 10 clean carbons, rugged construction, fully checked.
CARD READER:	
Speed	650 cards per minute.
Feature	Fully checked.
CONSOLE:	
Features	Printer and keyboard for both input and output, breakpoint switches.
AUTOMATIC PROGRAMMING AIDS:	
	EASY Assembly Program.
	FACT Business Compiler.

If you have any questions about this new and more powerful Honeywell 400, just write Honeywell EDP, Wellesley Hills 81, Mass. Or Honeywell Controls Limited, Toronto 17, Ontario.

Honeywell

Electronic Data Processing

Novel Applications of Computers

Neil Macdonald

Assistant Editor of Computers and Automation

From time to time, **Computers and Automation** publishes a section on "Novel Applications of Computers." Here is the call for information which we sent out on January 24:

The March issue of **Computers and Automation** will contain a special section on:

NOVEL APPLICATIONS OF COMPUTERS AND DATA PROCESSORS

If you have, or know of, any novel or unusual applications of computers or data processors, we should be very glad to publish three to six paragraphs about them, with the author's name. Pictures will be considered also.

May we hear from you by Friday, February 10, the closing date for the March issue?

If at any time you have any "novel applications of computers or data processors" to report, please write to us sending us the asked-for information, and we shall be glad to publish it in an early issue.

DIGITAL COMPUTER INSTEAD OF STABLE PLATFORM IN INERTIAL NAVIGATION SYSTEMS

S. H. McAloney

Ford Instrument Company
Division of Sperry Rand Corp.
Long Island City 1, N. Y.

Two new special-purpose digital computers, now being designed and built by Ford Instrument Co. as part of the AN/AJN-7 "strapped-down" inertial navigation system, moved recently from the theoretical to the hardware stage with construction of the first equipment modules.

Developed by Ford Instrument, under U. S. Air Force contract, for the Weapons Guidance Laboratory of Wright Air Development Command, the new "Fordac" computer is the heart of an airborne inertial navigation system that does away with the "stable platform" of conventional inertial navigation systems. The new system is called a "strapped-down" inertial system (or sometimes a "platformless" or "no-gimbal" system) because the gyroscopic components are body-mounted. The usual functions of a stable platform are performed by the computer mathematically.

In its final configuration "Fordac" will be a compact, lightweight, all-solid-state computer especially suited for airborne packaging. It employs novel techniques to compute and maintain the nine direction cosines that relate the coordinate system defining the vehicle axes to a space-fixed frame of reference. The name "Fordac" is derived from the words "Ford Altitude Computer."

In conventional inertial navigation systems, the moving gimbal structure requires a great deal of unobstructed space. Usually, space requirements increase with accuracy requirements. Furthermore, gimbal structures must be built to expensively close tolerances. All of these problems are bypassed in the AN/AJN-7 system.

The second computer, which was developed by Ford Instrument under a supplement to the original AN/AJN-7 contract, is a new solid state digital computer that combines incremental and DDA (Digital Differential Analysis) techniques. The computer has been nicknamed "Poco" from POsition COmputer. It will combine the output of "Fordac" with information from vehicle sensors to compute the position of the vehicle with respect to the earth.

"WRITING LETTERS" ON PAST DUE ACCOUNTS

William R. Platt

The National Cash Register Co.
Dayton 9, Ohio

An NCR 304 Electronic Data Processor writes letters on past-due accounts for Johnson's Wax.

Actually, letter writing is just a small part of the job done by the system. The NCR 304 processes orders received from 23 branches over leased wires, checks credit of purchasers, and prints invoices, bills of lading, and shipping labels. The processor also keeps an inventory for all 23 branch warehouses and the main warehouse and regulates shipments from factory to warehouse and from warehouse to warehouse so as to keep shipping costs down while maintaining an adequate supply of products at every outlet. Furthermore, the system handles payroll, accounts receivable, accounts payable and other accounting operations.

If an order exceeds the purchaser's allowable credit, the system prints out his complete credit history with Johnson's Wax, and also his Dun & Bradstreet rating and any other pertinent information available for review by the credit manager.

The letters on past-due accounts are pre-printed. The NCR 304 addresses them and fills in the details of the transaction on which payment is overdue.

There are four letters in the series, but only three are sent to any one customer in a given sequence. One letter is sent as a second letter if the situation

remains unchanged; a different letter is sent if another payment has become past due in the interval since the first letter was sent.

"SUGGESTING IMPROVEMENTS" IN THE DESIGN OF CIRCUITS, AND OTHER ENGINEERING WORK

J. R. Lamb, Jr.
General Precision Inc.
Pleasantville, N. Y.

In regard to computers used to assist engineering here, we have used the LGP-30, made by Librascope and marketed by Royal McBee, Port Chester, N.Y., for a wide variety of design applications.

These include (1) exploring the characteristics of filters for frequency trackers of Doppler radar navigation systems, (2) studies of the altitude-hold effect and its relation to antenna design in Doppler systems, (3) space navigation studies and error calculations, (4) calculations of the effects of frequency modulation in a carrier.

In addition, the computer has been used to check the reliability of designed circuits, and to re-design them when necessary to improve performance or to alter input-output specifications.

Take, for example, one such application, a four-transistor flip-flop. To begin with, the circuit used a basic two-transistor amplifier at each output. At the start of the analysis, an engineer writes separate, independent, nodal equations to satisfy the circuit. In these equations, the currents are expressed in terms of voltages across resistors. The engineer then establishes the criteria for circuit stability.

The basic equations describing the circuit and giving component values are then inserted in the LGP-30. The computer makes a run for each set of data with different values of transistor characteristics. It assigns a value to each resistor and voltage in the circuit. Each run differs from the others by a variation of one or more of the parameters involved.

The effects of aging, high temperature, fluctuations in power supplies, initial spread of transistor, and parameters of other components are evaluated. In some cases, the effects of several parameter changes can be lumped into a single, properly weighted, hypothetical parameter. When the computer finds a circuit with inadequate reliability, it can "suggest improvements" by introducing modifications of component values.

VOICE REPORTING OF CURRENT STOCK PRICES UPON INTERROGATION

Walter Clark
Teleregister Corp.
445 Fairfield Ave., Stamford, Conn.

A talking data processor will soon be reporting stock quotations over the telephone to brokers of the American Stock Exchange. Being built by The Teleregister Corporation, this processor is believed to be the world's first commercial system to use automatic voice output.

This is a real-time, on-line system. It will keep a continuously updated record of price and volume information on 1100 stocks, and will announce this data to some 750 brokers upon being interrogated via telephone dial. Within two seconds after a broker finishes dialing a stock code number, he will be listening to a report which will include the stock symbol, the prices, "bid, offer, open, high, low and last," volume, and size (number of shares bid for and offered).

The heart of the system, called a Telefile®, is a real-time data processor which can answer 20 inquiries per second, and which can talk to hundreds of brokers simultaneously, giving reports on any selection of different stocks.

Input to the magnetic storage is by keysets. The audio sub-system of the data processor stores a vocabulary sufficient for any possible reporting requirement. Subscribing brokers need only their regular telephones to obtain information from the data processor; but teletype inquiry and print-out is also available where desired.

Future functions of the Telefile may include operating the American Stock Exchange ticker system, performing clearing functions, and doing billing. It can also be expanded to handle more stocks and serve more subscribers.

The system is to be in operation by early 1963 and will cost $3,000,000.

The New York Telephone Co. cooperated on the communications phase and will supply the telephone lines.

A COORDINATE CONVERSION COMPUTER FOR PROJECT ECHO

John V. Cockin
Computer Control Co., Inc.
Framingham, Mass.

Project Echo is sponsored by the National Aeronautics and Space Administration to prove the technical feasibility of two-way microwave communication between the U.S.A.'s East and West Coasts using a 100-foot aluminized balloon satellite as a reflector orbiting 1,000 miles above the earth.

The earth's curvature constitutes a natural barrier to microwave transmission beyond the horizon. Previous attempts to bounce microwaves off layers in the ionosphere have not proved to be consistently dependable. Once the technological objectives of Project Echo have been established, a very important new method of global communication becomes available.

A significant contribution to the success of this project is a Coordinate Conversion Computer designed and built by this company for the Jet Propulsion Laboratory, Calif., a research facility of the National Aeronautics and Space Administration. The computer operates at a one-megacycle clock rate and continually positions the two 85-foot parabolic antennas at the West Coast (Goldstone, Calif.) site to track the orbiting satellite. The two antennas, their servo-drive systems, tracking optics, a microwave data link, and the coordinate converter combine to form a closed-loop tracking system.

The Computer performs the following functions:

(1) Accepts data on satellite position from precomputed orbit data recorded on paper tape, or from receiver antenna position data.

(2) Directs both receiving and transmitting antennas in hour-angle declination and azimuth-elevation coordinates, respectively.
(3) Computes orbital data from stored parameters by integrating the satellite's differential equations of motion. In these computations the Computer considers and makes corrections for parallax due to earth curvature and physical separation of the receiving and transmitting antennas.
(4) Extrapolates continuously to produce a smooth, well-timed, continuous series of commands between the computed commands appearing every one and two seconds.
(5) Time-compares all input orbit data for real-time computation.
(6) Generates error signals by a digital comparison of the digital antenna position readout signals and the computed position data.
(7 Introduces digital offset signals to correct for system misalignment.
(8) Generates a rectangular search scan pattern for the antenna.
(9) Accepts the receiver antenna readout as computer inputs and transforms these coordinates to position the transmitter antenna. In this mode the two antennas are directed to the same point in space through a radio frequency lock on the received microwaves.

The Computer proper is a general-purpose computer utilizing a stored program. The high-speed serial-parallel arithmetic unit performs the necessary coordinate conversions and parallax corrections. It provides output commands to the digital servos within 20 milliseconds from the time of input commands. These rapid computations are necessary to maintain systems synchronization and to reduce phase shift. In the time between basic computations the system integrates the differential equations of the satellite's motion. This computation provides an independent means of tracking the satellite should input data be in error or fail to be received. The Computer is given position data and velocity vectors of the satellite for a given time. These values are precalculated by a computing center at another location. Using this information the Coordinate Conversion Computer starts integrating the equations about one minute before the satellite balloon appears above the horizon. The Coordinate Conversion Computer keeps equations updated and synchronizes them with real-time.

While the Computer is operating from the orbital integration data, the commands to the digital servos are given at one-second intervals. When working from stored data on punched tape, the commands are given every two seconds. The Computer word length is 25 bits, including sign. The Computer can perform high speed addition, subtraction and multiplication. It can compute $A + B \times C + D$ in 50 microseconds. When multiplying it can transmit the product back to the multiplier or multiplicand registers controlled from the multiplication command. Built-in operations include octant reduction, sine-cosine manipulation, time conversion, maximum absolute value comparisons, extract or logical products, and block transfers.

APTITUDE TESTING AND ANSWER TIMING BY USE OF A COMPUTER IN REAL TIME

Wolf Research and Development Corp.
Boston 16, Mass.

A computer program which aids in the screening and selection of computer programmers has been developed by this company.

A Bendix G-15D computer has been programmed to administer multiple choice tests of 100 or less questions. The program is used in real time. Richard P. Gagan, an analyst, and Mrs. Frances Tessler, a programmer, devised the test. Time, as well as correct and incorrect answers, is an important element in evaluating the results of tests taken by applicants in this method.

The program is known as "PAT"—Programmer Aptitude Tester. To take the test, an applicant seats himself at the computer typewriter. Questions are contained on cards; a choice of five answers, one of which is correct, is provided. The computer is provided with a corresponding answer sheet. When the applicant has selected his answer, he types in the number of it. The computer then types out the number of the next question, and automatically starts to time the applicant on that question, stopping when the answer is typed in.

Upon completion of the test, a raw score (number of right answers minus one-quarter of the wrong answers), a time-adjusted score, and the mean time per question are typed out, followed by the time in seconds and results on each question.

The program is general enough for use with any multiple choice test.

THE COMPUTER DIRECTORY AND BUYERS' GUIDE FOR 1961, 7TH ANNUAL EDITION

The Computer Directory and Buyers' Guide for 1961, the 7th annual edition, will be published this year in July on a new basis.

We shall seek to make it a complete and inclusive directory and guide for the greatly expanding field of computers and data processors.

It will contain at least the following reference information:

1. **Roster of Organizations**
2. **Roster of Products and Services: The Buyers' Guide**
3. **Roster of Computing Services**
4. **Roster of Consulting Services**
5. **Descriptions of General Purpose Digital Computing Systems**
6. **Descriptions of Analog Computers**
7. **Descriptions of Special Purpose Computers and other reference information**

For subscriptions received March 1 and later, the "Computer Directory" will no longer be automatically included in every subscription to "Computers and Automation." The price of the directory will be $12 before publication, $15 after publication. Any purchaser of the directory will receive the monthly issues of "Computers and Automation" at no additional cost. If the directory is not included in a subscription, the price of the monthly issues of "Computers and Automation" will remain at $7.50 per year (in the United States).

NEWS of Computers and Data Processors

"ACROSS THE EDITOR'S DESK"

COMPUTERS AND AUTOMATION

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EIGHT POUND MEMORY DRUM STORES 358,000 BITS

Sperry Gyroscope Company
Division of Sperry Rand Corp.
Great Neck, New York

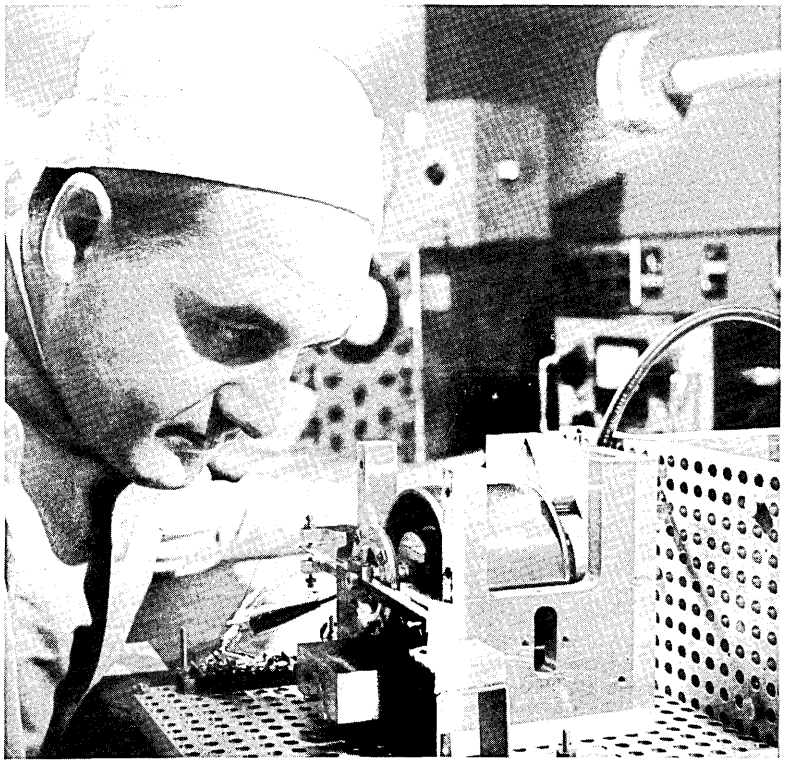
A miniature memory drum that can spin indefinitely and store an extraordinary amount of information within its baseball-size, cylindrical frame has been designed by this company.

The drum is able to operate reliably under extremely adverse conditions, and turns in an air-bearing suspension. It can be made to almost any size to fit the application.

The eight-pound aluminum cylinder can store information at 600 bits to the inch, and can hold 358,000 bits of information, about six times that of a comparable commercial drum.

"Floating magnetic heads" pick up and record data; they are cushioned on a film of air one ten-thousandth of an inch above the drum's surface.

The drum also has a "one-word loop", which speeds computer performance by enabling it to utilize information virtually as fast as it receives it and deposits it on the drum.



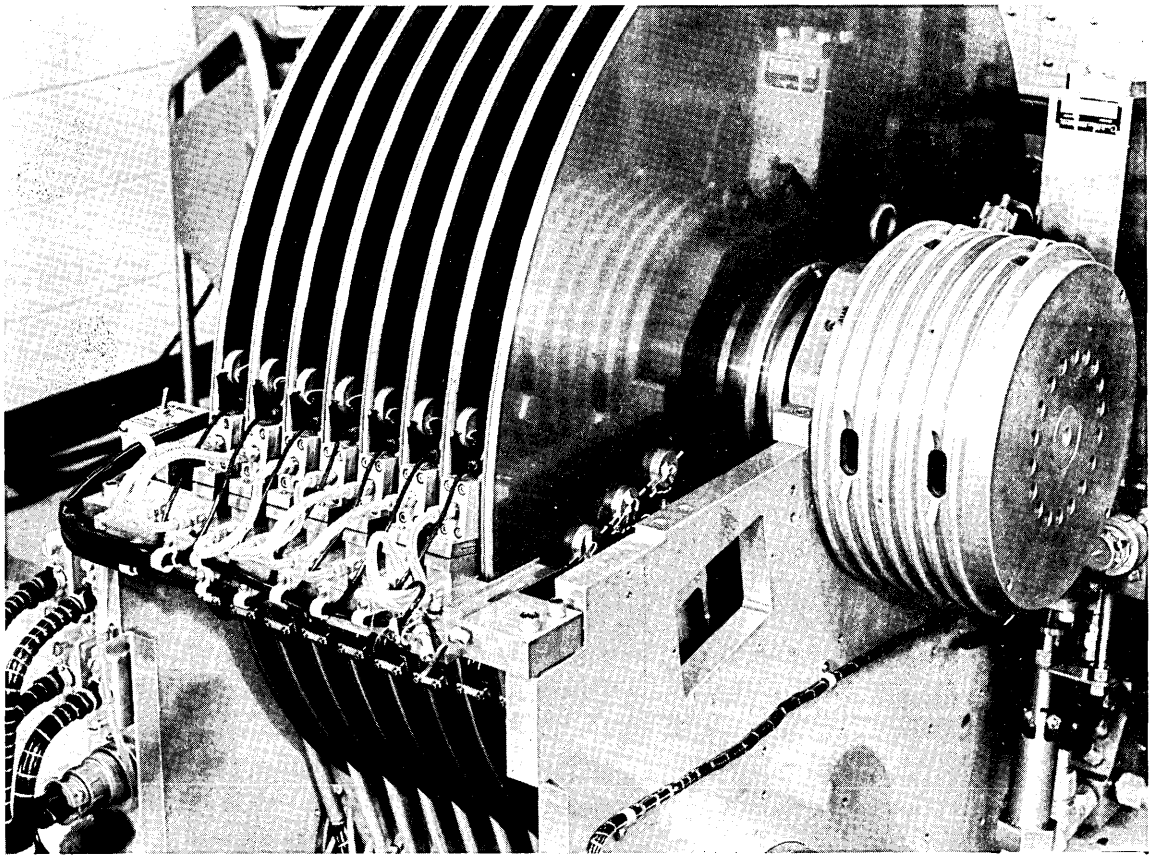
— An engineer in an ultra-clean, hospital-like laboratory tests the performance of the newly-developed computer memory drum, which is able to store 358,000 bits of information in its baseball-size frame. It is suspended on air bearings, instead of conventional ball bearings, and should be able to perform indefinitely, making it very suitable for prolonged use in space.

NEW MAGNETIC MEMORY DISC FILE DELIVERED

Joseph E. Smith, Gen. Mgr.
Bryant Computer Products
852 Ladd Road
Walled Lake, Mich.

The first random access, mass memory device made by an independent equipment supplier to the electronic computer industry has been delivered by this company.

The memory device is a magnetic disc file, which combines the reliability and fast access of magnetic drum memories, and the high capacity and low cost of magnetic tape memories.



A broad line of disc files, ranging in capacity from 30 million to 600 million bits of information is to be produced. Maximum access time of all units is 167 milliseconds, including 100 milliseconds for positioning. Average access time excluding positioning is 34 milliseconds. Cost per bit will range from one-tenth of a cent in the smallest unit to one-fortieth of a cent in the largest.

The disc files are precision electromechanical devices, in which business information is stored in magnetic code on a number of vertical discs. "Reading" and "writing" of information are accomplished by air-floated transducers which scan the sides of the discs.

A disc file may contain from one to 20 discs; they use a common base structure and a common drive system housed in a centralized pedestal mounted on the base. The discs are mounted on interchangeable precision spindles of the length required for the number of discs in a unit. Rotational speeds of 900-1200 RPM are standard.

"Reading" and "writing" on each disc face is accomplished by six magnetic heads mounted on a rocker arm which is movable to permit each head to serve 128 tracks. All of the rocker arms are locked together for movement as a unit under control of a digital actuator. The actuator is an open-loop, hydraulic system capable of moving the heads to any one of 128 positions with an accuracy of better than 0.0005 inches. Positioning is accomplished in less than one-tenth of a second in response to seven binary address signals. Positioning accuracy is guaranteed for the life of the file.

The recording surface of each disc is a hard magnetic oxide, micro-finished to insure recovery of all recorded information, and to

maintain a normal signal-to-noise ratio of 40 to 1.

Simultaneous positioning of all heads makes parallel "reading" and "writing" with a number of heads inherently possible. Clock tracks are used to time reading and writing accurately, and thus permit selective alteration of recorded information. A single set of six clock tracks is normally provided for the entire disc file, with one track for each of the six heads per disc side. Recording frequencies ranging from 174 kc in the innermost tracks of a disc to 431 kc in the outermost tracks, based upon a maximum pulse packing of 273 bits per inch, are standard.

Read and write circuits, head switching, and clock circuits are completely transistorized and modularly packaged to facilitate assembling of systems to meeting special needs for serial, parallel, or serial-parallel recording capability.

Additional flexibility may be achieved by including multiple, individually-addressable actuators, each controlling the position of a group of heads, or by including a second set of heads, serving the same tracks and positioned by an independent actuator.

VERSATILE DIGITAL TRANSDUCERS

De-Jur Amsco Corp.
Northern Blvd. & 45th St.
Long Island City 1, N.Y.

Development and production of sensors and transducers for direct use with digital computers has not kept pace with the tremendous progress of the digital computer industry.

Seeking to bridge this gap, this company has developed a complete line of digital transducers with true digital outputs. These devices reduce the overall size of instrumentation and control systems, increase their reliability and produce results which can be directly stored and used in digital computers.

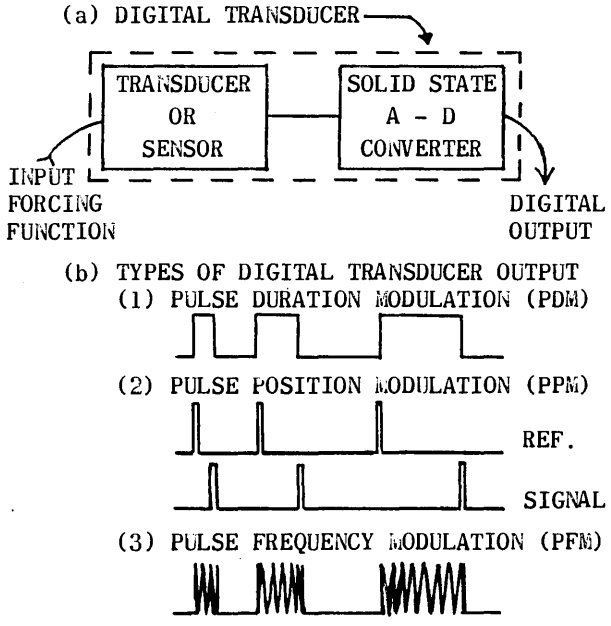
Figure 1(a) block diagram illustrates the principle of operation of these transducers. The input forcing function can originate from several primary sources of energy (pressure, temperature, acceleration, rate of flow, etc.). When fed into the transducer or sensor, the analog signal is subsequently converted into a true digital signal by means of solid-state conversion circuits.

Figure 1(b) illustrates various types of time base outputs that can be made available from the converter, and are directly proportional to the input forcing function. Output (1) is commonly referred to as pulse duration modulation (PDM); the width of the pulse in time units (microseconds) is directly proportional to the input signal. Output (2) is pulse position modulation (PPM) and consists of a reference pulse and a signal pulse whose position in time deviates from the reference pulse in direct proportion to the input signal. Output (3) is shown as pulse frequency modulation (PFM) and is made up of a number of pulses with the total per unit time directly proportional to the input.

Important features which characterize this unusual digital transducer is its ability to sense many different sources of energy in one miniature self-contained package, and deliver a true digital signal output directly proportional to the amount of energy detected. Also, its solid state circuits make this transducer relatively impervious to environmental variations. This desirable characteristic to withstand exposure to extremes of environment is a critical requirement necessary for military applications. Another advantage is the ability to pre-calibrate the digital output to correspond directly with the value of the parameter being measured without need for zero suppression. For example, a digital pressure transducer with a full range of 0-1000 psi can be made to indicate an output of 0-1000 microseconds (PDM or PPM) for this input pressure range.

Together with its new line of subminiature pressure instruments, digital pressure transducers for pressure ranges from 5 to 8000 psi can be supplied. Minor revisions will convert this device to a digital temperature or digital acceleration transducer.

FIGURE 1



AUTOMATIC COMPUTING OF PARKING CHARGES

Airport Parking Co. of America
1306 Prospect Ave.
Cleveland 15, Ohio

The first airport parking installation of automatic computing equipment to hasten the in-and-out flow of motorists, and make sure of the accuracy of the fees charged, is being tested by the Airport Parking Company of America in its lot at the Washington, D.C. National Airport.

-- The ticket coder shown in the doorway punches the time of entry into the parking ticket, in the test installation of automatic computing equipment at the Washington D.C. National Airport. When the motorist's parking check is fed into the slot of the automatic computer, the computer figures out the fee in less than 3 seconds, and flashes it on the easily visible panel at the upper right. --

As the motorist enters the lot, he receives a claim check with a pattern of punches expressing the time of entry. The same information is printed on a ticket stub which can be slipped under the windshield wiper or placed with the customer's keys in the attendant's shelter, for use if the motorist loses his own parking ticket.

When the customer leaves the lot, his ticket is inserted in a ticket reader slot of a parking computer. In 3 seconds or less, the computer adds up the cash total due and flashes it on a lighted panel easily visible to the motorist, who thus can be his own auditor in making certain the fee is correct.

The system in use at the Washington National Airport is a Unipark Parking Computer, produced by the Universal Match Corporation.

An automatic coder and dispenser of tickets is being designed; it will code, stamp, and cut off a ticket, and present it to the customer within easy reach on the driver's side, thus making entry into the parking lot even faster.

This company now has automatic equipment of various types in more than half of its airport and downtown parking facilities, and is planning many additional installations.

The new computing system offers particularly good possibilities for airport parking, because motorists using these facilities are usually in a hurry, either to catch a plane or to get home after a trip. Automatic computing to prevent delays is a major step in speeding entrance and exit, as well as assuring correct charging and improved financial controls.

COMPUTING MAP GRIDS FOR READING SATELLITE WEATHER PICTURES

Allied Research Associates
43 Leon St.
Boston 15, Mass.

I. By Robert A. Fischer, Development Planner

We at Allied Research were most interested to read the account "Computer Handling Satellite Weather Data," which appeared on page 1B of the January 1961, issue of your magazine. Recently some significant advances have been made in the state of the art which should be of interest to your readers. These are described in the following remarks by Dr. Christopher Dean of our company.

II. By Dr. Christopher Dean, Senior Scientist

The perspective grids to which your article refers were produced by this company as part of their first-generation techniques for operational TIROS data processing. They permitted maximum flexibility during the initial experimental work by using an auxiliary coordinate grid (the "rectangular grid" referred to in the article) which is thought of as sliding along the earth's surface so as to be always directly centered on the TIROS optical axis. Conversion to latitude and longitude involved a second step.

More recently, the company has developed and delivered to the TIROS II meteorological unit at Pt. Mugu, California, a program for the Bendix G-15 computer and plotter which will generate an individual perspective grid of true latitude and longitude for each TIROS picture. Grids are now prepared by a computer at the site shortly before each telemetry period, so that the picture interpretation can start immediately. Because true latitude and longitude are shown directly, the meteorological information can be transferred directly from the projected picture onto a standard map base, saving time and eliminating errors.

In the most recent version of the Allied Research program, the G-15 computer uses satellite orbit and orientation constants to calculate the parameters needed for each picture. With this program the grids for an entire sequence of pictures are produced automatically. This procedure eliminates a considerable amount of effort heretofore required to obtain these parameters graphically and to read them individually into the machine.

MECHANICAL DRAWINGS REPRODUCED IN ONE-HALF SECOND BY COMPUTER, CATHODE RAY TUBE, AND MICROFILM

Stromberg-Carlson-San Diego
Division of General Dynamics Corp.
San Diego 12, Calif.

Complex engineering drawings can now be produced by electron beams in less than one-half second from information supplied by a computer.

This company's S-C 4020 High-Speed Microfilm Recorder can use a mathematical code supplied by a computer and an electron beam for drawing; it then produces lines, curves, symbols, dimensions, captions, etc., necessary to give detailed drawings, in a fraction of a second. The views are produced on a cathode ray tube and photographed on microfilm.

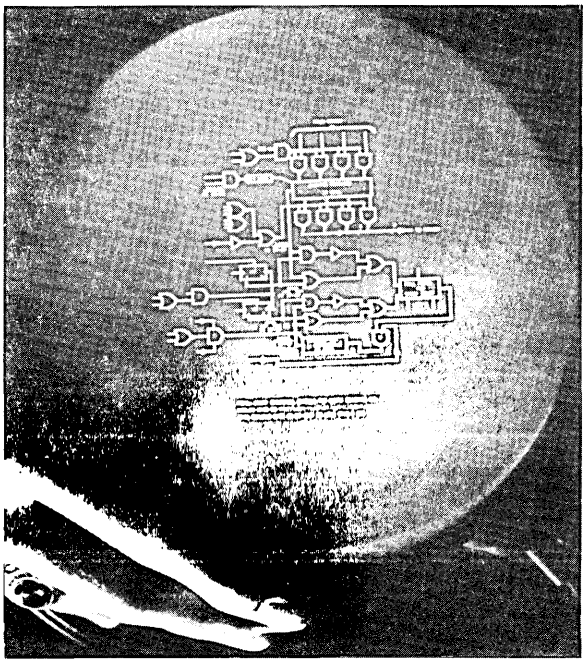
Until the development of this equipment, it might require from a week to a month to take a design engineer's ideas, convey them to a draftsman, produce an engineering drawing for the machine tool operator, and then have the parts made.

Now, a computer can be programmed with the contours and specifications of the part to be designed, and the information transferred to the Microfilm Recorder. This device then makes mechanical drawings of the part from a specified viewpoint in a fraction of a second.

Once the engineering specifications are placed in the computer, the equipment can be asked to produce drawings of any view or cross-section of the part in three dimensions.

Not only can the machine produce a mechanical drawing directly from a computer code but also it can use the same code to produce tapes to operate the production equipment.

Any individual view on microfilm frame can be photographically enlarged and reproduced in any quantity. An accessory unit permits automatic processing and projection of the film on a 2' x 2' screen within 8 seconds.



-- This complex circuit diagram was automatically drawn with an electron beam on the face of the 7-inch Charactron Shaped Beam Tube in the Stromberg-Carlson S-C 4020 High-Speed Microfilm Recorder. The equipment records drawings on 35-mm microfilm in less than one-half second. --

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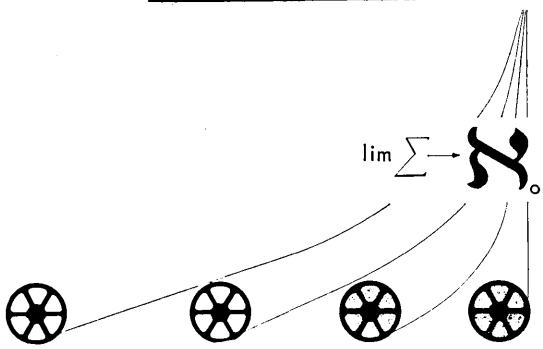


NEW COMPUTER SERVICE FOR SMALL AND MEDIUM-SIZED COMPANIES

National Cash Register Co.
50 Rockefeller Plaza
New York, N.Y.

A new computer service will make electronic data processing available for the first time to companies as small as a neighborhood store with one cash register. This computer service was opened in New York in January by this company, which plans to offer similar service in major cities throughout the United States.

Equipped with a new $75,000 computer, the NCR 390, the service will automatically prepare sales and inventory reports, payrolls, customer bills and other business records.

The center will be able to handle record-keeping jobs for many different types of business firms, including stores, manufacturing plants, brokerage houses and others.

In one hour, the desk-size NCR 390 computer can automatically turn out a detailed analysis of 50,000 retail transactions. In less than an hour, it can figure the earnings and deductions for a company with 250 employees, write their pay checks and prepare a complete payroll record for each individual.

Any company equipped with a National Cash Register adding machine plus a punched paper tape recorder will be able to use the new low-cost computer service. The computers also process paper tape created by accounting machines and cash registers equipped with recorders. In addition to punched tape, the centers also will process punched cards.

Companies will be able to obtain from the new service daily, weekly and monthly breakdowns showing sales and profits for each department and, if desirable, for each individual product. The service will also provide reports on the performance of sales personnel.

LARGEST SYSTEM OF PRIVATE TELEPHONES AND COMPUTER LINKS ESTABLISHED

Lockheed Aircraft Corp.
Burbank, Calif.

To speed up company communications and save a quarter-million dollars a year, this company on January 16 established the world's largest private telephone system.

Linking 65 Lockheed offices and facilities across the United States, the network involves 100,000 miles of lines leased from 15 major U. S. telephone companies, and connects 21,727 telephones.

Besides serving as an improved instrument for management of the company's missile, aircraft, electronics, shipbuilding, space, and related activities, the system will increase the flexibility of electronic computers for business and scientific work in the company's four main data processing centers.

The network is designed to transmit data between high-speed electronic computer centers at each of the company's major divisions during the light-traffic evening hours and early morning hours.

Four automatic switching centers -- routing calls and handling traffic for the network -- will operate in Sunnyvale (headquarters of Lockheed's Missiles and Space Division, near San Francisco), Van Nuys (serving the Los Angeles area), Marietta (headquarters of the company's Georgia Division), and Plainfield (in New Jersey, location of Lockheed Electronics Company's main office).

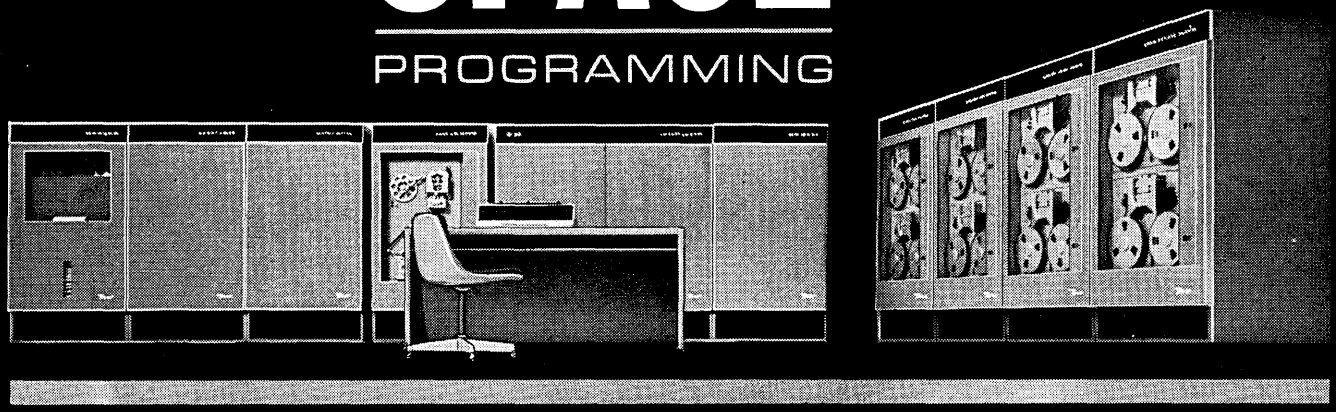
COMPUTER PAPERS AT THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS MEETING IN NEW YORK, JAN. 29-FEB. 3, 1961

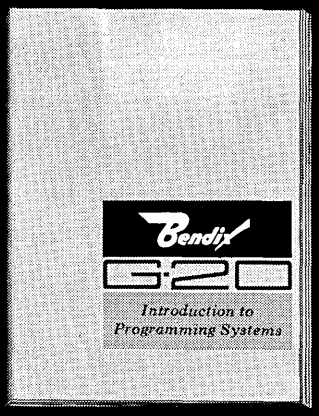
C. A. R. Kagan
Vice Chairman, Computing Devices Committee
American Institute of Electrical Engineers
33 West 39 St.
New York 18, N.Y.

Thirty-seven computer papers were presented at the AIEE Winter General Meeting in New York from January 30 to February 3, 1961. The 7 sessions sponsored by the Computing Devices Committee were: Advances in Data Processing Systems; Logic and Switching Circuit Theory; Shaft-Position Encoder Methods; Tutorial Session on Computer Application to Design Evaluation and Simulation; Man-Machine Aspects of Automatic Programming for Digital Control Systems; the Organization of Large-Volume Data-Processing Systems; Methods for the Automatic Design of Electronic Equipment. A total of over 100 sessions were scheduled, many others also being of interest to computer designers and users.

The AIEE makes preprints of all papers available before the meeting. A complete program of all sessions and preprints can be obtained from the Institute headquarters, address above.

BENDIX
G-20 COMPUTER
'SPACE'
PROGRAMMING





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EXECUTIVE—provides automatic program scheduling and component assignment . . . permits maximum-efficiency in parallel processing and utilization of components.

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THE Bendix CORPORATION

Bendix Computer Division

DEPT. D-30, LOS ANGELES 45, CALIFORNIA

AUTOMATED MATERIAL CONTROL

Paul L. Russell
Application Engineer
General Electric Co.

(Based on a talk before the American Society for Testing Materials, New England District, October 27, 1960, Boston, Mass.)

In some types of manufacturing, costs of handling the material can be as much as 40% of total product cost. These costs represent the real but as yet largely untapped potential for automation of material handling. Here's a major opportunity to reduce costs and achieve much greater efficiency, yet at the same time improve quality and service to customers.

It is convenient to refer to this whole area as automated material control, or AMC. Some people may think of automatic warehousing, but it encompasses more than that. Warehousing may be only a small part of AMC. What we are really talking about are automated material handling **systems;** whether they involve finished goods, in-process goods. or raw materials; whether they occur in warehousing, manufacturing, distribution, or related fields like airline baggage handling.

In the past few years there has been rapidly expanding interest in the application of automatic control to material handling. Simultaneously there has been a trend to automate much of the paper work of production and distribution. And, in wedding these two, lie big opportunities.

Why Automate Material Handling?

In the next decade we in New England, will be faced with critical pressures to increase the efficiency of our operations and at the same time improve our products and service. AMC is not only desirable, it is **essential,** if American industry is to continue to compete successfully; and the more complete we make it, the more competitive shall we be.

Because both domestic and foreign competition grows keener every day, our competitive position is of increasing concern. We worry about rising costs; we maintain closer controls over quality; we make maximum use of capital; we pay more careful attention to the availability and maximum utilization of electric powered equipment versus human energy; we continually strive to improve the speed and efficiency of our production; and we all look for ways to serve our customers better. In all these areas AMC can help.

Some of the immediate benefits to be obtained from automating material handling are:

Reduced Operating Cost—AMC systems can automatically control the handling and flow of your goods or materials with little or no human intervention, and with greater accuracy. Labor released from pure manual handling of goods is made available for more productive work. Daily output is paced by machine speed rather than being dependent on human variation.

Reduced Inventory—With quicker, more efficient handling and more accurate up-to-date inventory control, turnover of goods is faster, and investment in inventory can be reduced for immediate savings and this capital used elsewhere to further increase profitability.

Better Inventory Control—By integrating material handling control systems with accounting and inventory procedures, management can be provided with up-to-the-minute information on all items in the plant. From receiving to storage to shipment, you have **control** of the material flow.

Improved Customer Service—Customer orders are filled faster and more accurately. These faster shipments in turn allow customers to reduce their inventories with associated benefits repeated to them. Shorter shipping time, plus flexibility in meeting customer needs, results in more orders from more satisfied customers.

More Efficient Use of Space—Elimination of wasted aisle space and utilization of overhead areas makes use of otherwise unproductive space. Further savings result from the accompanying reduction in maintenance and service costs on the reduced area required.

Reduced Facilities Costs—Less stringent lighting, heating and ventilating requirements may be possible.

Reduced Losses of Goods—Automated material handling systems result in greater accuracy of records, reduced damage, spoilage, and pilfering. Some of the benefits of AMC cannot be assigned dollar values, yet they are equally important to the success of the business operation. Having current operational data is valuable to management. Continuous and accurate figures on production, inventory, orders and shipment can take much of the guess work out of many business decisions.

What Businesses Can Benefit Most from Automated Material Control?

Whether your business is primarily concerned with manufacturing, warehousing, or the distribution of goods, material handling automation can benefit you. Generally, a high volume of relatively few types of items tends to favor AMC. The higher the volume of goods handled, the greater is the need for material handling automation and the greater are the benefits

to be realized. Any business may have many profitable opportunities for material-handling automation, such as receiving and handling incoming materials and components; temporarily storing incoming items and later dispatching them to manufacturing areas; in-process handling or temporarily storing semi-finished components or assemblies; dispatching finished goods to stock; picking orders to fill customers' orders either from the factory or from a distribution center or warehouse. These are all opportunities for Automated Material Control system to lower costs and give customers better service.

What Does Automated Material Control Do?

Our experience with AMC systems indicates that there are certain common denominators. These can best be described in terms of five basic control functions as:

1—Identify
2—Dispatch
3—Store
4—Recall
5—Deliver

Identify—can be accomplished automatically or manually; **automatically** by photoelectric devices which can identify items by printed codes or by other electrical sensing devices which can distinguish items differing from each other in size, color, weight, chemical composition, or other physical characteristics. **Manual identification** involves an operator who visually recognizes different types, addresses, or whatever identity is provided. He then puts his information into the control system via a keyboard, or else he marks the item or carrier with a code which will be recognized by later portions of the system. Information from the identifying function can be used to **dispatch** these items to pre-selected locations. These may be areas for semi-permanent storage or short time storage before further processing.

Storage—represents a buffer between flow rates into and out of the system. For goods in storage, AMC systems can control flow into and out of storage in a first-in, first-out or last-in, first-out sequence. They can signal when maximum or minimum stock levels are reached. They can maintain a continuous up-to-the-minute record of inventory.

Recall—this is concerned with retrieving items from storage. The most frequent use of recall is in order picking. In an automated order picking system, information on customers' orders may be fed into the system in the form of punched cards or tapes and the necessary quantities of each item are then released from automatically controlled storage racks. Order picking is fast and accurate, and these punched cards or tapes used to control the material handling system may be the same, or generated at the same time, as the ones used by the data processing portion of the business. In addition to order-filling, automated recall systems can do such jobs as releasing parts and components to assembly areas, delivering baggage from temporary storage, or even releasing automobiles from an automatic parking system.

Once an order has been collected, it can be automatically **delivered** to a selected packing station or shipping dock ready for loading. Or in a manufacturing operation, items released from temporary storage may be directed automatically to the desired place.

Association of Functions

Any of the five basic control functions may be performed individually, or combinations of them may be associated or integrated into a completely automated material control system. One of the best examples of combining these functions is in a plant which manufactures a product like ceramic tile. In this process various bulk materials must be combined in precise proportions. A lorry car is programmed to run to a position below a bin containing a certain material, where a device weighs out the required amount into the car; then this operation is repeated a number of times before carrying the materials to a mixer. By inserting a new punched card into the system, the formula is readily changed, and a different type of batch concocted. In this process **recall** and **delivery** of the raw materials has been automated.

Integration of Material Handling and Data Processing Operations

The opportunities to integrate material handling operations with paper work or data processing represent some of the most fertile and beneficial areas of AMC.

As material-handling operations are being performed, large amounts of useful data and information respecting the volume and flow of these goods will become available to you. This information, when properly measured and recorded, can be fed into a data processing system to provide insight for improved customer service or for timely management decisions. This same information can be fed directly into computers for automatic control of inventory, production and billing. With such an integrated system, lists can be automatically made of items ordered, items shipped, and shortages, if any. Computing equipment can then calculate prices, total the bill, add transportation charges, and calculate discounts, sales credits, commissions, etc.

Some Examples

Here are some examples of installations where AMC is returning important cost savings.

At the **South Station Postal Annex,** in Boston, a "Mail-Flo" system helps process mail. After the mail is sorted for first class only and placed properly for stacking and cancelling, it is put into trays. These trays are automatically directed to primary sorting areas, then to secondary sorting areas. After this final sorting operation, the mail is sent to tying and bundling stations for exit from the post office.

AC Spark Plug Division of General Motors has an AMC system for handling dashboard assemblies. Cartons received from production are manually identified by an operator at a keyboard, automatically dispatched to storage areas, and then automatically recalled as needed.

Colgate-Palmolive Company uses an AMC system for order-picking from warehouse stocks. Cartons containing various products are stored on three levels of gravity-fed racks. Orders coded on punched cards are read by a control console, causing gates at each lane

to open in the proper sequence and drop the required number of cartons onto a take-away belt for delivery.

C&H Sugar Company uses an Automated Material Control system for identifying and dispatching bags of sugar to storage areas. When the pallet load is accumulated in one of the seven storage areas, no more bags are permitted to enter until the load has been released to its palletizer. Identification is accomplished by an operator.

Armstrong Rubber Company has an AMC system for transferring pallet loads of tires from production to warehouse. The pallets are automatically directed into elevators and are stored on the proper floors for later recall to shipping docks.

GE Appliance Park, Louisville, Ky., has used for four years an AMC system to dispatch "trains" of appliances to appropriate storage areas as they come from production. Here an operator manually identifies the trains as they pass near his keyboard; then the dispatching job is turned over to the automatic control system.

How to Start Your Own AMC Program

Before starting your own AMC program, you would do well to stand back from your operations to make sure you don't miss the forest for the trees. Verify to ensure there aren't unnecessary handling steps in your operation. While simplifying these operations, strive for a functional concept of which material-handling operations you desire to automate. One, two or perhaps all five of the control functions of "identify, dispatch, store, recall and deliver," should lay the foundations for this automation concept. In your thinking, consider the tie between the physical material handling and the data processing functions. Include in your plan future operations as well as present.

After you have planned what you would like to do, determine how much automating each of these functions would be worth to you. How much is it worth to utilize your manpower more effectively in production? How much does a reduction in inventory mean? How much is improved customer service worth to you? Make sure that you consider not only present cost but the costs which you are likely to face in the future if you continue operating in the same manner.

Now, you may decide that the worth of some automated function is presently insignificant and thus reject that one immediately. What may be worth a good deal to one business may be of little value to another. Therefore, only you can determine which factors are important to your operation and how much they are worth.

Now for the $64 question—"How much will it cost?" AMC systems require well engineered and properly selected equipment. Close cooperation is required between the user, mechanical equipment manufacturer, and electrical equipment manufacturer to produce reliable, realistic cost estimates.

Having now formulated desirable functions for automation and obtained estimates, you now can compare the worth and cost of these functions to decide which ones to automate. In planning for automation, keep the over-all system picture in mind. Set up a master plan for automating your material handling. Decide what part of this master plan you can economically do now, and do it. Do not let what **cannot** be done today deter you from doing what **can** be done today. Fill in the gaps in your master plan as they become economically and technically feasible. Perhaps you will decide to automate your recall function for order picking but decide to manually identify and place items in stock. Then in designing your system, provision should be made for future addition of equipment to automate the identify and place functions without disturbing functions already automated.

The Automatic Meteorological Observation Station (AMOS) Computer

National Bureau of Standards
Washington, D. C.

The National Bureau of Standards in cooperation with the U. S. Weather Bureau has developed the fourth model of a specialized digital computer for the Weather Bureau to use as a research tool in exploring the concept of the automatic weather station. The AMOS IV computer receives data from weather-sensing instruments and processes these data through such functions as sampling, comparing, selecting a maximum, and arithmetic operations. The results are transmitted via teletype to a central forecasting station and to other airport weather stations. Values of two quantities recently developed as aids to air safety —runway visual range and approach light contact height—are given by the machine through automatic table look-up.

Automatic Weather Stations

For a number of years, the Weather Bureau has been appraising the possibilities of an automatic weather station. Such stations could be widely distributed, and would be especially useful in relatively inaccessible locations that are important sources of early data on meteorological activity. The various developmental prototypes of this concept have been

called AMOS (Automatic Meteorological Observation Station); the current version, containing transistorized packages, is AMOS IV. This model was designed and built by Paul Meissner and J. A. Cunningham of the NBS data processing systems laboratory and by C. A. Kettering of the U. S. Weather Bureau. It is an outgrowth of previous work done by NBS for the Weather Bureau that resulted in a special computer for processing cloud-height signals from a ceilometer. The ceilometer was intended for use with the AMOS III.

Calculation Required

Several of the input quantities to the AMOS computers, such as cloud height and precipitation, cannot be satisfactorily represented by instantaneous values but must be time-averaged. Varying amounts of data processing must therefore be associated with the different instruments measuring these quantities. In the AMOS III concept, several complex units were required for these functions. Although many of the functions were similar, the hardware was not minimized because of a diversity of design that resulted from the isolated development of the individual units. Analysis of the over-all system indicated that a considerable reduction could be made in hardware and therefore in maintenance.

In AMOS IV, the automatic weather station is built around a single small, general-purpose computer designed especially for this application. The computer receives data from the input instruments at any desired interval. These data are suitably processed and arranged in a specified order for teletype transmission in a variety of message formats and at various speeds. The computer also operates local and remote displays. Much latitude is available for research into the most desirable form of data processing because of the inherent flexibility of the internally programmed machine.

Input Quantities

The computer continuously monitors new input data while simultaneously processing data already entered and transmitting messages on command. Among the input quantities which the AMOS IV computer can handle are temperature, dew point, wind speed and direction, atmospheric pressure, precipitation, transmissivity, and cloud height. Input data can be received directly from the instruments in the simplest possible form, such as analog voltage, current, or resistance; and pulse rate or contact closure. Information may also be received in coded form, such as the Gray binary code frequently used with shaft-position encoders. The nature of the weather instruments and of the quantities measured limits the input data to 2 or 3 decimal digits for the most part; word size is therefore 3 digits plus sign. Double-precision methods are available for those few instances requiring greater accuracy. Communication with the machine is via electric typewriter or punched tape.

The computer circuitry is based on transistorized plug-in assemblies designed at the Bureau of Standards for a variety of data-processing applications. These 50-kc packages perform flip-flop, analog switch, and gating circuitry functions, as well as others.

Storage

To store data, the machine uses a magnetic drum operating at 1800 rpm that carries 100 general storage channels of 100 words each and has space for 100 additional channels. Several dual-head channels are available for simultaneous read-in and read-out of incoming data, out-going messages, etc. The magnetic drum provides the extensive storage capacity required for the table look-up involved in the calculations of runway visual range and approach light contact height. About 35 tables are stored on the drum; each table has about 90 three-digit values.

Runway Visual Range

One set of these tables contains the data on runway visual range (RVR), i.e., the distance along the runway visible to a pilot from the point of touchdown—generally 1000 to 6500 feet, depending upon runway illumination (natural and artificial) and atmospheric conditions. The primary input for the RVR determination is a transmissometer reading. The computer continuously monitors this reading and "looks up" the proper corresponding value of RVR, which is then displayed locally and inserted into the teletype message.

Height for Identifying Approach Lights

The other set of tables contains the data on approach light contact height (ALCH), i.e., the height from which the pilot can identify the approach lights. ALCH is affected by background illumination level, atmospheric conditions, and the intensity of the approach lights, which are set in accordance with prevailing conditions. If limiting conditions are indicated by either low clouds, as shown by the ceilometer, or by fog or snow, as sensed by the transmissometer, a value of ALCH based on the interfering factor is obtained. If both factors are present, two calculations are made; the machine then determines and displays the lower value. Since there is a statistical uncertainty in this type of information, two values of altitude are presented. The higher altitude is that at which the pilot has a 20 per cent probability of seeing the approach lights; the lower altitude is that at which the probability is 90 per cent.

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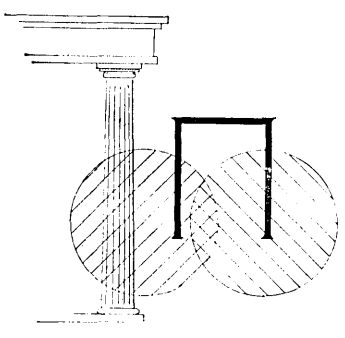


The Advantages of Numerically Controlled Machine Tools

G. S. Jollis

Flight Propulsion Division
General Electric Co.
Schenectady, N. Y.

Numerical control is simply the application of compatible numbers or values to control various elements of a given process. Specified numerical values are applied to control such functions as feeding, speeds, dimensions, pressures, temperatures, and many others. In practice, the number or "information," when placed on a convenient "storage medium," becomes the command signal for the "control system," which, in turn, causes a specific function to take place.

Whether the storage medium is punched paper tape or magnetic tape or a punched card, makes little difference to this evaluation. Equally unimportant for purposes of this discussion, is the system used for transmitting the information, electrical, electronic, optical, sound, or mechanical. However, it is important to remember that we are dealing with specific command signals or a combination of coordinated and synchronized instructions to the process to be controlled and that these signals are as accurately and unmistakably defined as a number is defined. A number in itself, does not have an error.

As long ago as 1807, a punched card system was devised by Joseph Marie Jacquard to control textile looms. More recently, the familiar paper piano-roll for player pianos performed essentially the same function. It produced music with great accuracy and repeatability; to change the tune took only as much time as was required to change the "tape." However, a serious study of the principles of numerical control and their more sophisticated and complex application to machine tools did not get under way until 1949. The study was conducted by Massachusetts Institute of Technology under sponsorship of the U. S. Air Force.

Since then, the development of numerically controlled equipment has made great strides, and helped accomplish things which otherwise might not have been possible.

Advantages

The first important feature of numerically controlled equipment is that the "input" is error-free and has zero tolerance. Templates and cams can be replaced by numerical data. The unavoidable accumulation of tolerances in the making and setting-up of templates is eliminated; in most cases, tedious and wasteful trial runs are no longer necessary. With numerical control, the first piece produced by a machine tool is usually correct. This greatly simplifies inspection methods; in fact, inspection itself can be conducted with numerically controlled devices.

Secondly, in the majority of cases, elaborate jigs and fixtures are no longer required. This not only represents considerable dollar savings, but permits rapid changeover from one set-up to another. In addition, the storage space for jigs and fixtures, etc., can be used for other purposes.

A third and very important advantage is that control set-up time, that is, the time required to schedule control signals, is essentially reduced to zero. Over-all machining time is therefore considerably decreased; the machine can produce more parts in a given period of time; the parts can be made in smaller quantities; and inventory can be kept at a minimum. The reduced cycle of machining time, in particular, represents one of the greatest dollar values in numerical control. However, the so-called "faster" machining is due only to the reduction in control set-up time and not to any other non-existent "miracles" during the actual operation of removing metal. Actual cutting speeds and feeds are still limited by the cutting tool itself and by the horsepower available. Numerical control does not change these factors. It does, however, provide conditions for the best utilization of tools. In the case of work-hardening materials, the ability to control dwell time and in-feeds is of major importance.

Modern vs. Old Machine-Tools

The advantages discussed so far are all due to the numerical control system itself. It is obvious, however, that the precision, the minute tolerances, and repeatability of a well designed control system would be of little use if applied to an out-of-date machine tool. Every operator is familiar with backlash and friction in machine tool slides. Depending on his skill, he can compensate for these conditions. Numerical control cannot do this. In addition, the combination of spring effect and slide inertia results in a resonance condition which, if not carefully considered in the design, may create inadequate performance. If we add to that, other factors such as resilience in screws, bearings, shafts, etc., we recognize that the machine tool itself must be designed for numerical control to utilize the capability of the control system. The over-all results will naturally depend on the weakest link in the chain.

BURROUGHS CORPORATION ANNOUNCES

THE B 5000, WHICH SETS NEW STANDARDS IN

DS IN PROBLEM SOLVING & DATA PROCESSING

The new Burroughs B 5000 Information Processing System is a decided departure from conventional computer concepts. It is a problem-oriented system. Its markedly different logic and language are in large part dictated by the characteristics of ALGOL and COBOL. And it incorporates a complete set of operating, monitoring and service routines.

Additional operational features include an average add execution time of three microseconds, and a memory cycle time of six microseconds. Both character- and word-oriented, the B 5000 operates in binary *and* alphanumeric modes; a single set of arithmetic commands operates interchangeably on both fixed-point and floating-point numbers.

More important than these features is the fact that they combine with compiler-oriented logic and language to provide a new concept in computing—an integrated hardware-software system which sets:

NEW STANDARDS OF PROGRAMMING EFFICIENCY

Incorporating logic and language designed to take advantage of modern compiler techniques, the B 5000 permits straightforward, efficient translation of common-language source programs. And it brings a new high in compilation speeds—20 to 50 times faster than those possible on conventional computer systems.

NEW STANDARDS OF AUTOMATIC OPERATION

A Master Control Program, incorporating the automatic operating, monitoring and service routines, is pre-stored on a fast-access drum. It automatically schedules work according to pre-assigned priorities; allocates memory and input/output assignments; and maintains maximum-efficiency use of all components through a comprehensive interrupt system. As a result, human intervention is minimized, system efficiency maximized.

NEW STANDARDS OF PROGRAM-INDEPENDENT MODULARITY

Availability of multiple, functionally independent modules provides the B 5000 with excellent system flexibility and expansibility. The system may include one or two independent processors; up to eight core memory modules with a total capacity of 32,768 48-bit words; and one or two fast-access bulk storage drums, each with a capacity of 32,768 words. Up to four independent input/output channels control a maximum of 26 input/output units, including up to 16 standard-format magnetic tape units. Additional input/output units include card punch and reader, two types of printer, plotter and keyboard.

NEW STANDARDS OF EFFECTIVE MULTI- AND PARALLEL PROCESSING

The Program Independent Modularity of the B 5000, combined with the automatic scheduling and control features of the Master Control Program, permits multi-processing—the B 5000's normal mode of operation. The addition of a second functionally independent processor provides true parallel processing ability.

NEW STANDARDS OF SYSTEM COMMUNICATION

The new B 5000 permits simultaneous on-line/off-line operation. It features completely flexible communication among all of its units. A central processor communicates with all memory units. Any input/output channel communicates with any peripheral equipment and any memory module.

NEW STANDARDS OF THROUGH-PUT PER DOLLAR

All of these B 5000 features combine to provide an important new standard of through-put—the maximum amount of work in the shortest possible time, using the fewest possible components. The result is large-scale performance in the medium-price range.

For details in depth on the B 5000, call our nearby office. Or write for a copy of "The B 5000 Concept" to Data Processing Division, Burroughs Corporation, Detroit 32, Michigan.

Burroughs—TM

Burroughs Corporation

"NEW DIMENSIONS / in electronics and data processing systems"

Realizing these requirements, the machine tool builder now employs devices which, until now, were used in the precision instrument field. Backlash, although practically impossible to eliminate completely, is reduced to a minimum to enable the control and measuring system to effect minute adjustments in both positive and negative directions. Ball bearing lead screws and other anti-friction devices are essential to minimize the problem of sticktion, especially during fine adjustments. Oscillations, which a stick-slip condition can cause, would greatly limit the performance of the control system. The same applies to resonance, particularly in the low frequency range. More rugged machine construction provides the answer to these problems.

Example of Economic Advantages

No true evaluation can be made of the advantages of numerically controlled machine tools without some mention of the basic functions and principles involved.

This following example illustrates the first economic advantage of these machine tools which is the precision and speed of control signals.

The production schedule for a magnesium gear box for a jet engine called for the purchase of an additional jig borer. A numerically controlled machine was obtained for $55,000 which took the place of two conventional pieces of equipment of $90,000 total value. The resulting equipment cost saving was $35,000. Savings in operation amounted to:

1. Drilling dowel pin holes:
   (a) Old time—1.67 hours per part
   (b) New time— .20 hours per part
   (c) Saving of 88%
2. Rough boring and drilling of flange holes:
   (a) Old time—2.5 hours per part
   (b) New time—1.0 hour per part
   (c) Saving of 60%
3. Line boring, complete:
   (a) Old time—16 hours per part
   (b) New time— 4 hours per part
   (c) Saving of 75%

In addition, costs of drilling and holding fixtures were reduced by over 50%. Reduction of reworking and scrap amounted to 95%. A closer study would reveal further savings due to simplified methods of engineering changes and to small-lot production possibilities. A changeover from one configuration to another usually involves no more than changing a tape. Obviously, improved machine tool construction also plays an important part in obtaining such results as this.

However, rather than look upon this second factor as a necessary evil, without which the controls could not perform to the best of their ability, we now find that it comes into its own right.

Machining of High Temperature Alloys

We turn now from machining of conventional materials and aircraft industry alloys to the considerably greater problems involved in handling the high temperature alloys of the jet engine and space vehicle manufacturer. The higher cutting forces encountered in this application demand the maximum in rigidity. Reduced vibration increases tool life and improves finishes.

Further, the precise control of in-feeds and dwell time reduces work hardening, which, again, amounts to added tool life. Thus, by keeping feeds and speeds within critical limits and away from operator control, we can maintain optimum conditions and achieve maximum results with respect to tool performance. Numerical control, therefore, not only helps to re-

Table 1

ECONOMIC ADVANTAGES OF NUMERICAL CONTROL APPLICATIONS — FIVE INSTANCES

Case History Number	*Operation*	*Time Savings*	*Scrap Savings*	*Machine Tool Cost Savings*	*Fixture Savings*	*Other Savings*
1. F-115	X-Y Positioning; boring and drilling.	60%-90%	95%	Replaces two conventional machines.	90%	Inspection time reduced 80%. Tool life increased 25%.
2. B-243	Rotary Indexing (Numerical Control); cycle controlled center drilling, drilling, counterboring, and reaming.	75%	97%	Replaces one jig borer and one radial drill.	94%	Small lot production; low inventory.
3. BD-382	Rotary Positioning; horizontal boring mill, multiple drilling operations.	74%	95%	Replaces 3 standard machines.	$12,000 per year.	Inspection time reduced 85%. Tool life increased 28%.
4. GL-388	Rotary Positioning (Numerical Control); cycle controlled drilling, boring, spot facing, back counterbore, rough, and finish.	30%	95%	None (additional)	89%	Inspection time reduced 75%.
5. B-01	X-Y Positioning; automatic tool selection, drilling, rough boring.	80%	None—Operation previously used high accuracy fixtures.	Replaces 3 standard machines.	95%	Inspection time reduced 85%. Tool life increased 100%.

duce manufacturing costs, as shown above, but also contributes considerably to the reduction in machinability problems and tool cost.

Table 1 reports some actual savings realized through the application of numerically controlled equipment. The cases apply to the manufacture of jet engine parts; details of part descriptions and materials are not essential and are omitted. Although the list is by no means complete, yet it is typical.

Summary

In summarizing the cost savings possible through numerically controlled machines, we arrive at the following conclusions:

1. Small lot production:
   - 1.1 Quick tape change permits small lot production. This reduces inventory, parts storage, records, and repeat handling.
   - 1.2 Job shop operation and "specials" become more economical.
   - 1.3 Fixture and template cost, partly, and at times, completely eliminated.
   - 1.4 Cost of fixture storage, maintenance, and set-up time reduced.
2. Improved Tool Life:
   - 2.1 Greater machine rigidity and controlled dwell times, feeds, and speeds result in longer tool life.
   - 2.2 Tolerances and finishes are improved.
3. Better Equipment Utilization:
   Zero data input times results in faster production, more parts per life of equipment, and a smaller number of machines for equal production.
4. Scrap Reduction:
   Precision of input data and repeatability reduces scrap and rework.

Computer Monitoring of Reactor Radioactivity Levels

Dr. Jan Paul
Bakersfield, Calif.

Computers are applied in a number of ways in nuclear engineering. Some of the more important are data logging, alarm scanning, on-line computation, sequencing data, reduction, automatic control, and reactor monitoring. All are important, but perhaps the most important single application is in reactor monitoring, for in such an application it is possible for the computer to monitor radioactivity in the reactor through a hook-up with the cooling and heat-transfer systems.

Perhaps one of the most interesting illustrations of computer monitoring is at the power plant of Electricite de France near Chinon, France. The system used there, while primarily for monitoring, actually combines a number of important uses. The system consists of two Ramo Wooldridge RW-300 computers, seven automatic typewriters, a paper tape punch and reader, radiation detectors, binary counters, sequencing and timing equipment, and input-output equipment for the computers.

The basic principle behind the system is quite simple: any kind of break or fault will cause an increase in the level of radioactivity in the reactor cooling system. This increase must be detected before it can become harmful to personnel or equipment. The radiation detectors in the system are placed in the cooling channels and connected to the binary counters, which, in turn, are scanned continuously by the computers. The computers use the data thus obtained to calculate a radioactivity level for each channel and compare it against a predetermined limit. If the calculated level thus obtained exceeds the limit, alarm and warning devices automatically go into action.

The computers are operated in parallel to assure uninterrupted protection. Both machines therefore receive all input data, and make all calculations; however, only one operates the automatic typewriters, and alarm devices. They are interlocked, however, so that should either computer stop, break down, or make an error, the remaining computer takes over all output devices. Each computer checks itself once a minute.

Of the seven typewriters in the system, five print computed radioactivity values. One does nothing but indicate equipment failure, while the remaining machine records reference values.

This particular reactor installation has 1,148 cooling system channles, which, for the purpose of scanning, are divided into 287 groups of four. Twelve channels are scanned per minute, so that a total scanning cycle takes 24 minutes. In the event of an above normal reading, all four channels in the group are switched to a "fine" scanning system through which the computers can calculate a normalized level for each separate channel. If the radioactivity in any of these channels exceeds normal, warning devices go into action.

A careful evaluation of this, and similar computer monitoring systems, indicates that these systems make possible the continuous calculating of radioactivity levels over an extensive channeling system with a maximum reliability factor and a minimum of alarm error.

Readers' and Editor's Forum

FRONT COVER: TELEPHONE TERMINAL TO OUTER SPACE

The front cover shows Bell Telephone Laboratories' "telephone terminal to outer space" at Crawford Hill, Holmdel, N.J. In the foreground is a horn-reflector antenna developed by the company as part of its system for receiving communications from satellites. The transmitter, a 60-foot dish, is shown in the rear. The antenna is aimed at a satellite in accordance with predicted orbit information provided by the National Aeronautics and Space Administration.

This equipment is part of a project to put the first station of a satellite relay system into space before the end of 1961.

The station would provide for the experimental transmission of telephone calls, television, data transmission, and other types of communication between the United States, the United Kingdom and continental Europe.

The company is in process of contracting for the launching of the necessary satellites orbiting at about 2,200 miles and solar-powered.

The proposed spherical satellites would be four feet in diameter and weigh about 175 pounds. About 60 per cent of the surface would be covered by glass-coated solar batteries. A metal skin and two slotted antennae would comprise the rest of the surface.

The initial system is expected to be able to transmit for a period up to about 35 minutes some three or four times a day—coordinated with the satellite passes over the earth station areas. The satellites would act as microwave towers in the sky, performing the same boosting and transmitting functions as the microwave towers of radio relay systems on the ground.

The project would be financed and the facilities operated by American Telephone and Telegraph, in coordination with telephone administrations abroad. This is similar to the practice for many years in handling overseas communications by cable and radio.

In the development of this project, the company expects to work closely with the National Aeronautics and Space Administration.

OPTIMIZATION OF BUSINESS OPERATIONS —MORE DISCUSSION

Raymond Overell
Riverside, Calif.

Regarding the "optimization of business operations —discussion" in the January, 1961, issue of **Computers and Automation**, optimum can be construed to mean practically any degree of operation efficiency,—given in any organization the management calibre, amount of flexibility in management planning, and the amount of competition.

For any one management to accept an "optimum" solution, that solution must conform to the prejudices and experience of that management, as well as to its capabilities. There are also the factors of management's judgment and hopes. Usually an "optimum" solution is not "optimum" unless it takes these into consideration, insofar as that management is concerned. Should the right weights be given these management considerations in arriving at the "optimum" solution, this management will be willing to use the mathematical solution, but in terms of the management "art."

As an organization progresses in time, the problem of "optimization of business operations" is indeed a "never-ending" one. This can be overcome only by flexibility in planning, and the realization that constant problem review and re-solution are necessary.

THE SIEMENS 2002

Majer-Trendel
Siemens and Halske A.G.
Munchen, Germany

In **Computers and Automation,** Vol. 9, No. 3, 1960, we find a brief outline of our data processing system Siemens 2002. Since some essential characteristics have changed since the information was gathered, we send you a revision of the description:

The Siemens 2002 is a transistorized, magnetic-core, data-processing system for scientific and administrative applications manufactured in series by Siemens & Halske AG (Hofmannstr. 51, München 25). Six machines have been installed and 13 are on order (June, 1960). 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 lengths: 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). Simultaneous operation between arithmetic and control units.

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. Backing store: magnetic drum. 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 (IBM 727 or 729 or AMPEX FR 300). They are connected with the computer by a magnetic tape control unit with magnetic core buffer store. This permits simultaneous operation of several tape units, while computing proceeds. Besides, high-capacity magnetic drum stores (LFE) can be connected.

Input: punched tape (200 or 400 char. per sec.). Output: punched tape (60 char. per sec.) and electric typewriter (10 char. per sec.) 80-column punched card equipment (IBM 077, 088, 514 and 544) line printers (IBM 407 and 421) and a cathode ray tube curve plotter inclusive of a photographic recorder may be connected. The possibility of connecting high-speed printers (ANelex and Siemens) is under development. Magnetic core buffers permit input (output) while computing.

Fixed-point operation speeds: 0.09 ms for addition and subtraction, 1.260 ms for multiplication and 3.510 ms for division. Floating 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. Average number of operations: 3000/sec.

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

CALENDAR OF COMING EVENTS

Mar. 16-17, 1961: Conference on Data Processing Techniques and Systems, sponsored by Numerical Analysis Laboratory at the University of Ariz., featuring "Discussions of data processing problems in engineering and scientific research," Tucson, Ariz.; contact Miss Betty Takvam, Conference Secretary, Numerical Analysis Lab., Univ. of Ariz., Tucson, Ariz.

Mar. 20-23, 1961: IRE International Convention, Coliseum and Waldorf-Astoria Hotel, New York, N. Y.: contact Dr. G. K. Neal, IRE, 1 E. 79 St., New York 21, N. Y.

Mar. 25, 1961: 5th Annual Symposium on Recent Advances in Programming Methods, Ohio State University, Columbus, Ohio; contact R. K. Kissinger, Publicity Chairman, c/o Nationwide Insurance Co., 246 N. High St., Columbus, Ohio.

Mar. 27-29, 1961: Conference on Character Recognition, Data Transmission, and Document Handling, Northampton College of Advanced Technology, St. John St., London, E. C. 1, England; contact Head of the Mathematics Dept., Northampton College of Advanced Technology, London, E. C. 1, England.

Mar. 27-30, 1961: POOL (LGP-30 and RPC-4000 Users Organization) Fourth Annual National Meeting, Jung Hotel, New Orleans, La.; contact H. M. Semarne, POOL Organization, 5834 Oso Ave., Woodland Hills, Calif.

April, 1961: Joint Automatic Techniques Conference, Cincinnati, Ohio; contact J. E. Eiselein, RCA Victor Div., Bldg. 10-7, Camden 2, N. J.

Apr. 13-14, 1961: UNIVAC Users Association Spring Conference, Statler-Hilton Hotel, Los Angeles, Calif.; contact Donald Houghton, Secretary, UNIVAC Users Assoc., Westinghouse Electric Corp., 3 Gateway Center 15-West, Pittsburgh 22, Pa.

Apr. 19-21, 1961: S. W. IRE Reg. Conf. and Elec. Show, Dallas, Tex.; contact R. W. Olson, Texas Instruments Co., 6000 Lemmon Ave., Dallas 9, Tex.

May 2-4, 1961: Electronic Components Conference, Jack Tar Hotel, San Francisco, Calif.

May 7-8, 1961: 5th Midwest Symposium on Circuit Theory, Univ. of Ill., Urbana, Ill.; contact Prof. M. E. Van Valkenburg, Dept. EE, Univ. of Illinois, Urbana, Ill.

May 8-10, 1961: 13th Annual National Aerospace Electronics Conference, Biltmore and Miami Hotels, Dayton, Ohio; contact Ronald G. Stimmel, Chairman, Papers Committee, Institute of Radio Engineers, 1 East 79 St., New York 21, N. Y.

May 9-11, 1961: Western Joint Computer Conference, Ambassador Hotel, Los Angeles, Calif.; contact Dr. W. F. Bauer, Ramo-Wooldridge Co., 8433 Fallbrook Ave., Canoga Park, Calif.

May 22-24, 1961: 10th National Telemetering Conference, Sheraton-Towers Hotel, Chicago, Ill.

May 22-24, 1961: Fifth National Symposium on Global Communications (GLOBECOM V), Hotel Sherman, Chicago, Ill.; contact Donald C. Campbell, Tech. Program Comm., I.T.T. — Kellogg, 5959 S. Harlem Ave., Chicago 38, Ill.

May 23-25, 1961: Symposium on Large Capacity Memory Techniques for Computing Systems, Dept. of Interior Auditorium, C St., Washington, D. C.; contact Miss Josephine Leno, Code 430A, Office of Naval Research, Washington 25, D. C.

June 6-8, 1961: ISA Summer Instrument-Automation Conference & Exhibit, Royal York Hotel and Queen Elizabeth Hall, Toronto, Ontario, Can.; contact William H. Kushnick, Exec. Dir., ISA, 313 6th Ave., Pittsburgh 22, Pa.

June 28-30, 1961: Joint Automatic Control Conference, Univ. of Colorado, Boulder, Colo.; contact Dr. Robert Kramer, Elec. Sys. Lab., M.I.T., Cambridge 39, Mass.

June 28-30, 1961: 1961 National Conference and Exhibit, National Machine Accountants Association, Royal York Hotel, Toronto, Canada; contact R. C. Elliott, NMAA, 1750 W. Central Rd., Mt. Prospect, Ill.

July 9-14, 1961: 4th International Conference on Bio-Medical Electronics & 14th Conference on Elec. Tech. in Med. & Bio., Waldorf Hotel, New York, N. Y.; contact Herman Schwan, Univ. of Pa., School of EE, Philadelphia, Pa.

July 16-21, 1961: 4th International Conf. on Medical Electronics & 14th Conf. on Elec. Tech. in Med. & Bio., Waldorf Astoria Hotel, New York, N. Y.; contact Dr. Herman P. Schwan, Univ. of Pa., Moore School of Electrical Eng., Philadelphia 4, Pa.

July 21-22, 1961: 1961 Northwest Computing Association Annual Conference, Univ. of British Columbia, Vancouver, British Columbia, Can.; contact Conference Information, Northwest Computing Assoc., Box 836, Seahurst, Wash.

Aug. 22-25, 1961: WESCON, San Francisco, Calif.; contact Business Mgr., WESCON, 1435 La Cienega Blvd., Los Angeles, Calif.

Sept., 1961: Symposium on Information Theory, M.I.T., Cambridge, Mass.

Sept. 4-9, 1961: Third International Conference on Analog Computation, organized by the International Association for Analog Computation and the Yugoslav National Committee for Electronics, Telecommunications, Automation and Nuclear Engineering, Belgrade, Yugoslavia.

Sept. 6-8, 1961: National Symposium on Space Elec. & Telemetry, Albuquerque, N. M.; contact Dr. B. L. Basore, 2405 Parsifal, N.E., Albuquerque, N. M.

Sept. 6-8, 1961: International Symposium on the Transmission and Processing of Information, Mass. Inst. of Technology, Cambridge, Mass.; contact Peter Elias, RLE, M.I.T., Cambridge 39, Mass.

Sept. 6-8, 1961: 1961 Annual Meeting of the Association for Computing Machinery, Statler Hotel, Los Angeles, Calif.; contact Benjamin Handy, Chairman, Local Arrangements Committee, Litton Industries, Inc., 11728 W. Olympic Blvd., W. Los Angeles, Calif.

Sept. 11-15, 1961: The Third International Congress on Cybernetics, Namur, Belgium; contact Secretariat of The International Association for Cybernetics, 13, rue Basse Marcelle, Namur, Belgium.

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.

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 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.

Multiprogramming STRETCH: Feasibility Considerations / E. F. Codd, E. S. Lowry, E. McDonough, and C. A. Scalzi, I.B.M. / Communications of the Assn. for Computing Machinery, vol. 2, no. 11, Nov., 1959, p 13 / A. C. M., Mt. Royal and Guilford Aves., Baltimore 2, Md.

This article discusses certain machine design techniques which allow for successful concurrent execution of several independent problems. In particular, design techniques applied to the STRETCH computer system are described, which place the burden of the programmed logic on the system program—control and supervisory program—rather than on particular problem programs.

RUNCIBLE—Algebraic Translation on a Limited Computer / D. E. Knuth, Case Institute of Technology / Communications of the Assn. for Computing Machinery, vol. 2, no. 11, Nov., 1959, p 18 / A. C. M., Mt. Royal and Guilford Aves., Baltimore 2, Md.

The RUNCIBLE I compiler system, developed at Case Institute of Technology for a standard I. B. M. 650 computer, is discussed. Its main features are listed and a logical diagram of the system accompanies the article.

Russian Visit to U. S. Computers / E. M. Zaitzeff and M. M. Astrahan / Communications of the Assn. for Computing Machinery, vol. 2, no. 11, Nov., 1959, p 4, / A. C. M., Mt. Royal and Guilford Aves., Baltimore 2, Md.

The negotiations which preceded an exchange of visits by U. S. and U. S. S. R. computer experts are explained, followed by a report on the visit by the Russians. The report covers visits to various computer centers, including M. I. T. Computation Center, I. B. M., and data processing centers in Washington, D. C., and Philadelphia. Some general comments follow the report.

The Multilingual Terminology Project / Dr. J. E. Holmstrom / Bulletin of the Provisional International Computation Centre, no. 8, Jan., 1960, pp 11-6 / Provisional Internat'l. Comp. Centre, Polazzo degli Uffici, Zona dell' E. U. R., Rome, Italy.

This article discusses procedures for establishing standard nomenclature and terminology in the computer field. These procedures are being formulated by the Internat'l. Comp. Centre with the help of such organizations as the Assn. for Computing Machinery, in the U. S. The important task of standardization, it is pointed out, requires the cooperation of scientists who assign names to new concepts and "brain-childs," without considering etymology or without consulting established terminology.

Optical Scanning Equipment / John H. DeJong / Data Processing, vol. 3, no. 1, Jan., 1961, p 11 / Gille Associates, Inc., 22nd Floor Book Tower, Detroit 26, Mich.

Some applications of optical scanning equipment are described, followed by a discussion of past, present and future equipment and applications. The author foresees significant improvements in optical scanners, with eventual replacement of the key punch by the use of modern techniques.

Optical Character Recognition / Weld S. Carter, Jr. / Data Processing, vol. 3, no. 1, Jan., 1961, p 7 / Gille Associates, Inc., 22nd Floor Book Tower, Detroit 26, Mich.

The possibility and feasibility of reading documents directly into a computer system by scanning methods is discussed. The special design features of any computer with such a facility are described; advantages of a direct system are discussed relative to current techniques.

Minimization over Boolean Trees / J. Paul Roth / IBM Journal of Research and Development, vol. 4, no. 5, Nov., 1960, p 543 / IBM Corp., 590 Madison Ave., New York 22, N. Y.

The general problem of the logical design of circuits with one output and no feedback, is solved, using an algorithm which this paper discusses. A discussion of Boolean functions is followed by a use of the algorithm to solve a particular problem. The solution, as programmed on a 704 computer, is described in detail. Two appendices discuss, "optimum criterion for termination," and, the "efficiency of the algorithm and of fast approximations."

Automatika and Telemechanika / University NAUK, Moscow, U. S. S. R. / 1960 (Tom. 21, no. 11), printed, 113 pp, cost ?.

This issue of the Russian-language publication contains fourteen papers on subjects relating to automation and data processing. Some of the titles are: "Stability of Nonlinear Controlled System," "Equivalent Transformations of Sequence Machines," "Calculation of Circuits for Stabilization of Compound Drives Using Three-Winding Transformer," and, "On Synthesis of Control Program in Systems Involving Discrete Machines."

Automatizace / Publishers of Technical Literature, ul. 51, Praha 2, Czechoslovakia / 1960 (no. 11), printed, 34 pp, cost ?

This edition of the Czechoslovakian-

(Continued on Page 25)

LINKAGE SYSTEM PERMITS COMBINING ANALOG AND DIGITAL COMPUTERS

Packard Bell Computer Division
Max Palevsky, Vice Pres.
Packard Bell Electronics
Los Angeles, Calif.

Computer linkage equipment combining analog and digital computers into a single powerful system is now available on a standard product basis from this company. Prior to this development, linkage systems were custom-engineered for each application. Now, a standard analog computer and any one of several digital computers can be "plugged together" without individual engineering.

Many engineering problems are encountered in our increasingly complex technology, which require solution at speeds appropriate to analog computers but with the extreme accuracy and repeatability attainable only with digital devices. By combining the two types of computers into a hybrid system, the advantages associated with each technique can be utilized. The speed of the analog computer, including its ability to solve differential equations in real time, is thus combined with the high resolution, accuracy, and repeatability of the digital computer.

In addition, a digital computer permits solution of problems involving logical decisions, the generation of arbitrary functions, and computation requiring storage of intermediate results.

Summary

The following specifications describe the computer linkage systems.

Specifications

General System

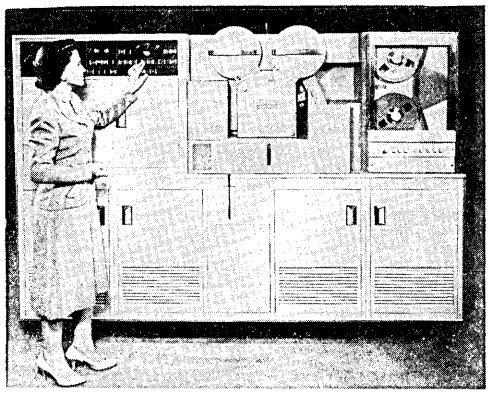
Digital Computers Applicable	PB 250, G-15, IBM 700-7000 Series
Dimensions	72" high by 24" wide by 22" deep
Grounding	Analog and Digital Grounds are isolated
Power	115 volts, 60 cycles, 250 watts
Temperature Range	$30^{\circ}C \pm 15^{\circ}C$
Temperature Coefficient	varies around $\pm 0.004\%/^{\circ}C$
Drift Rate	less than $\pm 0.006\%$/day
External Reference Option	the system reference may be slaved to an external reference source of -100 volts full scale

Analog-to-Digital Channels	DS-110(11 bit precision)	DS-113(14 bit precision)
Number of Channels	4 (expandable to 30)	3 (expandable to 30)
Analog Computer Outputs	±100 volts	±100 volts
Linkage System Load	10,000 ohms	10,000 ohms
A-to-D Accuracy	±0.1% (±200 mv)	±0.05% (±100 mv)
A-to-D Resolution	0.05% (100 mv)	0.01% (20 mv)
Multiplex and Convert Time	115 microseconds	75 microseconds
Frequency Without Sample and Hold	1.3 cps	0.7 cps
Frequency With Sample and Hold	140 cps	20 cps

Digital-to-Analog Channels		
Number of Channels	4 (expandable to 30)	3 (expandable to 30)
Analog Computer Inputs	±100 volts	±100 volts
Output Impedance	5 ohms	5 ohms
D-to-A Accuracy	±0.1% (±200 mv)	±0.05% (±100 mv)
D-to-A Resolution	0.05% (100 mv)	0.01% (20 mv)

COMPUTER PRINT-OUT SYSTEM YIELDS 20,000 CHARACTERS A SECOND

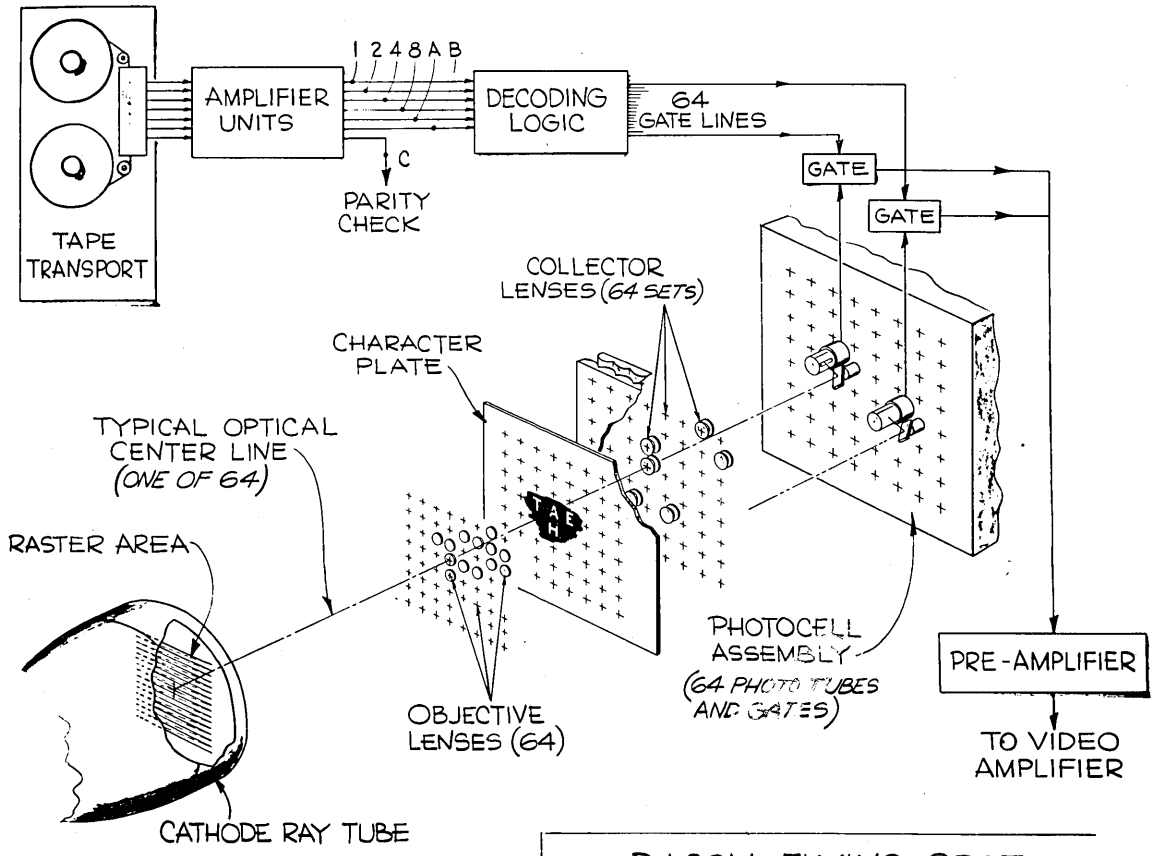
Recordak Corporation
Subsidiary of Eastman Kodak Company
Wanamaker Place
New York 3, N.Y.



A new high-speed computer print-out system known as the Recordak DACOM converts information from magnetic tape into plain language on microfilm at speeds up to 20,000 characters per second. The new system derives its name from DAtascope Computer Output Microfilmer.

The system complements modern computer equipment, and provides print-out speeds which will match computer output speeds. A complete page of data, containing 64 lines of 126 characters each, or 8,064 characters, is produced on a cathode ray tube by electronic and optical means reading the magnetic tape. It is then photographed on microfilm. Each picture can be reproduced "with graphic arts quality" in approximately one-half second, in a single 16 mm. microfilm "frame". Any desired background format, such as an accounting form, may also be optically combined with the information from the tape, so that the data can be reproduced in finished form.

Point-plotting can also be accomplished with the DACOM System photographically and at high speed. No overlays or descriptive labeling are required. Descriptions are automatically recorded by the system, which can vary between the plotting mode and the typewriter simulation mode at a sustained speed of 15,000 characters per second.



DACOM FLYING SPOT CHARACTER GENERATOR

"DIGITAL ARITHMETIC CENTER" COMPONENT FOR SYSTEMS

Mervin Eberle
Clary Corporation
408 Junipero St.
San Gabriel, Calif.

A component known as the Digital Arithmetic Center DAC-2500 is now available as an off-the-shelf unit. This is the first time, we believe, that this type of component has been offered by a manufacturer as a stock item.

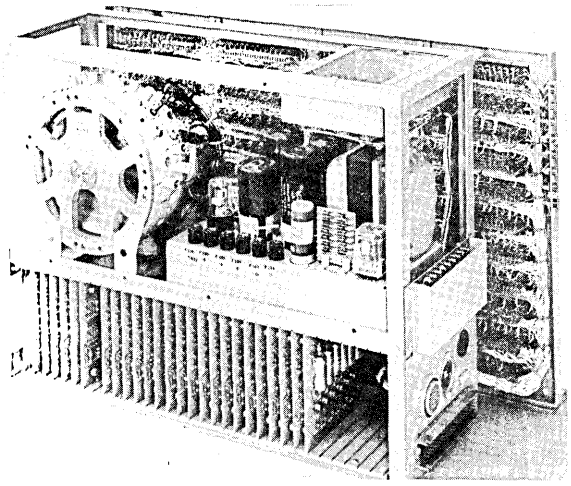
It is a solid state component for insertion into computing, process control, instrumentation, and test systems.

It is compatible with all varieties of input and output units and systems concepts. Flexible input and output control circuits allow a full range of peripheral equipment to be easily connected with the center. These include punched card and punched tape units, analog-to-digital converters, digital voltmeters, X-Y plotters and printers.

Following are some of the specifications of the DAC-2500:

Number system: decimal. Word length: 18 decimal digits and sign. Storage: magnetic drum. Storage capacity: 16 words per channel, with 10 channels available and two channels supplied as standard equipment.

Access time: average 8.5 milliseconds. Instructions: multiple address (up to five) and multiple operations. Input of data: unique pulse per digit or binary coded decimal. Input of instructions: DC voltage to proper connector pin or pins. Output: unique pulse per digit or binary coded decimal.



— The Clary Digital Arithmetic Center

Size: 28 inches long, 19 inches high, 13 inches wide. Weight: 97 pounds. Power: 117 volts AC, plus or minus 10 per cent, 100 watts maximum, 60 cycle, single phase. Construction: modularized, solid state, plug-in components.

NEW PHOTOELECTRIC SENSING DEVICE VERIFIES 90-COLUMN PUNCHED CARDS

Remington Rand
Division of Sperry Rand Corp.
315 Park Avenue South
New York 10, N.Y.

Photoelectric sensing has become an alternate method of verifying punched 90-column tabulating cards. The principle is applied through the use of a new Univac Photoelectric Key Verifier.

The machine makes it possible to verify, in one pass, either the Univac 63-character code or the standard 90-column, 37-character code used by tabulating machines.

Each card, during verification, is in full view of the operator. The operator presses keys to express the information that should be on the card, taking it from the original source document. When a variation in her keying and previous punching occurs, the keyboard immediately locks at the column in which the difference occurs, and an error lamp lights. The operator can then re-key and proceed if the error was hers, or reject the card if the error was in the previous punching. If erroneous, the card will automatically be delivered to the error receiver rather than the normal receiver.

COMPUTER WITH MAGNETIC TAPE TO PROCESS COLLEGE ENTRANCE EXAMINATIONS AND OTHER TESTS

Radio Corp. of America
30 Rockefeller Plaza
New York 20, N.Y.

A computer system with a magnetic tape memory has been put to use in the processing of college entrance examinations and other nationwide testing programs.

An all-transistor RCA 501 is now at Educational Testing Service, Princeton, New Jersey, to facilitate the reporting and interpreting of test results on the College Board examinations administered six times a year throughout the world.

The computer is associated with an electronic scoring and data transcription machine.

The system is able to process 100 test papers per minute. In addition to the main computer unit, the system includes a high-speed memory containing more than 32,000 characters, 7 magnetic tape memory units, each storing 10 million characters, and a card reader and a card punch. Reports are produced on a high-speed printer capable of printing 10 120-character lines per second.

CONVERTER TRANSFERS 50 WORDS PER SECOND FROM MAGNETIC TAPE TO PAPER TAPE OR VICE VERSA

Eugene Leonard
Digitronics Corp.
Albertson Ave.
Albertson, L.I., N.Y.

A new converter that transfers information from paper tape to magnetic tape or from magnetic tape to paper tape at 50 words per second has been developed for the Wear-Ever Aluminum Co., a subsidiary of Alcoa.

The Model D105 bi-directional converter will speed up the processing of orders and inventory information, and will reduce the overall time requirements in some cases (including mail handlings) from two days to one hour.

Prior to the use of the converter, the Alcoa subsidiary was faced with the problem of finding a way to step up the time required for the receipt and transmission of information between the main data processing center, the several warehouse centers, and its distributors throughout the country.

Utilizing a Univac computer, magnetic tape, punched cards, and teletype equipment, the customer found that the use of punched cards slowed down the entire process.

The Model D105 converter eliminates the need for punched cards, and thereby saves processing time, saves computer time, and eliminates some of the possibilities for error. The converter translates and edits the required information from the magnetic tape reel directly to teletype tape. As a result, all inventory control information can be transmitted to all the warehouse centers within one hour.

Since it is bi-directional, it also converts orders received from distributors via teletype tape directly to magnetic tape, in the format required by the Univac computer.

A HISTORIC TELEPHONE EXPERIMENT BEGINS IN MORRIS, ILLINOIS

Bell Telephone Laboratories
Murray Hill, N.J.

Bell Telephone Laboratories engineers have created a revolutionary new central office. At Morris, Illinois, an experimental model of it has been linked to the Bell System communications network and is being tried out in actual service with a small group of customers.

This is a special electronic central office which does not depend on mechanical relays or electromagnets. A photographic plate is its permanent memory. Its "scratch pad," or temporary memory, is a barrier grid storage tube. Gas-filled tubes make all connections. Transistor circuits provide the logic.

The new central office is versatile, fast and compact. Because it can store and use enormous amounts of information, it makes possible new kinds of services that will be explored in Morris. For example, some day it may be feasible for you to ring other extensions in your home . . . to dial people you frequently call merely by dialing two digits . . . to have your calls transferred to a friend's house where you are spending the evening . . . to have other numbers called in sequence when a particular phone is busy.

The idea behind the new central office was understood 20 years ago, but first engineers of this laboratory had to create new technology and devices to bring it into being. An invention of this laboratory, the transistor, is indispensable to its economy and reliability.

DIGITAL SHAFT ENCODER ACCURATE UP TO ONE PART IN 2 MILLION

Data-Tech
238 Main Street
Cambridge 42, Mass.

A miniature, high accuracy, digital shaft encoder has been developed by this company. The unit is designed for high accuracy, limited space and power, and low torque, such as needed in guidance and navigation systems. It is called Vernisyn.

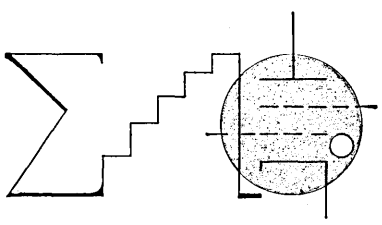
Devices currently in use require from 10 to 100 times the volume, weight and power of the Vernisyn units. In a 1½" diameter by 2" length, including electronics, the new units can give resolutions as may be required of one part in 2^{14}, 2^{15}, and 2^{16} in a single turn. Other configurations and accuracies up to 2^{21} are available to suit.

Output is in the form of alternate fine and coarse pulse trains on separate lines. The pulse trains provide a complete angular position answer with respect to a reference radius, into a 14 to 16 stage binary counter, every 40 milliseconds.

Accuracy is maintained up to slew rates of 1 minute to 4 minutes per second without a time correction. At higher rates the accuracy may be maintained if desired by means of a time correction, since the answers are valid at the start of the fine count. As an optional feature, provision may be made to synchronize answers with the sampling clock for much greater slew rates within the required accuracy. Fine counts will be significant up to slew rates of approximately 10^0 to 40^0 per second, but with coarse readings valid at any speed.

The device makes use of a dynamic readout technique. Thus the life of the transducer is a function of motor bearing life. A few watts of 400 cycle 2 phase (if available) and/or 28 volts D.C. comprise the required power.

Electronics for the device include the necessary shaping and logical switching circuitry to convert transducer output into the above described pulse trains.



SIMPLE CARD PUNCH OF SOURCE DATA

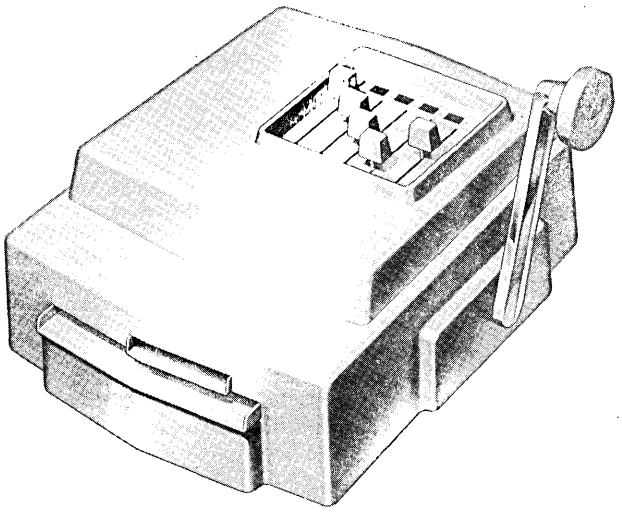
Datanamics, Inc.
7400 Deering Ave.
Canoga Park, Calif.

A Source Data Recorder, a device that eliminates a major bottleneck in sales by credit card, has been developed by this company.

A compact, lightweight, simple unit, the Source Data Recorder is a machine that imprints and punches IBM cards at point-of-origin in preparation for automatic machine accounting. It helps solve a major problem for concerns that use credit cards.

The machine is planned for installation at gasoline stations, banks, hotels, restaurants, department stores, in fact in any small or large business with a large volume of sales via credit cards. One California oil company alone has 4,000 West Coast filling stations with monthly credit card sales involving more than 1,000,000 transactions.

Under present methods, a mountain of credit charge slips must be optically scanned or manually keypunched to show account number and amount; and then the slips pass through several other steps before the accounting for each sale is completed. The Source Data Recorder eliminates these two major bottlenecks, through punching the amount of sale and the sale location at the time of sale.



FEDERAL RESERVE BANK BEGINS SHIPMENT OF COMPUTER-PROCESSED CHECKS

Federal Reserve Bank of Philadelphia
925 Chestnut Street
Philadelphia 1, Pa.

This bank recently began the first shipments of electronically processed checks to selected banks in the Third District of the Federal Reserve System.

Eighty-five southern New Jersey banks in the District were the first to receive checks processed through a newly installed computer system. Other Third District banks in Delaware and Pennsylvania will be added within 60 days.

This bank serves more than 600 Delaware, New Jersey and Pennsylvania banks, and is one of five Reserve Banks in the nation chosen to study automated check handling equipment. Similar pilot programs are being conducted at the Federal Reserve Banks of New York, Boston, Chicago and San Francisco. Each will test equipment manufactured by a different company. Reserve Banks are installing and testing specially designed high-speed equipment to catch up with the public's increasing use of checks.

The Philadelphia electronic system is manufactured and installed by International Business Machines Corporation and is known as the IBM 1412/1401 Data Processing System. It is the first such IBM system to be installed in any bank in the nation. The computer system is supplemented by encoding machines made by the National Cash Register Company.

Key to the system is a high-speed check sorter which will "read" magnetic ink characters printed on paper checks, transmit the information into the computer and sort the checks into proper sequence at the rate of 57,000 per hour.

Checks processed by the 1412/1401 bear strange-looking numerals which can be read by both man and machine. The numbers, which denote customer account, bank identification, check amount and reserve bank routing codes, are part of a new common language code sponsored by the American Bankers Association. Approximately 30 per cent of all checks now handled by the Philadelphia Federal Reserve Bank bear these numberals, and the number is growing at a rate of 8 to 10 per cent each month.

As checks are sorted by the reader-sorter, the computer directs the editing, sorting, classifying, proving, and transmitting of information to a specially developed high-speed printer.

This printer is capable of producing documents at speeds up to about 20 lines per second with a print span of 132 numeric characters. These speeds permit the bank to prove, list, and maintain an audit trail at the same speed as the checks are sorted. The printer utilizes interchangeable numeric and alphabetic chains of engraved type which permit the bank to prepare automatically a summarizing cash letter to accompany each batch of checks.

"DO IT YOURSELF" ANALOG COMPUTER COMPONENTS

Charles J. Marsh
Electronic Associates, Inc.
Long Branch, N.J.

A transistorized, "do-it-yourself" special purpose analog computer that will perform a variety of laboratory, engineering and process control computing tasks is being introduced by this company.

Known as the TR-5 Mounting Unit, it makes it possible for special purpose analog computers to be assembled easily and without the problems usually associated with such a task. Solid state analog computing components simply plug into the mounting unit where they may be interconnected according to the computing function to be performed.

The TR-5 mounting unit contains all the controls necessary to operate a 20-amplifier computer. The basic unit will house up to six computing omponents and a fully-transistorized power supply. It may be expanded to large-computer capability by adding units.

The PACE solid state analog computing components may be combined to perform a variety of laboratory and engineering functions. In the research laboratory the computing components may be used as a general purpose device to condition data to generate special forcing functions, to instrument special laboratory control systems, or to provide electrical isolation between components and circuits. If desired, the components may be combined to perform signal manipulations such as addition and subtraction, multiplication or division, integration or filtering, attenuation and amplification, holding of analog voltages, or generation of functions -- squares, square root, logarithm, antilog, or arbitrary.

Survey of Recent Articles

(Continued from Page 24)

language publication contains four papers on subjects relating to data processing, including, "Augmenting the Working Reliability of Measuring and Control Systems," and "Position Transducers." Fifteen brief reports on progress in various data processing projects in Europe are included.

Data Processing and Company Organization / E. Frederick Halstead / Journal of Machine Accounting, vol. 11, no. 12, Dec., 1960, p 14 / J. of M. A., 1750 West Central Rd., Mt. Prospect, Illinois.

The computer's role as an accountant's tool in advancing his status in company management is discussed. Various ways of communicating with the machine and interpreting its output are described. A list of questions which the accountant must answer, if he is to apply data processing successfully and economically, are presented, and some solutions are discussed.

Debut of First "Cobol" Narrator Rounds Out Complete RCA Automatic Programming Systems to Make Use of Electronic Computers Easier / Howard Bromberg, Mgr., Aut. Prog., RCA Electronic Data Processing Div. / Journal of Machine Accounting, vol. 11, no. 12, Dec., 1960, p 20 / J. of M. A., 1750 West Central Rd., Mt. Prospect, Illinois.

One of the first applications of the Common Business Oriented Language is described. The article discusses the features of the compiler, then discusses a problem to which it was applied. Examples of the solutions Cobol provided accompany the text. A brief discussion of ALGOL (Algorithmic Language), is included.

Russians Drive for Automation / Business Week, Nov. 19, 1960, p 59 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N. Y.

The research and development of automation techniques within the Soviet Union are discussed. Some Russian accomplishments in automatic control are considered to be more advanced than similar activities in the U. S.; these accomplishments are described. Soviet methods of narrowing the gap between theory and practice are explained, and a number of examples where automation has been applied are given.

Monsanto Unveils Integrated Computer-Controlled Process / Instruments & Control Systems, vol. 33, no. 11, Nov., 1960, part I, p 1888 / The Instruments Pub. Co., Inc., 845 Ridge Ave., Pittsburgh 12, Penna.

A set of brief reports discuss every aspect of the data processing system used to control an ammonia manufacturing plant. The computer, installation and maintenance, and the mathematical model, are described. The final report discusses "economic justification," where the feasibility of the system is pointed out.

Why Computers Take Up Games / Business Week, Nov. 26, 1960, p 137 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N. Y.

This article describes the activities at M. I. T.'s Computation Center in the area of teaching a computer to play chess, checkers and other games. The purpose of these activities in artificial intelligence is to help devise programs which can use logic to retrieve information and to evaluate concepts. Similar work being performed by RAND Corp.'s Numerical Analysis department is discussed.

An "Eye" for Oil / Noyes D. Smith, Jr., V. P., Shell Development Co., Houston, Tex. / Systems Magazine, May-June, 1960, pp 3-4 / Systems Magazine, Sperry Rand Corp., 315 Park Ave., South, New York, N. Y.

Scientific calculations necessary in the tasks of finding and producing petroleum are performed by a Univac 80 Computer. This brief report describes some of the problems which the computer solves, and discusses the manner in which a major oil company familiarizes its personnel with data processing.

Desk Top Computer and Companion Direct-Writing Recorder / David A. Taskett / Automatic Control, vol. 13, no. 6, Dec., 1960, p 49 / Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y.

The use of a small analog computer in the investigation and analysis of small or partial systems, and for simulation, is described. In particular, a technique for obtaining solutions to problems in network analysis and in positional control, is presented. Circuitry diagrams accompany the text.

Pneumatic Computer Research in the U. S. S. R. / Raymond N. Auger / Automatic Control, vol. 13, no. 6, Dec., 1960, p 43 / Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y.

This article reports on research and development at the Institute of Automatics and Telemechanics in pneumatic computation technology including digital plug-in logic blocks, subminiature air foil relays, etc. The components of a system which controls the flow of fluids are described, and economical aspects of the system are discussed. Photographs of the components accompany the article.

BOOKS AND OTHER PUBLICATIONS

Moses M. Berlin
Cambridge, Mass.

We publish here citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning **Computers and Automation.**

Sangren, Ward C. / Digital Computers and Nuclear Reactor Calculations / John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. / 1960, printed, 208 pp, $8.50.

Primarily, this book is for the nuclear engineer; however, some of the information, especially about numerical analysis techniques, will be of use to applied mathematicians and scientists. There are two major sections; the first section of the book, chap. 1-4, discusses reactor problems, computers, programming, and numerical analysis. The second section, chapters 5 to 8, are: A Code for Fisson-Product Poisoning; Diffusion and Age-Diffusion Calculations; Transport Equation-Monte Carlo; and Additional Reactor Calculations. Index and bibliography are included.

Boas, Ralph P., Jr. / A Primer of Real Functions / a Carus Mathematical Monograph of the Mathematical Association of America / John Wiley & Sons, 440 Park Ave., South, New York 16, N. Y. / 1960, printed, 189 pp, $4.00.

The purpose of this text is to introduce a few of the concepts and methods of real variables, assuming that the reader has no previous knowledge of the subject. In the first chapter, "Sets," countable and uncountable sets are discussed, along with open and closed sets, compactness, sets of measure zero, and Baire's theorem. The second chapter, "Functions," includes continuous functions, uniform convergence, linear, convex, monotonic and infinitely differentiable functions. Notes, answers to exercises, and an index, are included.

Elektronische Datenverarbeitung / Friedr. Vieweg & Sohn, (20b) Braunschweig, Burgplatz 1, W. Germany.

This publication offers papers dealing articles offer information about program controlled processes and applications of with basic ideas and special themes in automation and digital computers. The computers.

ALGO / Bendix Computer Div., 5630 Arbor Vitae St., Los Angeles 45, Calif. / 1960, printed, 28 pp, free on request.

The algebraic compiler for the Bendix G-15 digital computer, is the subject of this publication. ALGO, a machine language which closely parallels algebra, is described in detail. In seven chapters, the language, numerical data, control statements, programs, and arrays are discussed. A typical program is given. An index is included.

Bellman, Richard / Adaptive Control Processes, A Guided Tour / Princeton University Press, Princeton, N. J. / 1961, printed, 258 pp, $6.50.

This book presents a unified approach to the field of control theory, including a technique "for making problems involving deterministic, stochastic, and adaptive processes of both linear and nonlinear type amenable to machine solution." A new mathematical method is described, which scientists can use to solve problems in theory and application. Eighteen chapters, each covering an entire aspect of the subject, and each containing a "summing up" and a bibliography, are presented. Some of the headings are: Feedback Control and the Calculus of Variations, Uncertainty and Random Processes, The Theory of Games and Pursuit Processes, Some Aspects of Communication Theory, and Successive Approximation. The book is a RAND Corp. research study.

Boulding, Kenneth E., and W. Allen Spivey / Linear Programming and the Theory of the Firm / The MacMillan Co., 60 Fifth Ave., New York 11, N. Y. / 1960, printed, 227 pp, $6.00.

Recent developments relevant to the "theory of the firm" are discussed in this book. The developments concern economics, linear programming, operations research, management science, cybernetics, and sociology. The seven chapters, consisting in part of papers delivered at a 1958 seminar at the Univ. of Michigan, include some basic mathematical concepts, and an introduction to linear programming, in addition to information on the above mentioned topics. A bibliography and an index are included.

Sparks, Fred W. / A Survey of Basic Mathematics—A Text and Workbook for College Students / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1960, printed, 257 pp, $3.95.

The basic mathematics includes: 1) a comprehensive review of arithmetic; 2) algebra through quadratic equations, logarithms, ratio, proportion and variation; 3) graphs and graphical representation of statistics; 4) numerical trigonometry. Each portion of the text is followed by practice problems. The book contains thirteen chapters, a group of test problems and answers, and an index.

Shultz, George P., and Thomas L. Whisler, editors, and 11 more authors / Management Organization and the Computer / The Free Press, Glencoe, Ill. / 1960, printed, 257 pp, $7.50.

This book contains the proceedings of a seminar in Feb., 1959, at the Graduate School of Business, University of Chicago, on "Management Organization and Computers," with emphasis on business information processing. The four sections of the book are headed: 1. Information

Technology and Management Organization; 2. Technical Developments and Their Use by Management; 3. Organization: Concepts and Problems; 4. Information Technology: Experience in Five Companies. Thirteen papers plus discussions on the papers, are included. Bibliography and index.

Gartner, Dr. Wolfgang W. / Transistors: Principles, Design, and Applications / D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. / 1960, printed, 675 pp, $12.50.

A comprehensive and highly technical work, this book has four parts: The Transistor; Semi-Conductor Physics; Transistor Design, Construction and Characteristics; and Transistor Applications. The author is Manager, Electronic Semi-Conductor Department, CBS Laboratories, Stamford, Conn. In twenty chapters, the author discusses the P-N Junction transistor, amplifiers, pulse circuitry, oscillators, etc. Five appendices give "Values of the Fundamental Constants" and various tables and data. Index.

Gregory, Robert H., and Richard L. Van Horn / Automatic Data-Processing Systems, Principles and Procedures / Wadsworth Pub. Co., Inc., San Francisco, Calif. / 1960, printed, 705 pp, cost ?

The purpose of this book is to present an introduction to, and information on, automatic data processing, in a style and using terminology that will be readily understood by management—businessmen, accountants, and others unfamiliar with the technical aspects of computers and automation. The authors have covered, in seven parts, such topics as: Processing Data by Machine, Basic Computer Programming, Input-Output Equipment, Cost and Value, Systems Economics, Scientific Decision Processes, and Prospective Developments. Three appendices include: history of computation, questions and problems, and a glossary of automatic data processing terminology. A list of illustrations and an index follow the text.

Van Valkenburg, M. E. / Introduction to Modern Network Synthesis / John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. / 1960, printed, 498 pp, $11.75.

A comprehensive advanced study of modern methods of network synthesis is presented in this book. Beginning with a discussion of Brune's positive real functions, the author proceeds to discuss synthesis procedures, approximation, and the relationship of parts in a network system. Some of the topics covered in the sixteen chapters, are: Double Terminated Networks, Series and Parallel Realizations, and Symmetrical Lattice and Constant-Resistance Networks. A bibliography and an index are included.

Epstein, L. Ivan / Nomography / Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. / 1960, printed, 134 pp, $4.50.

Nomograms—alignment charts consisting of three scales—are studied in this book. The first of eight chapters discusses determinants, after which information is given about addition and multiplication nomograms, and circular nomograms. Chapters are devoted to Kellogg's method and to Empirical Nomography. A bibliography and an index are included.

Truitt, T. D., and A. E. Rogers / Basics of Analog Computers / John F. Rider Publisher, Inc., 116 West 14 St., New York, N. Y. / 1961, offset, 400 pp, $12.50.

The concepts, devices, and applications of the analog computer are discussed in

detail and with plentiful illustrations; generally, the language is simple enough for the beginner. Following a description of symbols and an explanation of abbreviations, three volumes with eleven chapters, discuss characteristics of analog machines, computer building blocks, general purpose computers, linear computing components, programming, and problems, etc. A glossary, notations and an index are included.

Integrated Data Processing and Computers, Report on a Mission to the United States by a Group of European Experts / Organization for European Economic Co-operation, Suite 1223, 1346 Connecticut Ave., N.W., Washington 6, D. C. / November, 1960, printed, 81 pp, $1.75.

The U. S. computer industry, as viewed by a group of European observers, is reported on. The different areas of consideration are discussed in chapters with such titles as: Integrated Data Processing, Problems of Installing E.D.P., Government's Role, and seven others. Eleven appendices include some examples of applications, information about training programs, and COBOL.

Lebedev, S. A., editor, and 8 authors / Computer Engineering / Pergamon Press, Inc., 122 East 55 St., New York 22, N. Y. / 1960, photo-offset, 184 pp, $10.00

The subject of computer engineering is discussed in eight papers, which are translations into English from the original Russian. The authors are design specialists who have worked on Soviet computers. Some of the titles are: "The Power Supply System of BESM," "Digital Integrating Machines," "Dynamic Flip-flops and Their Use in Parallel Action Computers," and "The Role of the Ferrite Core in a Matrix Storage Unit." The last paper presents a list of the basic nomenclature and the definitions of technical terms.

Ungar, A., editor, and 14 authors / Proceedings of the 1959 Computer Applications Symposium / Armour Research Foundation, Illinois Institute of Technology, 10 West 35 St., Chicago, Ill. / 1960, printed, 155 pp, $3.00.

The fourteen papers delivered at the symposium and the texts of two panel discussions are here published. The main theme concerns communication between man and the computer, with some of the papers discussing the relative merits of automatic programming and language design. Some of the Topics are: "The International Algebraic Language and the Future of Programming," "Current Developments in Common-Language Programming for Business Data Systems," and "A Modern Approach to Inventory Control Utilizing a Large-Scale EDPM."

The Replacement and Expansion of Durable Equipment / Frank W. Sinden / Journal of the Society for Industrial and Applied Mathematics, vol. 8, no. 3, Sept., 1960, p 466 / S. I. A. M., Box 7541, Philadelphia 1, Penna.

This paper discusses various concepts behind equipment replacement and/or expansion, directed toward facilities which provide a service. Hypothetical policies are presented, defined and discussed. Two theorems are stated and proved, and special cases are mentioned. Applications of the theories are discussed.

Digest of Military Electronics / RCA Service Co., Govt. Services, Bldg. 210, Camden 8, N. J. / 1961, offset, 205 pp, $3.95.

The technical language and nomenclature of current military electronics applications is explained in a non-technical

manner. The terms, code names and uniquely-used identifications are listed alphabetically, with accompanying explanations. Where appropriate, diagrams and/or charts are given. A very useful book.

Cooke, Nelson M. and John Markus / Electronics and Nucleonics Dictionary / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1960, printed, 543 pp, $12.00.

This new edition of the dictionary includes terms of nuclear science and electronics. The 12,000-odd entries are presented clearly yet without making sacrifices in technical accuracy. More than 400 of the definitions are accompanied by illustrations.

Leveson, J. H., editor, and 11 authors / Electronic Business Machines / Philosophical Library, Inc., 15 East 40 St., New York, N. Y. / 1960, printed, 272 pp, $15.00.

This book in 19 chapters provides the basis for an introductory study of the applications of computers to industrial needs, and offers information about recent developments in the field. The three sections of the book are: Programming for Business Purposes; Business Management and Electronic Data Processing; and Computer Equipment and Applications. The nineteen chapters, include as topics: programming; economics of computers; telecommunications; and managerial decisions for computers and organization patterns, etc. The book is printed in Great Britain. Index.

List of Books on Automatic Control / United Nations Educational Scientific and Cultural Organization, Place de Fontenoy, Paris, France / 1960, mimeographed, 73 pp, cost ?

Books on the theory and application of analog and digital computers are listed, under such classifications as: Theory of Automatic Control, Applications of Automatic Control to Industry, Transportation, and Transmissions, Physical and Mechanical Domains of Applications of Automatic Control, and Miscellaneous. The foreword and classifications are given in English and Russian. An authors' index is included.

The Instrument Manual / United Trade Press Ltd., 9 Gough Sq., Fleet St., London, E. C. 4, Eng. / 1960, printed, 800 pp, £5 5s. Od.

The third edition of this publication contains information about instruments and automation equipment of almost every type. The book's sections include a summary of the types of equipment, bases of operation and calibration, details of installation, etc. A section "Computers and Data Processing" covers analog computers. A survey of industrial uses is given, along with a list of institutions which are interested in instrument technology. More than 1000 illustrations accompany the text. A Buyers' Guide, conversion factor tables and a general bibliography are included.

Bendix Computer Application Report, no. 14 / Bendix Computer Div., Los Angeles 45, Calif. / 1960, printed, 8 pp, free on request.

This report concerns applications of the G-15 computer to problems in the field of chemical engineering. A number of chemical firms describe their applications of data processing to process control, inventory calculations, compound analysis, and material and flow balance. A computer exchange organization which maintains a library of G-15 programs is described.

Bulletin of the Provisional International Computation Centre / Prov. Inter. Comp. Centre, Palazzo degli Uffici, Zona dell' E. U. R., Rome, Italy / 1960, (July-Oct., 1960, nos. 10-11), printed, c. 120 pp, cost ?

This edition of the bulletin contains reports on international progress in research in, and development of, automation techniques. A review of "Soviet Computer Technology in 1959," and "News of Computing Laboratories," are included. The second part of the bulletin (un-numbered pages) consists of a listing of computation centers in various countries, their equipment, nature of work, and training facilities.

Gibson, E. Dana / Trends in the Educational Use of Computers in Schools of Business, Monograph 1.1, Oct., 1960 / Bureau of Business and Economic Research, San Diego State College, San Diego 15, Calif. / 1960, offset, 127 pp, cost ?

This paper reports on a study made by questionnaires sent out, returned, and tabulated, conducted to determine what schools of business were doing to educate their students for the computing age. The first of four sections discusses the nature and background of the study, including information about the schools which presently have the use of a computer. Subsequent sections present methodology, a summary of findings, and conclusions and recommendations. Eight appendices relate the experiences of some of the institutions with their computation centers. A list of publishers in the field, and a bibliography, are included.

Reifler, Erwin, Project Director, and 6 other authors / Linguistic and Engineering Studies in the Automatic Translation of Scientific Russian into English, Technical Report, Phase II / Univ. of Washington Press, Seattle 5, Wash. / 1960, offset, 492 pp, $10.00.

This is a second report under a contract with the Air Force on research in the field of machine translation conducted at the Univ. of Washington under the sponsorship of the Intelligence Lab., Rome Air Devt. Center, U. S. Air Force. The first part of the book is entitled "Linguistic Analysis," and includes four papers on linguistics and lexicography. A section, pp. 183-348, presents simulated machine translations. Part 2 of the book is entitled "Engineering Analysis," and contains three articles on the use of computers to process and translate texts. Two appendices discuss pattern recognition and logic programming.

Malcolm, Donald G., and Alan J. Rowe, editors, and 25 authors / Management Control Systems / John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. / 1960, photo-offset, 375 pp, $7.25.

The proceedings of a symposium held at the System Development Corp., in July, 1959, are here published. The nature of management is discussed in six sections: The Opportunity for Innovation in Management Controls; The Concepts of Management Control—Present Practices; The Impact of Computers on the Design of Management Controls; Examples of Automated Management Controls; New Approaches; and Research in Management Control System Design. Among the titles of the twenty papers presented are: "An Appraisal of Current Computer Applications," "Organization of the Data-Processing Function," "Sylvania's Data Processing Center," and "A Computer-Simulated Business Firm." Index.

Engineering and Technical Conventions, 1961, with Advance Listings of Meetings Through 1965 / Deutsch and Shea, Inc., 230 West 41 St., New York 36, N. Y. / January, 1961, offset, 42 pp, $4.00.

Almost 200 technical meetings of more than 100 societies and organizations for 1961 to 1965 are listed. The date, location, and title of each meeting is given. Indexes by organization, technical subject, and geographical location are provided. An appendix gives a list of the societies and their addresses.

EDP Idea Finder, The Data Processing Digest, 1957, 1958, 1959 / Canning, Sisson & Associates, Inc., 1140 South Robertson Blvd., Los Angeles 35, Calif. / 1960, photo-offset, 656 pp, $69.00.

The EDP Idea Finder has been assembled from the monthly *Data Processing Digest*, to provide a compact systematically ordered, collection of summaries of important articles in the field. These articles were previously digested and the summaries published in *Data Processing Digest* in 1957-59. The summaries are arranged under approximately 80 headings such as: The Role of EDP in Management; the Design of the EDP System; Random Access Storage; Bibliographies, Glossaries, Directories, etc. A list of periodicals, publishers, titles of articles, and an index are included.

Cooke, Nelson M. / Basic Mathematics for Electronics, 2nd Edition / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1960, printed, 679 pp, $7.50.

The purpose of this book is to provide students of electronics and electrical subjects with the background in mathematics that is requisite for their studies. The book covers: review of basic arithmetic; algebra with electrical applications; trigonometric functions, etc. In thirty-seven chapters, it includes such topics as: "The Slide Rule," "Ohm's Law—Series Circuits and Parallel Circuits," etc. The author is president of Cooke Engrg. Co. An appendix consisting of standard mathematical tables is included; solutions to the even-numbered problems of each chapter are given. Index. The previous edition had 32 printings.

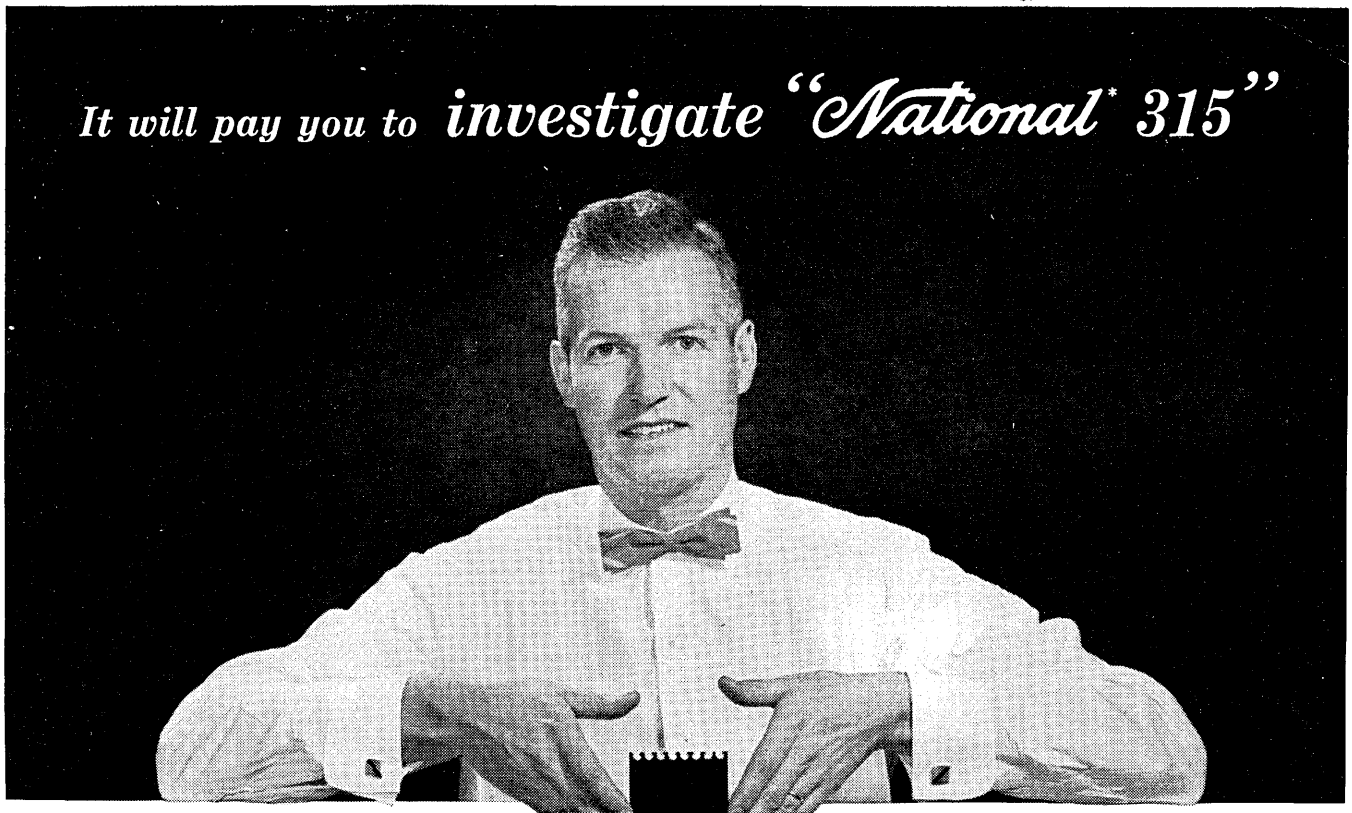
Bartee, Thomas C. / Digital Computer Fundamentals / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1960, printed, 342 pp, $6.50.

This book describes in understandable terms the principles of electronic digital computers. It contains chapters on computer operation, programming, number systems, and the various units or elements of the digital computer. Index.

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.

It will pay you to ***investigate "National* 315"***



This Card...

a new concept in Computers can revolutionize your data processing procedures.

This magnetic card is the heart of the National 315 Card Random Access Memory (CRAM) . . . an unequalled advance in economical magnetic file processing.

In effect, a reel of magnetic tape—3¼ inches wide—has been cut into 256 strips forming addressable magnetic cards. A single card is capable of storing 21,700 alpha-numeric characters. Each card contains seven recording tracks that can be addressed electronically by the central processor.

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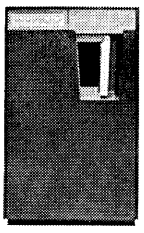

This unique system combines all the advantages of random and sequential processing . . . eliminates rewind time . . . requires fewer files . . . speeds sorting, up-dating, and reporting routines.

INVESTIGATE THE NATIONAL 315 for economical price performance • For unusual expansibility • For high-speed, balanced processing • For economy of programming • For ease of operation.

Learn why the National 315 is the most advanced electronic data processing system available today. Call your nearby National office, or write to Data Processing Systems and Sales, Dayton 9, Ohio.

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National*

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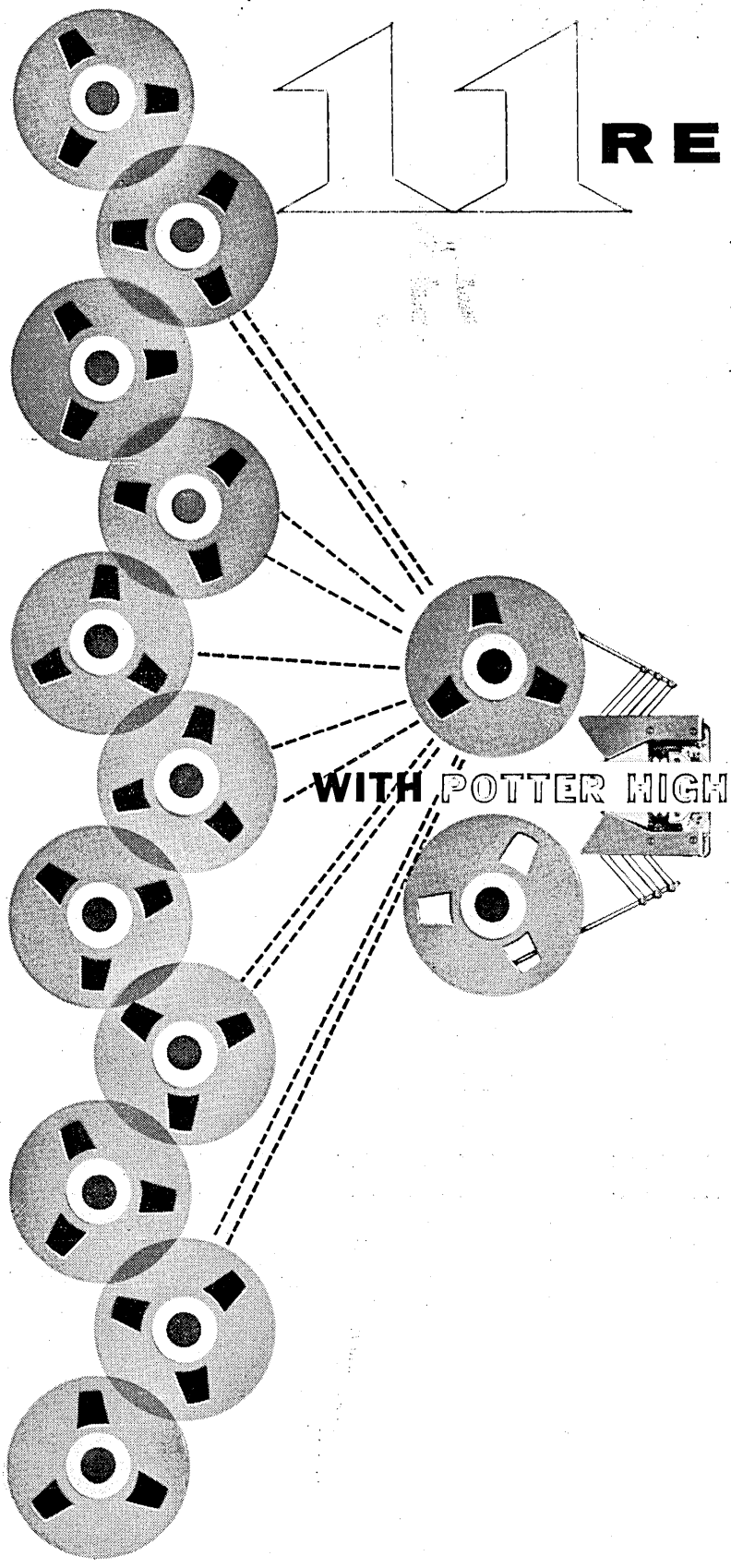
ADDING MACHINES • CASH REGISTERS
ACCOUNTING MACHINES • NCR PAPER

11 REELS IN 1



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