COMPUTERS
and AUTOMATION

DATA PROCESSING • CYBERNETICS • ROBOTS

MARCH
1958
•
VOL. 7 - NO. 3

NOVEL APPLICATIONS OF COMPUTERS

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2N404*	12	40 at −20	−100
NEW 2N582*	18	60 at −20	−100
NEW 2N583	8	30 at −20	−100
2N269	12	40 at −20	−100
NEW 2N584	18	60 at −20	−100
p-n-p Types for High-Current Switching Applications			
NEW 2N578*	5	15 at −400	−400
NEW 2N579*	8	30 at −400	−400
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p-n-p-Type for High-Voltage (−105 Volts) Switching Applications			
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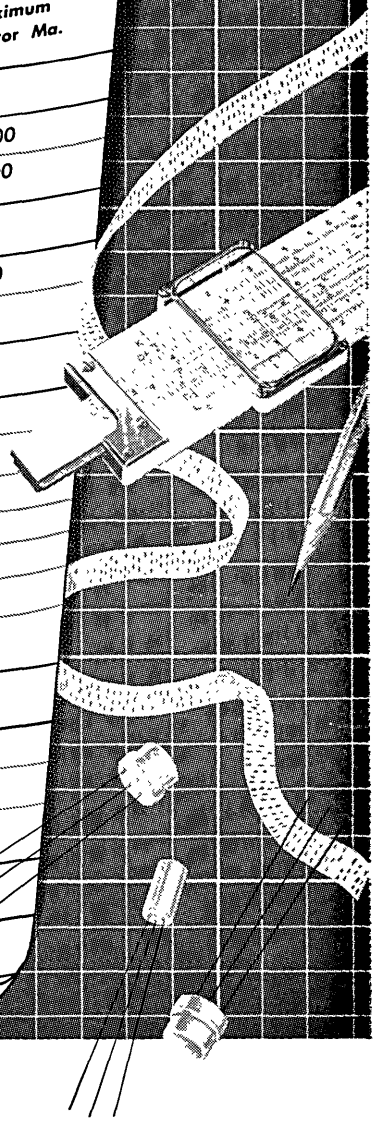
*Made in proposed Jetec size-group 30 Case



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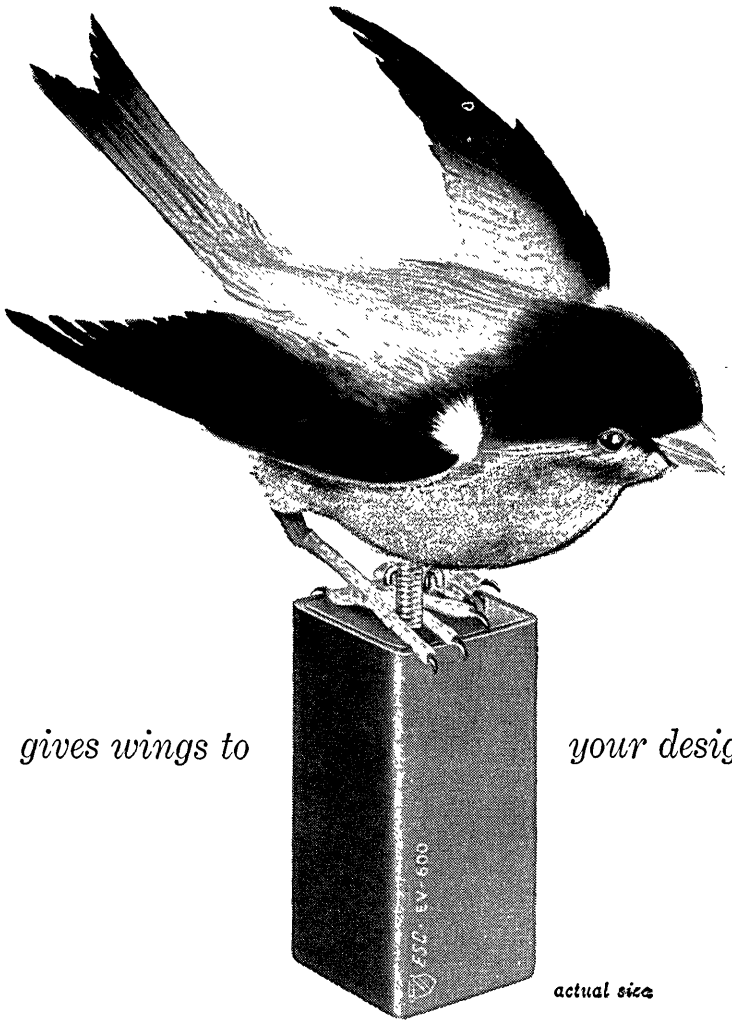

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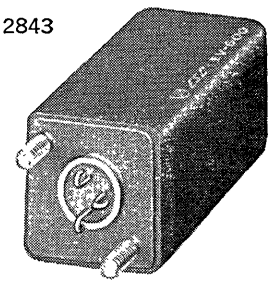


Readers' and Editor's Forum

FRONT COVER: COMPUTER AS MUSICIAN

The front cover shows a picture of the Bendix G-15 computer in the role of musician. During the holiday season this computer was on television playing carols. It is shown here being televised with Bob Cooper on the oboe and Howard Rumsey on the bass viol.

THE COMPUTER DIRECTORY AND BUYERS' GUIDE, 1958

The completely revised, up-to-date 1958 edition of "The Computer Directory and Buyers' Guide, 1958" will be published by letterpress in June (the June issue of "Computers and Automation"). It will contain at least 75 pages, and will probably contain many more entries than the 2000 printed last year.

The directory will as before contain two master lists:

Part 1, "Roster of Organizations in the Field of Computing and Data Processing."

This will be alphabetical by name of organization.

Part 2, "Buyers' Guide to the Field of Computing and Data Processing: Roster of Products for Sale or Rent." This will be classified under product headings (see the list of headings on page 28); under each heading entries will be alphabetical by name of company.

Each list will contain "ordinary entries," which are FREE and brief, and "Expanded Bold Face Entries," which give 20 to 50 words of information or more and carry a nominal charge of $10 (in some cases $5 only, or less). See the details on page 24.

Blank entry forms were mailed out in February to over 4000 organizations. But if you did not receive one, you can find in this issue the substance of the reporting form, on pages 26 and 28.

Please help us make this annual directory complete, by sending us the information that applies to your organization.

FILMS FOR INSTRUCTION IN ELECTRONIC DATA PROCESSING

Stanley Cohn
Avro Aircraft, Ltd.
Toronto, Ontario

In reply to the request of Mr. Henry B. Ramsey of Philadelphia for information on E.D.P.M. films, we have found the following to be of value:

1. "Integrating the Office for Electronics," available for rental from the Visual Education Department, American Management Association, 1515 Broadway, New York 36, N.Y.
2. Set of four filmstrips (with audio recording) on Data Processing and Computer Systems, available on purchase only ($110) from the same organization.
3. "Making Electrons Count," dealing with scientific computing, available on loan, shipping costs only to be paid, produced by the Digital Computer Laboratory, Mass. Inst. of Technology, Cambridge 39, Mass.

IRE NATIONAL CONVENTION, NEW YORK, MARCH 24-27, 1958 — PAPERS RELATED TO COMPUTERS AND AUTOMATION

The IRE National Convention will meet in New York, on March 24-27, at the Waldorf Astoria Hotel and the New York Coliseum. Over 50,000 attendance is expected; there will be 850 exhibits; and 55 technical sessions. The sessions of chief interest to computer people appear to be the two symposia on Tuesday evening:

Electronics in Space
Waldorf-Astoria, Starlight Roof

Propulsion and Interplanetary Travel, *E. Stuhlinger and K. A. Ehricke.*
Navigation and Control, *C. S. Draper.*
Man in the Space Environment, *D. G. Simons.*
Communications and Telemetering, *J. B. Wiesner.*
Terminal Environment, *F. L. Whipple.*

Electronics Systems in Industry
New York Coliseum, Faraday Hall

J. M. Bridges, C. C. Hurd, T. R. Jones and J. D. Ryder.

and the following day sessions:

TUESDAY MORNING, MARCH 25

Automatic Control — General
Waldorf-Astoria, Starlight Roof

A Servopressure Control System for the Iron Lung, *G. A. Biernson and J. E. Ward.*
Gain-Phase Relations of Nonlinear Circuits, *E. Levinson.*
On the Design of Adaptive Systems, *H. L. Groginsky.*
The Organization of Digital Computers for Process Control, *G. Post and E. L. Braun.*
A Self-Adjusting System for Optimum Dynamic Performance, *G. W. Anderson, J. A. Aseltine, A. R. Mancini, and C. W. Sarture.*

Aeronautical and Navigational Electronics
New York Coliseum, Morse Hall

A VORTAC Traffic Control System, *P. E. Ricketts.*
Airborne VORTAC DME for Federal Airways System, *S. M. Dodington and B. B. Mahler.*
IDEA — Integrated Defense Early-Warning Air Traffic Control, *B. H. Baldridge.*
The AN/APN-96 Doppler Radar Set, *M. W. McKay.*
Increasing the Traffic Capacity of Transponder Systems, *H. Davis and M. Setrin.*

WEDNESDAY MORNING, MARCH 26

The Canadian Automation System of Postal Operations
Waldorf-Astoria, Grand Ballroom

The Canadian Automation System of Postal Operations, *M. Levy.*
Organization of the Electronic Computer for the Canadian Electronic Mail Sorting System, *A. Barszczewski.*
Coding and Error Checking in the Canadian System, *M. Levy and V. Czorny.*
The Canadian Automation System of Postal Operations, *H. Jensen and K. H. Ullyatt.*

[Please turn to page 27]

NOVEL APPLICATIONS of COMPUTERS

THREE-PART MUSIC WITH A COMPUTER AS ONE PART

Phyllis Huggins

Bendix Computer Division
Los Angeles, California

One novel application for an electronic computer is playing music. While of no practical value probably, playing Bach to bop greatly increases a computer's circle of friends. The computer sounds like an organ playing a flute duet. The pitch is relative, and the timing more precise than a metronome. A combination composed of Bob Cooper on the oboe, Howard Rumsey on the bass viol, and the Bendix G-15 as middle musician, recently made beautiful music for visitors to the Bendix Computer plant in Los Angeles.

The tones produced by the computer are generated by bit configurations in the computer's memory. They are fed from one, or more, of the long lines of memory directly to the input of an audio amplifier. If a single bit is placed in an otherwise clear memory line, as the line recirculates on the drum this bit will be seen at the input to the amplifier as a voltage change. There are actually two changes — one up and one down — every time the note passes under the read head on the drum, or once per drum cycle.

By changing the number of ONE bits in each group, we can vary the output frequency over a wide range, the lowest being 34 cps and the highest being approximately 10 kc. In this particular routine, the notes range from 850 cps to 2443 cps, assuming a drum speed of 34 cps. The particular notes chosen in the 1½ plus octave range were selected for maximum flexibility in composition.

We arbitarily call the note which corresponds to two words of ONEs followed by two words of ZEROs, "Middle C." This note is actually nearly two octaves higher. On this basis, the available 15 notes are:

B_0, C, D, E, F#, G, A, B flat, B, C′, C#′, D′, E′, and F′

The hexadecimal symbols used by the G-15 correspond with these. Code O indicates a rest. A 16th note is the shortest possible note duration and is indicated with a code O. The hexadecimal symbols will cause 1 through 15 sixteenth notes additional time to elapse.

Each of the 15 available notes is stored in a long line of memory. The playing of a tune is accomplished by copying the melody into one long line and the harmony into another. The sign and three digits of a word define the note. Sign indicates whether a note of the melody, coded the same in two successive words, is to be repeated or sustained. The least-significant digit of each word specifies the duration of the note, the next digit specifies the pitch of the melody and the next one, the pitch of the harmony.

The routine first sets up a command that will fill line 02, for example, with the designated melody note, then forms a command which will fill line 03 with the designated harmony note. The latter command is executed first, and then the former. To compensate for the one drum cycle minimum delay between execution of these two command, the amplifier is attached to the input (write head) of line 03 and the output one cycle late (write head) of line 02. In this way, the melody and harmony sound essentially simultaneously.

MUSIC BY AUTOMATIC COMPUTERS

Neil Macdonald

The front cover of this issue of "Computers and Automation" shows a computer which played Christmas carols. This of course was a publicity feature — but it highlights some possibilities that are interesting and important.

The playing of fine symphonic music written by a great composer is without doubt the execution of a program. The music produced the different orchestral instruments, violins, woodwinds, tubas, cellos, ..., each played by a trained musician and each musician attentively following a great conductor — all this is without doubt something that automatic programming can produce. Give all the orchestral instruments automatic controls; include other musical instruments if desired; govern the timing of all the musical notes and rests down to milliseconds or perhaps finer; include in the program the skill of a great conductor in varying the meter and the relative loudness and softness of the different instruments; and we would without doubt have a symphonic music which would be marvelously beautiful.

Why not try it? We might well find a qualitatively new medium of musical expression that would be a great contribution to symphonic music.

We would no longer be limited by the number of musicians who can watch a conductor or by the inevitable departures from exact time as the number of human musicians is increased or by the distraction of human beings arising from hearing other musical notes played near them or . . . . .

There is at least another, much simpler, application of automatic information handling to music, which many students of music would bless. This is a device which would help the learner of a piece of music, by taking in ("reading") the printed notation on a sheet of paper (or punched on paper tape) and playing the notes musi-

cally. In this way, a student learning the piano or violin could use not only his eyes for reading the musical notation, but also his ears — so that he would also hear how the piece is played, and in this way be helped to learn it. This would be a particular help to those early students of music whose fingers won't behave easily. For the student could listen to any specified sequence of the music slowly or quickly, and over and over, if he wished. Yet modern controls would produce a result far different from the old pianola, with its punched paper tape pneumatically controlling the keys of the piano, so that every note was struck equally loudly, and there was no variation at all according to the melodic structure of the piece.

Let us hope that the powers of automatic programming may be applied more than they have so far, in the field of music.

ECONOMIC PLANNING BY ELECTRONIC COMPUTER: PLANNING OF SWEDEN'S POWER

D. G. Pacy

Ferranti Electric, Inc.
New York, N. Y.

An electronic 'brain' in London has been used to plan the power production of a nation.

The Swedish State Power Board set out to determine from figures taken over a 30 year period the best use of its hydroelectric power stations, the nation's main source of power. Dozens of possible alternative plans were to be considered: to examine each plan in detail would take an engineer at least six tedious weeks; even then, the problem would have to be considerably simplified and therefore the results would not be entirely realistic.

In a matter of days, the Board determined its plan by the use of an electronic computer at the Ferranti London Computing Centre.

The main Swedish industries involved were the wood pulp, paper, steel, timber, and river fishing. Some of the chief problems were to calculate how efficient the present system of power distribution was among Swedish industries in relation to their economic importance, and to plan for the national development of future power stations.

The computer had to take into account many factors: winter ice; steam power production; water-level in the reservoirs; the capacity of dams and turbines; export of electricity to Denmark; needs of the major wood pulp, paper and steel industries; shipping; and timber floating in the rivers. It even considered the amount of water needed by the salmon.

Alternative plans were considered on the computer, such as the effects of larger reservoirs, varying sizes of power stations, and eliminating the floating of timber down rivers.

ECONOMIC SYSTEM STUDIED BY ANALOG COMPUTER

A non-linear model of a portion of the United States national economy was simulated on the Beckman EASE analog computer. A system of 12 equations represented an economist's hypothesis of the interaction of the financial and monetary sector of the economy with the production market. Starting conditions for each solution were based on known mid-1952 economic data.

The conditions included in this study were total bank deposits, bank loans, bank reserves, total currency supply, bank reserve ratio, loan conditions, aggregate demand for all products, and the national product. The equations were postulated primarily on considerations in the field of economics without knowledge of the capabilities of the computer.

The purpose of the study was not primarily predictions of the future of the economy but rather simulation of the abstracted system to obtain the knowledge of its behavior. Among the results observed were the cyclical nature of the economy, the lag present in the supply and demand principle, and the fact that the postulated economic system, if unaffected by outside influences, would reach an equilibrium state in about 20 years.

AIR TRAFFIC CONTROL BY DIGITAL COMPUTER

Walter L. Anderson

General Kinetics, Inc.
Arlington 2, Va.

Under a contract with the Air Force Cambridge Research Center, General Kinetics, Inc., Arlington, Virginia, has prepared a terminal equipment plan for replacing the Volscan Air Traffic Control DATAC analog computers with a standard commercially available digital computer. A digital computer program was written which duplicates all the present computational and logical control functions of the existing analog equipment. Using synthetically produced radar information, the system was tested on the IBM 704 computer at the National Bureau of Standards. Trials were made with various aircraft and wind conditions. All scheduling and geometrical computations were performed in real time. The output commands were available for transmission to aircraft in times ranging from 24 to 55 milliseconds after receipt of the input radar information.

The feasibility of using standard commercially available computers in real time air traffic control applications has been demonstrated. The IBM 704 and other equivalent commercial computers have the speed and input-output capabilities to schedule jet or propeller aircraft to 8 different airfields at a landing rate of 120 aircraft per hour.

SUPERMARKET CHAINS COMPETING THROUGH CALCULATIONS

In a two day conference Jan. 27-28, 1958, at Palm Springs, Calif., supermarket executives matched wits with each other through a pair of automatic electronic computers.

Their decisions made in the operation of hypothetical supermarket chains were electronically plotted and rated by two desk-size E101 computers made by Burroughs Corp., ElectroData Division, Pasadena, Calif.

The businessmen compressed 2-½ years of experience of management into a novel "game of strategy."

Players were divided into five-man "boards of directors," each representing a supermarket chain. These boards attempted to out-maneuver one another, through executive decisions which were "umpired" and instantaneously evaluated by the computers.

Each chain was given the same share of business volume and identical operating statistics (number of stores,

overhead costs, etc.). The players then decided what action to take in a given quarter to strengthen their competitive positions — such as building or renovating facilities, increasing or decreasing advertising, raising capital through loans, etc.

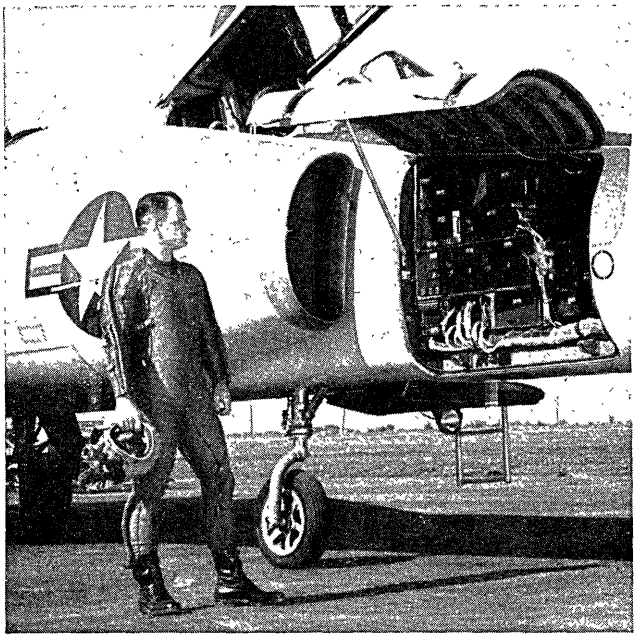
Their decisions were fed to the E101 computers, which had been previously programmed to evaluate them.

The computers automatically weighed the decisions and printed out financial statements for each chain. From these reports the competing executives saw at once which chain was operated in the wiser manner.

AIR FLIGHT AND COMBAT BY COMPUTER

Hughes Aircraft Company's Digitair, the first airborne digital computer in actual production, can fly an Air Force all-weather jet interceptor, first defense against the airborne H-bomb, through all phases of supersonic combat, from take-off to touchdown, leaving the pilot free to make tactical decisions.

Digitair can make 9,600 basic arithmetical computations in one second and render 6,250 decisions in one minute. Yet it weighs only 120 pounds and is small enough to fit into the cabinet of a 21-inch table model TV set. It works with coded information flashed to it by powerful ground control stations and the plane's own radar, and simultaneously takes in 61 different types of information while putting out 30 types. In doing so it performs or monitors 16 separate navigation and flight control functions during a program cycle of 1.8 seconds, all at least once, some of them several times.



COMPUTER TO FLY A PLANE IN SUPERSONIC FLIGHT AND COMBAT

A major scientific advance, vital in aerial defense, is the Digitair, the first airborne digital computer in actual production. Here Hughes Aircraft Company test pilot, Robert R. Carson, inspects a prototype test model installed in F-102A Air Force all-weather interceptor. The computer being produced is small enough to fit into 21-inch table model TV cabinet.

These functions include such operations as actuating the interceptor's control surfaces to correct pitch and roll, commanding the pilot to increase or decrease his speed; maintaining constant check on available fuel, and the distance the airplane can fly on it under existing conditions; target, range, azimuth and elevation information provided to the pilot; proper speed and altitude the pilot should fly in order to accurately intercept the target, and besides, a continuing check of its own accuracy and reliability.

The Hughes computer is not necessarily restricted to interceptor use. Another novel application would be its installation in a commercial jet airliner. It could automatically navigate and continuously compute speed and altitude for best performance, automatically program fuel consumption from take-off to landing, meanwhile considering varying flight conditions; automatically process and display navigation data; enable the pilot to insert alternate position, destination and altitude information; and automatically control communications between ground traffic and automatic landing control.

Installed in supersonic bombers, Digitair could automatically navigate, control target approach and bomb release, control communications, compute flight-control functions, direct defensive armament and escape maneuvers, and control evasive maneuvers.

NUCLEAR REACTOR SIMULATION ON A MEDIUM-SIZE COMPUTER

Phyllis Huggins

Bendix Computer Division
Los Angeles, California

An application using the Bendix G-15 computer and three MTA-2 magnetic tape units for simulation of a nuclear power plant reactor has been developed by Holley Carburetor Company. The application is of some interest as it uses a medium-size computer for a program for which it is usually considered necessary to have the largest computing equipment.

Computation, in effect, takes a snapshot of the entire power plant, per second, for 100 or more seconds per run. Partial differential equations are used to develop time-space-temperature relationships. Approximately 300,000 mathematical calculations are made for each snap shot. With these the computer generates steady-state maps for a performance study of the control system.

The methods of solution used are applicable to any process involving kinetic thermodynamics. The program is processed in the following manner: The magnetic tape units are used to extend the storage of the computer. Programs and constants are kept on tape. The memory drum of the computer is used for working storage and working commands. The variables for each control check are stored on the drum and recorded by the typewriter. Each control point of the plant is treated as a separate program, with a loading routine that calls in the next program. The last program for the plant operation reverses the magnetic tape and a loop operation is established. The sequence technique is used with each case operating on the variables produced in the previous run. Typed output includes: time per seconds at start

of the transients; all temperatures at all control points in the plant; and temperature profiles for the control points in the plant.

Investigation of reactor operation is still experimental and developmental. Equations have been written for each component of the power plant. Factors have been used for a scale model with data for computation. When this information is assembled it simulates the power plant. The plant is represented by a system of 250 differential equations. In two parts of the program a 180 x 180 matrix is solved.

The digital computer does not operate in real time. Five minutes of computation are equivalent to one second of power plant time. An analog computer is used for real time checks of samplings of the digital simulation. In the opinion of the Holley Carburetor Company, open use of the low-cost G-15 compared to scheduled use of a high-cost computer, has enabled them to complete in 1½ weeks work that required 5 months on a large-scale machine.

THE BEST CORN HYBRIDS CALCULATED BY ELECTRONIC COMPUTER

W. E. Clark

Hanover, Pa.

Illiac, the high-speed electronic computer at the University of Illinois, Urbana, Ill., is helping agricultural scientists to select new and better strains of hybrid corn.

R. W. Jugenheimer, in charge of corn breeding work, and W. C. Jacob, agricultural statistician, are turning the old art of plant breeding into a new highly-skilled and exact science.

For example, from 50 parent lines of corn, it is possible to make 1,225 single crosses and 690,900 double crosses. But, mathematics accomplished by electronic computer can predict which crosses are most likely to bring out the desired features in the hybrid corn.

The result is that the scientists need only take 40 or 50 of the best combinations into the field for testing.

The newest corn hybrids under study carry traits for high oil and high protein content. Other desirable characteristics the scientists are working toward include resistance to European corn borer, high yield, good standability and proper maturity.

In the tests, the scientists punch the known traits of each parent corn variety onto cards. The computer then matches up the desired traits into the various combinations. Corn breeders then can concentrate their field testing work on those parent lines that are likely to give the most desirable hybrids for farmers to grow.

FOREIGN LANGUAGE TRANSLATION BY AUTOMATIC COMPUTER

J. Speck

Burroughs Corp., ElectroData Division
Pasadena, Calif.

An electronic computer has been programmed to interpret four foreign languages and automatically print out idiomatic English translations.

Peter Toma, 32-year-old Hungarian, demonstrated his translation technique at the ElectroData Division of Burroughs Corporation in Pasadena, Calif. He fed a Datatron electronic data processing system four excerpts in Russian, French, German and Spanish. One was a headline from Pravda — "Mashina perevodit s odnovo yazeeka na drugoy."

Datatron printed on its electric typewriter the precise English equivalent: "Machine translates from one language into another."

According to Toma, this marks a real breakthrough toward a universal interpretation of all the world's tongues — and a common written language. His is the only technique formulated for multiple-language machine translation.

The program does not merely produce a word-for-word record, but correctly renders the thought or "sense" behind each foreign phrase.

To prime his electronic linguist, Toma first transmits to its magnetic memory drum four specially-condensed dictionaries of Russian, French, German and Spanish. These were previously punched on paper tape in numerical computer language, along with instructions telling Datatron how it should go about translating.

The computer — which adds or subtracts at the rate of 30,000 numbers a minute — electronically converts the code into alphabetic characters. Then it compares various semantic and logical patterns with the pre-stored glossaries. In several minutes, it types out a complete page of English translation.

ELECTRONIC LINGUIST — Peter Toma, standing at Datatron, holds punched paper tape used in entering his specially coded formula for translating languages into the electronic computer. Toma, 32, translated four languages — Russian, French, German and Spanish — into English in a demonstration at the ElectroData Division of Burroughs Corporation, which manufactures the Datatron.

PREDICTION OF TRANSLATION BY COMPUTERS FROM OTHER LANGUAGES TO RUSSIAN

John W. Carr, III

Univ. of Michigan
Ann Arbor, Mich.

Recent achievements of Soviet science in the areas of rocketry and space flight indicate that their efforts may very well be just as pronounced in other directions. The American scientific community has long had knowledge of the immense effort that the Soviet Union has been placing on translation of scientific documents from such languages as English, German, and French over into Russian.

There has been no comparable effort on the part of the United States to perform translation of Russian documents, and since most American scientists are not trained in Russian, the American scientific community has not been aware of the magnitude of the general Soviet scientific effort until its culmination in recent astronomical events.

A recent perusal of Soviet literature on digital computers with the aid of some translations by Morris Friedman of M. I. T. and by me indicates that another Soviet triumph in an area outside of missiles may very well be the announcement of full scale digital computer machine language translation of scientific and technical literature from English into Russian.

The efforts of world-famous Soviet mathematicians, including Kantorovich and Markov, as well as less well-known individuals located at the V. A. Steklov Mathematical Institute, have been concentrated on the development of both a theory and practical digital computer programs to solve this problem. The work reported in the Soviet open literature indicates that the theory behind this program was well developed over two years ago. The caliber of mathematicians involved and the description of the work done indicates that it is a major project.

On the other hand, the overall United States effort in this area has been negligible. What results have been obtained have been generally more in the way of trial experiments performed by isolated individuals than any concentrated effort.

In addition to the prestige value of such an achievement to the Russians, the value of machine translation to the Soviet Union in its continued perusal of foreign documents would be immense. There is today legitimate disagreement among American scientists as to the ease with which this problem can be solved. However, with the increased speed, capacity, and reliability of digital machines, their ability to do this job under the instruction of human beings cannot be denied. Moreover, this area of translation, along with the concomitant area of so called "automatic programming," is leading human beings directly towards the development of machines which will perform inductive reasoning — prove theorems, make decisions, evaluate complex situations, and behave in what might appear to be a more rational fashion than many human beings.

The Soviet literature indicates that their leading mathematicians are highly aware of the implications of these new devices. In the United States, because of the generally skeptical opinion of fundamental science among politicians and the military, there is little support for these "blue-sky," "science-fiction," problems. Very little money is available for research at universities, where the persons most competent in such problems are located. Responsibility for any effort at all has generally been left to commercial organizations, whose main effort is the sale or rental of equipment.

In such a situation, the announcement of spectacular results in the area of unusual applications of so-called "giant brains" by the Soviet Union may very well be expected.

SCIENTIFIC ABSTRACTING BY COMPUTER

H. T. Rowe

International Business Machines Corp.
New York, N.Y.

Researchers at International Business Machines Corp. have made an initial progress report on a method for producing abstracts of scientific and technical articles using an IBM 704 Electronic Data Processing System. The articles are analyzed sentence by sentence by the computer. The machine then selects the "most significant" sentences and reproduces them on an electronic printer. The human engineer or scientist by reading the sentences can then determine whether or not the article is of value to him.

In the machine abstracting technique, called Auto Abstracting, the article to be abstracted is first punched out on IBM cards, and then transcribed to magnetic tape, which is then placed in the machine. (Optical scanning now under development may eventually eliminate the card stage entirely.) The machine "reads" the magnetic tape in a fraction of a second, and applying a program, treats words as entities. It determines their "significance" by measuring the frequency of individual use and the frequency of combinations and couplings.

The entire article is submitted to a statistical analysis of word usage and placement, from which a table of values is made. The machine then analyzes each sentence based on this table, and awards a significance factor to it. Then, depending on the degree of these factors, the machine selects the several highest ranking sentences and prints them out.

If the significance is very high, a single sentence might serve as the entire abstract. If, on the other hand, the meaning is strung out in several sentences, the machine will print out all of these.

An advantage of machine abstracts is that only the original statements of authors appear in the abstract, and the abstracting sentences are not subject to misinterpretations by human evaluators. Another advantage is that the selection of the key sentence or sentences is made through mathematical analysis, and a constant standard.

The auto abstracting technique has grown from research into the problems of information retrieval carried on by H. P. Luhn of the IBM's Yorktown Heights Research Center. A host of tedious information-seeking problems are awaiting solution through electronic data processing methods of this type.

The patent office is faced with the Herculean task of first classifying millions of variations in machine designs offered as new patents, and then finding the entire class

of similar variations already filed, and then determining the degree of variation.

Physicians are considering the possibility of diagnosing diseases by feeding the symptoms to a computer that has memorized the thousands of combinations of symptoms for every known disease.

Given the specifications and cost limitations, chemical compounds including resins and plastics may be selected by computers from the thousands that have been developed.

IBM researchers point out that this progress report is merely a first step in literary abstracting, but enough success has been achieved to warrant further development.

ANALYSIS OF INVESTMENTS BY AUTOMATIC COMPUTER

The automation of investment analysis has begun, in the work being done by the Corporation for Economic and Industrial Research, as Investment and Technical Adviser to Automation Shares, Inc., a new Mutual Fund specializing in investment in automation equipment and component companies.

CEIR is using what it calls "Automated Portfolio Analysis." In its analyses of the various companies which are eligible for investment under the Fund's investment policy, it is making projections of estimated future sales, earnings, dividends, and prices of the various securities. By a procedure not at present being made public, it is also estimating the degree of confidence it feels can be placed on these estimates for each security. This mass of data, for the entire range of candidate companies, is then fed into its IBM 704 computer. The various types of portfolio investments are then explored by applying some of the latest linear programming techniques. Using these techniques the computer goes through thousands of different combinations of the whole list of securities, seeking out those combinations which will satisfy the investment criteria established by the Fund's Board of Directors, yet are expected to yield the desired results with a prescribed degree of confidence.

This process is repeated several times using different objectives, and the results then supplied for guidance to the Fund's Investment Committee. After a careful study of the computations, the Committee makes the final judgments as to the exact portfolio possibilities which it will recommend for consideration by the Fund's Board of Directors. The Board of course makes the final decision.

This is apparently the first time that computers have been used to assist investment advisers in developing portfolios to meet a particular set of investment objectives. In the case of Automation Shares Fund, these objectives are to obtain a modest current income but maximum possibilities of growth of capital and income in the future, while limiting to a specified degree the speculative content of the portfolio as a whole.

BRIDGE-PLAYING BY COMPUTER

Phyllis Huggins

Bendix Computer Division
Los Angeles 45, Calif.

The Bendix G-15 Computer has faced, and bested, its first human adversaries in bridge. The program dramatizes how the computer can be used to solve problems of sorting, decision-making, and record search such as are involved in bridge and other games apparently not related to mathematics. In the "beat the expert" hand a grand slam in clubs, the computer plays North and South, Plays made by competing hands are fed into the computer by code, and the machine makes the proper play in response.

North
S — A, K, 4, 3, 2
H — A, K, 2
D — A, K, 2
C — A, K

West	East
S — Q, J, 10, 9, 8	S — 7, 6, 5
H — Q, J, 10	H — 9, 8, 7
D — Q, J, 10	D — 9, 8, 7, 6
C — 6, 5	C — 4, 3, 2

South
S.....
H — 6, 5, 4, 3
D — 5, 4, 3
C — Q, J, 10, 9, 8, 7

The program was originated by Professor Robert F. Jackson of the University of Delaware. The G-15 rejects, with what he terms "a stern, minatory bell," any card that is illegally played from an opposing hand.

DESTRUCTION OF CIVILIZED EXISTENCE BY AUTOMATIC COMPUTING CONTROLS

I. By: Admiral Arleigh A. Burke

Chief of Naval Operations
Washington, D. C.

(excerpts from a talk to the Preparedness Subcommittee, United States Senate as reported and/or quoted in "The New York Times," January 30, 1958)

. . . The United States and the Soviet Union will soon have the ability to destroy each other. . . . Such a stand-off in nuclear striking power will continue for generations. It will involve the possibility, which we have got to learn to live with, of some madman pressing the button, and he will wipe out the Northern Hemisphere. I estimate the date on which the predicted stalemate will occur as (deleted by censor).

. . . Because of the calculating nature of the Russian people in high places, I believe that Khrushchev would be prudent, as far as starting a war would be concerned.

. . . Russia will attain sufficient striking power to

destroy the United States, and there is no amount of money, I think, that we can spend that will prevent that.

. . . When this occurs, I believe there will be more and more likelihood of small wars, of limited wars, and a greater and greater likelihood of psychological penetration.

. . . I predict that Russia will follow up the launching of two earth satellites with a lot of new advances, a lot of new things that we have not heard of. We are going to be surprised over and over again. . . .

II. By: Dr. W. H. Pickering

Head, Jet Propulsion Laboratory
California Institute of Technology
Pasadena, Calif.

(as reported in "Machine's Mistake May Doom World" in "The New York Herald Tribune," January 22, 1958)

Shortly after the end of World War II a popular quip heard around the Pentagon was "the era of push-button warfare has arrived — we have the push button." Today, however, we are in fact on the verge of an era of military technology which is fantastically beyond the concepts of a decade ago. We can now equate one push button to one city located anywhere on this planet. For if that push button launches an Inter-Continental Ballistic Missile, it is all that is needed to destroy the city target.

The ICBM with a hydrogen warhead takes less than half an hour to reach its target. This means, that within a few years every city on the globe will be living with a threat of sudden death — its life dependent on one man's action. And that man is not the ruler of an enemy country, but the soldier on guard in an isolated ICBM launching site.

The least we can hope is that he is not one of those young hotheads who frequently exchange rifle shots across a frontier. But no matter who he is, his decision is the death sentence of the target city.

With this situation rapidly becoming an accepted fact, military strategists have concluded that the only answer is the threat of immediate and total retaliation. Conceptually, the enemy's missiles are detected on route and the retaliatory missiles are launched even before the enemy missiles have reached their targets.

Thus, even if the launching sites do not survive the targets, destruction of the enemy is achieved. Even after the anti-missile-missile has been perfected, this basic strategy would be maintained.

Now, to attain the capability of instant retaliation, the military planner finds himself calling for long-range radar devices, elaborate computers to determine if the radar signal is due to an enemy missile, a friendly airplane, or a meteor from outer space, and a complex communication network for alerting the targets and for commanding the retaliatory missiles to be launched.

This is the prospect we face: the decision to destroy an enemy nation — and by inference our own — will be made by a radar set, a telephone circuit, an electronic computer. It will be arrived at without the aid of human intelligence. If a human observer cries: "Stop, let me check the calculations," he is already too late, his launching site is destroyed, and the war is lost.

It is a frightening prospect. Far more than being slaves to our machines, our very life depends on the accuracy and reliability of a computing machine in a far distant country. The failure of a handful of vacuum tubes and transistors would determine the fate of our civilization.

We have been prone to take comfort in the thought that no nation, no matter what its government, would embark on a war of mutual destruction. Perhaps this is true, but in a few years it will not be the government which makes the choice. The government will be committed to relying on the reliability of some electronic equipment and the skill of a few technicians.

Under these circumstances, if a period of international tension lasts for any length of time, failure of the equipment is almost inevitable and mutual destruction cannot be avoided.

This evolution from the push button era to the automatic push button era is inevitable. And when that day comes all of the "human" considerations which might stay the hand of a warmonger will mean nothing.

Is there an answer? With the present political climate it is difficult to imagine what it could be. But if the answer is not found in a very few years, there will be no need for the answer, because all that is left of humanity will be starting again the long climb from the stone age.

III. From the Editor

The Romans who lived for many years comfortable, normal lives in Pompeii at the foot of the volcano Vesuvius (then called Monte Somma and thought to be extinct) were surprised when it finally erupted in A.D. 79, destroyed their city, and themselves. See the younger Pliny's absorbing eye-witness account.

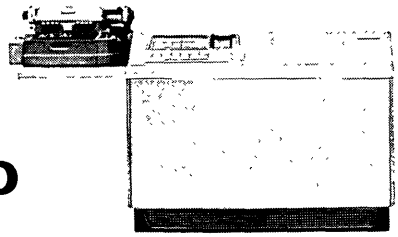
Nature has an answer for those who cannot adjust to possibilities and warnings of new conditions. She gave her answer to Pompeii.

Do we have to "learn to live with the possibility of some madman pressing a button, and he will wipe out the Northern Hemisphere?" or is the estimate of the situation by the Chief of Naval Operations wrong? or do we take urgent steps by negotiation and agreement to make sure that this application of computers can never happen?

Do we have to pay no attention, as if we were drugged or hypnotized, to the thesis "the failure of equipment is almost inevitable, and mutual destruction cannot be avoided"? or is the estimate of the situation by the Head of the Jet Propulsion Laboratory wrong? or do we start doing something about it?

TODAY'S GREATEST VALUE IN ELECTRONIC COMPUTERS!

ROYAL PRECISION LGP-30



Compare it, feature by feature, with the other computers in its class

Feature	Computer A	Computer B	Computer C	Computer D	LGP-30	
Memory Size	220 words for data only	2160 words	1000 or 2000 words	84 words for data only	4096 words for data & program (either or both)	LARGEST CAPACITY IN ITS CLASS
Max. Speed Add Multiply	 20/sec. 4/sec.	 Comparable to LGP-30	 Comparable to LGP-30	 3/sec. 1/sec.	 Over 440/sec. Over 50/sec.	SPEED EQUAL TO MANY ROOM-SIZED COMPUTERS
Size	17 sq. ft.	6.5 sq. ft. plus table for typewriter.	45 sq. ft.	9.2 sq. ft. plus table for typewriter & control unit.	11 sq. ft.	COMPACT, DESK-SIZED, COMPLETELY MOBILE
Input-Output	Keyboard only — tape at extra cost.	Independent tape preparation at extra cost.	Extra cost peripheral equipment required.	Tape and typewriter for numerical input-output only. Independent tape preparation at extra cost.	Tape typewriter for alpha-numeric input-output standard equipment.	DELIVERED COMPLETE. NO ADDITIONAL EQUIPMENT NEEDED TO PREPARE DATA, PROGRAM OR REPORTS
No. of tubes	165	450	2,000	248	113	FEWER COMPONENTS MEAN LESS MAINTENANCE, FEWER CHECKOUTS
Voltage	220 V	110 V	220 V	110 V	110V	PLUGS INTO ANY REGULAR WALL OUTLET
Power	2.5 KW	3.0 KW	17.7 KW	1.65 KW	1.5 KW	NO SPECIAL WIRING OR AIR-CONDITIONING REQUIRED
Ease of programming & operation	Not alpha-numeric. No internal program storage.	Alpha-numeric at extra cost. 8 part instruction. Requires computer specialist.	Alpha-numeric at extra cost. Requires computer specialist.	Not alpha-numeric. No internal program storage.	Alpha-numeric. Complete internal program storage. Standard typewriter keyboard. Simplest command structure of all.	EASY TO PROGRAM AND OPERATE.
Cost Sale Rental	 $38,000 $1000/mo.	 $49,500 $1485/mo.	 $205,900 $3750/mo. up	 $55,000 $1150/mo.	 $49,500 $1100/mo.	LOWEST COST EVER FOR A COMPLETE GENERAL PURPOSE COMPUTER

Nation-wide sales and service. Trained staff of applications analysts. Library of subroutines available, plus programs for wide variety of applications.

For further information and specifications on Royal Precision LGP-30, call your nearby Royal McBee office, or write Royal McBee Corporation, Data Processing Division, Port Chester, N. Y.

ROYAL McBEE

WORLD'S LARGEST MANUFACTURER OF TYPEWRITERS AND MAKERS OF DATA PROCESSING EQUIPMENT

AUTOMATION COMES TO THE BIBLE

Clair M. Cook

(Reprinted with permission from "The Christian Century," vol. 54, no. 30, July 24, 1957, published by Christian Century Foundation, Chicago, Ill.)

BACK IN 1953, Harvard scientists took a startled second look at the tall, black-haired young man of thirty-three who was at work in the inner sanctums of their Computation Laboratory: he was wearing a clerical collar. A clergyman might be at home with St. Luke, but what was he doing with their Mark IV electronic brain?

Strange as it may seem, Rev. John William Ellison was getting ready to introduce the two to each other. Eventually the 20th century Mark IV was to read the 1st century Luke in the original Greek. In fact, the big computer was to read 311 manuscript copies of Luke in order to inform the Harvard divinity school's doctoral candidate of every minute variation of one from another. It was to point out 2,000 differences in just two chapters, 400 in a span of fifteen verses. With its lightning speed it would produce results that would have taken lifetimes by the traditional methods of New Testament scholars.

Thirty Years to Two

Mr. Ellison did not stop with Luke, however, nor with Mark IV. Using Remington Rand's Univac, he went on to supervise translation of the entire Revised Standard Version of the Bible into the machine's own private language. Not only did he teach Univac to read the Bible from the four reels of tape comprising this magnetic-dot version, but with its help he has now produced a complete 1,600-page double-column concordance of the 1952 revision, sorting alphabetically and in Genesis-to-Revelation order the 800,000 words of the Bible's 66 books, with contexts.

It took James Strong thirty years to make the concordance for the King James Version which he published in 1894. Mr. Ellison did it for the R.S.V. in a little more than two years, using only his regular time off from his duties as rector of the thousand-member Church of the Epiphany in Winchester, Massachusetts, to direct work at Remington Rand's New York computing center. Thomas Nelson & Sons, who published his concordance early this year, say that the young Episcopal clergyman is "the only man in the world" with expertness in both texts and technology.

The story back of these modern scriptural miracles, so to speak, is one of persistent pursuit of an idea. It began while Mr. Ellison, having completed his undergraduate work at Harvard, was a student at Episcopal Theological School in 1945. Already familiar with the Koine Greek of the New Testament, he began to tutor in New Testament textual studies with W. H. P. Hatch, the eminent manuscript authority. It was then that he discovered with amazement a world of plodding, laborious research, a world of scholarship where for many years devoted men have been sifting and searching among the thousands of manuscripts of the New Testament scattered in libraries all over this planet. "I was appalled," he says, "to find people with two or three doctor's degrees sitting around cataloguing things on their fingers, so to speak. I was sure there must be some way to use mechanical means for the same purpose."

To get an idea of the importance to manuscript scholars of Mr. Ellison's copyrighted *Method of Using Digital Computers,* let us look for a moment at the almost insuperable "textual problem" of New Testament study.

Few people realize that the words of Luke or Paul which they read cannot be guaranteed to be in every respect the exact words these men wrote. They know, of course, that their English Bible is a translation. They may know that the King James Version was the production of a committee of scholars "authorized" by the Church of England, published in 1611 during the reign of James I. They may know that the Revised Standard Version is likewise an "authorized" translation, voted by the International Council of Religious Education in 1937 and published in 1952. This work, just read by Univac, employed a committee of 32 scholars for 15 years, with every change of wording requiring two-thirds approval.

But probably few people know that back of the problem of translating the New Testament is the more complicated problem of knowing what to translate. Perhaps no two of the 4,600 known manuscripts are identical in every word; certainly there are considerable, and important, differences among many of them, and it is a tremendously complicated task to "recover" exactly the original Greek of the authors. For even the oldest manuscripts are not in the handwriting of Paul or Luke, but come from the hand of unknown copyists a century or two later. By that time they may have been copies of copies of copies, with variations of two major kinds from the originals, accidental and deliberate. Both kinds of variations were due in part to the fact that at first these books were not "scripture" — as yet, only the Old Testament was holy writ — and scribes were not as careful as they were to be later. Also, language usages changed and meanings needed to be clarified. Most serious of all, theological differences sometimes dictated changes to justify an interpretation.

Thus the aim of the continuing search through mountains of manuscripts has been to compile the best possible "neutral" text. That is largely accomplished now. But there are still many lesser manuscripts that it has been impossible to analyze in close detail — for one reason, because they are scattered about in such libraries as the Vatican, the Bibliothéque Nationale and the British Museum; for another, because their sheer bulk is so formidable. Only now are microfilm copies being slowly collected for a central depository at the University of Chicago. The combination

of microfilm and digital computers can speed the work of detailed analysis by generations.

Hewing a Road

It was a long and unmapped road that Ellison began to hew through this wilderness when he set out in 1945 to cut down on New Testament finger counting. For two years he worked and experimented with punched cards. In the end he was forced to conclude that the big brain's little brother, the punch-card machine, could not handle the job. With his theological degree added to his Harvard sheepskin, he returned to his native Idaho to begin the professional life of an ordained clergyman.

Many a man might have dropped it there. But John Ellison knew he was on the right track. Teachers too encouraged him to keep trying. So in 1950 he went back to Cambridge to knock on the door of the keepers of Mark IV. Unlike others who had come to them from the social sciences, uncertainly asking "Can you help me?," here was a man who stated his need with the assurance of knowledge. "I have a problem," he said in effect, "that only your computer can handle. Will you teach me to use it?" Here was a reverse switch, not dumping a problem in the laps of the technicians but asking for the technique to solve the problem.

Need for R.S.V. Concordance

The logic of it, however, soon became clear to the computer scientists. The complexities of Ellison's problem would have been harder for them to master than would be his learning their techniques for securing answers. If the ordinary social scientist was baffled by the world of electronic computers, the lab men were baffled by the equally complex and technical world of Koine Greek, of Vaticanus, Sinaiticus and Alexandrinus manuscripts, of the Chester Beattie papyrus finds of the 1930s, and of the search for lost New Testament origins. They were the ones who needed to consult experts now. They turned to Henry J. Cadbury of the Harvard divinity school, a member of the R.S.V. translation committee. "Is this really a significant study in your field?" they asked him. Dr. Cadbury confirmed that it was.

But even with approval for use of the computer, the young rector faced another hurdle: finances. Surmounting that took two more years. Then came a year of preparatory work in Arizona. At last, in 1953, Ellison returned to the computer laboratory, and spent the next seven months mastering the techniques of "programming" and making the big brain work for him. Then he was ready to introduce it to St. Luke.

In the meantime, the complete Bible had made its appearance in the authorized modern-speech version. Never has there been such a phenomenal publishing venture as that which launched the Revised Standard Version in September 1952, with more than 3,000 public celebrations of the event. Put in a single pile, the 1,100,000 copies of the first printing would have soared 24 miles into the stratosphere. Today the total is steadily climbing toward the five million mark. Around 7,000 pulpit Bibles in this translation have been sold, and some 30 denominations are using it in their official church school publications. The need for a matching concordance has grown accordingly.

To many Bible owners the concordance is that little index of "helps" at the back of a copy where one can look up "adultery" and locate the Ten Commandments, or look up "prodigal" and find the parable. To a complete concordance such as Mr. Ellison and Univac have now finished, this is about what a vest-pocket dictionary is to Webster's unabridged. Here a single word such as "life" will have more than 400 listings, each with a phrase for identification — in the King James beginning with Genesis 2: 7, "breathed into his nostrils the breath of life," and running through Revelation 22: 19, "take away his part out of the book of life."

Univac Does the Job

To determine how well Univac could do the job, and particularly whether it could produce adequate reference contexts, a trial run of about 6,000 words — Matthew 13 and Romans 7 — pitted the machine against traditional file-card methods. Univac rose to the occasion handsomely, proving it could do in hours the work of weeks by the old methods, and do it just as well.

To translate the Bible for Univac to read, operators of the Unityper copied every letter, numeral, word and comma, from "In the beginning" to the "Amen" at the end of Revelation. That took from February to November of 1955. But even the best typist, like the scribes of old, can make unwitting errors. So the complete Bible was also translated for Univac's little punch-card brother, then run through a card-to-tape converter. The four reels of tape from each typing were compared by the machine, as with the Luke manuscripts, showing up every discrepancy better than any human proofreader could possibly do. Corrections gave a final copy identical to the last comma with the printed word.

In sorting, choosing and compiling, Univac was told to pay no attention to 132 such words as "and," "is," "of" and "it." The machine really had just two words of its own — "yes" and "no." But it makes its decisions with the speed of light. It took a fast look at each word on the tape, decided whether to keep it or pass it up, and before you could blink an eye went through eight to ten successive "yes" or "no" decisions. Dredging up from its fabulous "memory" every successive occurrence of the same word, it picked up the adjacent words between punctuation marks for the needed context, alphabetized the key words, gave the location, and spat out the results on its automatic printer, which is capable of producing 600 lines per minute.

For Strong, Young, Crudens and other concordance makers of the past it was a long and weary way from Aaron to Zichri. But where they had to walk, Univac zoomed with jet-age speed. Its completed copy was all in order for the typesetters. Indexing the words of any book can be done under Mr. Ellison's copyrighted system, but Univac still isn't bright enough to organize a topical index. Human brain power won't be outmoded for a while yet.

"The plans of the mind belong to man," says the writer of Proverbs, "but the answer of the tongue is from the Lord." Univac has read the "answer of the tongue" written by the many-voiced writers of scripture. But the "plans of the mind" still belong to man — in this case, a quiet young man with a clerical collar, the Rev. John William Ellison.

BOOKS and OTHER PUBLICATIONS

(List published in COMPUTERS and AUTOMATION, Vol. 7, No. 3, March, 1958.)

WE PUBLISH HERE citations and brief reviews of books, articles, papers, 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.

Canning, Richard G. / Installing Electronic Data Processing Systems / John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N.Y. / 1957, printed, 193 pp., $6.00.

Mr. Canning has written an earlier book ("Electronic Data Processing for Business and Industry," Wiley) dealing with the use of electronic data-processing equipment in business and industry; in this current volume he tells of problems, costs, and cost controls in the *installation* of that equipment, he describes conversion methods, and he discusses the early phases of actual equipment operation. The author writes for the layman. His work therefore requires no advanced mathematical or technical background of his reader, but since he does consider electronic data-processing equipment to be a "management tool," his presentation is everywhere directed to management.

Walker, Charles R., and 14 others / Man and Automation / The Technology Project, Yale University, New Haven, Conn. / 1956, printed, 117 pp., $2.00.

The proceedings of a conference sponsored by the Society for Applied Anthropology at Yale University in December, 1955. The 14 papers presented discuss automation in offices and factories, and points out fields needing future research, especially in government, universities, unions, and management. The chief theme touched by all papers presented at the conference was the way in which men's basic needs or attributes are affected by automatic machines.

[Please turn to page 29]

INDUSTRY NEWS NOTES

COMPUTER INDUSTRY NOTIFIED OF INFRINGEMENT OF MAGNETIC CORE PATENT

Paul Steen

Potter Instrument Co.
Plainview N. Y.

Notice to cease infringement of his rights under patent number 2,624,786 has been sent to leading manufacturers of digital computers and data processing systems by Mr. John T. Potter, President, Potter Instrument Company, Inc.

The patent held by Potter since 1953, will affect the manufacturer of approximately 100 million dollars worth of apparatus produced by major manufacturers; it is estimated that this figure will increase to about 200 million dollars in 1958. The originality of the patent is indicated by the fact that the patent examiner allowed its broad claims in the first action.

Virtually all high speed computing equipment presently manufactured uses an array of magnetic cores for storage of data; consequently a method of storing information in the cores and retrieving it efficiently is required. The patent covers the method used by most major computer manufacturers to store information in, and obtain information from, the cores. It is therefore apparent that a large number of computer manufacturers will be affected by the infringement notice.

Potter evolved the process described in the patent during the development of early data processing systems. At the present time he holds more than 30 patents on Data Processing Equipment including the well known Random Access Memory System.

Many additional patents in the computer field are held by engineers and others employed by Potter Instrument Company. The Company is a producer of peripheral computing equipment, including the first counter chronographs made for military purposes, original automation work in the steel industry, and high-speed digital data handling equipment.

IMPETUS OF DATA PROCESSING ON COMPONENT MANUFACTURERS

W. W. Stifler

Aladdin Industries
Nashville, Tennessee

One of the interesting results of the rapid growth of the data processing and automation field has been the impetus it has given to electronic component manufacturers. We are now spending much effort developing standard lines of components heretofore considered, by nature, specialty items at specialty prices. I am sure you will be interested in the enclosed copy of the Pulse Transformer Encyclopedia as an example of the way we have made it possible for a computer designer to select transformers in the same way a mechanical engineer might select gears out of the Boston Gear Works catalog.

Incidentally, another interesting development I look for is this: Manufacturers of data processing and automation equipment, who 5 years ago felt that they had to set up facilities to manufacture components, will turn more and more to manufacturers who are solely component makers. The equipment manufacturer's principal problem is the design, engineering, and marketing of *equipment.* He will find his vestigial component operations too expensive to continue. He will turn to component makers as the data processing field becomes more competitive, in order to reduce costs and conserve the time of his engineers.

LIBRARY FOR A COMPUTER

When a customer buys a $200,000 Datatron electronic "brain," he gets an unusual curriculum of courses which teach the computer its weighty ABC's . . . matrix inversion, linear regression, square root, differential equations, and a host of other mathematical intricacies. Secretary Patty Brown adds another course to the heap of learning which accompanies each Datatron computer shipped from the ElectroData Division of Burroughs Corporation, Pasadena, California. Inside each box are coded paper tapes with thousands of instructions . . . which Datatron learns, remembers, and electronically calls on for problem-solving. This library will join the Datatron installed at Celanese Corporation of America, Corpus Christi, Texas.

IBM 1957 GROSS INCOME OVER ONE BILLION DOLLARS

International Business Machines Corp. has announced, that, according to preliminary results for the year 1957, for the first time in the company's history, the gross annual volume of business has exceeded one billion dollars. Gross income for the year 1957 from sales, service, and rentals in the United States amounted to $1;000,-431,597, compared with $734,339,780 in the year 1956.

Net income for the year ended December 31, 1957, after U. S. federal income taxes amounted to $89,291,-

589. This is equivalent to $7.73 a share on the 11,552,460 shares outstanding after the 100 percent stock split effected May 7, 1957, and the 1,050,223 shares of additional stock sold through the rights offering which ended June 10, 1957. The net income after taxes for the year ended December 31, 1956, was $68,784,510, equal to $6.55 a share on 10,502,237 shares, the number of shares outstanding December 31, 1956, adjusted for the split-up of May 7, 1957.

During 1956 the corporation changed its method of computing depreciation for rental machines produced since January 1, 1956, from the straight line to the sum of-the-years-digits method. This change resulted in a reduction of net income after taxes amounting to $11,438,518 for the year 1957 and $4,264,688 for the year 1956.

For the year ended December 31, 1957, the net income after taxes includes $3,927,000 derived from the outright sale to customers of punched card accounting and data processing machines previously under lease to them.

Be Sure to Send us Your Entries for

THE COMPUTER
DIRECTORY AND BUYERS' GUIDE, 1958

See pages 24, 26, 28, 30, 32 in this issue.

HUGHES AIRCRAFT TO GRANT 150 FELLOWSHIPS IN SCIENCE WORK

Hughes Aircraft Company, Culver City, Calif., will grant master of science fellowships to 150 college graduates to help them pursue advanced studies in science and engineering. The fellowships will be awarded to applicants with outstanding scholastic records from universities throughout the nation. Inaugurated in 1952 to help alleviate the shortage of top scientific talent, the Hughes program so far has enabled 265 students to obtain master's degrees while an additional 217 are currently enrolled in the plan.

Successful candidates receive full tuition, books, and university fees plus salaries for part-time work as members of the Hughes research and development staff. While studying a half-time regular university curriculum, they also are assigned to advanced research in military and industrial electronics. Fellows selected will work towards masters degrees in electrical or mechanical engineering or physics at University of Southern California, University of California at Los Angeles, California Institute of Technology, or University of Arizona.

Acceptance of Hughes fellowships involves no obligation for future employment. Fields of study in science and engineering are left entirely to the choice of the individual fellows.

Applications sent to the company by April will be considered for awards for 1958.

THE COMPUTER DIRECTORY
AND
BUYERS' GUIDE, 1958

— the June 1958 issue of **COMPUTERS and AUTOMATION**
published at 815 Washington St., Newtonville 60, Mass. —

There is no charge for brief listing of your organization, key personnel, and products

The ONE Directory in the
COMPUTER AND DATA PROCESSING FIELD
— a useful fact book referred to and used by
over 15,000 Computer-Minded Readers
— all through the year

Two Master Lists

For the fourth year, the directory will, as before, contain two master lists:

Part 1, "Roster of Organizations in the Field of Computing and Data Processing." This is alphabetical by name of the organization.

Part 2, "Buyers' Guide to the Field of Computing and Data Processing: Roster of Products and Services for Sale or Rent." This is classified under product headings (see the list of headings); under each heading, entries are alphabetical by name of company.

Last year's directory contained ovr 790 organization entries and over 1370 product and service entries; this year's directory will be larger still.

Each list contains ordinary entries and EXPANDED BOLD FACE ENTRIES.

What is an Ordinary Entry?

Ordinary entries are free; they are brief, and condensed; they are set in ordinary type. They consist of one entry for the organization in the "Roster of Organizations," and an additional brief listing under each heading in the "Roster of Products and Services." Each of these additional listings consists of the organization's name only.

What is an EXPANDED BOLD FACE ENTRY?

These entries contain some 20 to 50 words of description or more, edited if necessary. These entries are set in Bold Face Type. They consist of a bold face entry for your organization in the "Roster of Organizations," with more information than for ordinary entries, and additional entries in the "Roster of Products and Services" for each of your products or services as you may order. These additional entries appear under the appropriate headings in the "Roster of Products and Services."

The charge for each expanded bold face entry, irrespective of the number of words, is $10, payable at the time when you order the entry — BUT the $10 paid can be a credit against the cost of your advertising in the Directory, according to the following rule:

If your organization takes a full page of advertising in "The Computer Directory and Buyers' Guide," your advertising cost will be decreased by $10 for each of your bold face entries up to eight entries. Similarly, for a 2/3 page or a ½ page of advertising, you will receive a credit of $10 for each bold face entry up to four entries. For a 1/3 page or ¼ page of advertising, you will receive a credit of $10 for each bold face entry up to two entries.

Please note also:

1. If you take advertising space in the Computer Directory, 1958, you are automatically entitled to a FREE Expanded Bold Face Entry for your organization in the "Roster of Organizations."
2. If you wish to list your Subsidiaries, Affiliates, Branches and/or Distributors in the "Roster of Organizations," right after your own main entry, and in Bold Face type also, showing for each:
   State .....
   City .....
   Local Address .....
   Phone No. .....
   Name and Title of One Contact .....
   you may do so, at a charge of $5 per additional entry. The information can be given to us on any piece of paper.

What are Examples of Entries in the "Roster of Organizations"?

Here is an example of an ordinary entry as it might appear in the 1958 directory:

ABC Company, 307 Railroad Ave., Palo Loto, N.J. / EXchange 5-0000 / J. J. Jones, Pres. / S. S. Smith, Sales Dir. / *C58 (meaning "checked in 1958") Magnetic cores. Ms(150) Se(1956) DIc RMSa

The last four abbreviations mean "medium size, 150 employees; established a short while ago, 1956; interest in computing field, digital, incidental; research, manufacturing, and selling activity.

Here is an example of an EXPANDED BOLD FACE ENTRY as it actually appeared in the 1957 Directory:

FERRANTI ELECTRIC, INC., 30 Rockefeller Plaza, New York 20, N.Y. / CIrcle 7-0911 / agent for Ferranti Electric Ltd., Moston, England, and Mount Dennis, Toronto, Canada / *C 57
General purpose electronic digital computers (Pegasus, Mercury). Special purpose data pro-

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[Continued from page 24]

cessing systems. High speed tape readers. Magnetic drums. Digital storage delay lines. Ls(12,000 including associated companies) Le(1896) DAIc RMSa

FERRANTI LIMITED, Computer Centre, 21 Portland Place, London W1, England / Langham 9211
Computer and information-handling centre. Ls (600) Se(1953) DAc RPCa

FERRANTI ELECTRIC LTD., Mount Dennis, Toronto, Ont., Canada
Digital computers; magnetic drums. DIc RMSa

In the 1958 directory, the names of two executives and their titles will also appear, if the company desires it.

What are Examples of Entries in the "Roster of Products and Services" or "Buyers' Guide"?

Here are two examples of EXPANDED BOLD FACE ENTRIES from the 1957 Computer Directory (and the headings under which they appeared):

54. RELAYS (COMPUTER TYPES)

AUTOMATIC ELECTRIC COMPANY, Northlake, Ill. / relays (telephone-type) / DESCR: small size, light weight, twin contact springs, very resistant to vibration, humidity, and extremes of temperature / USE: standard screw mounting; some are available with special mounting for tin-dipped printed circuit cards, or mounted on regular octal-type or industrial plugs. Wired or unwired / $3 to $8; hermeticallly sealed at approximately twice as much / 54

20. DIGITAL COMPUTERS

INTERNATIONAL BUSINESS MACHINES CORP., 590 Madison Ave., New York 22, N.Y., and elsewhere / IBM 604 Electronic Calculating Punch / DESCR: a 1400 tube general-purpose computer that reads problem data from IBM punched cards at a constant speed of 6,000 cards per hour and can go through as many as 60 separate steps to obtain the solution to a single problem / USE: the 604 is widely used in science, engineering, and business / Monthly rental is $550 and up. Selling price is $33,850 and up / 20

Here are two examples of ordinary entries from the 1957 Computer Directory: (and the heading under which they appeared):

32. MAGNETIC HEADS

Brush Electronics Co. / magnetic heads / 32
Wharf Engineering Labs., England / magnetic heads / 32

Who will see "The Computer Directory and Buyers' Guide, 1958"?

"The Computer Directory and Buyers' Guide, 1958" goes as the June 1958 issue of "Computers and Automation" to all subscribers to the magazine. The February issue had about 3900 subscribers. We have evidence that each copy on the average has about 3 or 4 readers, so that each issue reaches over 15,000 computer minded people.

The print order for the June issue, the Computer Directory, will we expect be 5500 or 6000 copies.

How can I see the entries we put into last year's directory?

Probably COMPUTERS *and* AUTOMATION for June last year is in the technical library in your organization, or in some library nearby. Besides this source, we have set aside 300 copies of last year's directory to send out on request to persons making entries for this year's directory. If you request a copy, telling us your organization and title, we will send you one, on a first-come-first-served basis, as long as the 300 copies last.

What do I do to get our entries into the Directory?

Fill in the entry forms (use any paper) and send them back to us SOON, along with double-spaced typewritten copies of the EXPANDED BOLD FACE ENTRIES that you desire for your products and services, and your check for these entries. (Your organization is described in the report on the front page of this questionnaire.) Below is the style for a "Product or Service Entry" (it may be copied on any piece of paper) and pages 6 and 7 of this questionnaire form repeat it.

ORGANIZATION ENTRY FORM, COMPUTER DIRECTORY 1958

(may be copied on any piece of paper)

1. Organization Name? .....
2. Street Address? .....
3. City, Zone, State? ..... 4. Telephone Number? .....
5. BRIEF DESCRIPTION OF YOUR PRODUCT LINES AND SERVICES: .....

.....

Under what headings should they be listed? (Please look in the list of headings, and copy heading numbers.)

6. Types of Your Activity: ( ) Research ( ) Manufacturing ( ) Selling ( ) Consulting
   Other (describe) .....
7. Approximate Number of Your Employees? ..... 8. Year Established? .....
9. Free Listings for two of your executives? Name..... Title.....
10. This data supplied by ..... Name..... Title.....
    (signature) Name..... Title.....
11. ( ) $10 enclosed for this if it is to be an Expanded Bold Face Entry.

Send to **COMPUTERS and AUTOMATION,** 815 Washington St., Newtonville 60, Mass., to arrive before April 25, 1958.

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Readers' and Editor's Forum

[Continued from page 6]

WEDNESDAY AFTERNOON

Computers and Control
Waldorf-Astoria, Sert Room

A Preventive Maintenance Program for Large General Purpose Electronic Analog Computers, *R. P. Sykes.*

The TRICE — A High-Speed Incremental Computer, *S. Ruhman and J. M. Mitchell.*

Digital Moon Radar Antenna Programmer with Analog Interpolator Servo, *O. A. Guzmann.*

A Balanced Precision Reference Regulator for Computer Application, *D. A. Noden.*

A Solid-State Analog-to-Digital Conversion Device, *M. Palevsky.*

J-Axis Translation of Transfer Functions, *J. L. Ryerson.*

THURSDAY MORNING, MARCH 27

Magnetics and Computers
Waldorf-Astoria, Starlight Roof

A High-Speed *n*-pole, *n*-position Magnetic Core Matrix Switch, *A. L. Lane and A. Turczyn.*

Apertured Plate Memory: Operation and Analysis. *W. J. Haneman, J. Lehmann, and C. S. Warren.*

Molecular Storage and Read-Out with Microwaves, *C. H. Becker, R. L. Pierce, and J. R. Martin.*

Calculation of Flux Patterns in Ferrite Multipath Core Structures, *S. A. Abbas and D. L. Critchlow.*

Logic by Ordered Flux Changes in Multipath Ferrite Cores, *N. F. Lockhart.*

Flux Responsive Magnetic Heads for Low-Speed Read-Out of Data, *L. W. Ferber.*

Data Reduction and Recording
New York Coliseum, Morse Hall

Instrumentation for Recording and Analysis of Audio and Subaudio Noise, *D. D. Howard.*

A Xerographic Cathode-Ray Tube Recorder, *H. H. Hunter, O. A. Ullrich, and L. E. Walkup.*

Theory of Magnetography, *S. J. Begun.*

Applications of Magnetography to Graphic Recording, *J. B. Gehman.*

A Shaft Position Digitizer System of High Precision, *L. G. deBey and R. C. Webb.*

A High-Precision Digital Shaft Position Indicator, *D. H. Raudenbush.*

CENTRAL OHIO ASSOCIATION FOR COMPUTING MACHINERY — SECOND ANNUAL SYMPOSIUM — COLUMBUS, OHIO, MARCH 29, 1958

The Central Ohio Association for Computing Machinery will hold its Second Annual Symposium Saturday, March 29, 1958, on the campus of the Ohio State University, Columbus, Ohio.

The subject of the Symposium is "Recent Advances in Programming Methods." The speakers include: Dr. H. R. J. Grosch, IBM; Dr. John Mauchly, Sperry Rand; Dr. Everett C. Yowell, National Cash Register; Mr. Frank Engel, Westinghouse Electric; Mr. J. H. Wegstein, National Bureau of Standards; and Dr. John W. Carr, III, University of Michigan.

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[Continued from page 26]

PRODUCT OR SERVICE ENTRY FORM, COMPUTER DIRECTORY 1958

(may be copied on any piece of paper — use a separate sheet for each product or service)

1. Name and Address of Organization? .....

.....

2. Name or Identification of Product or Service? .....
3. Description? .....

.....

.....

4. Uses? .....

.....

5. Price Range? .....
6. Under what Headings should this be Listed? (Please look in the list of headings; copy heading number.) .....

.....

7. ( ) $10 enclosed for this if it is to be an Expanded Bold Face Entry.

Send to **COMPUTERS and AUTOMATION,** 815 Washington St., Newtonville 60, Mass. to arrive before April 25, 1958.

THE COMPUTER DIRECTORY AND BUYERS' GUIDE, 1958

LIST OF HEADINGS

Below and on the next page are listed headings for products and services for sale or rent in the field of computing and data processing. These headings will be included or covered in the "Buyers' Guide to the Computer Field: Products and Services for Sale or Rent."

Please note that some products are included under more than one heading. Please list all classifications in which your products belong.

If you do not find a heading you like, please word your own heading and write it on the entry form.

There is NO CHARGE for listing your organization's name under each heading where it should be listed.

A:
- Adding Machines —— A1
- Addressing Machines —— A2
- Amplifiers ..... —— A3
  - — Magnetic —— A4
- Analog Computers (SEE Computers, Analog)
- Automatic Assembly Equipment —— A5
- Automatic Control Equipment —— A6

B:
- Boards — Plotting —— B1
  - — Plug —— B2
  - — Strip Type —— B3
- Bobbins, Coil Winding —— B4
- Boxes — Metal, Plastic or Waterproof —— B5
- Breadboard Kits —— B6

C:
- Cable —— C1
- Cable Assemblies —— C2
- Cameras ..... —— C3
  - — Data Recording —— C3A
- Capacitors (Computer Types) —— C4
- Cards (SEE Also Punch Cards) —— C5
  - — Punch —— C6
  - — Magnetic —— C7
- Chassis — Metal —— C8
- Circuits .....
  - — Arithmetical (for Digital Computers) —— C9
  - — Computer, Packaged —— C10
  - — Logical (for Digital Computers) —— C11
  - — Plug-in —— C12
  - — Potted —— C13
  - — Printed —— C14
- Clutches ..... —— C15
  - — Magnetic —— C16
- Coatings ..... —— C17
  - — Conductive —— C18
  - — Protective —— C19
  - — Salt Spray Resistant —— C20
- Coils (Computer Types) —— C21
- Communications Systems (Computer Types) —— C22
- Computers, Analog —— C23
- Computers, Digital —— C24
- Computers, Test Equipment —— C25
- Computer Components (SEE ALSO specific types) —— C26
- Computing Services ..... —— C27
  - — Digital —— C28
- Connectors —— C29
- Consulting Services —— C30
- Controls ..... —— C31
  - — Automatic —— C32
  - — Signaling —— C33
  - — Sorting and Counting — C34

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Books and Other Publications

[Continued from page 21]

Kunz, Kaiser S. / Numerical Analysis / McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N.Y. / 1957, printed, 381 pp., $8.00.

Mr. Kunz, a research physicist, proposes here to "develop a fundamental understanding of the use of finite difference methods in obtaining numerical solutions to problems" in applied mathematics. He stresses especially computation procedures which can be programmed for electronic digital computers. The numerical solutions of ordinary and partial differential and integral equations are described, finite-difference tables and notations are treated. The author developed the book from a series of lectures for a graduate student course given at Harvard, intended to train men for the design and use of electronic computers. The book presupposes a knowledge of calculus and differential equations.

Susskind, Alfred K., editor, and others / Notes on Analog-Digital Conversion Techniques / The Technology Press, Massachusetts Institute of Technology, Cambridge 39, Mass. / 1957, photo-offset, about 412 pp., $10.

The material presented here was prepared for use at the Massachusetts Institute of Technology 1957 Special Summer Session for Analog-Digital Conversion

[Continued from page 28]

- Converters, Electrical ..... — C35
  - — High Frequency — C36
  - — Low Frequency — C37
  - — Power Frequency — C38
- Converters, Information ..... — C39
  - — Analog to Digital — C40
  - — Card to Magnetic Tape — C41
  - — Card to Paper Tape — C42
  - — Computing — C43
  - — Digital to Analog — C44
  - — Magnetic Tape to Card — C45
  - — Magnetic Tape to Paper Tape — C46
  - — Paper Tape to Card — C47
  - — Paper Tape to Magnetic Tape — C48
- Cords — C49
- Cores ..... — C50
  - — Ferrite — C51
  - — Magnetic — C52
- Counters ..... — C53
  - — Electronic — C54
  - — Frequency — C55
  - — Mechanical — C56
  - — Proportional — C57
- Courses by Mail (Computer Field) — C58

D: Data Processing Machinery (SEE ALSO specific types) — D1
- Data Recording Equipment (SEE ALSO Input/Output devices) — D2
- Delay Lines (Computer Types) — D3
- Desk Calculators — D4
- Dials — D5
- Differential Analyzers — D6
- Diodes (Computer Types) ..... — D7
  - — Germanium — D8
  - — Power — D9
  - — Silicon — D10
- Discs, Magnetic — D11
- Drums, Magnetic — D12

E: Education (see also courses) — E1
- Embedded Assemblies and Components — E2

F: Facsimile Equipment — F1
- Fasteners and Fastening Devices — F2
- Fire Control Equipment — F3

G: Generators, Function — G1
  - — Electronic — G2
  - — Mechanical — G3
- Geophysical Apparatus — G4

H: Heads, Magnetic ..... — H1
  - — Reading — H2
  - — Recording — H3

I: Indicators (Computer Types) — I1
- Information Retrieval Devices — I2
- Input/Output Devices — I3
- Integrators ..... — I4
  - — Electronic — I5
  - — Mechanical — I6
- Inventory Systems — I7

J: Jacks — J1

K: Keyboards — K1

M: Magnets — M1
- Memory Systems — M2
- Multipliers ..... — M3
  - — Diode — M4
  - — Electronic — M5
  - — Frequency — M6
  - — Servo — M7

O: Office Machines — O1

P: Panels ..... — P1
  - — Jack — P2
  - — Relay Rack — P3
- Paper Tape — P4
- Patch Cords — P5
- Plotters (SEE ALSO Boards — Plotting) — P6
- Potentiometers (Computer Types) — P7
- Power Supplies — Regulated — P8
- Printers ..... — P9
  - — High Speed — P10
  - — Keyboard — P11
  - — Line-a-time — P12
- Publications ..... — P13
  - — Book Publishers — P14
  - — Magazines — P15

R: Readers ..... — R1
  - — Character — R2
  - — Magnetic Card — R3
  - — Magnetic Tape — R4
  - — Mechanical — R5
  - — Paper Tape — R6
  - — Photoelectric — R7
  - — Punch Card — R8
- Recording Papers — R9
- Rectifiers — R10
- Registers, Shift — R11
- Relays (Computer Types) — R12
- Resistors — R13
- Resolvers ..... — R14
  - — Coordinate Transform — R15
  - — Product — R16
  - — Sine-Cosine — R17
- Robots — R18

S: Scanners — S1
- Semiconductors — S2
- Simulators — S3
- Storage Systems ..... — S4
  - — Magnetic — S5
- Switches ..... — S6
  - — Stepping — S7
- Synchros — S8

T: Tachometers — T1
- Tape Handlers — T2
- Tape, Magnetic ..... — T3
  - — Filing Systems — T3A
  - — Readers — T4
  - — Recorders — T5
- Tape, Paper ..... — T6
  - — Filing Systems — T7
  - — Punches — T8
  - — Readers — T9
- Telemetering Systems — T10
- Terminals — T11
- Transformers ..... — T12
- — Pulse — T13
- Transistors ..... — T14
  - — Germanium — T15
  - — Silicon — T16
- Translating Equipment — T17
- Typewriters, Electric, Controlled — T18
- Tubes, Electronic — T19

V: Visual Output Devices — V1

[Please turn to page 32]

Books and Other Publications

[Continued from page 29]

Techniques. All material is treated in detail, but "is aimed primarily at readers who have been away from formal academic work for some time and who have little previous knowledge of the field." The authors discuss systems aspects of digital-information-processing which influence the specifications for analog-digital conversion devices; they present detailed analyses and evaluations of such devices; they discuss in detail a case study of work done at the Servomechanism Laboratory of MIT's Department of Electrical Engineering. Ample illustrations clarify the text.

Newton, George C., Leonard A. Gould, and James F. Kaiser / Analytical Design of Linear Feedback Controls / John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. / 1957, printed, 419 pp., $12.

This is an important book, presenting analytical techniques for solving "practical control problems." The text is written for scientists and engineers who have had graduate training, or for graduate students who are studying advanced work in feedback control theory. The authors explain that by *analytical design,* they mean "the design of control systems by application of the methods of mathematical analysis to idealized models" representing physical equipment. They point out that other textbooks on the subject of feedback control actually present trial-and-error methods of design procedure, since they discuss numerous ways of modifying parameters, under the designer's control, for improved system response. Such trial and error design in no way guarantees performance demanded by specifications. The analytical design method, on the other hand, starts with the specifications and proceeds directly to the compensation needed for the specified performance index. The book is well-illustrated. It contains a valuable glossary, a bibliography, and several useful mathematical appendices.

Pyke, Magnus / Automation: Its Purpose and Future / Philosophical Library Inc., 15 East 40th St., New York 16, N.Y. / 1957, printed (in Great Britain), 191 pp., $10.

Mr. Pyke discusses automation in mass-production industries, in businesses, and in everyday living. He defines and debates its social effects and possibilities, expressing an optimistic viewpoint of those possibilities. He also discusses at some length the problems arising from accumulating hours of leisure for the working man, as automation reduces the working-hour week from six to five and from five to four days. The book is interesting and informative for the layman who wishes to learn about automation — its definitions and implications in his living.

Singer, Bertrand B. / Basic Mathematics for Electricity, Radio and Television / McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N.Y. / 1957, printed, 513 pp., $5.75.

A practical basic and refresher course and textbook in mathematics of electricity, radio, and television fields for skilled workers. The method of presentation on a "job" basis, with examples of job applications, and reviews of principles, makes the text clear to its intended readers. Good diagrams, illustrations, and problems are provided. Contents include: electrical measurements: electrical energy, electrical power, resistance, capacitance, parallel and series A-C circuits, and A-C power.

IRE National Convention Record, 1957 / Institute of Radio Engineers, Inc., 1 East 79th St., New York 21, N.Y. / 1957, photo-offset, 179 pp., $4.00 to members, $12.00 to non-members.

Contains 30 papers concerned with computers, automatic control, and medical electronics. These papers were presented at the IRE National Convention in New York, March 18-21, 1957, during sessions on non-linear control systems, automatic control in general, medical electronics, digital computers, analog computers, and computers in simulation, data reduction and control.

Bratten, F. W. / Dynamic System Studies: Analog Computation / Wright Air Development Center, U.S. Air Force, Wright-Patterson Air Force Base, Ohio, distributed by Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D.C. / 1956, photo-offset, 69 pp., cost $2.00.

A report on electronic differential analyzers and their applications to flight simulation problems, where the analyzers must solve systems of "high order linear and nonlinear equations that represent the aerodynamics, guidance, and control systems of a missile or aircraft," at a real-time rate. Recent analog computers are described and discussed.

AUTOMATIKA I TELEMECHANIKA

December, 1957

FOLLOWING are citations of the papers appearing in the December, 1957 issue (Vol. 18, No. 12) of *Automatika i Telemechanika* (*Automatics and Telemechanics*), published by the Academy NAUK, Moscow, U.S.S.R. Each item ordinarily consists of: author / title / page. In some cases, the item includes all or part of the summary of the paper (each paper is printed in the journal with both a Russian and an English summary).

Kilin, F. M. / Transient and steady processes in pulse systems with step variables / The paper deals with determination of transient and steady processes in pulse systems with step variables. To describe phenomena in such systems step functions are used together with continuous functions. / 1061

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THE COMPUTER DIRECTORY AND BUYERS' GUIDE, 1958

WE INVITE YOU to join these distinguished organizations who took advertising space and /or expanded product entries in "The Computer Director and Buyers' Guide, 1957."

Adalia Computations, Ltd.
Adalia, Ltd.
Addressograph-Multigraph Corp.
AEC Computing Facility
Airborne Instrument Laboratories, Modac Div.
Aladdin Electronics
Allegheny Instrument Company, Inc.
R. C. Allen Business Machines, Inc.
Allies' Products Corp.
Alwac Corp.
American Electronics, Inc.
American Machine and Foundry Co.
Amperite Co., Inc.
Ampex Corp.
Amphenol Electronics Corp.
Andersen Laboratories
The Arnold Engineering Company
Atlas Precision Products Co.
Audio Devices, Inc.
The Austin Company
Automatic Electric Company
Automatic Engineers Co.
Autonetics, a Div. of No. American Aviation, Inc.
Bank of America National Trust and Savings Assoc.
Beckman Instruments, Inc., Systems Div.
Bell Aircraft Corp.
Bendix Aviation Corp.
Bendix Aviation Corp., Research Laboratories Div.
Bendix Computer Div., Bendix Aviation Corp.
Berkeley Division, Beckman Instruments, Inc.
The Bristol Company
British Tabulating Machine Co., Ltd.
Bryant Gage and Spindle Division
Burlingame Associates, Ltd.
Burndy Corp.
Business Electronics, Inc.
Canning, Sisson & Associates
CBS-Hytron
C. P. Clare and Company
Computing Devices of Canada, Ltd.
Control Instrument Co., Inc.
Council for Economic & Industry Research
Cubic Corp.
Cudahy Publishing Company
Datamatic Corp.
Data Processing Digest
The Datics Corp.
Daystrom Systems
John Diebold & Associates, Inc.
Donner Scientific Company
Ebasco Services, Inc.
Electralab, Inc.
Electrodata Div. of Burroughs Corp.
Electronic Associates, Inc.
Electronic Engineering Company
Elliott Addressing Machine Company
Epsco, Inc.
ESC Corp.
Fairchild Engine & Airplane Corp.
Ferranti Electric, Inc.
Ferranti, Ltd.
Fischer and Porter Company
Ford Instrument Company, Div. of Sperry Rand Corp.
The Foxboro Corp.
The Franklin Institute Laboratories for Research and Development
Friden Calculating Machine Co., Inc.
H. S. Gellman & Co., Ltd.
General Ceramics Corp.
General Electric Company
General Kinetics, Inc.
General Transistor Corp.
The Geotechnical Corp.
Haller, Raymond & Brown, Inc.
Hammerlund Mfg. Co., Inc.
N. V. Hollandse Signaalapparaten
Hoover Electronics Co.
Hughes Research and Development Laboratories, Hughes Aircraft Co.
Industrial Nucleonics Corp.
International Business Machines Corp.
International Resistance Co.
J. V. Kane & Co.
KCS Data Control
A. Kimball Co.
The Kybernetes Corp.
Laboratory for Electronics, Inc.
Lansdale Tube Co., Div. of Philco Corp.
Link Aviation, Inc.
Littelfuse, Inc.
Lockheed Missile Systems
Magnetic Research Corp.
Marchant Calculators, Inc.
Marchant Research, Inc.
Massachusetts Institute of Technology
Mellon Institute of Industrial Research
Metron Corp.
Monroe Calculating Machine Co.
Moore School of Electrical Engineering
F. L. Mosely Co.
National Analysts, Inc.
National Cash Register Co.
Northrop Aircraft, Inc.
Nuclear Development Corp. of America
Olivetti Corp. of America
ORRadio Industries
Packard-Bell Electronics Corp.
Panellit, Inc.
George A. Philbrick Researches, Inc.
Phillips Electronics, Inc.
Potter Instrument Co., Inc.
Radiation, Inc.
Radio Corp. of America
Radio Corp. of America Components Div.
Radio Corp. of America Electronic Tube Div.
Radio Corp. of America Semiconductor Div.
Radio Receptor Co., Inc.
The Ramo-Wooldridge Corp.
Raytheon Manufacturing Co.
Recording and Statistical Corp.
Remington Rand Univac Div., Sperry Rand Corp.
Resistance Products Co.
Richardson Camera Company
Schweber Electronics
The Service Bureau Corp.
Sola Electric Co.
Soroban Engineering, Inc.
The Standard Register Co.
Sturrup, Inc.
Sylvania Electric Products, Inc.
Telecomputing Corp.
Telemeter Magnetics, Inc.
Teleregister Corp.
Texas Instruments, Inc.
Trio Laboratories, Inc.
Tung-Sol Electric, Inc.
Typatape, Inc.
University of Michigan
University of Toronto
Victor Adding Machine Company
The Walkirt Co.
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ADVERTISING SPACE DEADLINE . . . May 10, 1958

$240 per black and white page
$185 per ⅔ page b & w
$140 per ½ page b & w
$ 95 per ⅓ page b & w
$ 75 per ¼ page b & w

COMPUTERS *and* AUTOMATION
815 Washington Street
Newtonville 60, Massachusetts
DEcatur 2-5453

To: COMPUTERS *and* AUTOMATION, 815 Washington Street, Newtonville 60, Mass.

We are interested in advertising in "The Computer Directory and Buyers' Guide, 1958." Please send data to the attention of:

Name ..... Address .....

Automatika I Telemechanika

[Continued from page 31]

Readers' and Editor's Forum

[Continued from page 27]

For further information, please write to Mr. Benjamin L. Schwartz, Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.

The Central Ohio Association for Computing Machinery is not affiliated with the national Association for Computing Machinery, but sponsoring organizations include Battelle Memorial Institute, Ohio State University, North American Aviation, Nationwide Insurance, and several other central Ohio concerns.

UNIVERSITY OF MICHIGAN 10-DAY SUMMER COURSE IN AUTOMATIC CONTROL

Lawrence L. Rauch

Chairman, Instrumentation Engineering Dept.
Univ. of Michigan, College of Engineering
Ann Arbor, Michigan

We believe the following announcement may be of interest to the readers of "Computers and Automation." We would appreciate very much having the notice appear before the closing date for registration in the course, April 15.

The University of Michigan, College of Engineering, is offering a summer Intensive Course in Automatic Control June 16 to 25, 1958, inclusive. The course is intended for engineers who wish to obtain a basic understanding of the field, but who cannot spare much time for this purpose. The aim of the course is to make the subject easy to learn by a coherent presentation in class of the fundamentals of modern automatic control, and by providing a comprehensive set of notes to serve as a framework for further study.

The course is built around the principles and application of measurement, communication and control. Extensive use will be made of computing, instrumentation, and servo laboratories on the campus. The role of analog computing methods will be emphasized. This course has been given in the summers since 1953.

April 15 is the closing date for registration. Further information may be obtained by writing to us.

CORRECTIONS OF DECEMBER ISSUE

I. From H. G. Sparks

Univ. of Pennsylvania
Philadelphia, Pa.

I would like to compliment you on the fine article entitled, "A Pictorial Manual on Computers — Part 1" in the December, 1957 issue of "Computers and Automation."

I am afraid, however, there has been a slight mistake in the labeling of the photographs of the University of Pennsylvania Computer Center. In your article on page 10, figure 1, the label reads, "The new Computing Center at the Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa., showing its powerful modern automatic digital computer, a Remington Rand Univac. The central machine is the supervisory control." The Univac is located in the University of Pennsylvania Computer Center, not in The Moore School as described above. I would appreciate it if you would correct this error in a future issue.

II. From E. M. McCormick

U.S. Naval Ordnance Laboratory
Corona, California

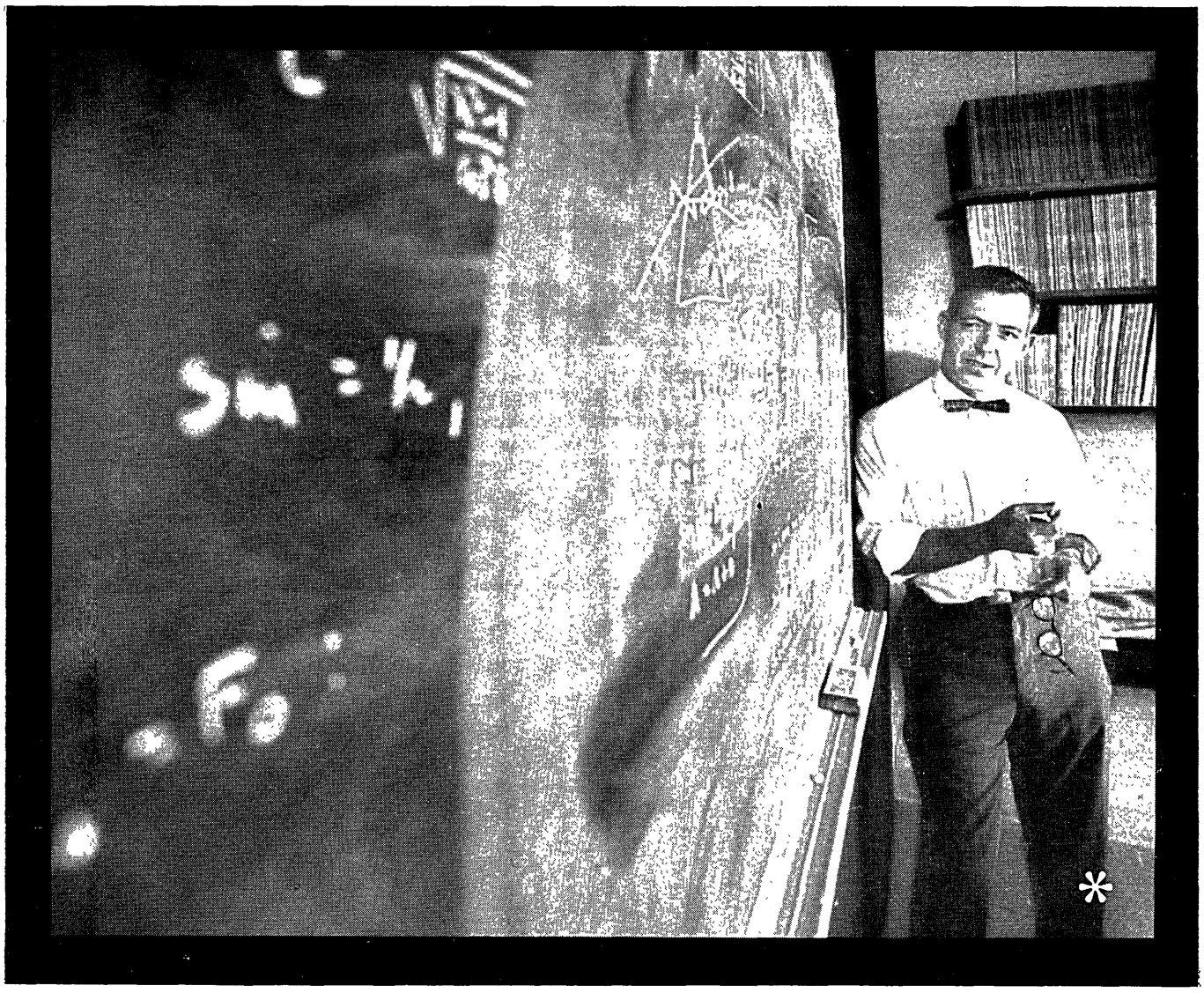
We note that page 13 of the December issue of "Computers and Automation" includes a photograph of our Datatron installation. It was incorrectly identified as being at the Naval Ordnance Laboratory, Washington, D. C.

Since our Laboratory is newer than the one in Washington, this mistake occurs frequently. Although the names are practically alike, the two NOL's are independent activities of the Navy.

Incidentally, the picture shows our Datatron 204. However, we are now installing a Datatron 205.

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 the agency if any.



an oblique look

tech/ops scientists know there are at least three ways of attacking a problem: head on, as an amphibious force hits a beach; flank-wise, as a tactician likes to strike; and *slantwise*, the offbeat way.

This is a basic principle in operations research, the new *team* method of attacking problems, in which *tech/ops* is a leader and pioneer. It is this habit of taking an oblique look—of applying a group of apparently unrelated disciplines to the problem—that has developed, at *tech/ops*, unique solutions in weapons systems, tactics, organizations and logistics.

You may profit by taking an oblique look at your own career problem—and joining a team of *tech/ops* scientists looking for new ways to the future.

Address: ROBERT L. KOLLER

TECHNICAL OPERATIONS, INCORPORATED
Burlington, Massachusetts

at your career in

BURLINGTON, MASS., or Washington, D.C.: mathematical statistician (PhD with five years' experience) for research in sensitivity of stochastic games, statistical analysis of such games; creative, with skill to develop essentially new mathematics in relatively unexplored area; also mathematician (PhD with five years' computer experience) to develop sophisticated computer programs.

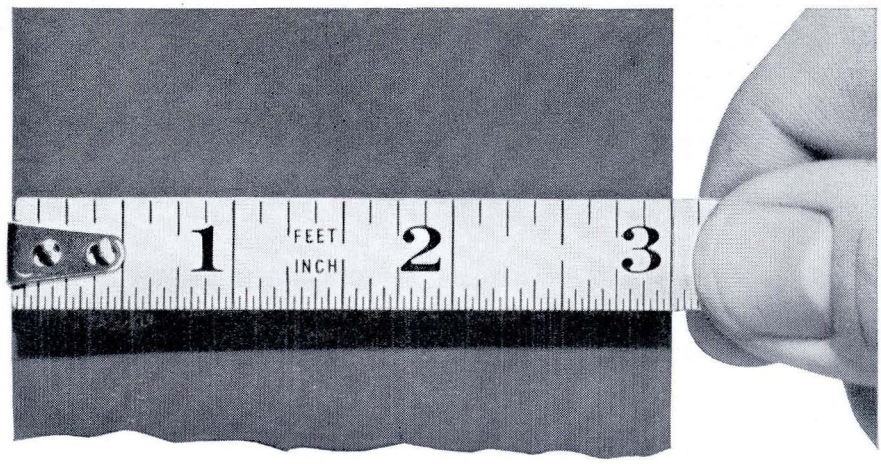
FORT MONROE, VA.: Logician with computer knowledge; mathematical economist; electrical engineer with background in information or queuing theory; senior operations analyst, master's level or above, in physical sciences or mathematics.

MONTEREY, CALIF.: Applied mathematician with understanding of application of high speed computers to data analysis; scientist or engineer with heavy math orientation to act as project leader of field experimentation group; senior scientist on PhD level in operations research, math, physics.

(Please indicate location preference.)

tech/ops

* *Dr. Eric Clarke, tech/ops vice president, takes a look at a problem in his office at Burlington, Mass.*



New business weapon in the war on paperwork

Extra-wide magnetic tape is a key factor in enabling Honeywell's DATAmatic 1000 to process business data at new record-breaking speeds. New recording techniques and the tape's greater capacity team up to exploit the electronic speeds of the central computer.

This ingenious tape helps explain DATAmatic 1000's ability to devour all sorts of business information at the rate of 900 fully punched cards a minute.

Most important, it steps up the flow of this information to and from the central computer to a peak rate of 120,000 digits per second, or a sustained speed of 60,000 digits per second.

Consistent with these speeds is DATAmatic 1000's ability to print insurance premium notices, inventory reports, bank statements, production schedules, mailing lists — or what have you — at the eye-blinking speed of 15 lines a second (up to 120 characters a line)! As many as 14,000 typical paychecks, for example, can be printed in one hour.

By now it should be clear there is something extra special about DATAmatic 1000's new magnetic tape.

There is.

It holds far more business information than conventional tapes. First, because it's wider. Second, because unique recording methods now utilize its surface more completely and efficiently. Data is organized for more rapid accessibility, and to save valuable time DATAmatic 1000 can even read the tape in both directions, coming or going!

This new magnetic tape is but one of the many features of DATAmatic 1000 designed specifically for business use. That is why consideration of any business data processing program is incomplete without the facts on DATAmatic 1000.

Our applications engineers will be glad to discuss your requirements. Write for details to Walter W. Finke, President, DATAmatic Division, Dept. A3, Newton Highlands 61, Massachusetts.

Honeywell

H DATAmatic
ELECTRONIC DATA PROCESSING