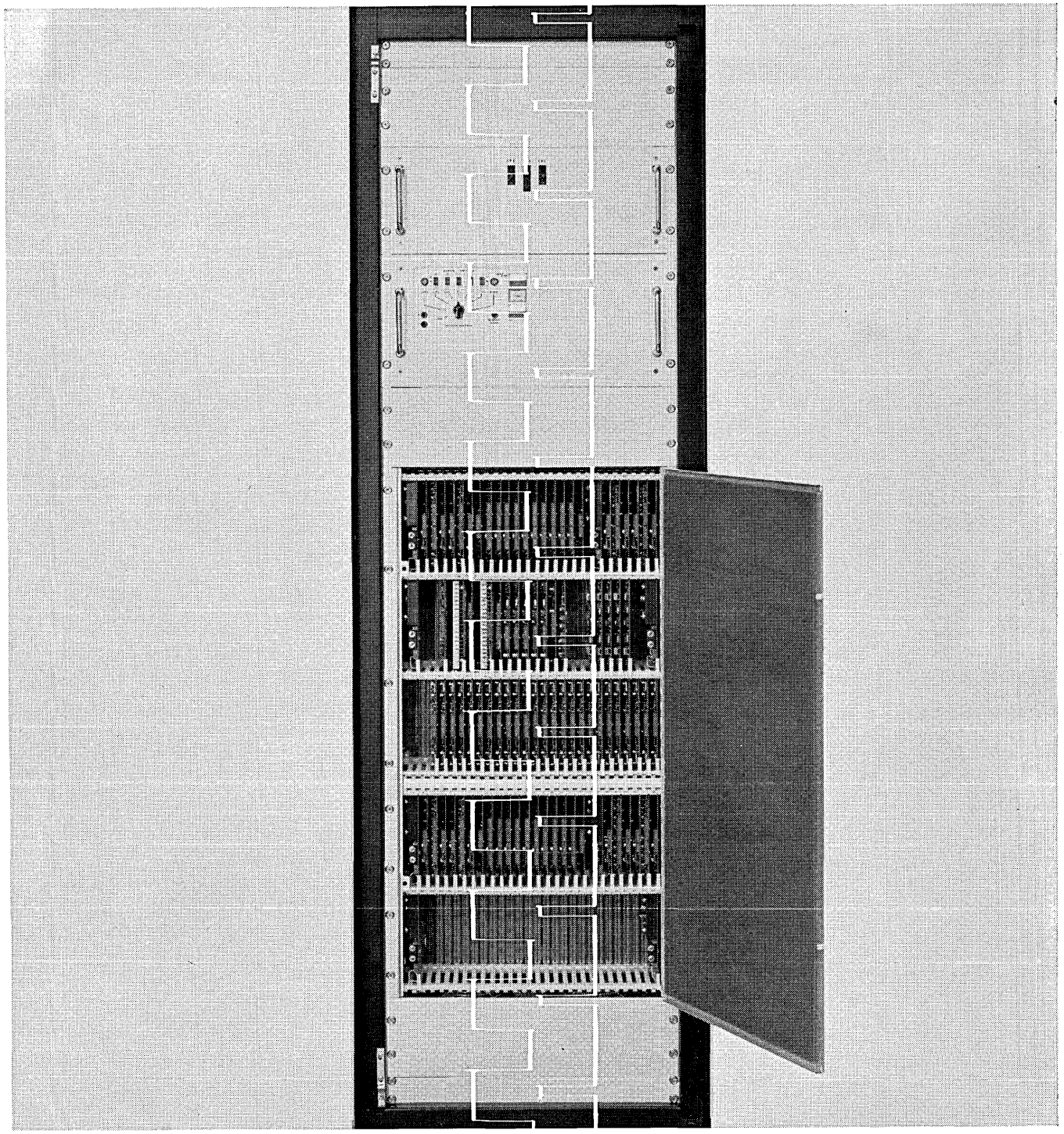
DATAMATION 64®

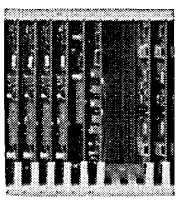
September

'FAR-OUT' COMPUTING: EMERGENT INDUSTRIES



Special introductory offer: 1.8 microseconds for the price of a 6.

Introducing the Ampex RZ, up to 16,384 words of core memory with a complete cycle time of only 1.8 microseconds. And a price tag lower than many 4 and 6 microsecond memories. The latest in the highly successful Ampex R series (RVQ, RQA, RQL, RVS), the RZ also offers a longer word length: 8 to 56 bits. With no redundancy in drive circuitry. Access time is faster: 650 nanoseconds. And the RZ has a wide environmental range: +10°C to +45°C. The RZ is fast, big and flexible enough to be used as a main-frame memory, an auxiliary memory or for high-speed bulk storage.



AMPEX

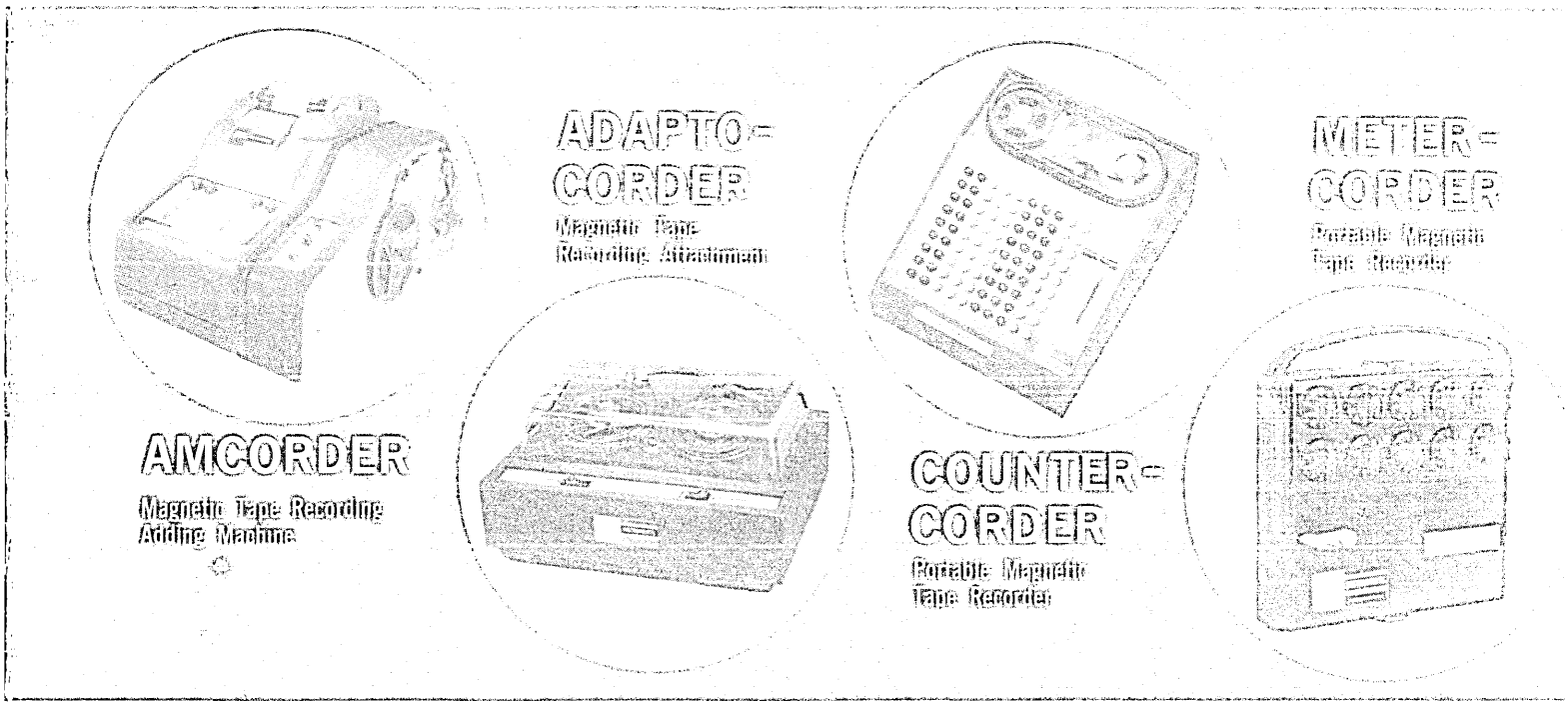
And because of its relatively low-cost, it's well worth your consideration, whether you're looking for a high-performance system, a/d conversion, or a way of updating your present computer. Suggestion: write Ampex for full details. Why Ampex? Because we can offer you core memories in a wide variety of storage capacities and speeds. With cycle times from 24 to 1 microseconds in capacities up to 1 million bits or more. Ampex Computer Products Division, Culver City, California. Term leasing and financing. Sales and service engineers throughout the world.

CIRCLE 1 ON READER CARD

SODA

SOURCE ORIENTED DATA ACQUISITION SYSTEMS

FROM UGC® INSTRUMENTS



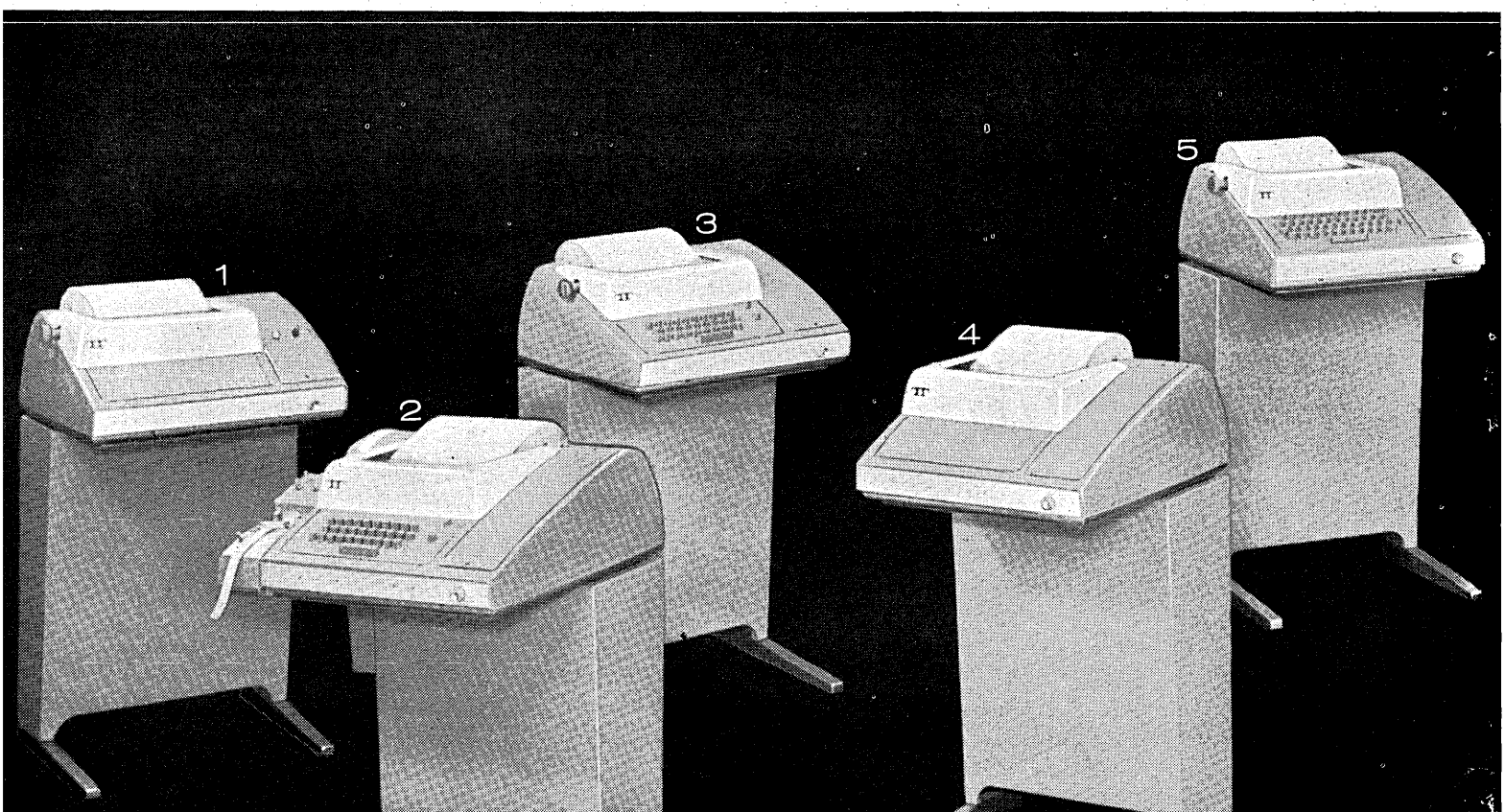
The sophistication of today's electronic data processing systems has made it imperative that there be computer-readable data capture at the source. ▫ UGC Instruments has developed its SODA (Source Oriented Data Acquisition) systems to meet this need. ▫ The SODA devices are all a part of a family of digital magnetic tape producing and converting systems. They have application for field, office, plant and warehouse, wherever there is a need for data capture at the source ready for computer processing. ▫ If data can be recorded numerically it can be captured on a SODA system recorder.

UGC INSTRUMENTS INCORPORATED

P. O. Box 6070
Shreveport, La.
Phone: 865-1438

CIRCLE 4 ON READER CARD

NINE PROVED WAYS TO LINK DATA PROCESSING SYSTEMS



Regardless of how sophisticated data processing systems become, effective communication is most essential. And these nine basic sets in the new line of Teletype equipment are still the fastest, most reliable, and least costly communications equipment for sending, receiving, storing, and retrieving quantities of information. These sets offer many advantages for improving and simplifying your communications system.

COMMUNICATES WITH BUSINESS MACHINES

Speaking the same "language" as many types of business machines, Teletype sets with punched paper tape facilities can do much to automate communications procedures. For example, using existing lines of communications, requests for information from a branch office can be sent directly to a central office computer by a Teletype machine, and the answer returned in minutes over the same equipment.

FAST, ACCURATE, AND LOW COST

Messages and data can be punched on paper tape off-line to avoid errors, and collected for later transmission on-line more economically at maximum speed. Basic information can be stored on punched tape for reuse or combined with variable data to save retyping.

SPEEDS INTERNAL CLERICAL OPERATION

Teletype machines can print on *any* business form to provide multiple copies both locally and at remote stations. This speeds clerical procedures, as well as improves order processing and production control.

TYPICAL SYSTEMS APPLICATIONS

A public warehouse operator solved his problem of control over the movement of goods by installing Teletype sets in all seven warehouses . . . information from outlying offices is fed over Teletype equipment to a central computer to help a Midwestern railroad expedite the classification of more than 50,000 freight cars daily...a large auto manufacturer uses Teletype sets as terminal equipment in international real-time computer operation to speed the flow of information.

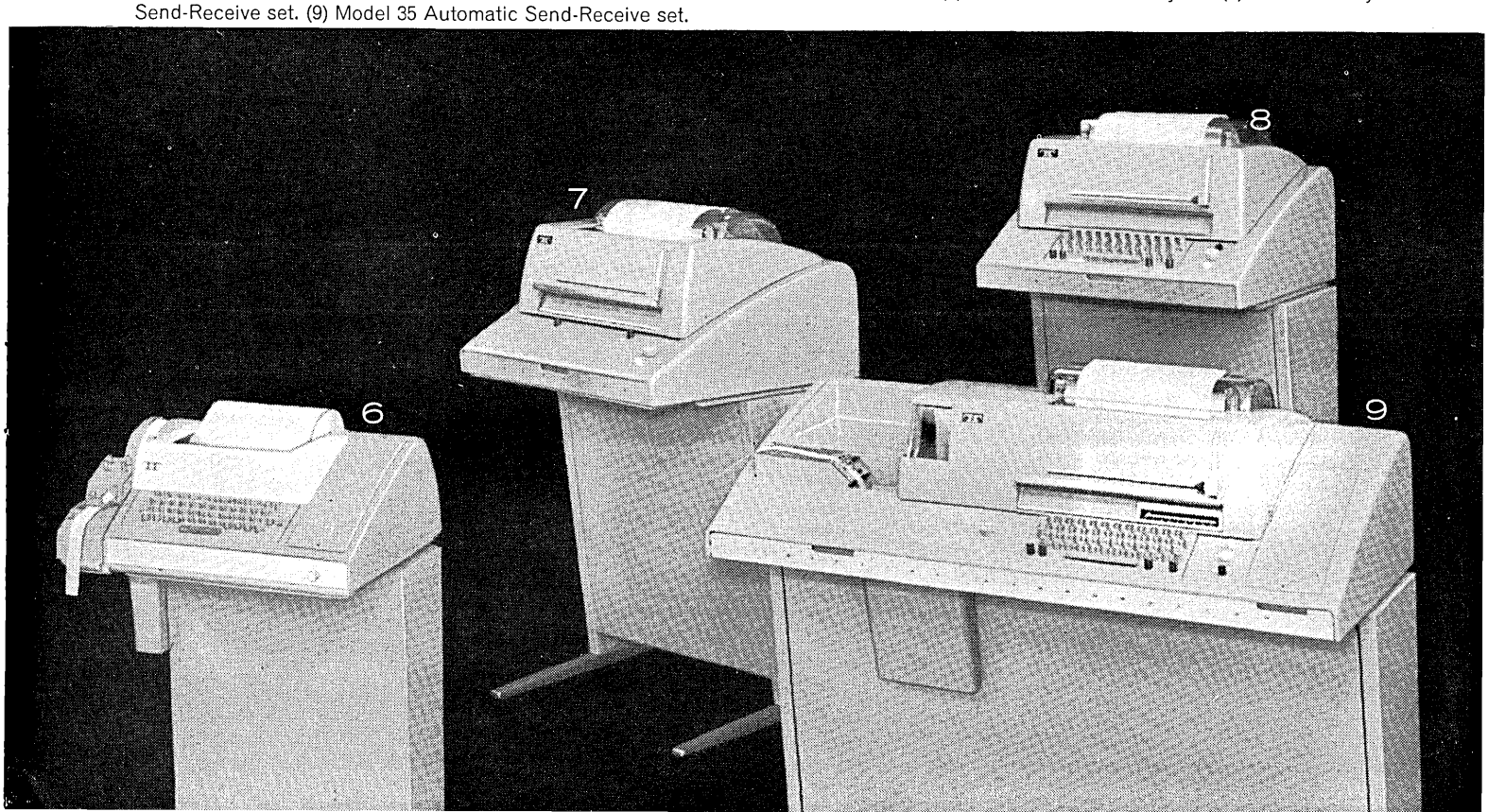
These are only a few examples of how effective Teletype machines can be in any communications system. And, also, why this kind of equipment is made for the Bell System and others who supply the nation's communications services.

To learn how the new line of Teletype equipment can be used to improve your communications system, write for a new brochure: Teletype Corporation, Dept. 81J, 5555 Touhy Avenue, Skokie, Illinois 60078.

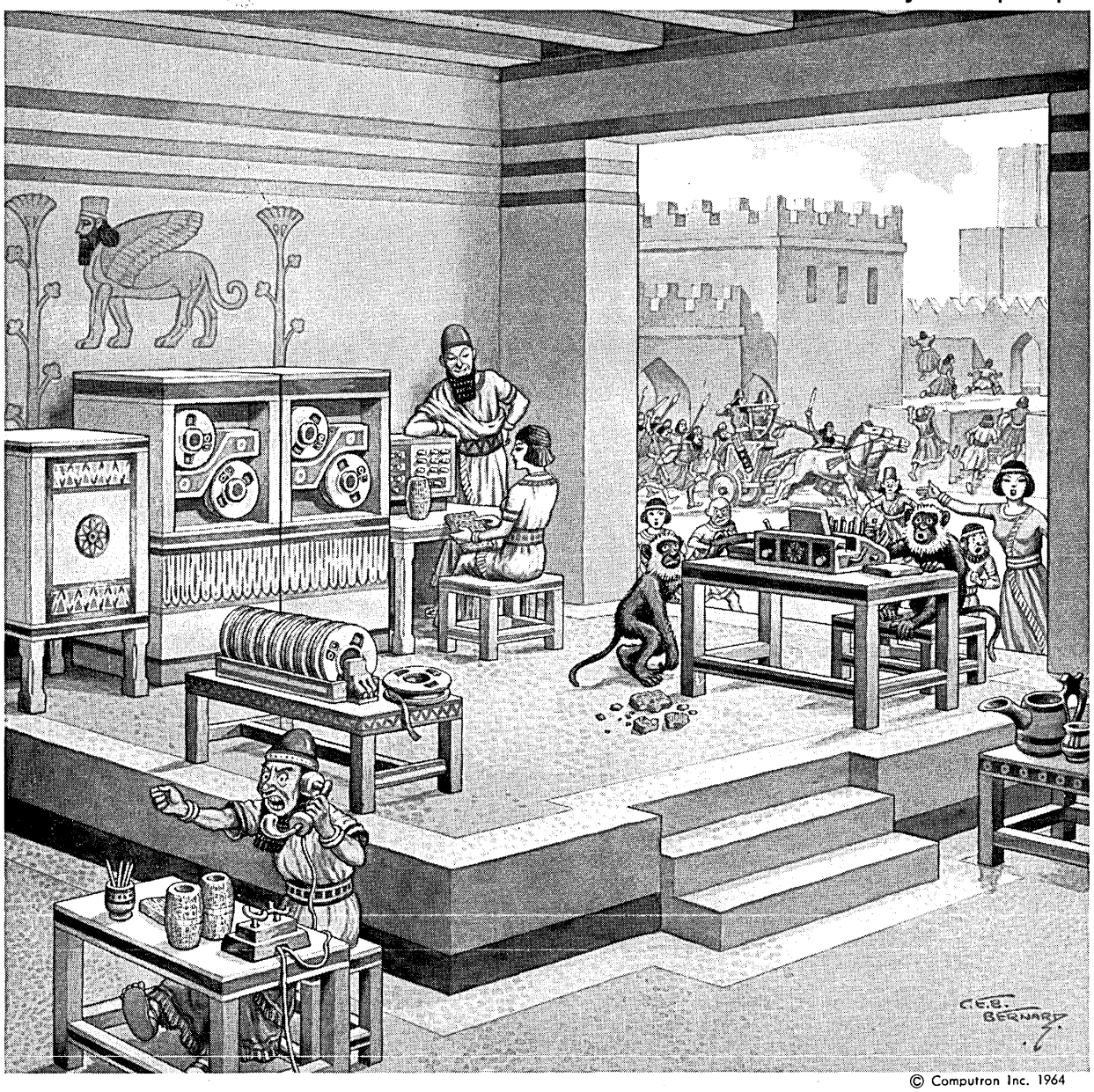
TELETYPE®

CIRCLE 5 ON READER CARD

(1) Model 32 Receive-Only set. (2) Model 32 Automatic Send-Receive set. (3) Model 32 Keyboard Send-Receive set. (4) Model 33 Receive-Only set. (5) Model 33 Keyboard Send-Receive set. (6) Model 33 Automatic Send-Receive set. (7) Model 35 Receive-Only set. (8) Model 35 Keyboard Send-Receive set. (9) Model 35 Automatic Send-Receive set.



AN OFF-BIT HISTORY OF MAGNETIC TAPE... #2 of a series by Computape



According to a tablet recently dug up in Mesopotamia, computer tape was involved in the Hittite conquest of Babylon.

The tablet states that the Hittites conquered the city as the result of a communications breakdown — something went wrong with the Babylonian computer. Naturally, there was a congressional investigation immediately, where it was disclosed that the tape had functioned perfectly. (If you'll look at the brand name closely, you'll see why.) The fault was found to lie elsewhere; insufficiently trained personnel had been operating the card-punch system.

The moral was clear, and a resolution was duly written. "Monkeys," it said, "should never henceforth be permitted to people around with computers."

Of course, there are authorities who prefer not to believe a word of this story. Mesopotamian tablets, they'll tell you, are to be taken with a grain of salt.

But this objection is obviously sheer nonsense. You just *try* taking a Mesopotamian tablet with a grain of salt. You'll wind up breaking your teeth.

This fascinating bit of tape history, incidentally, is presented for your edification by Computape — about whose many virtues we could Babylon and on. But all we could possibly say would add up to simply this:

Computape is heavy-duty tape so carefully made that it delivers 556, or 800, or (if you want) 1,000 bits per inch — with no dropout — for the life of the tape.

Now — if Computape can write that kind of computer tape history — shouldn't you be using it?

COMPUTRON INC.
122 CALVARY STREET, WALTHAM, MASSACHUSETTS

COMPUTAPE — product of the first company to manufacture magnetic tape for computers and instrumentation, exclusively.

CIRCLE 6 ON READER CARD

DATAMATION 64

the automatic handling of information

volume 10 number 9

Staff

EDITORIAL OFFICES

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Feature Articles

Departments

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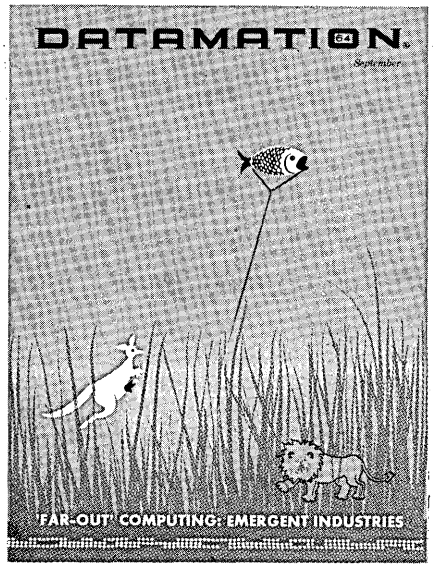

Cover

This month's Datamation looks at computing in three out-of-the-way corners of the world: Australia, Japan and South Africa. A whimsical depiction of our coverage is offered on the cover, designed by Art Director Cleve Boutell.

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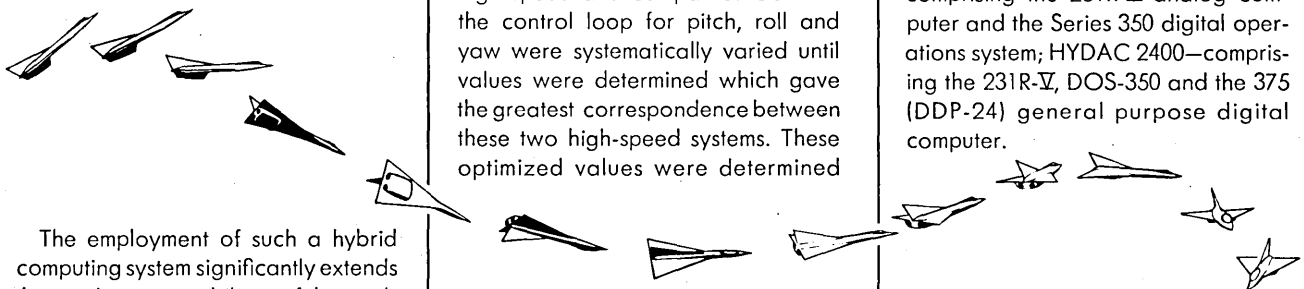
Solution by simulation

CONTROL SYSTEM OPTIMIZATION ATTAINED IN RECORD TIME WITH HYBRID SIMULATION

A new generation of problems have emerged in recent years, exceeding the complexity and accuracy requirements of those which had previously challenged equipment and personnel capabilities of major computing laboratories. Traditional computing techniques, i.e. analog or digital, were unable to handle them. New techniques and equipment were required.

One form of hybrid computation is the association of a general purpose analog computer with a complement of general purpose digital logic, memory and conversion components. Its genesis was rooted in the desire to exploit the high-speed integration capability of the analog computer. The consequent need to control and change the analog's program on the basis of previous results at correspondingly high-speed, led to the adoption of parallel digital devices programmed to exercise the necessary logic, control, timing and data storage functions.



The employment of such a hybrid computing system significantly extends the simulation capabilities of the modern computing laboratory. It permits the actual "automating" of certain classes of problems and achieves impressive savings in computation time and engineering evaluation effort.

Optimizing the Real Time and 1000 X Real Time Simulations

Optimizing response to pilot input commands can significantly improve the performance of high-speed aircraft. A recent study at the EAI Princeton Computation Center confirmed this. An aircraft adaptive control system was simulated on a HYDAC 2000 hybrid computing system.

The analog portion of HYDAC 2000 simulated dynamics of the aircraft both in real time and at 1000 times real time. A reference model representing the idealized aircraft response was also simulated at 1000 times real time. The digital portion of the computer made an efficient multi-parameter search through a decision making sequence accomplished with programmed logic elements.

For a given pilot command, the response of the reference model and the actual aircraft were computed at high speed and compared. Gains in the control loop for pitch, roll and yaw were systematically varied until values were determined which gave the greatest correspondence between these two high-speed systems. These optimized values were determined within 0.1 second after the pilot initiated his command. The gain settings were then implemented in the real time model of the aircraft. This process continued to occur with gain values being upped ten times a second as the input signals changed.

The study is described in EAI Application Study 3.4.5H, available on request.

Advanced Hybrid Computing Systems

EAI undertook in 1961 the development of a hybrid system that would meet the requirements specified in its own and customer computer laboratories. These advanced computing tools extend the science of simulation by: 1. *enabling complete system simulation*. Onboard digital computers, actuators, etc., may be readily included within the simulation. Transport delay simulation, accurate function storage, multi-variant function generation, partial differential equation solution and other complex functions and calculations are now practical. 2. *increased simulation laboratory efficiency*. Logic control, high-speed iterative techniques permit automatic parameter search, optimization, stability studies, parameter sensitivity analyzing, etc.

EAI's series of integrated hybrid computers includes: HYDAC 2000 — comprising the 231R-V analog computer and the Series 350 digital operations system; HYDAC 2400—comprising the 231R-V, DOS-350 and the 375 (DDP-24) general purpose digital computer.

For detailed information on HYDAC 2000 or 2400 and their application, or for research support services available at EAI Computation Centers, write today.

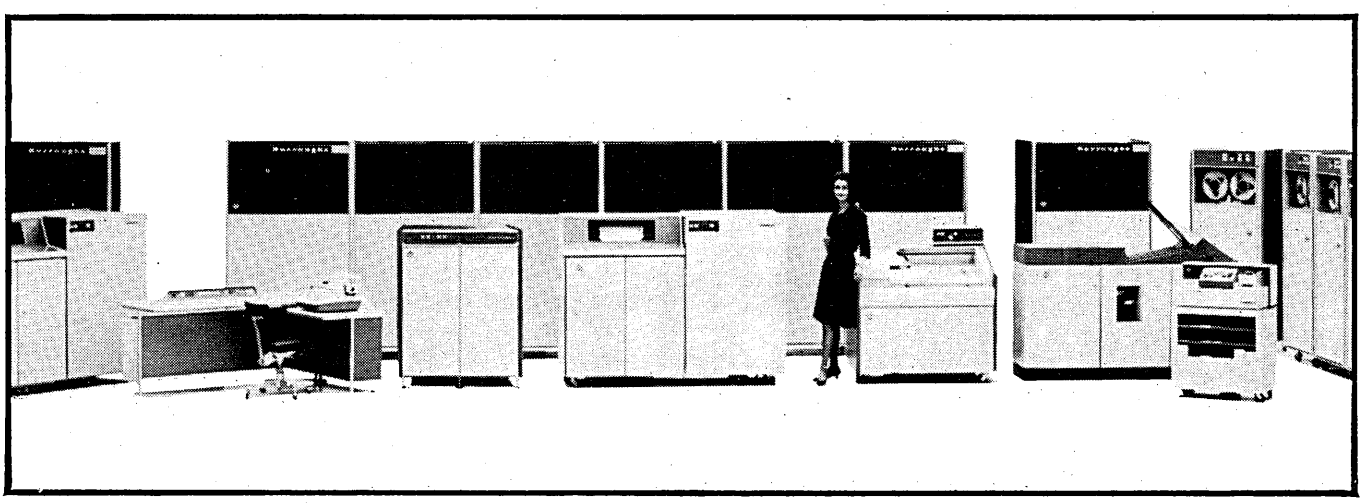
EAI®

ELECTRONIC ASSOCIATES, INC., *Long Branch, New Jersey*

ADVANCED SYSTEMS ANALYSIS AND COMPUTATION SERVICES/ANALOG COMPUTERS/HYBRID ANALOG-DIGITAL COMPUTATION EQUIPMENT/SIMULATION SYSTEMS/SCIENTIFIC AND LABORATORY INSTRUMENTS/INDUSTRIAL PROCESS CONTROL SYSTEMS/PHOTOGRAMMETRIC EQUIPMENT/RANGE INSTRUMENTATION SYSTEMS/TEST AND CHECK-OUT SYSTEMS/MILITARY AND INDUSTRIAL RESEARCH AND DEVELOPMENT SERVICES/FIELD ENGINEERING AND EQUIPMENT MAINTENANCE SERVICES.

CIRCLE 7 ON READER CARD

BREAKTHROUGHPUT



the new Burroughs B 5500 Information Processing System

The B 5500 is a highly advanced data processing system that spans the medium, intermediate and large scale ranges of computer equipment. Its design concepts and software have been thoroughly proved in installations of the B 5000 and D 800 series which introduced multiprocessing of independent programs, efficient use of problem oriented languages, automatic system control and program independent modularity.

As a result, the new, more powerful B 5500 offers you these advantages:

MORE THROUGHPUT PER DOLLAR INVESTED:

The high performance of the B 5500 is made possible by its unique system organization which permits a high degree of simultaneous operation, including use of two processors to double computational performance. The Burroughs B 5500 works as a balanced system to accomplish more in the same period of time than more expensive computer systems.

REDUCED PROGRAMING COSTS:

Programing is simpler and less costly because of exclusive hardware/software features that enable the B 5500 to rapidly compile efficient programs written in COBOL, ALGOL, FORTRAN II, and FORTRAN IV.

REDUCED OPERATING COSTS:

The Master Control Program of the B 5500 is the most complete, most advanced, most tested automatic operating system ever used. The result is maximum operating efficiency, minimum human intervention.

EXTENSIVE CAPACITY FOR EXPANSION WITHOUT REPROGRAMING:

The modularity of the system is dynamic: You may expand or contract the system at any time without reprograming—or recompiling.

SUPPORT IN DEPTH FOR PROFITABLE OPERATION:

Burroughs Corporation has long provided back-up support for all products. Customers receive as normal practice:

- Systems counsel • Programing and operational training • Business and scientific application support • Experienced field engineering support

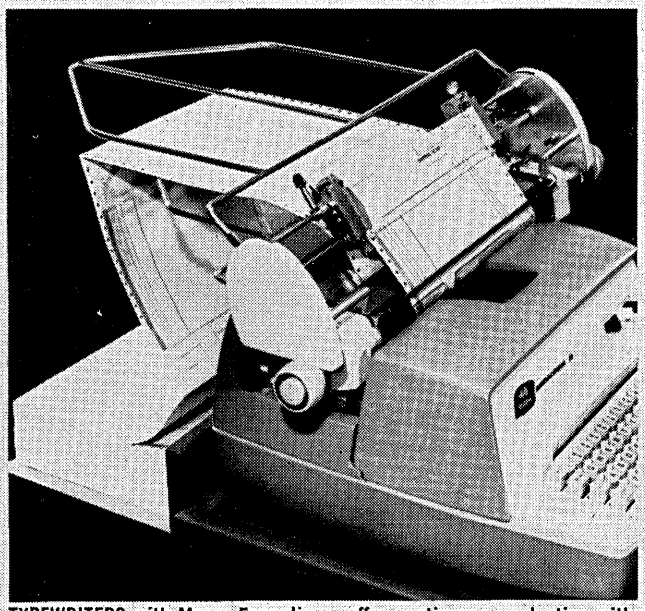
Get complete details by calling our local branch office. Or write to us at Detroit, Michigan 48232.

Burroughs—T.M.

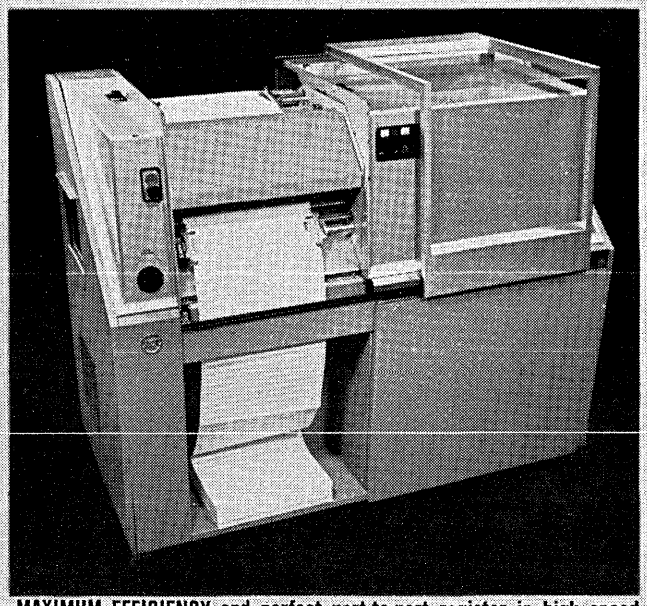
Burroughs Corporation

CIRCLE 8 ON READER CARD

Moore has the right form



TYPEWRITERS with Moore Formaliners offer continuous production with Moore narrow-carbon Speediflo or marginal-punched Fanfold forms.

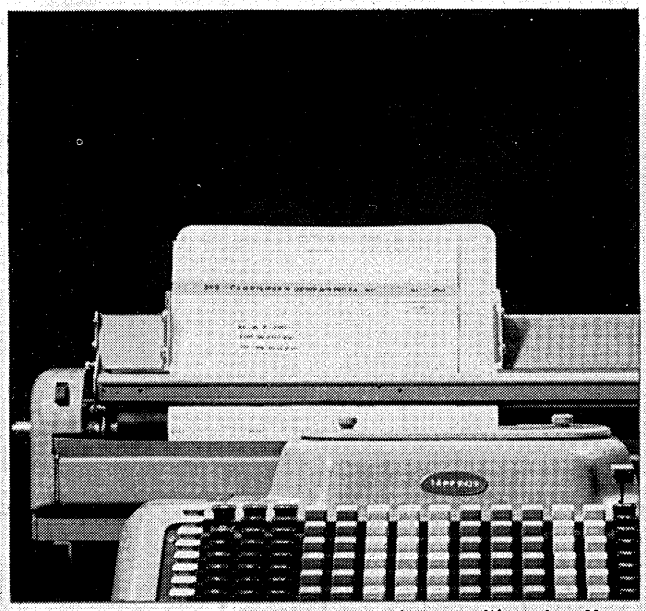


MAXIMUM EFFICIENCY and perfect part-to-part register in high speed printers result from use of Moore Speediflex, Speediflo and Fanfold forms.

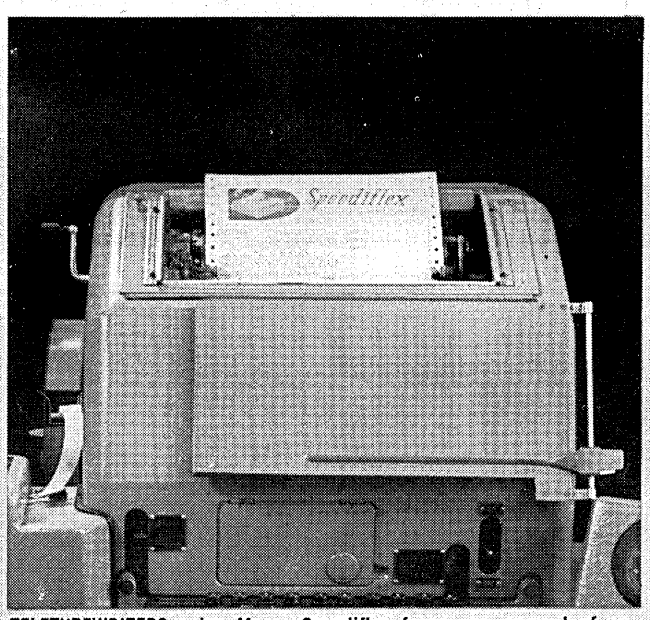
QUALITY COUNTS with forms users. Moore forms are quality made for efficient work flow and handling ease by the entire office staff.

Whatever your data-writing equipment—from a simple typewriter to the newest electronic equipment—the forms used in them must be precision made. Faulty forms cause downtime, delays, illegible copies, higher running costs.

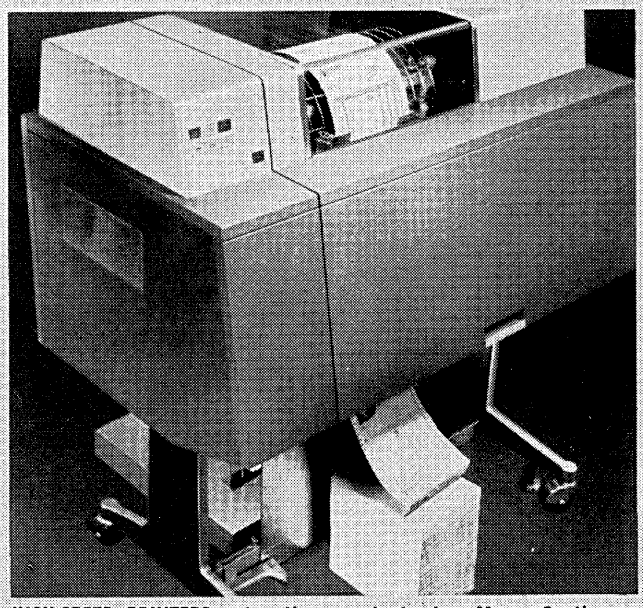
Moore knows data processing equipment and the exact requirements of each piece. That is why Moore forms are precision engineered for your specific machine. With Moore forms you are closer to trouble-free running on your writing equipment. Machine writing speeds, type of feed, manifolding requirements, refolding . . . all have their individual charac-



BOOKKEEPING MACHINES prepare accounts in one writing when Moore Carbon-Ready statements and ledger cards are used to speed work.



TELETYPEWRITERS using Moore Speediflex forms are assured of uninterrupted work flow because the Speediflex form is precision made.



HIGH-SPEED PRINTERS get optimum output when Moore Continuous Tab Cards, Moore Speediflex, Speediflo or Fanfold are the forms used.

for every kind of machine

teristics that require thorough construction 'know how,' all of which Moore builds into its forms.

This takes equipment—and skilled personnel. Moore's 32 plants are the most modern in the industry, producing almost unlimited forms constructions to meet machine requirements. You can depend on Moore for forms that give longer trouble-free runs. If you work with forms we can show you how to make forms work for you.

'The right business form for every form of business'

NIAGARA FALLS, N. Y. PARK RIDGE, ILL. DENTON, TEXAS
EMERYVILLE, CALIF. OVER 500 OFFICES AND FACTORIES IN NORTH AMERICA

MOORE BUSINESS FORMS INC

DATAMATION calendar

● The Fourth National Symposium of the Society for Information Display will be held at the Shoreham Hotel in Wash., D.C., Oct. 1 and 2.

● A national conference on Electronic Information Handling will be held in Pittsburgh, Oct. 7-9. Site of the conference, co-sponsored by the U. of Pittsburgh, Goodyear Aerospace Corp., and Western Michigan Univ., is the Webster Hall Hotel.

● The 17th annual international Systems meeting of the Systems and Procedures Assn. will be held at Philadelphia's Sheraton Hotel, Oct. 12-14.

● The Instrument Society of America will hold its 19th annual Instrument-Automation Conference & Exhibit at the New York Coliseum, October 12-15.

● GUIDE International, user organization for large scale IBM dp machines, will hold its next regular session at the Royal York Hotel in Toronto from Oct. 13-16.

● The Association of Data Processing Service Organizations, Inc. will hold a symposium at New York's Statler-Hilton on Oct. 14 and 15.

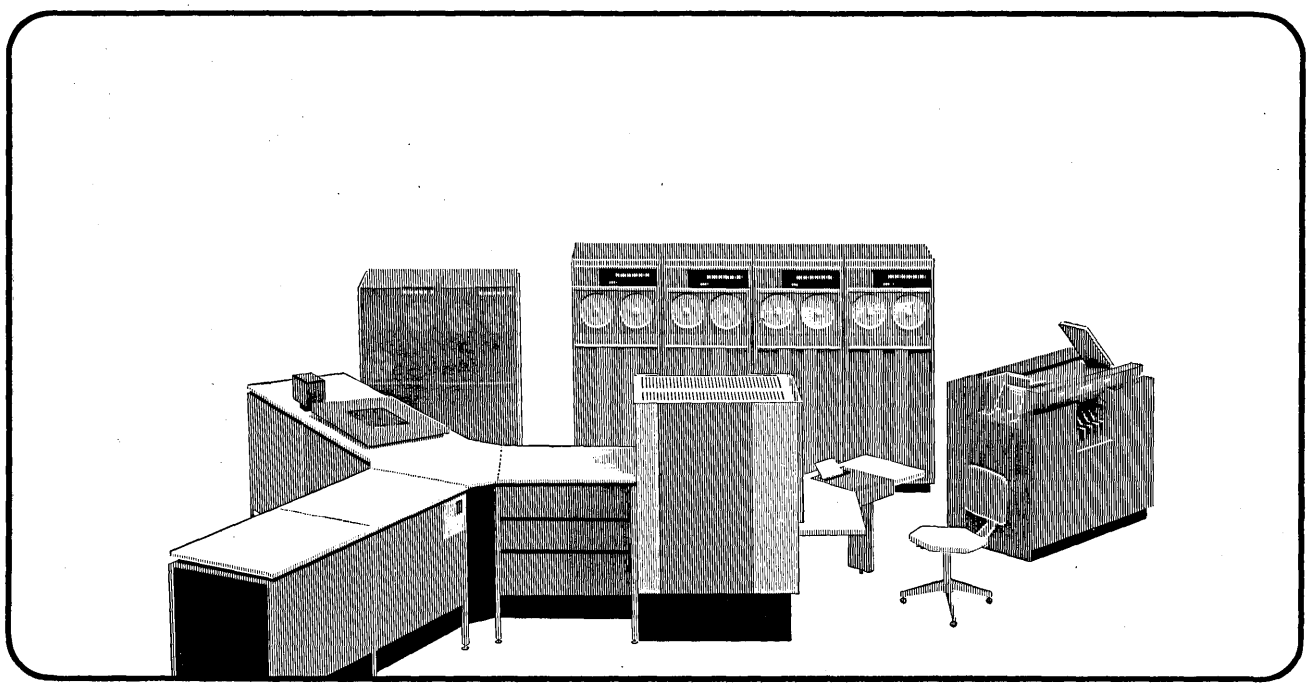
● The 6th annual Business Equipment Exposition will be held at the Los Angeles Memorial Sports Arena, Los Angeles, October 19-23.

● A computer workshop, planned for the civil engineer with little or no computer experience, will be conducted at Purdue University, Lafayette, Ind., Oct. 26-28.

● The Fall Joint Computer Conference, sponsored by AFIPS, will be held in San Francisco, Oct. 27-29, in the S. F. Civic Auditorium. Exhibits will be chosen in Brooks Hall and headquarters will be the Jack Tar Hotel.

● Automation Training Center, Phoenix, Ariz., will offer courses on "EDP Audit and Controls," Oct. 26-30 and Dec. 7-11. Fee is $250.

● Data Processing Management Assn. will hold its fall dp conference and business exposition at the Hilton Hotel, San Francisco, Nov. 3-5.



The low-cost Honeywell 300 is 50 to 150 times faster than the most widely used scientific computers

Honeywell 300 is a fast (1.75 microsecond memory cycle), low-cost (starts at $2,345 per month), binary (24-bit fixed, and 48-bit floating-point word) computer.

This makes it the fastest low-cost scientific computer on the market. True, there are faster systems, but only in the highest-priced, larger-scale models. There are also lower-priced systems, but they are considerably slower. As much as 150 times slower.

To this basic speed-cost advantage, you can add several other features that make the Honeywell 300 attractive: A separate control memory, plus an expandable main memory that can be accessed using an interlace technique, greatly speeds up the execution of instructions. The full complement of Honeywell peripheral units is available for use with the Honeywell 300. Furthermore, up to three peripheral operations can be conducted simultaneously with computing, or with a fourth peripheral operation.

The ability to work with individual characters permits fast, efficient input-output data editing, and an automatic interrupt feature permits efficient handling of communications and real time applications. Thus the Honeywell 300 is not only the most powerful, but also the most versatile system in its class.

For more information contact your nearest Honeywell EDP Sales office. Or write to Honeywell EDP, Wellesley Hills, Mass. 02181.

Honeywell
ELECTRONIC DATA PROCESSING

CIRCLE 11 ON READER CARD

letters

npl & beady eyes

Sir:

Here is our entry for the "Find McCracken's Errors Contest." In Example 1, following his excellent review of the IBM-SHARE New Programming Language (July, p. 31), Mr. McCracken proposed to solve the equation:

$$S = \frac{\frac{18{,}000}{R^2}}{1 + 18{,}000} \quad \text{for } R \geqslant 120$$

with the following NPL formula:

S = 1.8E4/ (1 + R * R/1. 8E4).

By our calculations, the equation that the above formula solves is:

$$S = \frac{18{,}000}{1 + \frac{R^2}{18{,}000}}$$

This is a far cry from the desired result. Please forward our prize in duplicate.

W. E. Hoke
P. F. Poellinger
IBM General Products Division
Development Laboratory
Endicott, New York

Your prizes have been shipped, and more await subsequent contest entries.

Sir:

Mr. McCracken's article was most interesting and helpful. However, in his listing of the members of the Language Development Committee he has failed to give credit to a seventh member of the group. Mr. Robert C. Sheppard of Cincinnati was a late arrival on the committee but nevertheless was able to make contributions because of his broad background in business programming, small computer FORTRAN, and matrix programming.

Although Mr. Sheppard's present employer or his "user group" associates may not care to be connected with NPL, this is no reason why he should not be given proper professional recognition.

Robert L. Morris
Cincinnati, Ohio

origin of eniac

Sir:

The story on ENIAC (July, p. 67) has some misstatements of fact which I feel should be corrected. The ENIAC was conceived, developed, designed and produced at the Moore School of Electrical Engineering of the Univ. of Pennsylvania. . . The work was undertaken as any other R&D work for a government agency, and was entirely the school's own in all technical aspects.

The statement that ENIAC "went on the air the following January at the Ballistic Research Labs of the Aberdeen Proving Ground" is untrue. It was completely set up, dedicated, and operated at the school before being moved.

Name Withheld on Request

Right you are on both counts. As to the latter point, we believe it is common knowledge that before going "on the air," a machine undergoes initial operation at the shop where it was produced.

cobol & comparisons

Sir:

The article, "Is COBOL Getting Cheaper?" (June, p. 46) carefully points out that compile speed alone is not a sufficient criteria for comparing COBOL implementations. Mr. Cowan then turns right around and presents tables comparing *compile speed only!*

The tables show cost per COBOL statement, but the definition of a statement is missing. Those of us who have implemented such things as COPY, COMPUTE, and CORRESPONDING are penalized for the extra time required. Those compilers without these elective features are *not* penalized for the additional statements required to accomplish the same results using other constructs.

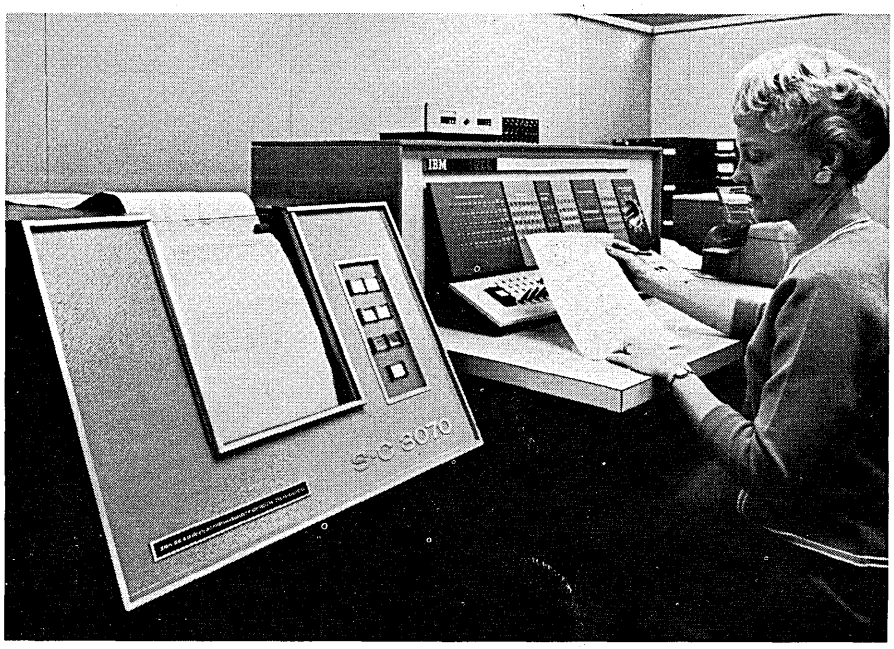
Finally, I feel that the *essential* speed for a COBOL compilation is from the time the source card deck is placed in a reader until the listing is completed on a printer. No logical—let alone clerical—debugging can occur without the listing. I know that several speeds shown in the table do not include either card reading or list printing, and are therefore misleading.

COBOL *is* getting cheaper, but reductions in compiling times is not the *only* reason.

Paul E. Sleeper
Marketing Division
Burroughs Corporation
Detroit, Michigan

Seven reasons why the S-C 3070 is the best output printer for small and medium sized computers

The S-C 3070 printer uses a unique cathode ray tube to generate characters. Letters, numbers and symbols are formed by extruding electron beams through selected characters etched into a tiny matrix within the cathode ray tube. Characters from the tube are projected through a lens to a paper where they create an electrostatic image. Powdered ink adheres to the latent electrostatic image of the characters and is fused to the paper using heat to form a permanent copy. This electronic and electrostatic system of printing offers these seven advantages to users of small and medium sized computers:



Asynchronous—The printer starts and stops under commands of the computer. When the computer doesn't wish to fill an entire line, the printer proceeds immediately to the next line. Unlike the S-C 3070, synchronous printers must delay until the entire line is filled with characters or blank space before accepting anything more. With the S-C 3070, therefore, you save valuable computer time.

High speed—The printer is capable of producing 500 perfectly formed characters per second in lines containing up to 120 characters. If the lines are completely filled, a minimum of 225 can be produced in one minute. Ordinarily lines are not completely filled, resulting in an average speed of 400 lines per minute. In many printing applications where only a few characters are used in each line, the rate reaches approximately 500 lines per minute.

Reliability and stability—Because of the stability of the electronic circuits and basic design simplicity, reliable unattended operation is provided. Mean-time-between-failures exceeds 500 hours. In a 72-day government-run test, the S-C 3070 was run constantly 24 hours a day, producing 164,000,000 bits of information, without an error. Downtime for routine maintenance during the test was only 1%.

Low maintenance—There are no critical operator adjustments to make, no type to clog, no hammers to readjust, etc. Over 10,000 feet of printed copy can be produced before minor cleaning is required.

Inputs—The S-C 3070 operates on-line with computers or accepts cards, punched paper tape or information from communications terminals. Interface equipment is available to match the unit to the output of virtually any data source. Typical of the small or medium-sized computers with which it may be used are the IBM 1620, Univac M1218 and Burroughs D825.

Low cost—The basic S-C 3070 printer is priced at less than many other computer printers that do not offer all these features. The basic printer is available at a low monthly lease price of $695, including service in major metropolitan areas.

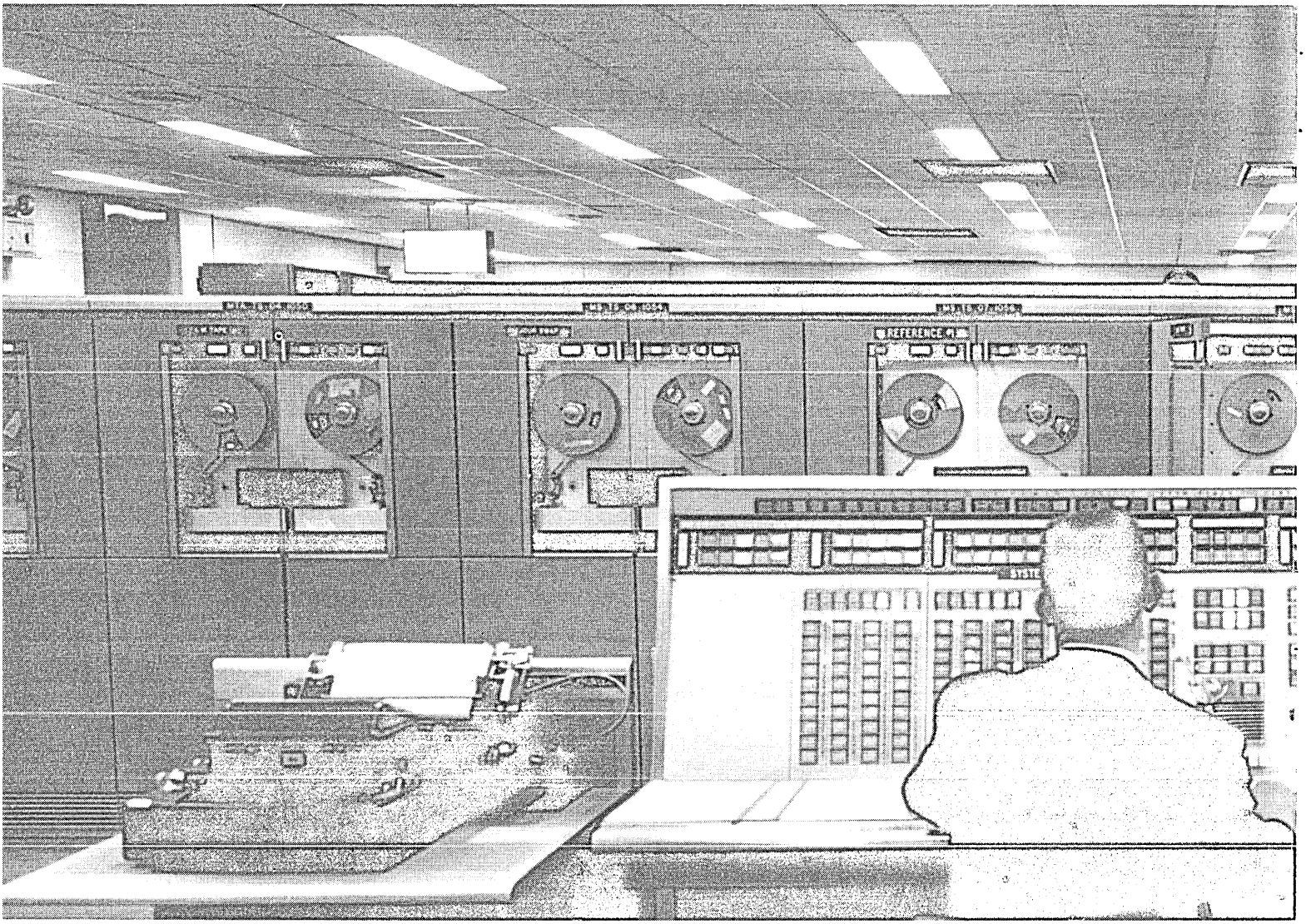
Non-impact printing—The electrostatic printing process results in copy that is highly legible and produces very little noise. Under normal office ambient noise conditions, non-impact printing is so silent it is difficult to tell when the printer is running. Quiet operation creates an improved working environment. The printed copy may be stored on rolls or cut and stacked in sheets.

Write for information—For additional information on the S-C 3070, write to Department E-55, Stromberg-Carlson, P.O. Box 127, San Diego, California 92112.

STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS

CIRCLE 12 ON READER CARD

"Add eight more computers...



...double the capacity of AUTODIN"

Big order! "Expand AUTODIN to provide more than *double* the present capacity," said the Department of Defense.

Why the expansion? Because AUTODIN has proved its capabilities... in speed, flexibility, efficiency and economy.

Big job? Certainly—a project in excess of $55 million. But big jobs designing and installing private wire systems to accomplish extraordinary communications tasks are a Western Union specialty.

Western Union engineered and installed the first AUTODIN network—now the world's largest

digital data system—in 1963. Our task is to complete the expanded system by 1965—and we'll do it!

Here's the expansion arithmetic:

- Add four new centers.
- Install eight additional computers at the new centers.
- Increase access lines from 550 to 2,700.
- Expand outstations from 400 to over 2,000.
- More than double the present daily capacity to a total of 24 million punched cards—the equivalent of 320 million words.

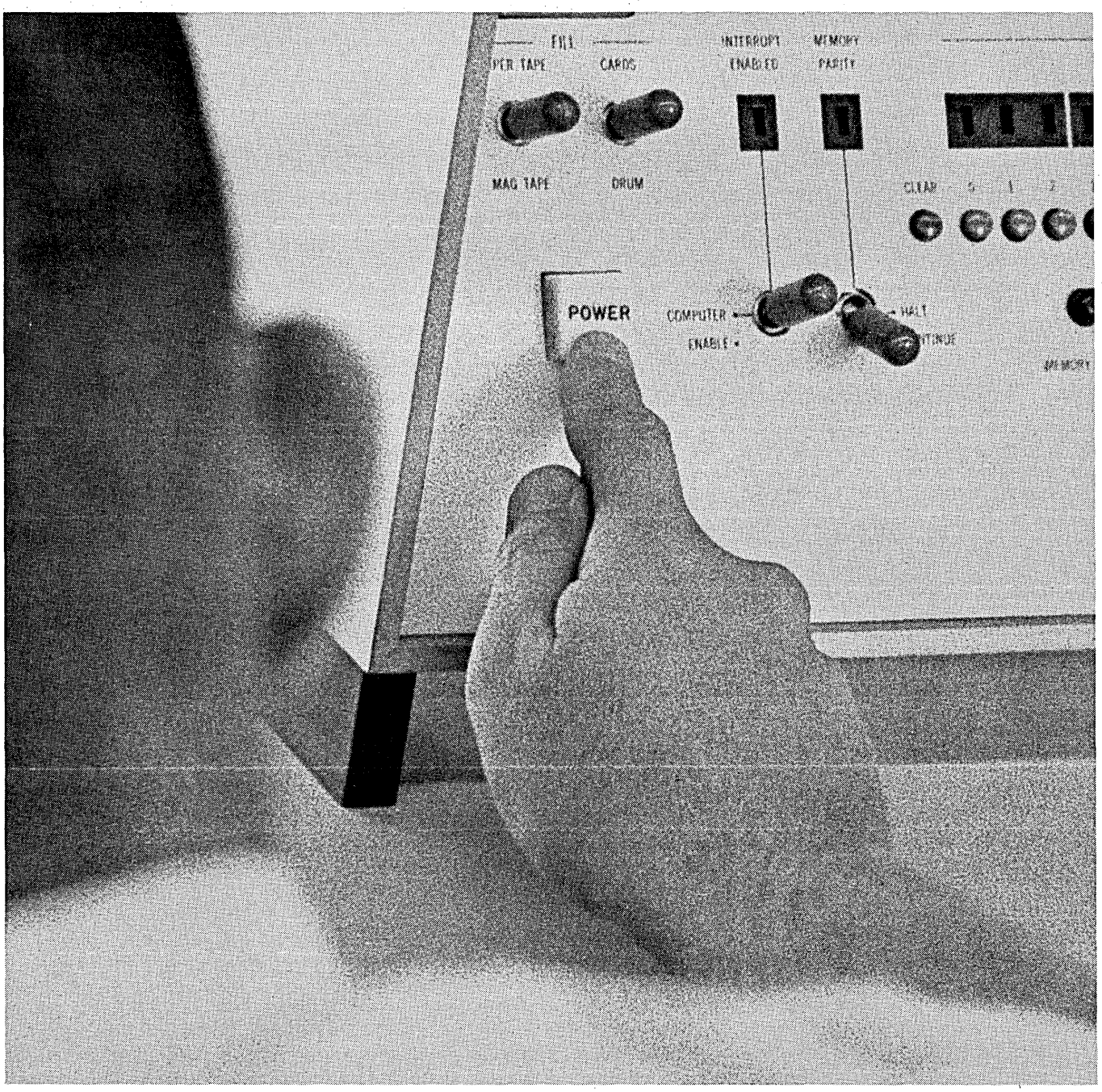
AUTODIN telescopes time. Cuts through mountains of paper work by revolutionizing military command control, logistics and administrative support for the Department of Defense. "Minutes-fresh" data are made available on a worldwide basis.

AUTODIN is one of the many advanced systems engineered and installed by Western Union to handle data, facsimile, voice and other communications for government and business.

WESTERN UNION

CIRCLE 13 ON READER CARD

There's only one way to tell the new SDS 930 from the old SDS 930.



Turn it on

The new 930 makes the old one look like it was standing still. You can't miss the difference: 3.5 μsec add time, 7 μsec multiply time and 1.75 μsec memory cycle time.

The new SDS 930 retains its complete program and peripheral equipment compatibility with present 930 installations and all other SDS 900 Series computers. It has one standard and as many optional buffered input/output channels as you need, all of which can operate simultaneously with computation. All SDS 900 Series computers have all-silicon semiconductors, buffered I/O, floating point and multi-precision operation, and a comprehensive software library including FORTRAN II and ALGOL.

To be perfectly truthful, though, there is one other way to tell the new SDS 930 from the old SDS 930. Look at the price. The new 930 sells for only $95,000 and leases for $2,150 per month. For full information, write Scientific Data Systems, 1649 Seventeenth Street, Santa Monica, California.

SDS SCIENTIFIC DATA SYSTEMS
1649 Seventeenth Street, Santa Monica, Calif.

Sales offices in New York, Boston, Washington, Philadelphia, Huntsville, Orlando, Chicago, Houston, San Francisco. Foreign representatives: Instronics, Ltd., Stittsville, Ontario; CECIS, Paris; F. Kanematsu, Tokyo; RACAL, Sydney.

CIRCLE 14 ON READER CARD

BUSINESS & SCIENCE

THEY'RE COMIN' IN THE WINDOWS . . . BIG MACHINES

Consultants & users staggering under a plethora of information about more computers than they know what to do with will find no relief in sight. At the high end of the scale alone, several new machines are in the works. Among them, mod 92 of IBM's ever-expanding 360 line, the Philco 9000, the Burroughs D 851, and CDC's 6800.

The 9000, Philco's latest offering in the large-scale market they've settled on as their primary target, is a big, big system -- mx up to four microprogrammed processors, a 1/4 usec thin film memory, and four levels of store, including a electromagnetic tube random access unit. Under new marketing manager Jim Callahan, Philco says its 212 -- with memory cycle time cut from 7.5 to 2 usec and a prototype 240 kc tape unit operating -- ain't dead yet. The company is trying to persuade parent Ford Co. to use Philco gear exclusively.

Although Burroughs has proposed the thin-film 851 in a few places, it is not a standard product. But it's safe to presume that if enough customers show up, it could be available.

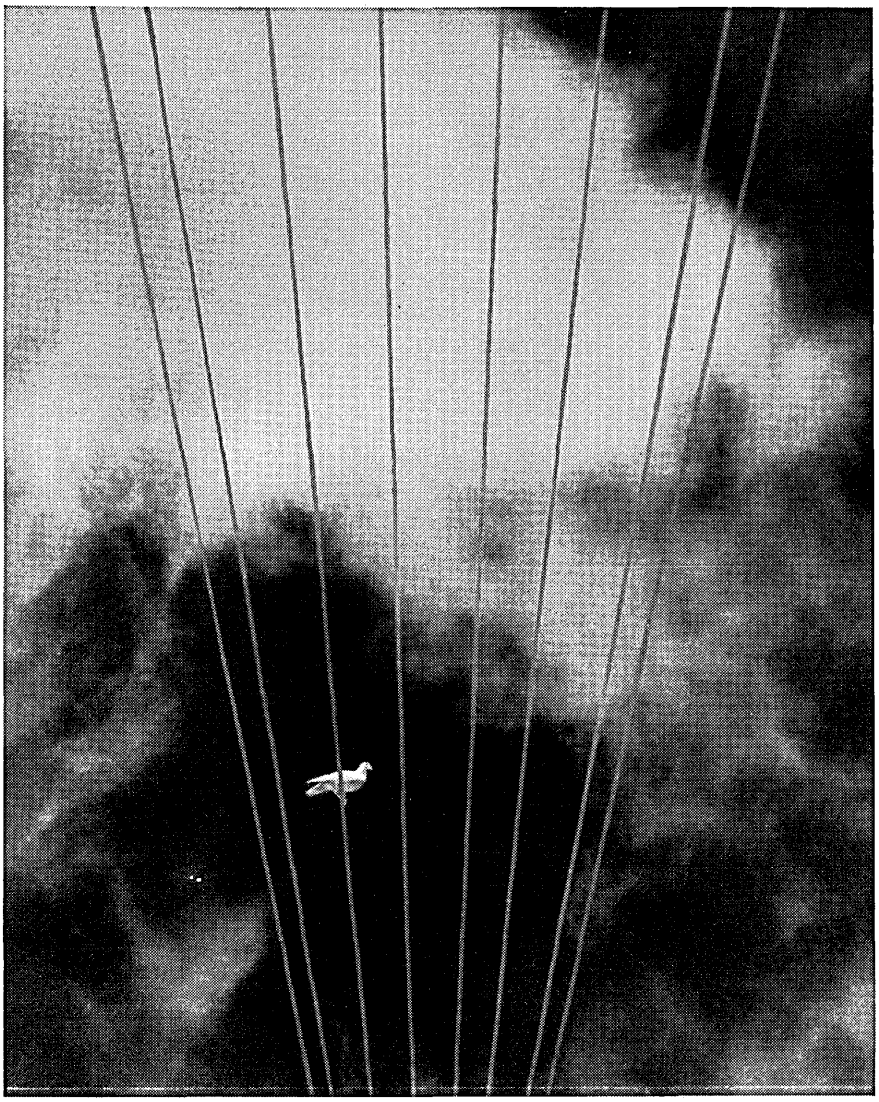
Of the announced machines, GE's 600 series looks like the hottest. We understand that 16 machines have been allocated on the basis of letters of intent, including MIT's Project MAC (see below). Other systems seem headed for ASEA, a Swedish organization; and several GE departments. Martin, NASA and a couple of other big scientific users are leaning toward 600's; one company is thinking about ordering eight of 'em. One tentative GE order knocked a man out of the SHARE presidential race . . . won, incidentally, by Jim Babcock of RAND.

. . . AND LITTLE ONES

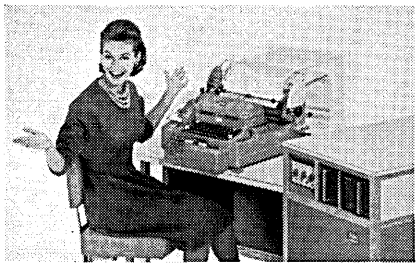
Then there are the little machines. Three C's has announced their DDP-116, an under-$30K machine to buck the SDS 92 and the PDP-5. It's a 16-bit machine with a 1.7 usec memory cycle time, 51 commands plus optional multiply and divide, and some software.

H-W Electronics, little-known Massachusetts firm, may announce a successor to its 15K machine (it sells for closer to $20K), which has totalled seven orders so far.

The Marc (sic) I is a new machine out of a new outfit, GFI, Encino, Calif. Headed by Marc Goldwater, mathematician turned logic designer, and David Fuchs, GFI calls the Marc I a multiprogrammed version of the SDS 92. It's supposed to offer arithmetic units, eight sets of three index registers, a 1024-word core memory, a 40-usec add time. Designed for systems requiring plenty simultaneous I/O from slow input devices, the Marc I is supposed to be offered, half-heartedly, at $21.5K as a forerunner to a bigger, faster model.



Paperwork by wire



Parodi Cigar Company of New York, Inc., ends manual re-writing from one Pennsylvania plant to another with punched tape.

And ordinary telephone wire.

When sales orders reach Scranton, Pa., the information is put on tape with Flexowriter* automatic writing machine by Friden.

Teledata* tape-operated transmitter-receiver by Friden sends the data seven miles over telephone wire to Parodi's shipping center in Moosic. Shipping information is added to the tape. The tape is transmitted back to Scranton.

Then, Computyper* automatic billing machine by Friden (shown) writes and calculates invoices using data from the tape.

Parodi says: *"We wanted to speed our order-writing system. Now we put all our data on punched tape. New information is simply added to the tape in each plant. The system lets us ship sooner. Mistakes are infrequent. And our invoices reach customers, on the average, two days earlier than before."*

Friden offers sales, service and instruction throughout the world. Call your local Friden systems man to see how to speed all paperwork. Or write Friden, Inc., San Leandro, Cal.

Friden®

*A TRADEMARK OF FRIDEN, INC.

Friden, Inc. is a subsidiary of The Singer Company

CIRCLE 15 ON READER CARD

ADVERTISERS' II

Decisional Control Assoc., Newport Beach,Calif., is setting up a subsidiary, Data Machines, Inc., to make and market a line of machines -- from delay line to core -- selling for under $30K. Primary targets will be education and control. And DSI, newly swallowed by Union Carbide, is getting ready to announce a new little one to add to the 1000 (of which they plan to sell 300). Charlie Adams better get busy.

TIME-SHARING MARCHES ON

Time-sharing, despite pot-shots from stuffy, profit- and production-oriented pros, staggers onward. The Mass. General Hospital and Bolt Baranek & Newman, Cambridge consultants, have developed a prototype on-line computer-based communication system under an NIH research contract, with additional support from AHA (American Hospital Assoc.). Now being checked out, the system is built around a 24K PDP-1, includes a Fastrand drum, a 128K DEC drum and a 1.1 mc bit-rate Univac channel.

Remote mod 33 Teletypes have been installed at the hospital, and another 12 reserved for programmers. Purpose of the research: to determine the feasibility of time-sharing for real-time acquisition and use of medical record information in a general hospital. Emphasis is on acquisition of machine-readable medical records and improved use of the records for research, administration and patient care.

And the L.A. City Police are experimenting with the time-sharing system at SDC. The dept. has some 2-3000 robbery reports filed on the system, is tinkering with the use of the data base to pull together odd-ball facts from various robberies to ferret out crime patterns.

At Project MAC, king of the time-sharing research efforts, a decision has been reached on the next round of gear. The winnah and new champeen -- despite stiff IBM in-fighting -- GE, with a modified 635, which will include two processors, 131K of core, beaucoup communications lines (for an initial configuration of 64 on-line consoles), plus disc files and drums.

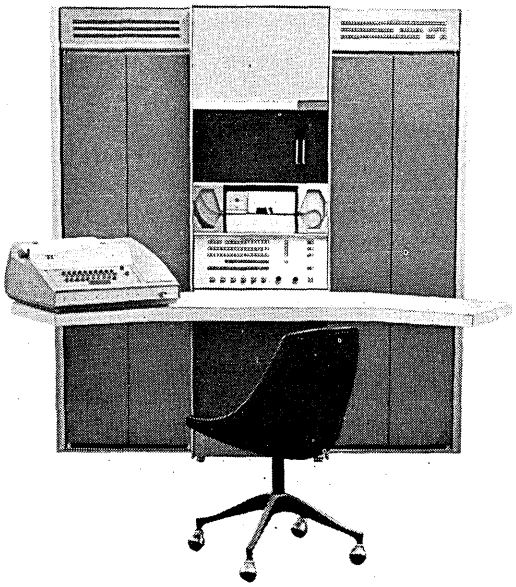
And STL is putting in a four-station, on-line system built around a Bunker-Ramo 340. The system is an upgraded version of a system using the RW 400, which has been in operation at Bunker-Ramo since '61. Developed by Drs. Culler and Fried, the BR system employs two keyboards which provide several levels of operation -- from basic machine language commands through elementary arithmetic and higher mathematics. Results can be displayed in graphical or alphanumeric form on a CRT. Essential to the technique is ability of a user to compose basic subroutines into new ones on-line at the console.

SHIFTING COMPUTERS ON THE WEST COAST

Is the west coast service bureau market softening? CEIR has shifted its San Francisco 7094 to L.A., where Douglas will use it; Douglas has also booked the rest of the available time on CEIR's L.A. 94. CEIR is now selling time on standard Oil's S.F. 94. Result: one salesman, Ben Ferber, sold himself out of a job. He's now consulting out of Tarzana,Calif. Meanwhile SBC has pulled a '94 out of L.A., where it says it was meeting a temporary peak-load condition.

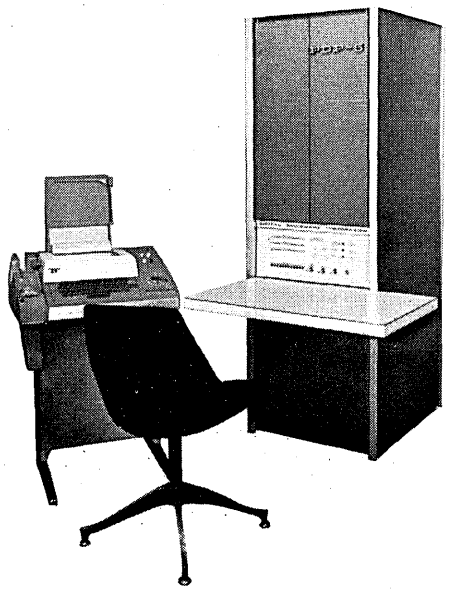
Continued on page 75

COMPUTERS BY DIGITAL



PDP-7

Word Length: 18 bits
Memory: 1.75 μsec, 4096 to 32,768 words
In-Out Transfer: 570,000 words per second
Standard I-O Devices: Printer-keyboard, high speed perforated tape reader and punch.
Instructions: 16, expandable as optional equipment is added. Micro-instructions provide 17 additional operate and conditional functions.



PDP-5

Word Length: 12 bits
Memory: 6 μsec, 4,096 to 32,768 words
In-Out Transfer: 166,000 words per second
Standard I-O Devices: Printer-keyboard with perforated tape reader and punch
Instructions: 8, expandable as optional equipment is added. Micro-instructions provide 17 additional operate and conditional functions.

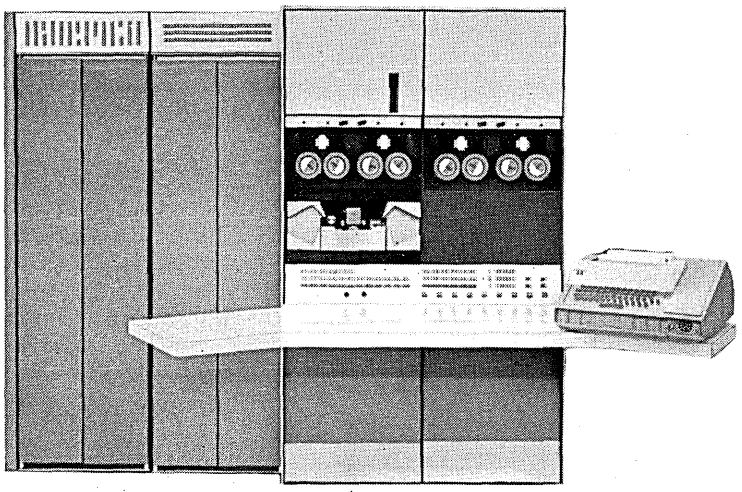
PDP-6

Word Length: 36 bits

Memories: Core memory: 2 μsec, 16,384 to 262,144 words. Fast memory: 0.4 μsec, 16 words.

Input-Output: Console has provision for a printer-keyboard, perforated tape reader and punch, and Micro Tape dual transports.

Instructions: 363, with extra assignable operations codes. Includes logical or Boolean, memory and accumulator modification and testing, half word, and byte manipulation.



THE SOFTWARE . . . All three Programmed Data Processors come with FORTRAN compilers, assemblers, on-line debugging routines, editors, and other programming aids. PDP-6 has a time-sharing Operating System, consisting of a supervisory control program, system programs, and system subroutines.

AND THE PRICES . . . Sample prices are $27,000 for a PDP-5 with 4096 words of core memory; $88,000 for a PDP-7 with 8192 words. PDP-6, a modular system, can expand from a basic configuration with 8192 words of core memory costing $210,000 to a system with 262,144 words connected to 128 input-output devices. All prices given are for completely operational systems.

digital
EQUIPMENT
CORPORATION
MAYNARD, MASSACHUSETTS

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Washington, D. C. • Parsippany, N.J.
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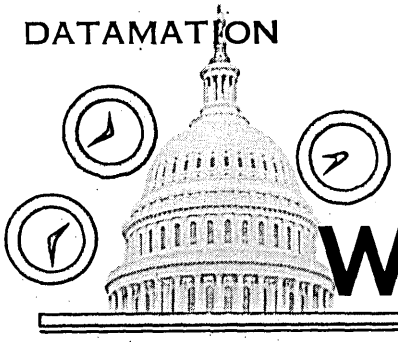
CIRCLE 16 ON READER CARD



WASHINGTON REPORT

EIGHT MORE NOTCHES FOR H-200 BELT

Honeywell turned the trick with its 200 at the Internal Revenue Service, signalling what may be an important break in the vast government 1401 replacement market. The Treasury agency will have eight 200's installed in its regional centers by the end of the year, replacing a like number of 1401's. The purchase deal should be in the $2-3 million range. Eventually the IRS plans to ditch all 18 of its 1401's in favor of 200's, though it will hang onto its five 7094's. Price first caught the agency's eye but processing speeds and rapid equipment delivery, along with program compatibility (thanks to Liberator), were also good arguments for the 200, an IRS official noted.

Side note on Big Brother: Testifying before the same committee, Bertrand M. Harding, deputy commissioner of the Internal Revenue Service, credited ''fear of the machinery'' with stimulating the conscience of a great many taxpayers. The well-publicized switch by IRS to a computer-based account numbering system brought in almost $4 million in delinquent returns from over 800 taxpayers in the first nine months of 1963 ''who have said they were motivated to do so by a fear of being caught up in the ADP process.'' Further, Commissioner Harding said, many taxpayers filed returns for the first time in 1962 while others reported income for the first time, particularly on dividends and interests, under the less-than-subtle pressure of EDP.

BROOKS BILL HEADED FOR LIMBO?

Mid-September seems the likely date for release of the long-awaited Clewlow report on computer policies and practices inside the Government. Substance of the report remains a deep, dark secret, but no one really expects much startling information to be forthcoming. ''I'll be surprised if there are any surprises,'' said one Government official. Some think the report may suggest that any necessary changes in the Government's current way of managing computer affairs can be made without reference to outside efforts at direction; i.e., the Brooks Bill. This would be a bureaucratic flog at a dead horse, however. With Congress preoccupied with the elections, agitation for action anytime soon on the Brooks Bill has become largely subliminal.

PHILCO LOW BIDDER ON OVERSEAS AUTODIN

Philco Corp.,which has been suspected of making Mustangs in recent months, was the surprise low bidder in the competition to provide computing gear for ten message switching centers to be established outside the continental U.S. by the Defense Communications Agency as part of its global Autodin System. The Ford division came in with a $31 million proposal,besting by a goodly margin its closest competitors. Tight-lipped, hard-nosed DCA has said nothing about an award, but the agency is already a user -- one of the few -- of Philco computing equipment.

Continued on page 85

DATA-PHONE WORKS AT NIGHT TO MAKE YOUR DAYS MORE PROFITABLE

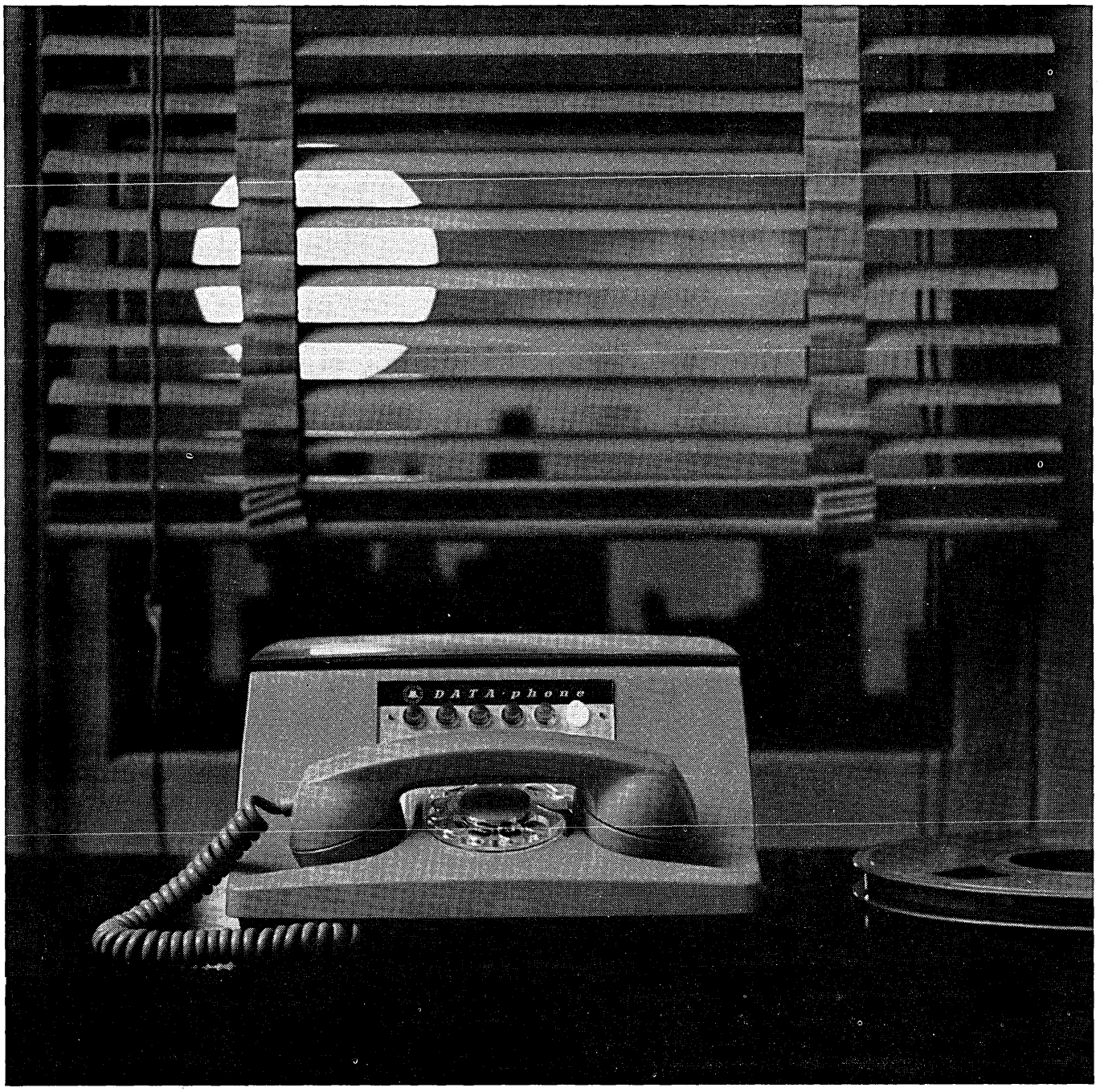
DATA-PHONE service lets your business machines "talk" over regular telephone lines—16 times faster than people talk.

Overnight it can transmit the day's accumulation of business data to and from your branch offices—payrolls, waybills, inventories, orders, technical data—anything that can be punched on cards or tape.

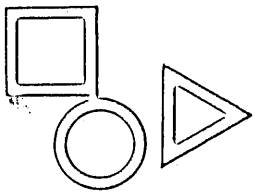
Bright and early next morning, everyone has the vital information needed for the day's work. No mailing. No costly delays. No postponed decisions.

Just call your Bell Telephone Business Office and ask for a Communications Consultant to contact you.

BELL TELEPHONE SYSTEM
Serving you



CIRCLE 17 ON READER CARD



EDITOR'S READOUT

CHECKLIST FOR OBLIVION

A friend of ours sat in on a meeting of hardened veteran programmer supervisors the other day, and recorded a summary of their comments on that strange beast. Here's our summary of his summary, passed on in the form of a checklist against which you may wish to measure your own favorite programmer.

A programmer:

✓ **doesn't want to be questioned, doesn't want to account accurately and in detail for his time. He doesn't want to be supervised . . . doesn't want to supervise. Says he wants responsibilities, but gripes if they're assigned him.**

✓ **wants his specs in black and white . . . complains if they are. He doesn't believe in flowcharting or overlays, creating specific parameters for test data . . . complains about the furnished live data. He can't tolerate any systems work other than his own, won't accept any documentation standards but his own. Anyone else's program is incapable of modification. There's nothing lower than a coder.**

✓ **must have his hands on the machine . . . but doesn't believe the machine. Instead he plays computer roulette. He complains when software is absent . . . and when it's present. Does all his debugging from post-listings. Core is never large enough, or I/O sufficient. The computer was acquired for him, not for operating results.**

It's not a very pretty profile. Although we'll have to admit that probably the world's worst programmer probably couldn't incorporate all of these traits. But in a technology which seems dedicated to the proposition that computers should be made available to people—as opposed to programmers—it may behoove programmers everywhere to check their own attitudes and behavior against this list.

Those with a high match percentage are nominated—if not marked—for oblivion.

COMPUTERS IN AUSTRALIA

comments on the current evolution

by NED KELLY*

A few years ago Herb Grosch, visiting Australia, heard about the 7090 destined for the Weapons Research Establishment at Salisbury. Herb commented on the new machine and the happy salesman's partiality for lemon squash in his *Datamation* column. One would have been hard put to name any other place within a radius of, say, 5000 miles where any big, expensive computer might find a home. Following this intelligence little more was heard about Australia in computer circles until last summer.

Americans, other than Second Marines after Guadalcanal and other servicemen who experienced Australian hospitality during World War II, know little about the country. The usual stereotype includes kangaroos and sheep and a vague awareness that Australians resemble Yanks in many respects. On the other side, Australians know quite a bit about the U.S. though not always the best side, through motion pictures, television programs and magazines. They, too, often feel that Americans are not bad blokes and probably closer to Australians than people of any other nation, bonds of empire not withstanding. Of course, there are important differences: a population of less than 12 million and greater homogeneity of origin are significant.

Horace Greeley said "Go west young man," doubtless feeling that there was enough "west" to last awhile. In the sixties California achieved the dubious distinction of becoming the nation's most populous state. The new generation of young men with restless feet who look west will discover only Australia. The tide of migration is now only a trickle, but the signs are that it is increasing and *if* more were known about the "land down under," to use once more that hackneyed phrase, more would make the trip, experience a mixture of favorable and unfavorable impressions and end up, nearly all, falling in love with the place.

Australia is big, and empty, and has a predominently urban population. While industrialized it is not yet automated and has, to the American view, a curious mixture of socialistic planning and buccaneering free enterprise. Extremes of wealth and poverty are rare, and there is no pervasive "ethic of work." The country seems ready for automation, and the existing social system is probably able to absorb automation's impact. What seemed less than an asset in the Australian character—the insistence of the working man on "having a fair go" at leisure, even if the job didn't get done on time—might now become an advantage and few Australians would find it difficult to put a three or even four-day weekend to profitable and enjoyable use. This willingness *not* to work, together with the solid push towards ever higher living standards, makes Australia a place to watch. The country has always advanced on the "back of the sheep," as the saying goes, and the capital needed to build new automated factories must still come from the primary products in the production of which Australia excels. Japan has just displaced the U.K. as the nation's leading customer, with the trade balance in Australia's favor by a factor of three to one. Since Japan is a major industrial producer with post-war demonstrated competence in electronics and other automation-related fields it would be surprising if the factor of trade does

*Ned Kelly is the pseudonym of a publicity-shy American computer specialist now working in Australia.

not eventually encourage purchase of automation equipment.

early hardware

In the early fifties Australians built two of the early electronic machines called Silliac and Sirac. Comparatively few commercial computers came in use during the ensuing decade with industry proceeding cautiously and the commonwealth government having better uses for its funds in the rapidly growing economy.

Last summer rumors were heard of two major sales competitions for computer orders from the Commonwealth Bureau of Census and Statistics and the Commonwealth Scientific and Industrial Research Organization. In both cases, *networks* rather than single machines were required and the goal was to obtain equipment which would be adequate for several years into the future rather than merely to satisfy already demonstrated needs. Americans following the computer business have become quite casual about the megabuck but this deal was expected to be in the neighborhood of 10 million dollars, an amount which looks more like twice that to the Australian.

The reports suggested that Remington Rand (1107), English Electric (KDF-9), Ferranti (Atlas), and CDC (3600) were the prime contenders with IBM's customary sales magic less than efficacious. No one knows either how to compare machines properly (and they are, after all, built to compete with each other) much less predict the results of the complex interplay between salesman and prospect. The intuitively appealing selection was the underdog since, after all, Australians tend to think exactly that way. The underdog had to be Control Data simply because, of all the contenders for the prize, only CDC had failed to open an office in Australia and was entrusting its future to a manufacturer's representative. To clinch matters the "salesman" involved was not even a salesman, but one of Australia's early computer designers, and so atypical of hardware peddlers that competition hardly considered Control Data a contender.

Control Data got the order: two large 3600's and 10 of the then unannounced 3200's. In one step the nation was acquiring more computer power than exists now in Switzerland, Sweden or the Netherlands, which are, of course highly industrialized countries of comparable population. Such a statistic is only mildly surprising if interpreted as compensation for rather late recognition of a new and quite well demonstrated technology. The last word had not been said, however, as the Australian universities were also granted substantial funds late in 1963 to equip themselves with modern computer centers which would become ex-officio members of the Commonwealth Scientific and Industrial Research Organization's network.

Two matters must be explained to complete the story: first, C.S.I.R.O., a group of superb reputation in fields as diverse as animal genetics and radio-astronomy, is responsible for much of the research done in Australia. Private industry is still relatively inactive in research, and C.S.I.R.O. fills the void as a quasi-government organization. Second, there are only 13 universities in the country and half of these are quite small. Sydney University had already decided on the KDF-9 (installed in March) and Adelaide was to share a 3200 with C.S.I.R.O. Five of the remaining universities were allocated nearly $1,600,000 to procure equipment. These universities: Melbourne, Monash, Western Australia, New South Wales, and the Australian National University, either had ancient equipment or small computers. Thus the planned step was a substantial one with great potential effect on computer usage in the country.

tough competition

Again the competition was intensive and some new entries occupied favored positions. Excepting IBM, only the most modern machines were proposed. Ferranti-Packard offered the FP-6000 and emphasized time-sharing. Digital Equipment Corporation, materializing out of nowhere much as CDC had done earlier, proposed the new PDP-6, and CDC offered the 3200 formally announced just weeks before. IBM, in the face of rumors of the long delayed "new product line" appeared to be attempting to dump older machines on the Australian market and proposed 7040's kludge-connected to 1401's via the 1301 disc. Melbourne University chose a large 7044 system at a reputed 85% discount, thus disposing of the largest of the white elephants brought to the country in IBM's spasm response to Control Data's earlier success. (Earlier, IBM had taken a difficult-to-justify full page spread in the *Melbourne Age* asserting that IBM was installing five million pounds worth of equipment in Australia).

As of June, small DEC was the favorite to get the order from one or two of the remaining universities, Control Data closed an order for a large 3200 at Monash, and IBM seemed likely to place one or two 360's (Model 50) in schools which seemed unconcerned about two-year delivery.

Of course, in the onrush of modern technology an "underdeveloped" country does not necessarily have to make all the mistakes made by the pioneers in a new technology. The high-speed "tape floggers" that have developed out of the frenetic competition of the last decade are soon to become obsolete as the dinosaur for educational and research use, and true time-shared multiple console computing is rapidly approaching the stage of practical application. Some of the universities seem aware of the new trends and importance of education-oriented centers. The human desire to upstage a rival institution tends to confuse the issue in other instances. The move by the Australian universities is especially interesting when one considers scale effect (here 20:1). What is happening would be comparable to *one hundred* U.S. universities and colleges making a concerted decision to buy the most modern equipment available (with an emphasis on its use as an adjunct to education!) and with the added circumstance of the availability of a super-computer as reserve capacity for the larger processing requirements. It is clearly a critical decision and one which can have effects of importance to developing Australian science and technology. It is certainly important that a maximum number of students be exposed to the application of computers since the shortage of computer personnel of all types will soon be felt in Australia; and a scarcity of potential users who know what machines can do is likely to be an even more fundamental limitation on immediate progress.

Australia, even in the age of trans-Pacific jets, is a long, long way from the U.S.A. and yet closer than is generally realized in importance to us. In material terms, the U.S. is only a decade or two away from substantial import of minerals, and fortunately Australia complements our failing resources in many instances. Trade between the two countries is certain to increase and with it contacts between the two peoples. Even now, if the United States did not have an archaic and sometimes anomalous immigration policy, more young Australians would come here rather than to the United Kingdom, for a period of experience abroad.

It is interesting and exciting after many years in the computer field to find a place where much is about to happen and where there is little residual inertia from earlier practice and considerable willingness to try new ideas. It seems fairly certain that the exciting new concept of time-shared user-on-line information processing will be quickly accepted and the "number factory" phase bypassed. ■

COMPUTING IN JAPAN

by JOSEPH C. BERSTON and KEN IMADA

In any country, an industry grows, flourishes—or languishes—under a certain "climate" which must be understood before a clear picture of that industry can be obtained. The computer industry in Japan is no exception.

First off, it is necessary to realize that the climate under which Japan's computer industry grows is quite different from that of the United States. It can be thought of as similar to that of England. The Japanese and English climates are almost identical in the following respects:

- The domestic market is small compared to the world market.
- There are a number of domestic manufacturers trying to corner this limited market.
- The market is now dominated by American manufacturers.
- The government is supporting the industry, hoping that computers will become a plus figure in its balance of payments.

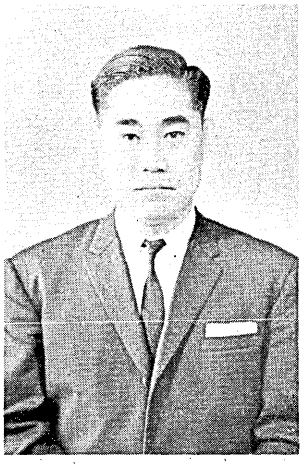
The problems to be solved in developing a computer industry in Japan do not differ greatly from those found in other countries. However, in developing a sales and service organization there were new problems which will be discussed later. The problems of the industry were compounded because at the same time their solutions were being sought, the government was moving from a tightly controlled trade policy (government restrictions imposed on 96% of import items in 1950) to a liberal, unrestricted trade policy (at present, allocations are imposed on only 8% of import items[1]).

delay in development

The development of computers was proceeding during World War II in the U.S. and England, and the pace rapidly accelerated immediately after the war. The U.S. had the Mark I and ENIAC in 1944. In 1949, England had completed EDSAC. The basic circuitry in EDVAC, developed by Dr. von Neumann in 1952 was at once incorporated in U.S. and English computers.

Contrast this with progress in Japan. There, 10 years later (in 1963), the computer in use in Japan was the old tube machine of American manufacturers. The experimental Japanese ETL (Electronic Testing Laboratory) Mk I, a relay computer, was finally completed in 1953. The study of TAC (Tokyo Atuomatic Computer) was started at Tokyo Univ. The experimental Mk III of 1957-58 and the NEAC 1102 (a solid-state machine) were studied by the industry. As you can see, the Japanese computer industry is about 10 years behind the U.S and England. . . both in computer technology and manufacturing techniques.

The development of the market is also about 10 years behind. This lag includes the lack of developed computer applications for industry as well as a lack of awareness



Mr. Imada is computer sales manager of Takachiho Koheki Co. Ltd., a position to which he was elevated after a one-year stay in the U.S. During this time, he studied American dp techniques and completed a computer sales training course. He is a charter member of the Japan Data Processing Management Assn., and is a graduate of Shizuoka Univ.

Mr. Berston started working with computers at Purdue Univ. After graduation, he joined Elctro Data Corp., which has since become a division of Burroughs. He is now in Japan, working with Takachiho Koheki Co. Ltd., distributors of Burroughs products in Japan. He holds degrees in math and education, a BS from Michigan State Univ., and an MS from Purdue.

[1]Government restrictions, or allocations, referred to are those on the conversion of the yen to foreign currency. This was a sort of closed circle: to get an import license, one needed the foreign capital allocation, but to get the foreign capital allocation he needed an import license. In effect, he got both or none. The allocation, a total value control, rather than on numbers or units, could be called a ceiling. As of April 1, 1964, the government had to make the yen freely convertible to foreign currency for the purchase of imports. The control remaining on the 8% is in the approval of import licenses.

by the general businessman of the importance the computer can have on the operations of his business. In the scientific field, the lag is not as noticeable because there is an awareness of the importance of computers in present-day scientific and research work. While the scientific people are aware of the way they could use a computer, they are limited by the number of computers available, so that in terms of use they are also about 10 years behind.

domestic manufacturers

We find two areas in which quite different conditions prevailed during the early years of the computer industry in Japan and other foreign countries. First in importance is the government financial support given. A very large portion of the development cost of the U.S. and British computer industry was paid for by the governments. The support was indirect through the development of computers for military uses. The governments paid the entire development costs of these military computers; the manufacturers could then, with a little additional development cost, produce commercial computers patterned after those developed for the military.

Second in importance was the type of companies that entered the computer field. In the U.S. and England, it was companies with a long history of successful business contact in the data handling and accounting fields. IBM, Sperry Rand, and International Computers & Tabulators had been manufacturing and marketing punched card equipment for many years. NCR and Burroughs have long histories of success in the accounting machine business. All of these companies had large sales networks that could early be used to promote and sell the new products of the computer industry.

By contrast, there is no military program to support the industry in Japan. The industry, finding no substitute for this financial support, has had to bear the heavy burden of development costs. It has been developing a new sales organization under the most adverse conditions, and has been trying to market computers that are technically 10 years old. The government has been and is of some help here through import restrictions.

Seven companies are now manufacturing data processing machines, and two are making process control computers. From the standpoint of the parent company, there are three classes of companies. The breakdown is as follows:

While these parent companies have all been successful in their own fields, computers represented a completely new and different product. Development costs, together with the expense of organizing a capable sales and service staff, placed a heavy burden on them; they have made blunders because of their haste and lack of experienced personnel, and these blunders have added heavily to the burdens borne.

With the government exhibiting no long-range plan for this new industry, there has been completely free competition among the companies for the Japanese market. Each company, of course, felt an urgent need to become the industry leader, considering this leadership in computers to be of help to them in other fields. It appears that they have allowed this desire to completely override the economies of the situation . . . or, perhaps, as some U.S. manufacturers, they greatly underestimated the cost.

sales

By 1960, when serious development of the Japanese industry started, IBM, NCR, and Burroughs already had a trained sales and service staff, and were able to expand the staff to include computers with little trouble. The Japanese had nothing to expand; they had to organize a completely new organization. This, of course, was not done overnight, and to date they really cannot cover the market.

A further problem is the fact that the cost of computers is high, and users have tax advantages in renting. Most computers are therefore rented, not sold, and Japanese manufacturers have found it difficult to arrange this financing. American companies have had little trouble with this through the Export-Import Bank in Washington and other financial institutions. This, then, is another area where the Japanese find themselves at a disadvantage in a sales situation. Conditions have improved with the formation of Japan Electronic Computer Co., Ltd., a financing organization, under government sponsorship in late 1961. The effects of this company have been good but it was not effective until late 1962. The question now is, was this too late?

The "hot-house" growth of the Japanese industry has been over-stimulated by sales to the government and by internal company sales. We find most of the companies have sold about 50% of their computers to the government, which is its way of supporting the industry. The other 50% has been sold to their own organizations. The industry has attempted to boot-strap itself in. These sales look impressive, but they have not been made in free competition. We feel that while these sales organizations look good, the fast growth has produced a weak organization that will

Company	Trade Name	Computer	Technical Ties
Communications Equipment Manufacturers			
Fujitsu[2]		FACOM, FIDAP, CAMA	
Nippon Electric[2]	NEAC	NEAC	Honeywell
Oki Electric Ind.[2]		OKITAC, OPC-1	Remington Rand
Electrical Appliance Manufacturers			
Hitachi[2]		HITAC, HIPAC, HIDAM, MARSI	RCA
Matsushita Electric Industrial Ltd.[1]	National		
Mitsubishi Electric Corp.[2]		MELCOM, LD-1	TRW
Tokyo Shibaura Electric[2]	Toshiba	TOSBAC	GE
Yasukawa Electric Mfg. Co., Ltd.		CAB	
Electrical Control Manufacturers			
Hokushin Electric Works		HOC	
Matsushita Communication Industrial Co., Ltd.[1, 2]		MADIC	

[1] No computer is produced by Matsushita Electric Industrial Ltd., but rather by its subsidiary, Matsushita Communication Industrial Co. Ltd.

[2] One of the seven associate companies of Japan Computer Co. Ltd.

not be able to stand up in a free, competitive situation.

From the latest information available, we find the number of computers installed in Japan at the end of 1963 to about equal the total in England and France, but it represents a fraction of the number in the U.S. The breakdown as of December 1963 is as follows:

United States	16,482
Japan	970
France	701
England	574

The Finance Ministry counts 1,323 installations for the same period; the variation is due to the fact that some computers have been installed in more than one location—that is, moved from one site to another. The figure of 970 computers in use, we feel, is quite accurate.

The Nippon Electric Co., since its formation, has kept accurate records on sales and related statistics in the computer industry. The tables below give, in chart form, a picture for the last seven years. The forecast chart of future sales was made by the Ministry of International Trade & Industry, and is its estimate of what is in store for the computer industry in Japan.

profits from sales

Of approximately 60 different computers produced and marketed in Japan, the HITAC 3010 has proved to be the most popular; about 40 units have been installed. The average number of units produced per model is only about 12. Prices were based on larger sales which have not been reached, and as a result the industry has been operating in the red. Adding to its woes, the industry had underestimated the cost of its sales organization: manufacturers had counted on an appliance-type merchandising of their computers. Much to their surprise, they found the sales effort represented only a fraction of the expense, compared to the cost of providing the required post-sales service.

Another factor not yet encountered that will increase this already unprofitable operation is obsolescence. To date, manufacturers have had no experience in dealing with this but the dawn is about to break because of the invasion of more advanced solid-state computers now being marketed by American manufacturers. The protective policy of the government, implemented through import restrictions and high import duties, has slowed foreign producers. But in light of Japan's trade liberalization policy, it cannot maintain these for long. When these are lifted, the Japanese industry will come in face-to-face battle with foreign producers.

Contrary to what might be thought, domestic manufacturers do not have a price advantage. The high import duty (about 15%) has about equalized the price but has not created a price advantage. For example, a domestic tape unit sells for more than 10 million or over $28,000; the FOB factory price of the Burroughs 421 tape unit is $29,000.

Japanese industry has always hesitated to make large expenditures on basic research, a restraint under which the computer industry now is operating. While exact numbers of those engaged in research are difficult to determine, it is known that at the start of 1964 the total number of people employed in the computer division of all seven companies in Japan was only 5,840. Of this number, 1,240 were in sales departments. Thus it can be seen that very few people can be involved in basic R & D work.

The one exception is Fujitsu. This company is working on new ideas of its own and has a small but qualified basic research staff. But the small effort of this one company is as a grain of sand. The other six manufacturers seem to have given up the idea of developing their own computers, and are now taking the path of assembling or building computers designed by foreign companies. There has been a frantic race in the last year to form technical tie-ups with American manufacturers.

Hitachi started assembling and marketing the RCA 301 under the name of HITAC 3010 — earlier noted as the biggest seller. Nippon Electric soon followed with the Honeywell 200, 400, 1400, 800, and 1800, being marketed as the NEAC 2200, 2400, 3400, 2800 and 3800. Mitsubishi likewise followed, displaying the TRW 530 with the nameplate changed to MELCOM 1530. MITI has approved, with tongue in cheek, these foreign-developed computers bearing the nameplates of domestic computers. This approval was welcomed by users because it enabled them to get good foreign hardware with local names on them. If this marketing arrangement works out, it is possible the government and industry will give up the goal of developing their own computers. There is a great deal of discussion pro and con on this matter, which is by no means settled and, in all likelihood, will not be for some time. ■

Domestic & Foreign Computers Installed

	1957	1958	1959	1960	1961	1961	Sept. 1963	Total
Domestic	2	3	15	31	79	155	161	446
Foreign	1	5	20	25	91	94	49	285
Total	3	8	35	56	170	249	210	731

Sales of Computers & Value of Domestic & Foreign (Value in Millions*)

	1957	1958	1959	1960	1961	1962	Sept. 1963	Total
Domestic	103	67	525	1367	2645	6290	5018	16,017
Foreign	24	848	269	4639	11,380	13,786	7213	40,559
Total	127	915	794	6046	14,025	20,086	12,231	56,576

Forecast Sales, Domestic & Foreign (Value in Millions*)

	1964	1965	1966	1967	1968
Domestic	13,000	17,600	23,400	30,500	37,200
Foreign	13,000	14,400	15,600	16,500	16,800
Total	26,000	32,000	39,000	47,000	56,000

*360 = $1.00

COMPUTING IN SOUTH AFRICA

the market and applications

by VIRGINIA E. MARTING

South Africa is an exciting place to live these days, especially if one has anything to do with EDP. Practically every international journal reports the phenomenal economic boom in this country, a condition which has grown in the two years since leaving the British Commonwealth. The ready availability of capital is perhaps reflected in the increase in computer investment shown in the accompanying bar-graph. We like to think that this investment justifies itself by its own feedback thereby contributing even more to the overall economic growth. From a country previously dependent entirely on the exploitation of its vast reserves of mineral wealth and exporting these wasting assets to the rest of the world, we are now witnessing a conservation of human, material and capital resources. Through the application of rigorous import controls and protective tariffs the government has fostered the growth of local industry and provided sufficient incentive for major U.S. corporations to assemble or even manufacture here so that now South Africa is an exporter of consumer goods, pharmaceuticals and farm implements.

It is interesting to note that this late-day industrial revolution, unhampered by the necessity to displace long-established precedents and cumbrous methods to displace, is associated with a progressive young management that is eager for the application of scientific management techniques. One hears daily of the demand for linear program-

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ming, mechanised quality control and production scheduling.

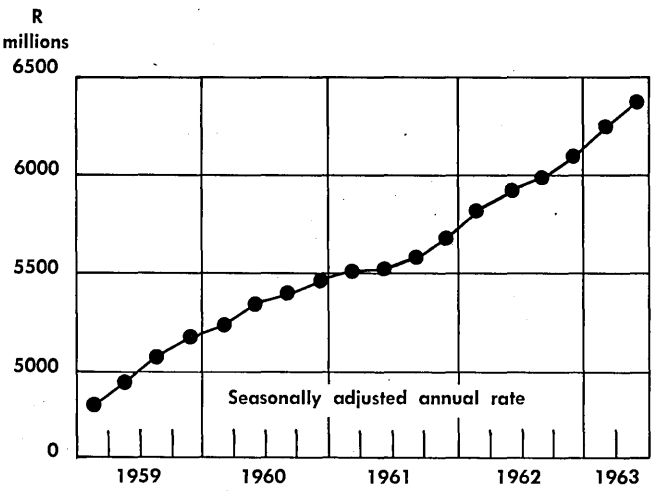
In retrospect, this is how the acute awareness of mechanization and its benefits has been brought about. Punched cards made their debut on the South African scene as early as 1911 when Hollerith equipment was installed at the South African Railways. For its time, this was quite an esoteric application involving the computation of station-to-station mileages and their applicable rates using a binary technique.

In succeeding years the Hollerith Machine Company which merged in 1959 with Powers-Samas to form International Computers and Tabulators, S.A. (Pty) Ltd., built up a profitable organisation having some 200 punched card customers. Some of the larger of these customers, for example the South African Iron and Steel Corporation, were among the first to convert to stored programme computers of the HEC 1200/1/2 type. Competition had an almost insuperable task to break the bonds of customer loyalty established through the I.C.T. tradition of service. Two other early computer installations in S.A. were at two major insurance companies who selected the Burroughs 205 and a Ferranti Perseus respectively for the accommodation of their voluminous policy files.

sales see-saw

IBM started on the road to sales success locally with the IBM 1401. Most of these installations are card systems of quite small memory size but the exception was a 16K IBM 1401 magnetic tape system for the Receiver of Inland Revenue . . . one of the first orders placed. With the introduction of a *Paye-As-You-Earn* system the increased number of applications demanded faster throughput, and the existing installation was augmented by a 40K 1410 in 1963. The Internal Revenue accounting applications developed in South Africa are perhaps as sophisti-

GROSS NATIONAL PRODUCT GRAPH



cated and integrated as will be found anywhere in the world.

Apart from this prestige IBM installation, the lion's share of computer contracts in government departments have gone to the I.C.T. 1500, possibly on account of its attractive price tag. The inflexible World Trade list prices cannot compete with the discounts I.C.T. have been able to offer. Many installations found the 10 K.C. hi-data magnetic tape adequate for their requirements, whereas they could not find justification for the more expensive IBM 7330.

The sales see-saw tipped the other way with the announcement of the IBM 1440, of which some 32 systems are scheduled for delivery in 1964 and 1965. In a great many competitive sales situations a 1440 is proposed against an I.C.T. 1500 in spite of the fact that there might be no random access concept involved but because of the ability for fast serial processing, fast sorting and opportunities for interesting file organization. The 1440 brought within the range of a smaller organization the computing power that was unattainable before except perhaps through a service bureau, and there appears to be a continuing market for small computers in this country. The recent rationalization of the IBM product line with the announcement of the IBM 360 therefore, represents to an outsider an almost complete reversal of policy. To enable installation of a core size able to take full advantage of the programming systems and time-sharing facilities, IBM will have to persuade many smaller organizations to form consortia and approach their problems on a group basis.

Against this battle of the giants, NCR and Burroughs have been minor protagonists with a noted upswing in their sales during 1964. For the straight commercial type applications these simpler machines have a ready market.

The first bank to swing to EDP selected an NCR 315 and are encoding their cheque forms with the E13B magnetic ink encoding.

There are 15 service bureaux in operation of which three, that are quite independent and not tied to any supplier, have selected the Burroughs B280 because of the simplicity and power of its report generator.

It can be realised already that many other suppliers of electronic data processing equipment have come to regard South Africa as "The goose that laid the golden egg" and at least three other companies have surveyed the potential of establishing marketing subsidiaries.

In spite of vigorous education programmes, the number of programmers and systems analysts falls short of the number required to staff this year's sales. Advertisements in our newspapers reveal that a programmer is almost in a position to nominate his own salary. Perhaps this may act as an encouragement to systems analysts and programmers abroad who might consider emigrating to this country. It is quite common to see blatant recruiting of the staff of one supplier by another. The ultimate sales battle will probably resolve in an expression of the customers' confidence in the firm that can provide an adequate number of experienced systems engineers to assist with pre-installation planning.

Early programmes were written in machine or assembly languages, and programmers had their first taste of the use of a FORTRAN compiler in 1962 through the IBM 1620 and an IBM 704 installed at the Council for Scientific & Industrial Research. The latter machine was ordered to supplement the computing facilities at the C.S.I.R. established earlier with a Stantec Zebra. The scientific computing requirements have grown by leaps and bounds on account of the establishment of the Atomic Energy Board's reactor at Pelindaba and South Africa's entry into the space programme. There are several missile tracking stations in the neighbourhood. The Atomic Energy Board has an Electronic Associates analog computer on order.

The C.S.I.R. has also provided some encouragement to data transmission experiments to enable the transmission of experimental data from their distantly placed Institutes to the central computing centre. The use of data transmission facilities on a country-wide commercial basis will probably be realised in 1967 when a number of intervening manual

exchanges have been eliminated, and the major cities will be linked on a dial-up basis. In this area Siemens and Standard Telephones have perhaps greater experience than the suppliers of the central processors.

Across our borders in Northern Rhodesia IBM has been conducting successful teleprocessing experiments in order to link the copper mines placed approximately 35 miles apart from the central IBM 1410/1401 computing centre of the Anglo American Corporation in Kitwe. As a whole, the copper mining industry of Northern Rhodesia is ahead of the corporation's computer applications in the gold mining industry, and the installation of the 1410 has replaced previous 1401 installations at individual mines; but an IBM 1620 imported earlier for operations research at Nchanga Consolidated Copper Mines has been retained. Consultants from Johannesburg have been actively engaged in the O.R. programme, and a recent mathematical model of the Nchanga Open Pit is perhaps a "first" in determining the optimum ore recovery without endangering men and equipment by the failure of the side slopes of an open cast operation.

edp mines for gold

Within the gold mining industry a new awareness is growing of how the utilisation of men, materials, machines and money may be optimized by what is known as the concentrated mining technique. Briefly, the concentrated mining technique consists of a greater rate of advancement in rock breaking along a fewer number of stopes. The management of the Rand Mines Group has a real appreciation of how computers may be used to schedule these operations, and some assays in this direction have already been made.

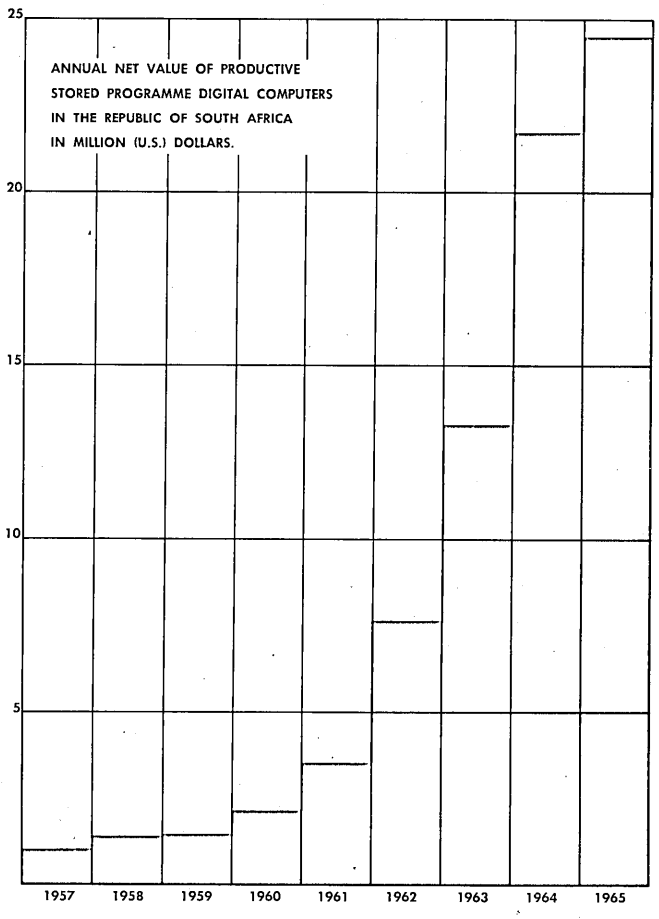
Rand Mines Group invested capital in Leo Computer Services (Pty) Ltd., which installed a Leo III in 1962 and is presently processing the pay packages of 100,000 mine workers from their own and other mining groups. Apart from servicing the Rand Mines requirements, the same computer is available to the public on a service bureau basis. This is the first computer installed in South Africa offering true time-sharing facilities, and the constant running of engineering diagnostic routines in parallel with production runs perhaps accounts for its reliability. English Electric-Leo have not concluded any more orders for Leo III or machines of the KDF series partly because, unlike their competitors, they do not have an aggressive sales force and on account of a prevalent myth about the complexity of programming.

Goldfields of South Africa Ltd. have recently placed an order for an I.C.T. 1500 computer with 30 k.c. magnetic tape units on account of their need to have a computer equipped with an adequate CPM programme in order to coordinate the detailed planning on their new Kloof mine. The computer will of course be used for payroll and stores accounting as well.

civil engineering

All of the suppliers of EDP equipment have CPM or PERT programmes accommodating a varying number of activities but restricted to the scheduling phase alone. There is as yet no computer large enough equipped with a programme to handle the cost aspect as well. All firms of management consultants are offering CPM network-planning but there is one firm of consultants which has found for very large projects, such as the erection of a power station, the best service is obtained on a rapid turnaround from the GE service bureau in Paris using the GE 235 PROMOCOM monitoring programme.

The opening of new gold fields in the Klerksdorp and Orange Free State, together with the demands of industry and the resulting population explosion, have caused us to look carefully at our water resources. At present the growing needs of man are competing with the thirsty African sun. The $420 million Orange River Scheme has been designed to conserve what is perhaps our most precious asset of all and harness its power for hydro-electric use. Data collection for flood control is under way and, in due course, computers will become indespensible for the design of concrete structures. The northern tributary of the Orange, the green sluggish Vaal river, which supplies the irrigation and domestic needs of the whole Witwatersrand area, is also under the microscope, and a simulator programme has recently been written for the IBM 1620 in order to determine a rule for its operation in the future and



assist in the location of additional storage dams. The eventual solution to the losing battle we wage against evaporation may come in the form of subterranean storage in the Dolomites.

Another civil engineering problem that provides adequate justification for computer usage is the planning of the national highways, on which 168 million dollars is spent annually . . . and the budget for the coming two years even exceeds that of the Orange River Scheme. Like California, gasoline taxes and the excise on the purchase of automobiles is ear-marked toward the development of these highways, and around the Cape Peninsula there is a throughway system which is of a standard comparable with Los Angeles. A suite of IBM 704 programmes has been developed in order to locate a road over difficult terrain and perform a complete design which is more comprehensive than the normal cut-and-fill found in programme libraries.

Computer applications in engineering and the mining industry will probably provide a greater pay-off than those of pure data processing, and at the southernmost tip of Africa computers are writing a chronicle of progress. ■

THE MECHANIZED LIBRARY

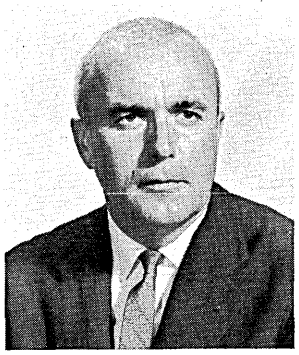
an experimental model

by L. H. MARTIN

The enormous storage density achievable on photographic film has focused much attention on its possible uses as a storage medium in mechanized information-handling systems both for binary-encoded information and information contained in documentary replicas.[1, 2, 3, 4] High storage density reduces the storage volume required for an information collection. This reduction in storage volume not only conserves storage space, but may also increase the accessibility of the information since the magnitude of motions required to select an information field are correspondingly reduced. Another feature of photographic storage techniques is that when combined with appropriate optical elements, large amounts of information can be transferred or manipulated rapidly by optical projection or contact printing of the photographic film. The information can be recorded on photosensitive media or sensed and converted to an electrical signal by a variety of means.

Another attraction of optical and photographic techniques for storing documentary information is that an actual replica of the document page itself can be recorded. This approach does not make maximum use of the high-storage density capability of the photographic media; however, it may eliminate any requirement for encoding the document contents before recording, and drawings and pictorial information can be readily recorded.

Information storage and retrieval systems are only beginning to be studied from the point of view of modern production, inventory theory and economics. In particular, the many advantages of expendable copies (whether micro or full scale) produced at low cost per duplicate have not been thoroughly explored. One attempt in this direction is a mathematical model originally based on the experimental system described here, but generalized for dissemination by other than photocopies. This model describes a dupli-



Mr. Martin is president of Intectron Inc., Newton Lower Falls, Mass., which is engaged in research, development and manufacturing activities related to electro-optical instruments and biomedical lab apparatus. He has specialized in the development of automatic control and instrumentation systems since 1949, when he joined MIT's Servomechanisms Lab. He holds a BS (communications) and MS (servomechanisms) in electrical engineering from MIT.

[1] R. Shaw, "The Rapid Selector," *Journal of Documentation*, No. 5, 1949, p. 164.

[2] Emik A. Avakian, "AMFIS—The Automatic Microfilm Information System," The Teleregister Corp., Stamford, Connecticut, Special Libraries, April 1957.

[3] G. W. King, G. W. Brown, and L. N. Ridenour, "Photographic Techniques for Information Storage," *Proc. IRE*, 41, October 1953, p. 1421.

[4] A. W. Tyler, W. L. Myers, J. W. Kuipers, "The Application of the Kodak Minicard System to the Problems of Documentation," *Amer. Doc.*, Vol. 6, No. 1, January 1955, pp. 18-30.

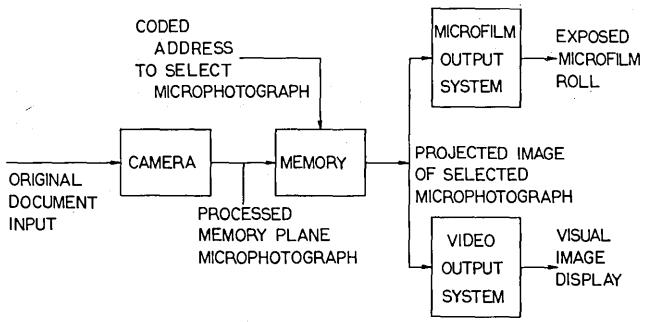
cating or D library for dissemination of expendable copies of any kind of stored record, as contrasted with dissemination by the older circulating or C library.[5] A computer program embodying the model enables determination of the total cost per duplicate page issued.

In late 1956, a program[6] was started by the Crosley Division of the AVCO Corporation to explore the application of photographic media, optical and electronic techniques to high-density information storage by actually constructing an experimental document storage system.* At this time a memory configuration was conceived[7] in which rectangular image fields were arranged in rows and columns on a group of rectangular planes that were in turn automatically positioned by digital servomechanisms. This rectangular plane configuration appeared more attractive than a serial arrangement of images (such as a microfilm roll) because it would be possible to proceed directly to a point in the plane where an information field was located, eliminating the need to scan through many images in the serial arrangement. The scope was considerably expanded in 1958 by the Council on Library Resources, which assumed sponsorship. Full responsibility for the technical development remained, however, with the AVCO team. Below are described briefly the main parts of the prototype system (later called Verac) and some of the principal technical considerations which entered their design. While elements of the system have operated in the laboratory, they have not yet been field tested in a library environment.

basic elements of the system

The basic elements are shown in the block diagram of Fig. 1. They consist of a camera for photographic entry of documentary material for storage, a high-density photographic storage unit or memory, means for automatically selecting any image in response to a coded address signal, and two illustrative output channels, a television-type display and transfer to microfilm.

Fig. 1 Basic elements of VERAC-903



For a library-type application to bound-book conversion, original document pages are manually inserted in the camera. Microphotographs of the document pages are stored on a film or plate called a memory plane. On this plane the microphotographs are arranged in rows and columns. Reductions on the order of 100:1 are used, so that a typical memory plane may contain on the order of 10^4 document page images. Forty 250-page books can be stored in one plane. One hundred of these planes are stored together in a compact unit occupying about one cubic foot. Any particular page can be directly selected in response to a coded signal, within a period not in excess of three seconds, and averaging about one second. Images selected for output are enlarged and projected either on microfilm or on a vidicon tube which converts the image to a video signal. The video signal can be stored in an electrostatic storage tube and displayed on a kinescope screen, or it may be electrostatically printed, or transmitted.

problems in storing microimages

To perform the above functions there are needed combinations of digital position control, photographic, optical and electronic facsimile techniques.

Possibility of high-density photostorage depends primarily on use of high-resolution photostorage media. for this purpose Kodak's Lippmann emulsion was used. Its resolution[8] appears to exceed 1500 lines per mm. Efforts to use high reduction ratios were not motivated solely by the resulting impressive conservation of storage space. Small size also increases the accessibility of the stored record by reducing mechanical travel distance, decreasing the weight of moving parts, shortening access time, and reducing power requirements. All this is not gained without increased cost since the registration problem becomes increasingly difficult.

Use of a flat plane for storage was adopted to eliminate time inequalities in the operation of selection. One possible way to select images is to move every picture in the memory sequentially into the field of view of the mechanism for optical projection. When the desired image appears it may be transferred out of the memory. In a microfilm roll, for instance, this method occasionally requires very long access times for images located at the tail end of the roll. Another approach is to move the memory picture field by a more direct path. High reduction ratios together with arrangement of images in rows and columns on a group of plane surfaces appears to yield uniformly lower access times as well as reduced storage space.

Access to the collection is both "direct" and "random." That is, it is possible to select any given microimage located anywhere in the memory and bring it into registration with the field of view of the output mechanism. If the collection were small or the access time long, the conditions for this motion would be chiefly kinematic. With very large numbers of images and short access times it is necessary to consider also the dynamic aspects of registration. Since there is motion of both memory planes and output mechanism, and since each has mass, accurate control of power is needed in order to achieve precise registration. Peak power depends upon selection time, total number of images, size of images, the mass associated with the image fields, and the mass of the optical transfer mechanism. The cost of positional control increases rapidly as peak power increases. This offers an incentive for reducing mass by linear photoreduction. On the other hand, as the mass is reduced by using higher reduction ratios, the precision of registration and its cost increase. Design of the selection system requires compromise among the two factors. An analysis of a simplified registration operation illustrates the relationship among these factors. Assume that a source of power applies a constant accelerating force

*The author was manager of the project in the period 1956-1960. Present manager is Victor Scott, AVCO Corporation, Electronics and Ordnance Division, Evandale, Ohio.

[5]Heilprin, L. B., "The Economics of 'On Demand' Library Copying," *Proc. National Microfilm Association*, 1962. pp 311-339.

[6]Bowker, J. K., Lucas, E. J., Martin, L. H., Phaneuf, C., "Technical Investigation of Elements of a Mechanized Library System." Final Report No. EW-6680, 11 January 1960, AVCO Corporation, Crosley Division, Electronics Research Laboratories, Boston, Massachusetts.

[7]Martin, L. H., Lucas, E. J., U. S. Patent 3,084,334, "Direct Access Photomemory for Storage and Retrieval of Information," April 2, 1963.

[8]"Kodak Plates and Film for Science and Industry," Eastman Kodak Co., 1962, pp 4d-5d.

first in one direction and then in the opposite direction for an equal period of time.

Let M = Mass of the moving element
L = Distance the element is moved to obtain registration
T = Time within which registration is achieved

If the effect of damping is neglected and only the mass of the moving element is considered, it can easily be shown that the peak power to be controlled is

$$P = 8ML^2/T^3$$

In order to keep P as low as possible we require small values for M and L, and a large value for T. For selection within a given time T, the mass M of the moving parts must be as low as possible. But this mass tends to vary inversely as the square of the reduction ratio. In addition the maximum distance of travel L should be as short as possible. L depends on the size of the picture fields and the total number of images moved. Thus L also varies inversely as the square of the reduction ratio. For a given retrieval time T the peak power varies approximately as the inverse fourth power of the reduction ratio. This is a strong motive for use of a high photoreduction ratio.

On the other hand, the reduction ratio is limited by the registration accuracy that can be achieved with the selection apparatus. For example, if absolute registration accuracy of 0.001 inch can be achieved, an image of dimension 0.1 inch could be misregistered by 1%; and positive selection of an image of dimension 0.001 inch would be impossible. Thus a compromise between cost of peak power and cost of precision has to be made.

Fig. 2 Memory plane

A second compromise is necessary because peak power varies inversely as T^3. A small decrease in access time of motion must be paid for by cubically increased peak power. This in turn brings on problems concerning the selection and cost of suitable actuating motors. It is possible to offset the effect of shorter access time by higher reduction ratios, as suggested above. But again, this can be done only to within requirements for minimum registration precision.

We now describe the principal parts of the system.

the camera

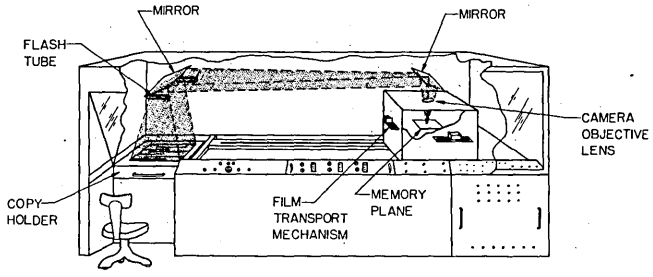
The camera produces micro-photographic reproductions of original documents on memory planes such as that illustrated in Fig. 2. The memory plane once completed becomes part of the memory, which stores 100 memory planes per unit. Fig. 3 is a sketch of the optical and mechanical arrangement of the camera. The document page to be recorded is, in the prototype model, manually inserted in the copy holder. From here on operation is automatic. The copy holder is moved into the field of a high-resolution microscope objective lens which forms a reduced image of the page on the memory plane. Before passing through the objective, the optical path is reflected from two mirrors which suitably "fold" the focal distance and shorten the camera. Even with this compression the camera is about seven feet long. A lens similar to the objective is used in the output mechanism of the memory.

The illumination power store provides a high-voltage pulse to drive the flash tubes. Exposure is controlled by changing the voltage pulse amplitude. After exposure, the transport mechanism moves the film along orthogonal directions into position for the next exposure. Drive motors, brakes, and linear optical code plates are attached to the moving elements of the mechanism. Signal pulses are generated for small equal increments of motion of the optical code plates by sensing the light transmitted through evenly spaced translucent regions of the code plates. The electrical drive motors are actuated until a pre-set number of pulses is counted. The motors are then stopped and the motion is braked.

The maximum field that can be copied in the camera is 9½ x 14 inches. The field size and the spacing between centers of microimages recorded on the memory plane can be varied (by varying the pre-set number of pulses) in integral multiples of 0.004 inch between adjacent row and column centers, up to a maximum spacing of 0.200 inch. The camera was designed to operate at fixed reduction ratios between 70:1 and 140:1. For the first, the detail reproduced corresponds to 10.3 optical lines per mm of the original; for the second, to 5.5 lines per mm.

Since the Lippmann emulsion is relatively insensitive to light, high-intensity flash tubes are used to illuminate the original document page in the camera copying position. Exposure times are on the order of 0.001 second. The interval is much shorter than the time required to charge the illumination power store and to shift the memory plane—about one second. This latter period is in turn shorter than the mean interval at which the operator can feed original document pages into the camera, at least four seconds per page. Therefore, the actual limiting

Fig. 3 Optical and mechanical arrangement of camera



operational rate is that of the manual operation. This could be reduced if cut pages and automatic feed were used, but was not practical for a prototype library model designed primarily for storage of pages from bound volumes.

the memory

The memory has a capacity for handling 100 memory planes at a time. The memory planes are rectangular frames 7.6 inches wide, 7.8 inches long, and 0.03 inch thick (see Fig. 2). Suspended in the frame are flat sections of high resolution Lippmann emulsion film sufficient to store approximately 10,000 individual images of 9½ x 14 inch originals. Fig. 2 shows the equivalent number of pages at full scale, and in a memory plane. On 100 planes one million images can be stored. This corresponds to 140:1; for 70:1 reduction the memory contains 250,000 images.

A photograph of the electromechanical components of the memory is shown in Fig. 4. Electromechanical operations of the memory are illustrated in Fig. 5. When a binary coded signal is given which designates the address of any one image in the memory, the memory planes are automatically manipulated so as to project the image from the correct plane, row and column. In this operation of selection the microphotograph is registered within the field of view of the optical projection system by three linear motions. First, the memory planes are moved as a group in the "Z" direction, until the plane containing the image is aligned with an access port where the plane can be withdrawn. This plane is then shifted in the "X" direction until the column in which the microphotograph is located is registered with the field of view. Simultaneously with these sequential motions the field of view of the output mechanism is itself shifted in the vertical "Y" direction until aligned with the row of the microphotograph.

The three linear motions of selection are controlled by digital servomechanisms. Analog-to-digital converters are attached to the moving elements of the memory so that their linear positions are encoded. The converter is a 13-bit Gray Code pattern formed by opaque and translucent areas on a glass plate. A line light source illuminates one side of the plate. Various combinations of light transmitted and absorbed by the plate are sensed by a bank of 13 photosensitive diodes. The encoded position signals are compared with the binary coded address signal of the desired microphotograph.

The digital differences between addresses and position signals are computed for the three motions of the mechanism, converted to three analog error signals and distributed to the appropriate servoamplifiers. The latter drive servomotors, and mechanical brakes are applied to the moving elements in order to insure that the microphotograph is stationary during read-out.

The output mechanism contains an optical projector consisting of a high-resolution microscope objective lens, zirconium arc light source, optical condenser, and shutters. A device to focus the microphotographs, and mirrors to split the projected beam are included. The projected images are thus supplied to both vidicon camera and microfilm camera.

The time interval between initiation of an address command to the memory selector, and completion of transfer of the image from the memory via one of the two cameras varies with the relative position of the selected microphotograph within the memory, and with the output method used. Preliminary operation of the memory servomechanism system indicates the range of time intervals as between 0.3 and 3.0 seconds. The average is on the order of one second.

the output systems

As stated above, the two original output systems for the prototype model were a microfilm camera and a video camera. These shared a beam from the optical projection system designed to resolve a minimum of 2,200 optical lines on the field diagonal of a 140:1 reduction of a 9½ x 14 inch page. Later, hard-copy output has been added.[9]

Fig. 4 Memory selection mechanism

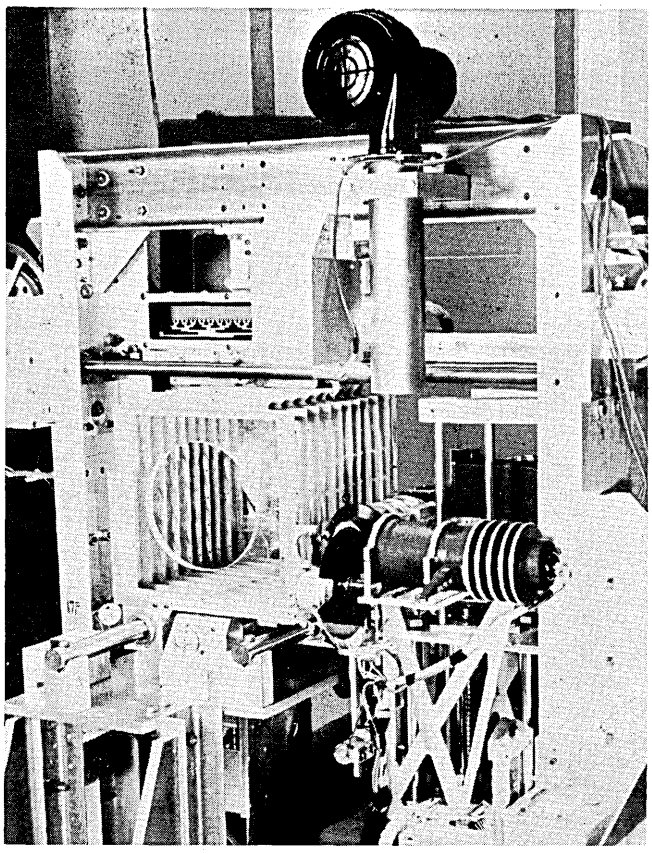
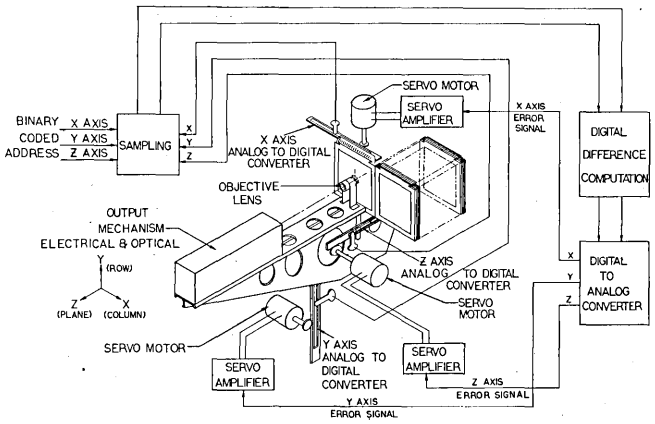


Fig. 5 Electromechanical operation of the memory



The microfilm camera reproduces the selected microphotographs on a roll of 35-mm microfilm. The film is advanced and exposed automatically when a reproduc-

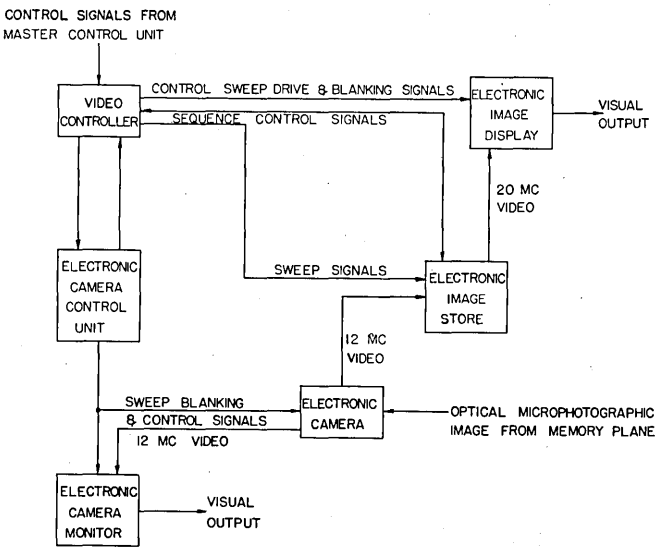
[9]Waring, R. L., Stacy, R. A. "Technical Investigations of Addition of a Hardcopy Output to the Elements of a Mechanized Library System." Final Report, 20 September 1961, prepared for Council on Library Resources, Report No. 940101, AVCO Corporation, Electronics and Ordnance Division, Cincinnati, Ohio.

tion is desired. A film transport mechanism is attached to the memory output mechanism. The image of the microphotograph is projected on the film, and exposure is controlled with a focal plane shutter and capping shutter. Film frames can be advanced at a rate of two per second. The film transport magazine contains a fifty-foot roll on which images are enlarged to a size of field 1.0 x 0.75 inch (900 images per roll). After exposure, the film is processed by conventional techniques. The processed film can be viewed with a low-power (10X) magnifier or viewer, can be projected, or enlarged and reproduced as hard copy. Resolution of the microfilm output is limited primarily by the stored microphotograph and the output objective, and only to a small extent by the microfilm itself.

The video output system provides both video signals for transmission or print-out, and visual access to the microphotograph, through a monitor. The system converts the image projected from the memory plane into an electrical video signal. This can be transmitted to a remote point and displayed on a kinescope. A temporary storage channel included in the system frees the memory for additional selections during the time a given microphotograph is viewed. This is accomplished by scanning the projected image for a short time, and recording it in a temporary storage channel. The recorded signal can then be played back for viewing on the kinescope while the selector is free to produce additional outputs from the memory.

The principal elements of the video output system are outlined in the block diagram of Fig. 6. The electronic camera is mounted on the output mechanism of the memory. In this camera a vidicon tube is so arranged that

Fig. 6 Video output system

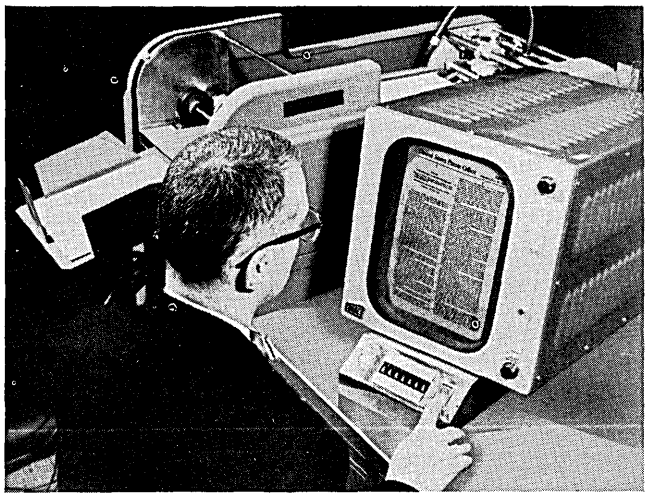


one of the images formed in the projection system of the optical output may be focused on the vidicon target screen. The scanning raster of the vidicon tube has an aspect ratio of 4 to 3. The scanning beam is swept 1600 times in the longer direction to cover a complete picture frame in 0.33 second. The video signal generated in this operation is displayed on the camera monitor and also recorded in the electronic image store. The monitor provides a direct display of the electronic camera signal so that the vidicon tube and associated circuits can be properly adjusted.

The electronic image store (designed and made by Image Instruments, Inc.) contains an electrostatic store tube, QK 685, made by Raytheon Corporation. During operation a raster corresponding to that in the electronic camera is scanned by the recording beam of the storage tube. This beam is modulated by the amplified video signal from the vidicon. The amplified signal bandwidth is limited to 12 megacycles. A charge distribution corresponding to the image is set up in the storage tube. In read-out the storage tube raster is interlaced 2 to 1 and scanned at a continuous rate of 60 images and 30 frames per second. The raster frames, with a 4 to 3 aspect ratio, are generated by sweeping the scanning beams 1001 times in the longer direction. The higher scan rate and interlacing techniques were chosen to avoid objectionable flicker in the kinescope display. The signal may be stored and scanned for a number of minutes while it is displayed. The recorded temporary signal can be erased in a few seconds, and a new signal recorded.

The video signal from the electronic image store is the input to a display kinescope made by the Dage Division of Thompson-Ramo-Wooldridge (see Fig. 7). This unit is scanned with an interlaced raster corresponding to the

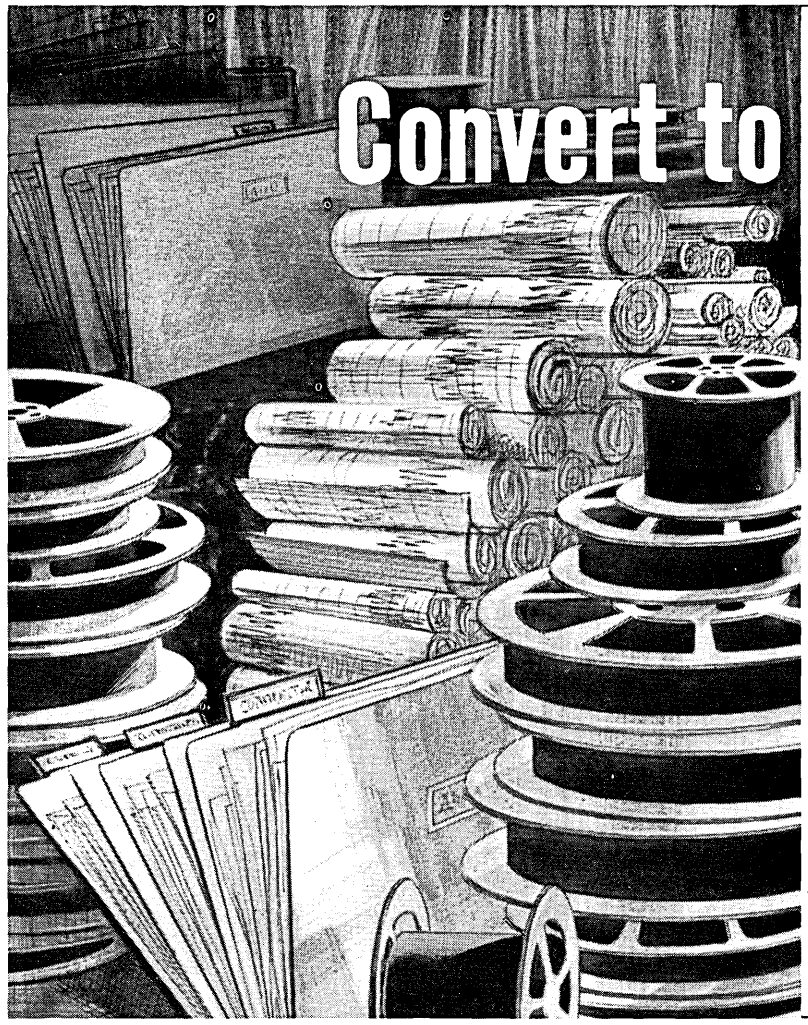
Fig. 7 Electronic image display



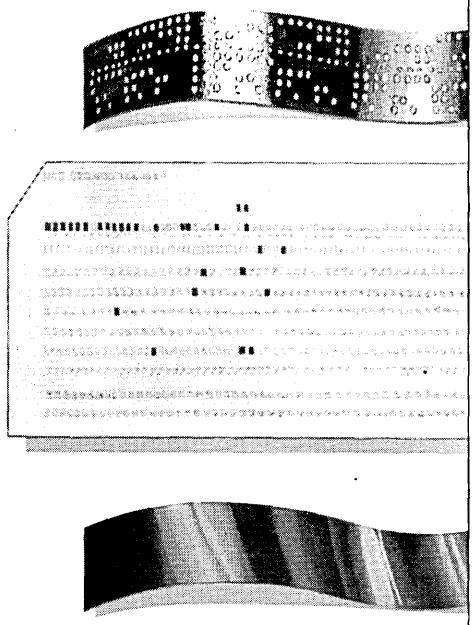
read-out raster of the image store. The video signal (band width 20 megacycles) is amplified and modulates the scanning beam intensity of the display kinescope. The latter is large enough to accommodate an 8 x 11 inch picture. Additional units of the video output system coordinate and synchonize sweep operations, and control erasure and recording in the electronic image store.

The bandwidth of the video signal amplifiers, the scanning rasters, and the scanning rates were chosen so that the resolving capabilities of the vidicon and electrostatic storage and display kinescope tubes would be pushed beyond or close to their limits. Development work has continued on the output system and limits on the over-all resolving capabilities of the video output system.

The work on Verac was supported in part by the Council on Library Resources, and in part by the AVCO Corporation. Original encouragement for the project was given by John W. Marchetti, director, The Electronics Research Laboratory, Crosley Division, AVCO Corporation, and by Verner W. Clapp, president, Council on Library Resources. The author wishes to acknowledge the important contributions to the concept, design and construction of Verac by J. Kent Bowker (Camera and Optics), Edward J. Lucas (Memory) and Charles Phaneuf (Video Output). The author also wishes to acknowledge the continual encouragement of Dr. Laurence B. Heilprin, staff physicist of the Council on Library Resources, throughout the program as well as his helpful comments and suggestions on this article. ■



Convert to Reduce



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Fast, meaningful analysis of data film, oscillogram, or ballistic plate data with increased efficiency and realistic economy is made possible through the Data Instrument line of record readers.

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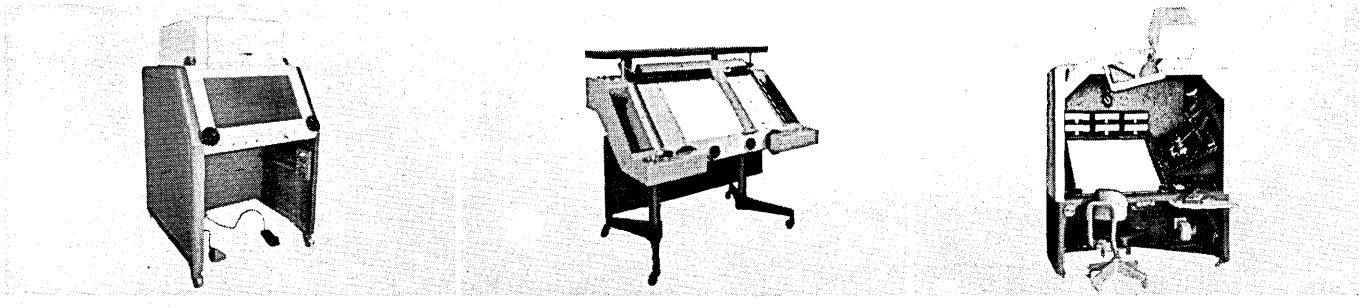
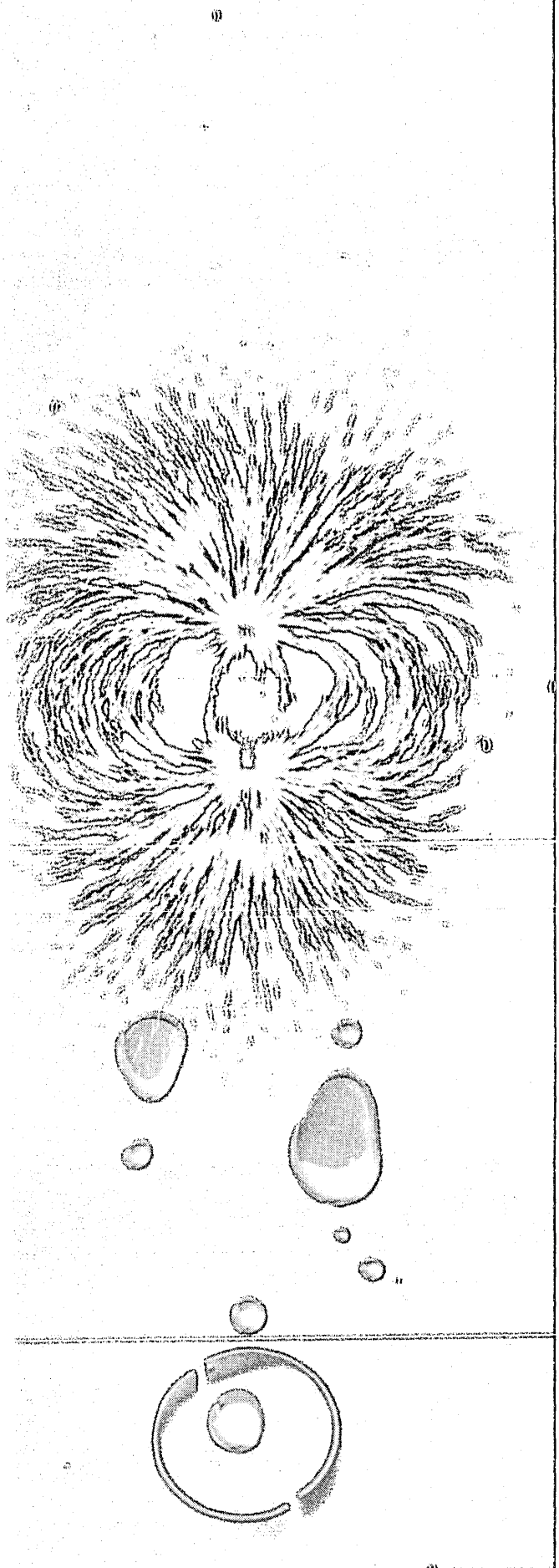


CIRCLE 18 ON READER CARD



The Magnetic Personality of MHD Bearings

We've been analyzing it at the Research Laboratories.

Frankly, we don't know what the practical applications of our MHD analysis will be. Not yet, anyway.

But we're nevertheless pleased that our engineers were the first to successfully demonstrate the much-investigated MHD bearing.

Recently, with the help of the University of Chicago's 32.5-inch cyclotron magnet, they proved experimentally a theory that has been described only by mathematical analysis; that is, when electrically conducting liquid metals are used as bearing lubricants, load carrying capacity can be dramatically increased by subjecting them to a magnetic field. The more powerful the magnetic field, the more viscous becomes the liquid-metal lubricant . . . and the greater the load the MHD bearing will support.

Even more important, our engineers found excellent agreement between their mathematical predictions and the measured performance of the experimental MHD bearing.

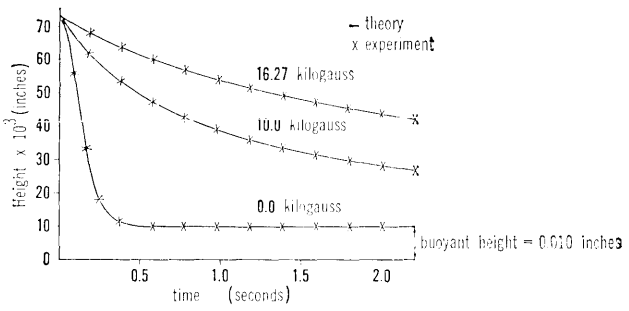
GM bearing designers are intrigued.

Consider the operating characteristics of the magnetohydrodynamic bearing: the possibility of zero frictional torque . . . high thermal conductivity . . . the ability to withstand high temperatures and nuclear radiations . . . and automatic electrical adjustment to compensate for transient loads.

From theoretical analysis through confirming experiment, the successful demonstration of the first experimental MHD bearing is typical of the full-circle research philosophy of General Motors.

General Motors Research Laboratories

Warren, Michigan



Predicted rate at which a film of mercury is squeezed from between two flat circular plates agrees closely with measured values.

Symbolized elements of MHD bearing.

CIRCLE 19 ON READER CARD

OPTICAL HANDLING OF CHECKS

a pilot postal system

by WALTER DIETRICH

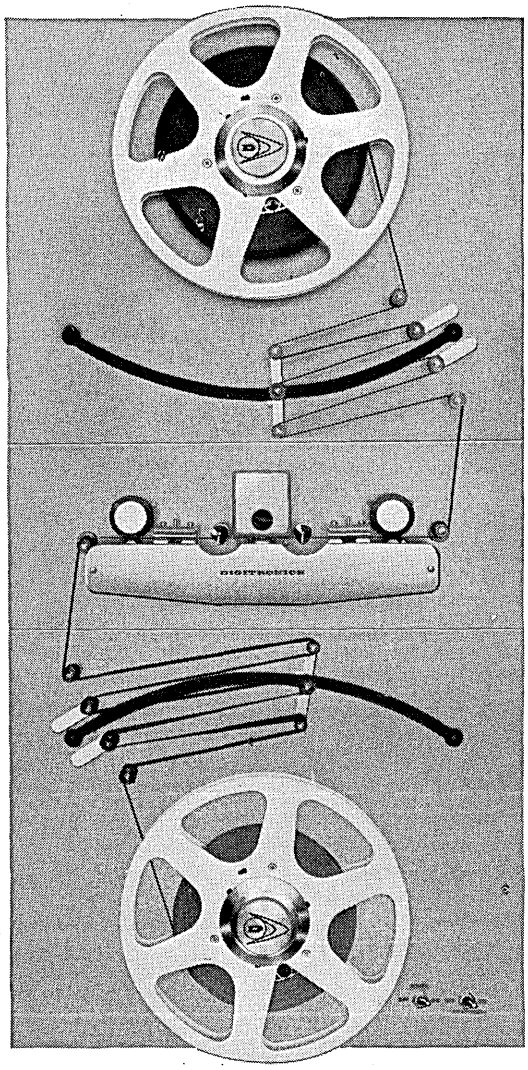
A pilot system for automatic postal check-handling has been developed by Standard Elektrik Lorenz AG (SEL), of Stuttgart, Germany (an associate of International Telephone and Telegraph Corp.), in cooperation with the German Posts, Telegraphs and Telephones (PTT) administration. The German postal check system comprises 13 banking centers with a total of some two million accounts and a volume of about three million documents per day.

There are many different modes of payment that the customer may choose and, accordingly, different kinds of documents. The four main types and their occurrence on the average are:

- 45% Postal order for paying at any post office and crediting to an account. Typical application: the "little" customer of utilities or mail order houses who does not have his own account.
- 40% Giro forms for the direct transfer from the consignor's (debitor) account to the consignee's (creditor) account. Typical customer: business organizations.
- 14% Cash payment orders and checks. The cash payment order is submitted by the consignor to his postal check center for debiting his account and cash payment to the consignee by the postman. Typical application: pension payment by the government and insurance companies.

The check is used for the same mode of payment. But it is handed over or mailed by the consignor directly to the consignee, for it is in general use. In addition, the check can be credited to the consignee's account on his request. Typical application: for direct personal payment or if the consignee's account number is not known.

Dr. Dietrich is team leader in the development of automatic reading machines for Standard Elektrik Lorenz AG in Stuttgart, Germany. He had previously served for several years as scientific assistant at the Technical University in Stuttgart, and commenced his duties at SEL with the development of production control and measuring devices.



Digitronics Model 6090 Tape Handler equipped with 10½" NAB reel operates at 1000 cps.

What's your handle?

Digitronics new tape handlers are designed to operate with 10½" NAB reels. Hardly any of that size around. They have twice the capacity of an 8" reel. Surprisingly, we've priced them to compare favorably with what you'd expect to pay for 8" reel equipment.

What else?

They go fast. Model 6090, with 10½" reels, whirs at a smart 1000 cps. And it is compatible with our high-speed reader, Model B3000.

Or they go slow. Model 6071, with 10½" reels, purrs at 300 cps. It is compatible with our low-speed readers, Models 2500 and B2500.

Some operate at in-between speeds. Model 6070, with 10½" reels, glides along at a brisk 500 cps. It is compatible with all of our high-speed readers.

Our 10½" reels spool up to 1300 feet of 5 to 8 level paper, paper mylar laminated and mylar tape, interchangeably.

We also have several 8" reel tape handlers. And, if you have a king-size volume of punched paper tape, say 3000 feet, we'll deliver a tape handler with a 16" NAB reel. It will go as fast as the punch that feeds it, or up to 300 cps with a reader.

No matter what your handle is, we have a quality tape handler (and tape reader) to fit your requirements. For complete information, contact your local Digitronics representative. Or, if you prefer, write direct to Digitronics Corporation, Albertson, New York or call Area Code 516, HT 4-1000.

DIGITRONICS

when every bit counts

CIRCLE 20 ON READER CARD

- 1% Other documents. There are more than a dozen slight modifications of the modes of payment mentioned (e.g., telegraphic transfer, telegraphic information of the consignee, etc.).

This variety of modes of payment stems from the fact that in the past only a few people had an account (see the postal order), and is maintained now as a customer service or convenience. It can be seen from the typical applications that each mode of payment has its special advantages for the customer. On the other hand, this variety causes additional organization problems. In other European countries, similar modes of payment exist.

As to printing and paper handling, considerable advantages exist, compared to American banking systems. Preprinting of the fixed data (account number) is done in the PTT's own letterpress printing shops, thus being under efficient control. The variable data (amount, date, destination) are imprinted only in the 13 centers, thus also being under control. In the future, only one document size (148 mm x 102 mm) and two different paper qualities (80 and 170 gr/m)[2] will be used. Since the documents are not so commonly used as a means for payment, they are in general not stored in the customer's pocket but in the office or at home. Therefore, they are kept rather clean and are seldom crumpled or creased.

the system

The basic functional diagram is shown in Fig. 1. The special modes of information processing depend on the different kinds of documents, which cannot be shown here.

The encoded documents (1) are fed into the reader/sorter (2) at random and booked on-line (that is, accounts are credited and/or debited while the document is travelling through the sorter from the reading station into the first mechanical gate). Hence, the computer is able to control the path of the document and to direct it into pockets corresponding to various criteria—e.g., "account overdrawn" . . . "to be credited at the foreign center" . . . "large local customer: special pocket" . . . "encoding error" . . . and others.

This computer-controlled, on-line concept allows the documents to be pre-sorted to a great extent in the first machine pass, reducing considerably the time of the digit-per-digit sort procedure. In addition, since the documents can be fed into the reader-sorter at random, more time is available for encoding the documents. Both factors help to balance the operator and machine-time schedule within a 12-hour working day. On the other hand, short access-time memories are required as account stores. Magnetic drums are used (4).

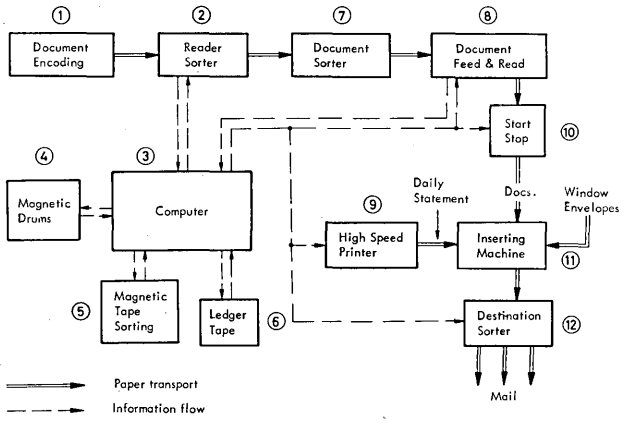
Then, the documents are sorted in a sequential account number order (7); simultaneously, the data are magnetic-tape-sorted in the same order (5).

In the last stage, the "enveloping phase," the documents are fed again (8) and batched by account (10). Simultaneously, the information is read again and checked against the ledger tape (6). If the check is correct, the high-speed printer (9) will produce the statement indicating the transactions, the balance, and the mail address. Since as many as 10 transactions may be imprinted on one statement, there is a heavy asynchronous operation between the machines, which is balanced by the start-stop track (10). The statement and documents are then inserted into an envelop (11) which in turn is sorted to five destination zones (12), ready to be mailed. (Further details of the system have been reported).[1]

character recognition

The optically-read type font CZ 13 is of the so-called bi-code mode and quite similar to that used by NCR for reading cash register tapes.[2] Fig. 2 shows the numerals and special symbols. The upper document is a sample of a giro form, with the meaning of the encoded information indicated. The lower document illustrates pitch, vertical misalignment and skew of the characters tolerated by the reading machine. The table below compares specifications of the CZ 13 and E13B type fonts.

Fig. 1



The SEL computer ER 56 (3) has 15 I/O channels, up to six parallel operations, and 3,600 (35-bit) words of core. The drum (4) has a capacity of 12,000 words, average access time of 10 msec. The tapes (5) have a capacity of 12 million words. The sorter (7) is an NCR unit with 12 pockets and a CZ 13 reader. The enveloping machine (11) is an SEL unit developed for banking applications.

	E 13 B	CZ 13
1. Type font		
2. Detection	magnetic	optical
3. Reading speed		
Docs./sec.	12.5 to 25	12.5
Chars./sec.	1250 to 3200	1500
4. Printing Materials	magnetic ink magnetic ribbon	normal black ink normal carbon tape
Character height (mm)	2.97	3.10
Stroke width (mm)	0.33; 0.66; 1.32	0.30
Tolerance (mm)	± 0.08	± 0.10
Vertical Misalignment (mm)	± 0.18 and 1.50	± 1.50
Character skew, max.	± 1.5°	± 2°
Pitch, chars./inch, max.	8	10

[1] K.-H. Klönne, "SEL-Versuchsanlage zur Automatisierung des deutschen Postscheckdienstes", SEL-Nachrichten, Heft 1, 1964.

[2] R. K. Gerlach, "Wide-tolerance optical character recognition for existing printing mechanisms", Optical Character Recognition, Spartan Books, Washington, 1962.

The reading speed of 1,500 characters per second, as quoted for CZ 13, is here limited only by the transport mechanism used in this installation; the reading circuitry itself allows a doubling of speed. This reading speed is high in comparison with other known optical reading methods used for document handling, and is achieved by scanning each character in a parallel manner with the aid of a vertical row of photodiodes.[3]

The vertical stroke elements contained in the shape of the characters are arranged in a top and a bottom set of five vertical elements each, in such a way, that each character differs from each other by at least two vertical stroke elements. This configuration allows for a simple, reliable, and low-cost reading machine.

Optical instead of magnetic ink character recognition is preferred in order to be able to deal with economic printing devices and normal inks. On the other hand, special attention must be given to possible interferences on the documents. Here the infrared—in addition to the visible range of the light waves—is efficiently used, based on the physical effect that most interferences (caused by, e.g., stamps, ball points, coloured pencils) appear fairly white in the infrared range and, therefore, do not interfere with printing inks which will absorb (i. e., appear black) in the infrared range too. This method will fail only when the interferences would show the same spectral behaviour as the printing inks. A typical example is the graphite pencil.

Fig. 2 illustrates the effect of the scanning method used: the dark blue office stamp shown on the document causes an electrical signal of about 12% of the magnitude of the printing ink signal, thus scarcely being above the general paper noise level and not affecting the recognition procedure.

Printing methods successfully experienced include: letterpress with normal black ink, the multi-purpose, widely automatic encoder shown in Fig. 3, some adding machines and electrical typewriters with carbon tape.

Although black ink silk or Nylon ribbon could be well used, the one-time carbon tape is preferred because it guarantees in the simplest way that the tape be changed in due time.

Fig. 2

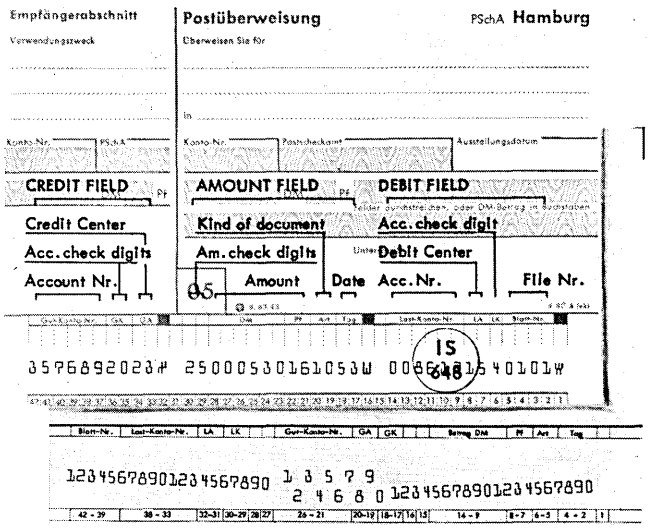
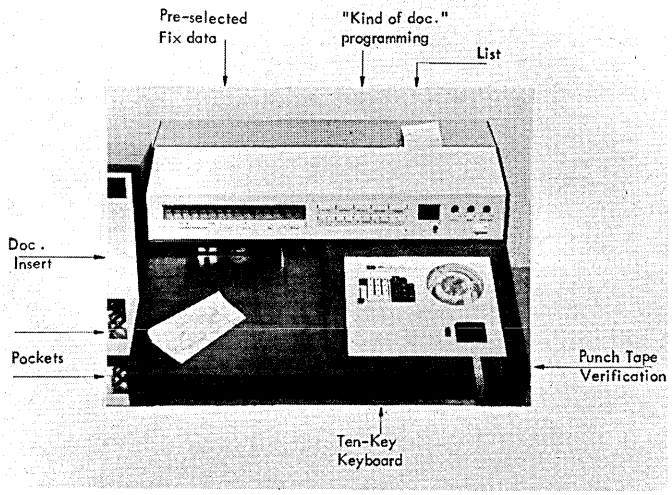


Fig. 3

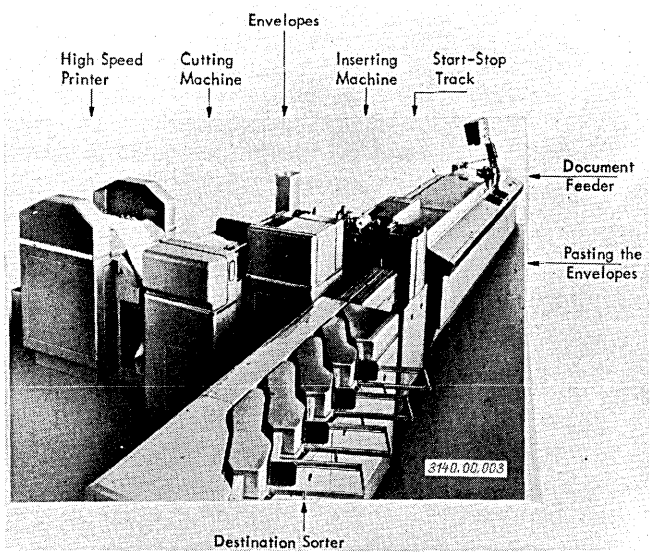


results

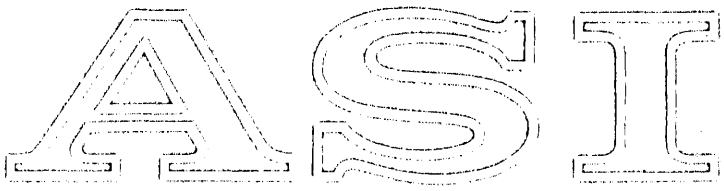
In order to find the character-recognition system (printer, sorter, reader) best suited in its application, the German PTT has conducted tests on the magnetic type fonts E13B and CMC 7 and the optical font CZ 13. Nearly two million documents have been imprinted and sorted on equipment from six different manufacturers. As an overall result, the reject and error rates for CZ 13 were approximately 10 times better than those obtained with the best E13B equipment. Detailed test conditions and failure analysis have been reported.[3, 4, 5]

The other parts of the system described have been tested at the different plants of SEL and are being installed in Nurnberg, Germany. The pilot system has a capacity of 20,000 accounts and is laid out to process 40,000 documents per day. ■

Fig. 4



[3] W. Dietrich, "Zeichenleser für die automatische Belegverarbeitung im Zahlungsverkehr," SEL-Nachrichten, Heft 1, 1964.
[4] W. de Beauclair, "Aus der Praxis der Datenverarbeitung, Teil III. Die Schrifttypen für maschinelles Lesen," Automatik, November 1963, pp. 437-441.
[5] "Magnetische und optische Zeichenerkennung im Zahlungsverkehr," Betriebswirtschaftliche Blätter für die Praxis der Sparkassen und Girozentralen, Heft 1, 1964.



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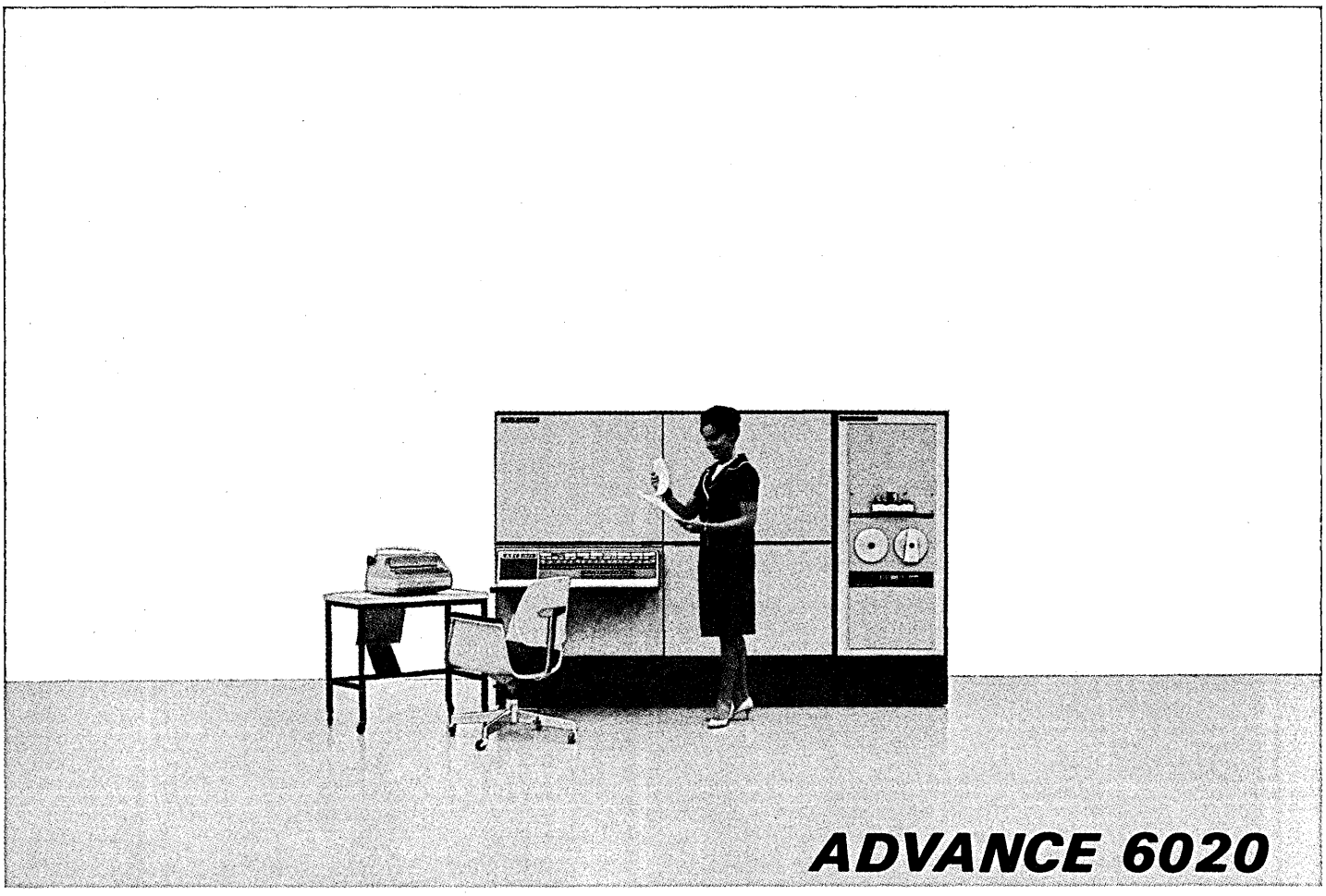
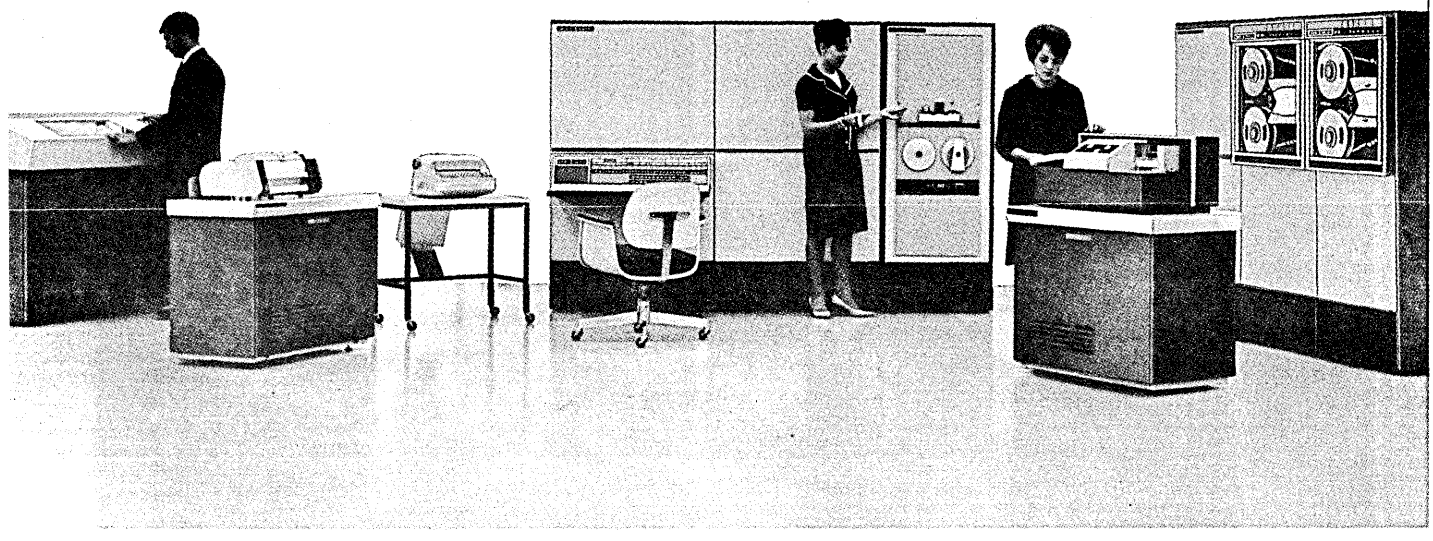


ADVANCE 6020

ADVANCE 6040



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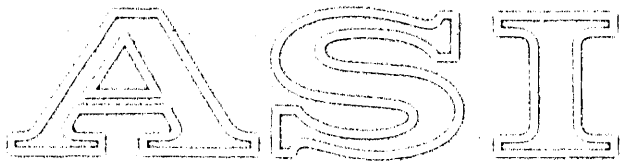

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THE SEAC

there was a machine

by IDA RHODES

Say it's weary, say it's slow,
Say that luxury ignored it,
Say it's growing old, but know
We all adored it.

SEAC was born on the wrong side of the tracks with only 11 commands and 512 storage registers, but in the hearts of its grateful users this prodigy has left a glowing spot that none of its opulent, sophisticated successors will ever dislodge. In fact, I often shed a tear for the *nouveau riche* programmer: a programmer who is unable to communicate with his machine in its own natural language, but must instead transmit his intent in the alien speech of the Court; a programmer who is denied the thrill of personally wielding a tremendously powerful, yet utterly compliant, tool; a programmer who is bereft of the mentally invigorating need ever to explore new means for squeezing a maximum of information into a minimum of storage space; a programmer who is deprived of the privilege to effect ameliorating changes in the structure of his machine.

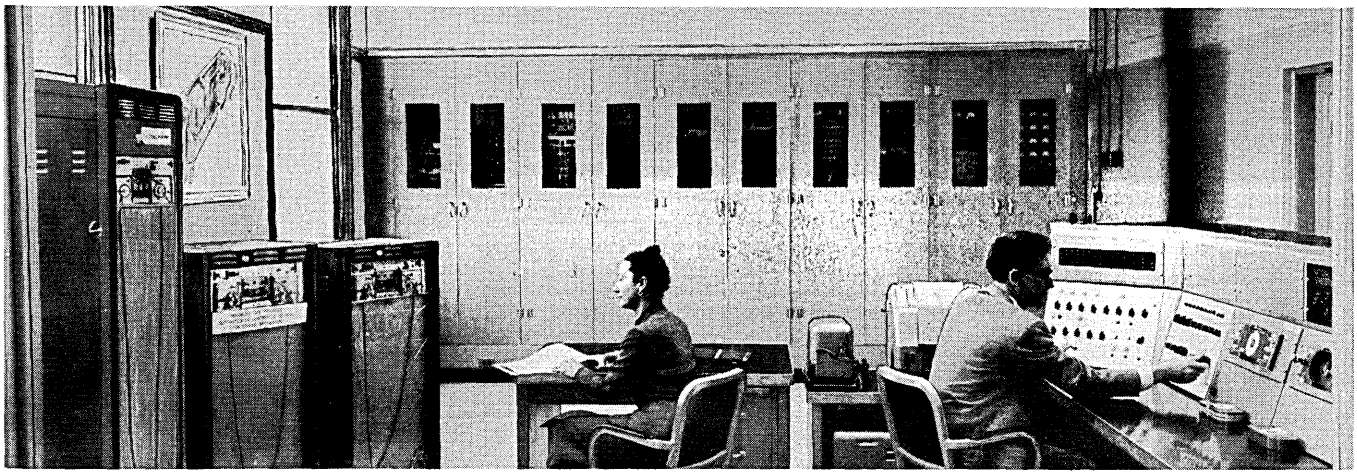
Ere future generations venture to sneer at SEAC's operational speed of one millisecond for addition and three for multiplication, let them ponder over those sweet uses of adversity from which the pioneers in electronic computation derived such huge benefits. SEAC's devotees could rightfully assert that it was the first device in this country to function with an automatically sequenced, internally stored program, but that claim would be based on a technicality. Much of its success must be credited to the advances made by previously conceived instruments, whose gestation periods were necessarily prolonged because of their higher degree of sophistication and more ample physical endowment. But we do claim with gusto that its features have been a source of ease and comfort to the tyro programmer and coder.

Take for example its four-address system, which in the early stages was SEAC's only mode of control. What could be a more natural bent for the coder than to direct the machine to perform a basic process on a pair of operands located at the first two addresses, to store the result at the third, and to look for the next command at the fourth? If it were found necessary to omit, or to alter the sequence of, a set of instructions, a readily effected change in the fourth address of a command or two would correct the routine at once. Additional aid was granted by the fact that SEAC needed only one command for reading into the storage, and again only one command to write out.

Humble SEAC's time was so inexpensive that the coder could frequently allow himself the luxury of code-checking and correcting his routine all in one run. Since each command bore a break-point bit, key instructions were usually coded with it. If a routine ran into trouble, a flick of a console switch caused the result of every such instruction to be printed out. In dire distress, the coder could, by a switch setting, automatically monitor the results of every consecutive operation. With what dignified silence has our noble SEAC borne the base canard that its mercury tanks were misbehaving—a pretense so often voiced by the human bungler as he resorted to that all-too-handy switch!

SEAC's users enjoyed a priceless boon in the constant presence of its creators. Not only did these magicians watch unceasingly over their brainchild, but graciously permitted us to offer suggestions, while they continuously introduced improvements that amazed and delighted us. The SEAC of today bears little resemblance to the immature fledgling of 1950; and as it grew and developed, so did the skill and confidence of the pioneer coder. That Spartan individual was never compelled to swallow the predigested pap prepared by the Higher Caste for the benefit of the Untouchables. He knew the precise location and function of every bit in his routine, and he learned to manipulate the computer with the same care and reverence that a dedicated musician accords the instrument of his choice.

Now that SEAC has passed into glorious history, let a tender tribute be recorded for posterity to this superbly diligent, faithful, and efficient servant that so frequently doubled as a serenely patient and exceedingly effective trainer. ■



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CRIME IN REAL-TIME

by PHINEAS FLACKMIRE, JR.

A distinguished government operations research team established to develop a real-time crime surveillance system — best known as operation RATFINK — has become the target of a vicious smear campaign. Following in the ill-fated footsteps of the CIA, Christine Keeler, STRETCH, and FORTRAN VI, RATFINK has become grist for every rumor mill between coffee klatch and cocktail hour. The pernicious nature of these attacks is apparent from even a moment's consideration of the facts vis-a-vis the pathological smears now in circulation:

Fact: *RATFINK has introduced a brilliant approach to quantifying the dollar impact of organized crime on our economy.*

Smear: *The whole thing's just a new way of dressing up statistical garbage for the lurid appetites of a sensation-hungry press.*

Fact: *Operation RATFINK is the first application of real-time inter-industry analysis to the problems of economic planning.*

Smear: *It's a desperate attempt by programmers and analysts to overthrow our democratic form of government through the subterfuge of computers and econometrics.*

Fact: *RATFINK is concerned only with seeking out and disseminating the truth, however unpopular that might be considered by the prevailing currents of public opinion.*

Smear: *The RATFINK Ratpack is only interested in building an empire founded on inter-industry grids and input-output matrices.*

We could go on distinguishing fact from smear ad infinitum. But having dealt with some of the more preposterous insinuations, let's go straight to the heart of the matter and put the entire affair into proper perspective. First, some background and credentials are in order. The RATFINK computer system is operated by the Bureau of Inter-Industrial Statistics and Multiple Regression Analysis (BISMRA), a quasi-governmental organization charged with the responsibility "to inform and advise legislative thinking in matters relating to economic policy." As the head of BISMRA, I am frequently criticized for generating unusable reports. And I must admit that our techniques are so complicated, our hardware so advanced that I seldom understand what we're doing either. But I can assure you that this has never stood in the way of an enthusiastic effort.

In the three years of our existence, BISMRA has been a prolific producer of computer-related advisory studies dealing with economic problems throughout the world. None of our reports attracted much popular interest, however, due conceivably to the fact that they went largely unread.

Then one day a junior programmer happened upon a statistical correlation between the stock market and some data he had abstracted from the police blotter. To his amazement, he found a nearly 1-to-1 positive correlation. As crime goes up, market prices go up.

This led to similar correlation studies between crime and other leading business indicators; e.g., steel ingot production, crude oil, bituminous coal, car loadings. Everything seemed to support the thesis that crime is one of the leading indicators for measuring the state of our economy.

Already rumors were beginning to circulate to the effect that we were using public monies to plead the cause of crime and violence. There was even some talk of a Congressional investigation.

These charges, of course, were utterly ridiculous in view of the fact that BISMRA never talked about crime as such . . . merely the form in which it existed. For example,

---

Phineas Flackmire Jr. is the nom de plume of a real non-real-time author of countless brochures and ads extolling the products and services of countable dp manufacturers and consultants. From these assignments it was a short, logical jump into the fantasy of the Ratfink Report.

we were the very first to introduce a scaling system to distinguish the various stages of crime from C_0 to C_9. C_0 indicates the primitive or infantile level of development. C_9 refers to the most advanced stage, characterized by a social hierarchy of strict status barriers for syndicate czars, gambling kingpins, forgers, conmen, gun molls . . . all the way down to hop heads and stool pigeons.

With echoes of corruption still in the air, word came down from the Hill that Operation RATFINK was to be top priority. We locked our target dates into a critical path schedule, hired every software consultant in sight, then ran off in all directions compiling meaningful data; e.g., total histories of business, commerce, industry, and crime in America; secret ledgers from the Mafia; the unexpurgated diaries of Al Capone; digested plots from old Bogart and Cagney films.

Then to satisfy the whims of several overpaid statisticians we included an on-line input of opinion sampling, depth probes, motivational research, wire-tapping and biomedical telemetering of data from random members of the criminal population.

When the hardware-software system was operational, we began to turn out copious quantities of statistical reports. A vast super-monitor controlled machine operations, sampling and directing the telemetering. A bristling arsenal of software manipulated, analyzed and printed out the data in matrices, charts and other report formats designed to reveal the inter-industry impact of crime.

One report, I thought, was particularly cogent. In it, we proved beyond statistical doubt that crime is the invisible bellwether of our entire economy. From the production of hard goods to soft goods, black sedans to pin stripe suits, we showed that crime is inextricably tied to the Gross National Product. Imagine my chagrin to find that this superlative report, along with all the others, was merely collecting dust in the sub-basement of the Capitol building.

Such was my dismay that I hardly recognized one of our softwear consultants when he stepped forward with a proposal for RATFINK. Having been a former adman before being defrocked by Madison Avenue, he emphasized the need for a gimmick to dramatize our message.

I couldn't think of anything better at the moment so I set about allocating several kilobucks worth of cathode tubes, luminescent screens, and all the surplus digital logic circuits I could get my hands on.

The defrocked adman, master conniver that he was, sought out a brilliant team of circuit design engineers who had been locked into a back room at IBM due to the radical nature of their hardware concepts.

When their design was finished, using plans dating back to 1960, we had a whiz-bang real-time system with multiple display screens conservatively described as generations ahead of their time. Throughput was close to the speed of light. Turnaround was negligible. Natural interrogation was accepted in both optical and auditory modes; the output was translated and displayed in terms that made sense even to a novice.

When the data first came streaming across the large, luminescent screens, I can only describe the experience as something akin to a religious conversion. Legislators who came to scoff at our new system stayed to become its loudest adherents.

I was well satisfied with the results we were getting, but the defrocked adman was pregnant with new ideas for upgrading the efficiency of the operating system. According to him, a gimmick by itself is of little value without an angle to exploit. The angle, in this case, turned out to be an heuristic program he had been working on since the day he became an outcast on Madison Avenue.

It all started out on a rather modest scale with a self-modifying routine somewhat comparable to the learning process. But somewhere along the line, the whole system picked up speed at an exponential pace. Before long, commands fed into the system were capable of sweeping across the data, recognizing and replacing errors, building new decision tables, creating new segments of program and information. The system went from the logical to the creative, then onward to self-control.

To be completely honest, I must report several erratic events during that period which have not yet been fully explained. First, no one has yet found out how to pull a plug and turn the machine off. Then, from time to time, some of the more recalcitrant Congressmen have been sucked into the photo reader and roughed up slightly. They would be the first to admit, however, the beneficial results to their way of thinking.

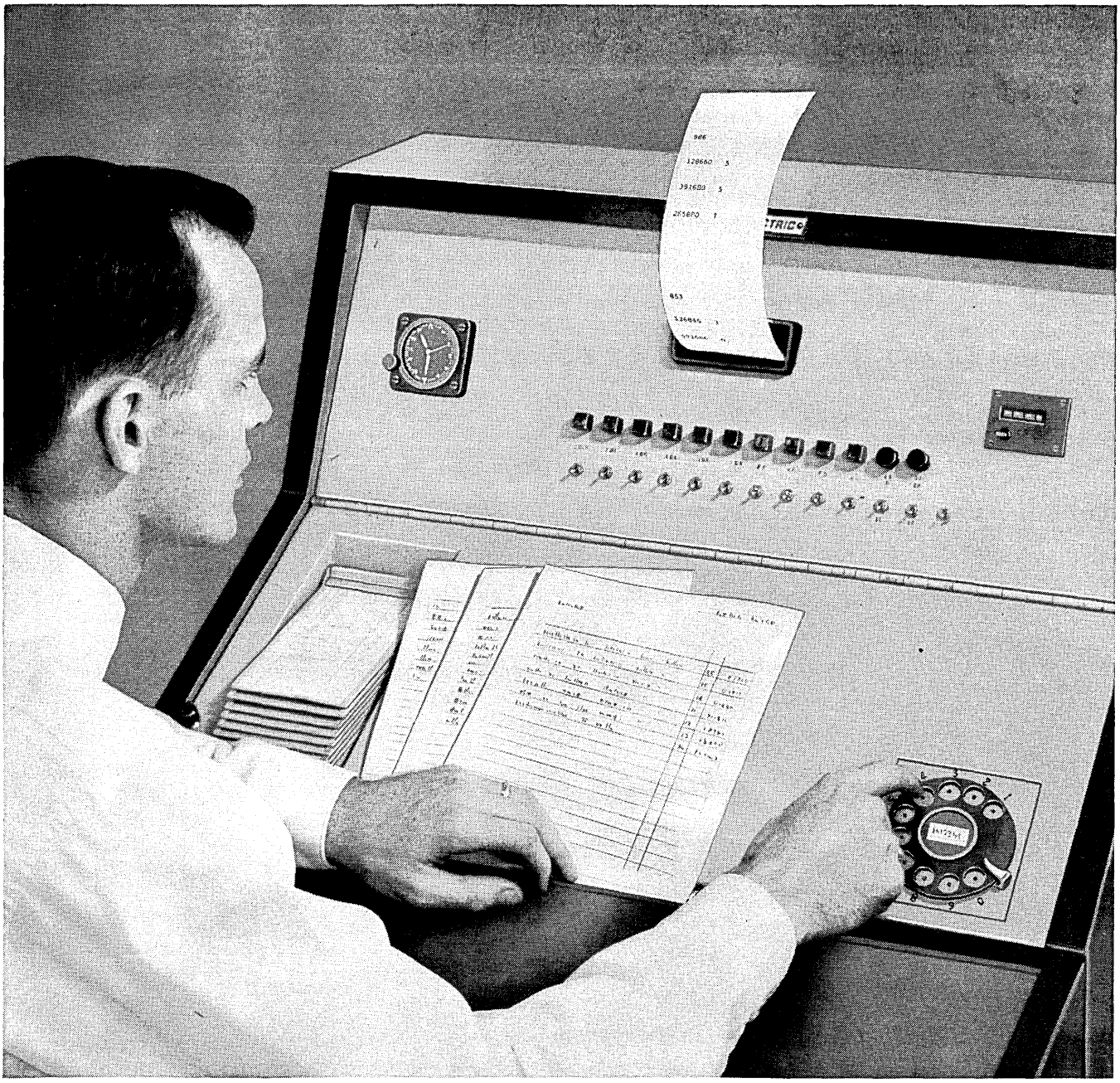
A combination of operant behavior mechanism and automated teaching machine, RATFINK was perfectly designed to get its message across fast, fast, fast. RATFINK provided proof positive that sudden cutbacks in crime could topple the rest of the economy like an avalanche of falling dominoes.

Armed with this truth, Congress decided to act. They immediately appointed a committee. And that committee immediately published a report, the salient articles of which may be summarized as follows:

- That our public posture regarding crime is based upon a mixture of mythology and myopia.
- That what's good for crime is good for business.
- That the market for bullet proof cars has been dropping steadily since 1936.
- That highly developed (C_9) crime invariably signals the more civilized, urbanized, better educated, more highly industrialized, and technological pace setters.
- That three-fourths of the world's population is forced to subsist at petty graft and black market (C_3) level of criminal organization.
- That the C_3 nations should emulate C_9 as a step toward independence from the domination of major economies.
- That our foreign aid is failing precisely because we show so little appreciation for the need of C_9 in the development of a viable economy.
- That in those rare cases where we have exported C_9 technicians, it has usually been to Europe where the tradition for criminal genius antedates our own by many centuries.
- That the United States is backsliding toward C_8, as evidenced by the comparatively few young hoods today who are willing to embark upon a career of organized crime as long as they can become engineers, doctors and programmers without compromising basic personality traits.
- That other nations of the world are losing respect for the crime index of this country. Khrushchev has even gone so far as to declare publicly that we are a full five years behind Russia.

As a result of this Congressional report, together with the continuing progress of BISMRA, some very encouraging trends are in the making. Public officials throughout the nation, for example, are beginning to speak out boldly, demanding to know who is accountable for the dangerous "crime gap" developing between the East and West.

This, of course, is only a beginning. Vicious rumors still cast a pall over our good intentions. So keep those contributions coming in, all you programmers out there in computerland. Make crime pay . . . or else! Think RATFINK. ■



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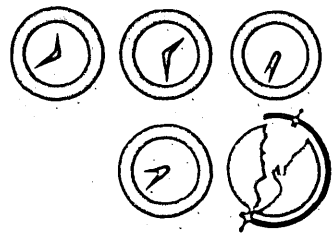


NEWS BRIEFS

1,326 COMPUTERS OPERATED BY FEDERAL GOVERNMENT

More than 400 IBM 1401's were in the service of your federal government at the end of fiscal '63 according to the 1964 *Inventory of ADP Equipment in the Federal Government,* recently released by BuBudget. Thus this model, alone, accounts for almost a third of the 1,326 computers installed at the time (June 30, 1963). Some 21% of all systems were purchased, 79% leased; anticipated percentage changes this year are 38.5-61.5%, respectively.

The Defense Dept. leads all other bit-worshipers with 815 systems installed; NASA runs a poor second with 153, followed by the AEC's 142. It is estimated that in FY-64, the DOD will spend $739 million for dp activities (hardware, personnel, etc.) and civilian agencies another $367 million. Copies of the report are available for $1 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

BURROUGHS SAYS B5500 WILL HAVE FORTRAN

The new B5500 computer announced last month by Burroughs Corp. will have FORTRAN II and FORTRAN IV, and it is understood that B5000 mainframes currently installed will be upgraded to the 5500. The latter reportedly has a three-fold increase in throughput capacity.

Memory cycle time has been cut from six to four usec, reducible to two usec with the fetch-overlap feature. The 5500 also has 19 new commands to increase the speed of the Master Control Program in the compilation and execution of programs. A typical two-processor system rents for about $35K, and sells for $1,473K. Deliveries will begin early next year.

CHECK-CASHING EASED BY COMPUTERIZED SYSTEM

Another move toward decreased reliance on cash by consumers has been instituted in southern California. Eleven banks and their branches and more than 1,500 retailers in Los Angeles and Orange counties have subscribed to a computerized system that certifies whether a personal check being cashed is covered by sufficient funds. (Some 85% of local bad checks are of the "not sufficient funds" and "account closed" variety).

Member banks are issuing plastic ID cards to holders of checking accounts. The number on this card, shown when cashing a check is phoned to Telecredit Inc., Los Angeles, by the retailer. Within four seconds, verification is received (signifying that the bank stands behind the check) and the amount is subtracted from the individual's "average monthly balance" which sets a limit to his check-cashing prowess. The system is also capable of detecting unusual buildup in account activity, and warns subsequent inquirers of this.

Telecredit continues its verifying system which uses the number on the driver's license of California residents, and thus has about 10 million names in its files. Cooperating with local police departments, the firm has participated in the apprehension of 1,750 bad-check passers in its 2½ years of operation, stopped 100,000 worthless checks, and approved two million good ones. The system is also being used by banks to determine whether to open a checking account for an individual. While the system is operating only locally, plans are to expand through the state and across the nation with an on-line interrogation capability. Present hardware is a dual IBM 305 RAMAC system.

NCR DEVISES CHEAPER LINK FOR ON-LINE BRANCH BANKS

Adapting the party-line telephone concept, the National Cash Register Co. has developed a communications monitoring system that allows several branch offices of a bank to share a single set of duplex voice-grade communication lines. It reportedly reduces by up to 50% the cost of data subset and line costs.

A remote controller at each branch scans up to 16 NCR teller machines for a message signal and transmits data through a line monitor, each serving as many as eight branch locations, at the computer center. As many as eight monitors can be used with a single buffer unit.

NCR has also announced four computer/software "packages" for handling bank checking accounts. Software for other bank applications will also be made available. Prices of the 315-150 series range from $212-276K, and rentals from $4.9-6.2K.

IN STANDARDS ARENA: ROUNDED CARDS, FLOWCHARTS

IBM, reportedly experiencing disappointing reaction to its rounded

CHICAGO STUDIES EFFECTS OF AUTOMATION ON BUSINESS

The creation of seven all-new, billion-dollar industries, and major changes in employment and technology in six current industries, are predicted for the Chicago area in what is perhaps the first major study of the effects of automation and technology on a metropolitan area. New industries anticipated are in vacuum technology, biomedical engineering, engineered materials, oceanography, space simulation electronic metalworking, and waste product control and utilization.

Present industries to be affected drastically are electrical, chemical, steel, printing, metalworking, and the office industries. All are expected to experience rising employment except for the electrical/electronics industries.

The two fields that have particular promise for Chicago, according to the report, are biomedical engineering and vacuum technology. The former, with current sales of $560 million, will grow to over $1.2 billion by 1970. And vacuum technology sales are expected to more than double in the next five years. The study urges stepped-up education and training on a national scale, based upon its finding.

Conducted by Corplan Assoc., a management-consultant affiliate of IIT Research Institute, the study was sponsored by numerous local firms, the city government, and the Ford Foundation.

NEWS BRIEFS . . .

corner punched cards, has won a large victory. The streamlined ducats have been accepted by the ASA committee for publication, which will be followed in six months by a final vote on its acceptance as a standard. Until then, there'll be much commotion.

Bankers are against the rounded card because the shaved material brings the edge intolerably close to their imprinted MICR characters in the lower right-hand corner. They'll probably move to have checks excluded from the standard.

Present outlook is for acceptance of the flowchart standard (already published) and the optical character set (yet to be published). The rounded-corner card is slated for September or October publication . . . final vote in February or at the May meeting.

● Following closely the U.S. Supreme Court's decision requiring reapportionment of state legislatures, the computer-redistricting of a state has been announced by Computer Applications Inc., New York City. The method was used to plot a new district alignment for New Jersey, one of six states ordered by the high court to redraw district lines so that the population of each is equal regardless of geographical area.

A task estimated to require 20 people at least four months, the job was completed in two weeks—and now will take 30 minutes for any other state. Graphic output is handled by an SC-4020.

● A $230K contract for the development of a machine-independent ALGOL translator has been awarded to Computer Sciences Corp., El Segundo, Calif., by the Defense Dept. The system reportedly will enable users to write and run programs for a variety of computers, including the IBM 7094, Univac 490, CDC 3600 and SDS 910.

● More than 30 Chicago-based contractors are reported to be using CPM for one or more of their projects at General Electric's service bureau in Chicago. The center is also monitoring construction projects on its GE-225 for contractors in Cleveland, Ohio, and in South Bend and Indianapolis, Ind.

● All-day computer-orientation seminars for students and teachers will be held during each day of the Fall Joint Computer Conference in San

Francisco, Oct. 27-29. Facilities to accommodate 400 will be available daily, and the wind-up session will cover the potential impact of computers on adult pursuits in the future. Classes will be held at the Del Webb Town House.

● The cost of redeeming state warrants will drop from $24 to $5.16 per thousand, according to the state of Iowa, which expects to save $65K annually by having local banks perform the bulk of the routine processing. Selected banks act as clearing houses for redeemed warrants, and turn over transaction tapes to the state treasurer. The master file is maintained by the state with a GE-225.

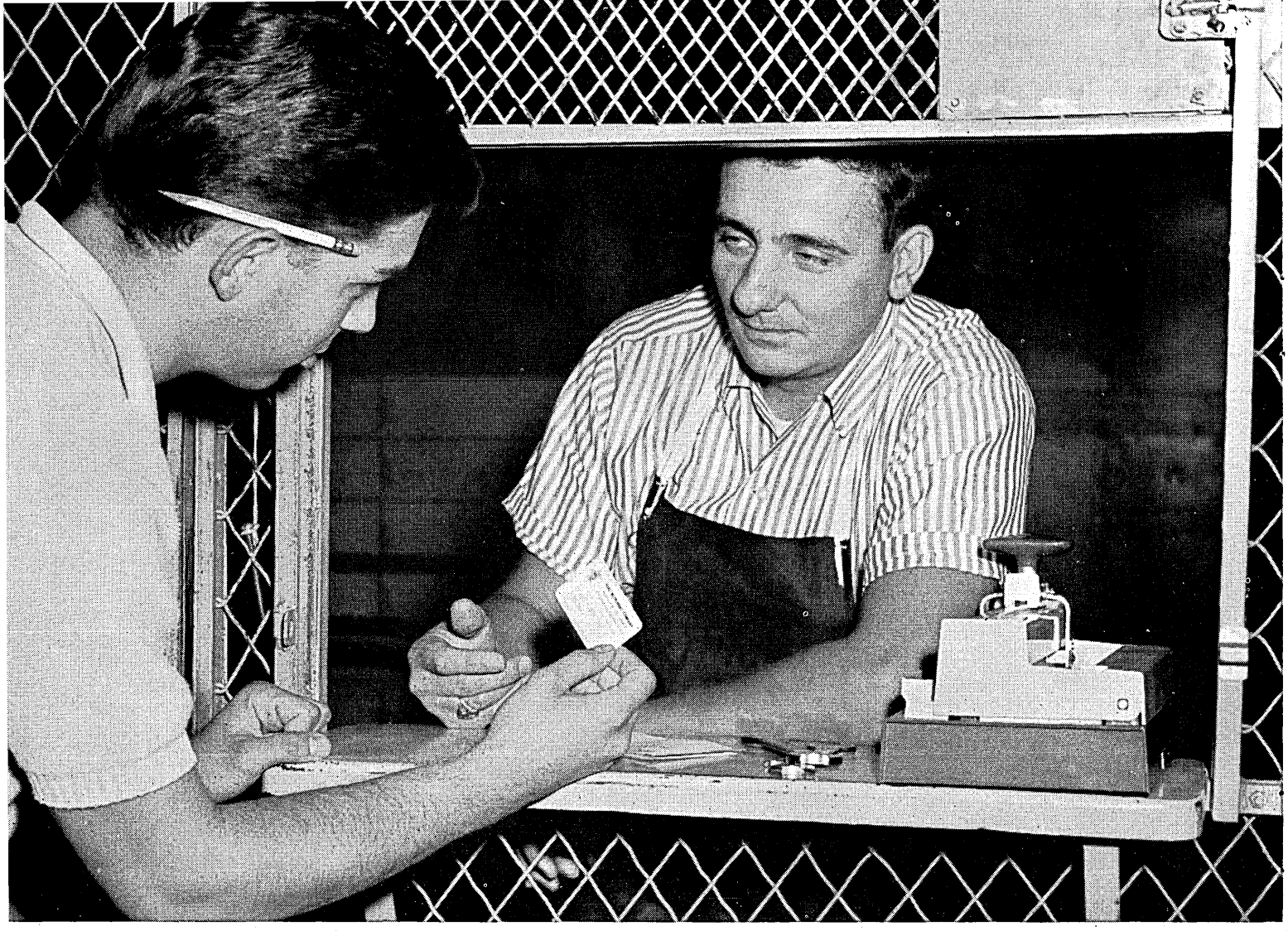
● An information retrieval system for engineers and technicians working on the Minuteman program is operational at the Boeing Co., Seattle. More than 300,000 items of equipment and document information are stored, and responses to queries are made in less than 24 hours. The system is built around an IBM 7080.

● A two-megabuck Apollo dp system, consisting of data recovery and data reduction subsystems, has been delivered to North American Aviation's Space & Information System Div., Downey, Calif., by Radiation Inc. of Melbourne, Fla. The system includes two digital computers.

● The Q-11 computer subsystem of the Air Force 473L command control system in the Pentagon was demonstrated recently by its maker, General Precision's Librascope Group, Glendale, Calif. The dual system, driving displays, updates data on AF functions going according to plan, but signals activities varying from the preprogrammed norm.

● A storage and retrieval system for the handling of autopsy records—eliminating the hand-coding to technical information, the one big objection to conventional systems of retrieval of pathological diagnoses—has been devised at Western Reserve Univ. Designers are Dr. Chandler Smith, assistant professor in the Pathology Dept., and Mrs. Jessica Melton, associate director of WRU's Center for Documentation and Communication Research.

● First export of a Japanese-built IBM computer is a 1400 for Constructora Delta y Cia Ltda., Guatemala's



Addressograph® tool crib methods improve quality control at Ford Instrument Company

Progressive management at Ford Instrument Company, Long Island City, New York, Division of Sperry Rand Corporation, and system engineers from A-M teamed together to create a highly successful tool crib operation. ■ Employees are issued plastic identification cards in five distinctive colors to determine employee tool withdrawal eligibility. Plastic tool data cards have replaced traditional brass tool checks. ■ With an Addressograph Data Recorder Model 12-80, a record of both the employee identification card and the tool data card are written simultaneously with each tool withdrawal. These records are used subsequently as a tool quality control check in meeting rigid manufacturing specifications. ■ This same Addressograph principle of recording both man and tool identification also provides a method of tool protection and accounting where government-owned tools are used. ■ To learn how you can simplify tool accounting in your tool crib operations, call or write your Addressograph representative. Addressograph Multigraph Corp., Dept. T-6501, 1200 Babbitt Road, Cleveland, Ohio 44117.

Addressograph Multigraph Corporation

CUTTING COSTS IS OUR BUSINESS

CIRCLE 27 ON READER CARD

largest real estate development company. Other shipments of 1440's from IBM Japan Ltd. are scheduled to Australia, Brazil, Hong Kong, Mexico, Peru, and Venezuela.

● A 15-megabuck multi-computer command control center, said to be the largest single dp installation in the Navy, has been installed by Control Data Corp., Minneapolis. Four 1604-A's and five 160-A's are among the 100-piece configuration. With a switching network developed by CDC, any of the mainframes can communicate with any other and with any of the peripheral units.

● Delivery of the first production model of its cartridge-type disc file with integrated circuits has been announced by Data Disc Inc., Palo Alto, Calif. Shipment is to Elliott Bros. Ltd., London, England. Data Disc has converted production lines from transistors to integrated circuits by Fairchild Semiconductor. Average access time of the unit, with a cartridge capacity of 12,000 IBM cards, is 200 msec.

● Specializing in transforming source data to computer-input form, Allied Data Production in New York City is jetting source documents to England, getting back cards or tapes, and claiming a 25-35% savings from the lower cost of British labour.

● Making another inroad in the aerospace market, Univac has shipped a 490 system to Lockheed-Georgia Co. in Marietta for a plant-wide, real-time information system. On-line will be more than 40 remote I/O units and two-billion characters of drum capacity. Initial applications will be material status and shop order location information.

● A simulation program that aids the study of proposed flood prevention measures on small watersheds has been developed for the U.S. Soil Conservation Service by CEIR Inc., Arlington, Va. The software determines the most vulnerable points in a watershed—those areas of a flood plain at which a river's banks would be most likely to overflow.

● With the addition of four more, RCA now has eight computers at its Wall St. service bureau, handling the paperwork for New York's financial community. The complement includes three 501's and five 301's in a $4.5 million center.

How long would it take us to show you the advantages of the new 315 RMC Rod Memory Computer?

About 800 billionths of a second.

Because its entire main memory is made up of thin wire rods plated with a magnetic thin film that permits cycle speeds of 800 nanoseconds (800 billionths of a second). That memory, incidentally, has a capacity of up to 240,000 digits.

Also available for this new 315 RMC — and all 315's — is a new line of faster and more efficient peripherals, such as: speedier tape drives (66 KC conversion of data from other computers and 120 KC for direct processing); a 1000 line-per-minute printer; a 250-cpm card punch; a data communications controller for "on-line" applications; built-in floating point arithmetic; new high capacity CRAM III (Card Random Access Memory) that has up to 16,000,000 characters of random access storage in each CRAM cartridge.

The 315 RMC is completely compatible with all existing 315 peripheral equipment. All 315 programs and software, including NEAT, COBOL and the recently announced program generator BEST may be run—as is.

Deliveries begin in mid-65. For more information about the versatile 315 family of computers (and, especially, the new 315 RMC), call your local NCR office. Or, write to NCR, Dayton, Ohio 45409.

NCR

BE SURE TO VISIT THE NCR PAVILION AT THE N.Y. WORLD'S FAIR

THE NATIONAL CASH REGISTER COMPANY ®

CIRCLE 29 ON READER CARD

NEWS BRIEFS . . .

● Alexandria, Va., is conducting a community-wide, at-home cardiac survey of its citizens, using a portable, battery-operated Honeywell electrocardiograph, DataPhone transmission, and a computer. The experimental study, the first on a large scale involving patients at home, is being made by the Alexandria Health Dept. and the U.S. Public Health Service's Heart Disease Control Program.

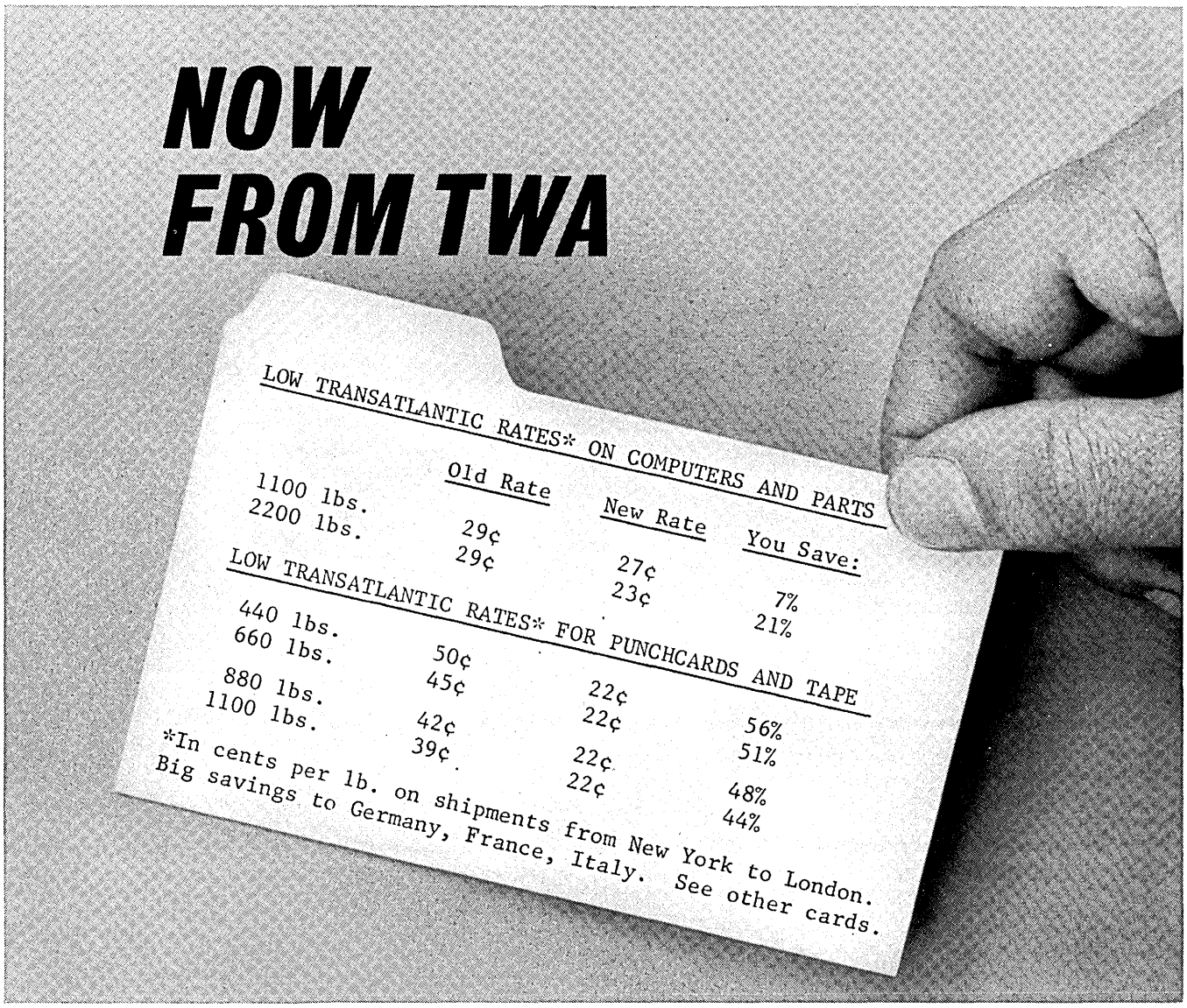
● An off-the-shelf programming system for the maintenance and reporting of stockholder records has been announced by Computer Sciences Corp., El Segundo, Calif. It is available to companies with more than 5,000 stockholders, and handles dividend calculation and payment, proxy notification and verification, reports to government agencies, stock transfers, and shareholder mailings.

● The first of three dual-RCA 301's has been installed as part of TWA's on-line reservation system. The Los Angeles system will be joined next year by centers in New York and Chicago—all three linked to a central inventory processor (by Teleregister Corp.) at Kennedy Airport. A fourth regional computer is scheduled abroad to handle international reservations offices.

● After field-testing since the beginning of the year, a Honeywell 1800 operating system is being released to users. It permits operation of all major H-1800 software systems and their object programs under control of the Admiral II monitor, and includes also Automath 1800 and the COBOL 800/1800.

● Raytheon is back in the computer business. The firm, which sold its share of Datamatics to Honeywell in '57 so it could concentrate on defense contracts, last month purchased Packard Bell's Computer Division. Raytheon says the re-entry decision was helped by these facts: the company is bigger and healthier now; defense business is no longer a growth proposition; they like the PB 440.

Present plans call for operation as is at PB's Santa Ana facility under a yet-to-be announced general manager. The computer activity will take its place in Raytheon's Space & Information Systems Division under James C. Elms. The savvy of Elms and the new computer manager were cited as prime reasons for Raytheon's faith in their ability to side-step the



File this card under "Profit"

Here's why. Lower rates make it more practical to ship delicate machinery to Europe by air. Jet speed reduces exposure to possible damage, lost productivity—eliminates the need for excessive packaging. Parts for established installations, punch cards, tape—just fill orders as they're needed and you'll reduce inventory investment.

Why TWA? Because only TWA offers you a one-airline supply line between 70 U.S. cities and 17 world centers in Europe, Africa and Asia. Because only TWA offers thru-plane jet freighters to and from all these markets abroad: London, Paris, Rome, Frankfurt, Zurich, Geneva. Call your agent, forwarder, or your nearest TWA Air Cargo office.

Send for new free booklet, "Electronics and TWA Jet Age Distribution." Prepared by distribution experts especially for your industry. Tells how you can save money on warehousing, inventories, insurance, inland freight, and more. Write: Mr. P. G. Yovanovitch, Vice President—Cargo Sales, Trans World Airlines, Inc., 605 Third Ave., New York, N.Y. 10016.

Nationwide
Worldwide
depend on TWA AIR CARGO

CIRCLE 31 ON READER CARD

News Briefs . . .

non-profit pitfalls which have derailed many a computer manufacturer . . . including Packard Bell.

● General Precision, Inc. has signed an agreement with Toko, Inc., Tokyo, to manufacturer, sell and distribute in the U.S. a new thin-film, woven-wire memory plane. GPI says the plane is in use in the Mark VI computer, developed by the Japanese government's Electro-Technical Laboratory, where it stores 4,096 bits in an area 2½ inches square.

● IBM says its new QUIKTRAN program will permit simultaneous operation of up to 40 different programs from remote locations. The program was developed for the running of FORTRAN programs on the 7040/44, linked through a 7740 communication control system to model 1050 remote terminals via telephone lines. Availability is scheduled for the first quarter of '65.

● Scientists at Argonne National Laboratories will use a GE-225 to reduce data concerning the effects of radiation on plant and animal life.

● New York University unveils its Systems Science Lab this month. Operated by the School of Engineering and Science, the lab will contain a PDP-7, displays and related gear, purchased with the aid of a $50,900 matching grant from NSF.

● Hope for future systems is indicated by a Post Office report on acceptance of its Zip Code. Postmaster General John A. Gronouski says that, after a year, 88 percent of more than 55,000 firms contacted are participating in the program "to some extent." And he adds, "Today 30 percent of the mail in our larger cities is ZIP coded and the rate . . . goes up to 60 percent in smaller communities."

● Herner & Co., Washington, D.C., is seeking information for the next edition of *Nonconventional Technical Information Systems in Current Use*, a publication they prepare under contract to the NSF.

● Simultaneous testing and recording of the alertness of up to five subjects is possible through Vigilometer, a new device developed by the National Bureau of Standards.

people IN DATAMATION

■ Dr. Grace M. Hopper, automatic programming pioneer, has been appointed staff scientist, systems programming, and Milton Bryce has been elevated to manager of systems programming information processing for Univac.

■ John O. Paivinen has been appointed general manager of Advanced Scientific Instruments, a division of Electro-Mechanical Research, Inc.

■ John W. Rudan has been named director of the Cornell University Computing Center, replacing Richard C. Lesser, who has joined the State University of New York.

■ Theodore H. Bonn, formerly chief engineer of research and peripheral development at Univac has joined Honeywell EDP as special assistant for research and development.

■ Fred W. Bauer, formerly product planning manager for Univac, has rejoined the product planning staff of Burroughs Corp. in Pasadena.

■ Norman H. Carter has been named vp in charge of management information systems administration for Union Bank (California). He was formerly with Lockheed Aircraft Corp.

■ Dr. Robert R. Johnson is the new corporate director of engineering, dp at Burroughs Corp.

■ The promotions of Dr. Munro K. Haynes to director of technology and engineering planning, and M. L. Lesser to the position of director of systems technology, corporate staff have been announced by IBM.

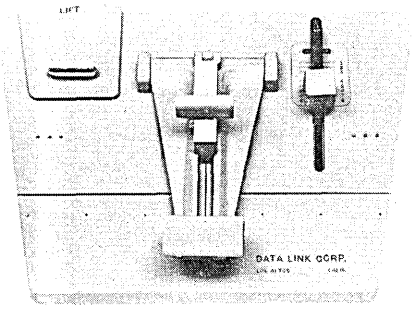
■ Burroughs Corp. vp Ken T. Bement has been elected president of Burroughs Business Machines Ltd., the Canadian subsidiary. He will succeed J. Louis Rapmund, who is retiring.

■ John C. Quinn, Jr. has been promoted to vp and general manager of Monroe dp service, a division of Litton Industries. Quinn succeeds Eugene F. Murphy, who has advanced to planning director of Litton's Business Equipment Group.

NEW PRODUCTS

paper tape repairs

Portable unit is a punched tape splicer, gauge, and punch that handles 5, 6, 7 and 8-level tapes. Butt or



overlap splices can be made without moving the tape. DATA-LINK CORP., 4546 El Camino Real, Los Altos, Calif. For information:

CIRCLE 200 ON READER CARD

gp computer

The 1108 is compatible with the 1107, has a memory cycle time of 750 nanoseconds, and 32-128K words of core. The control memory is composed of integrated circuits, and the machine is said to be five times faster than its compatible brother. UNIVAC DIV., SPERRY RAND CORP., Sperry Rand Bldg., New York, N.Y. For information:

CIRCLE 201 ON READER CARD

linear programming

ALPS is a linear programming software for users of the H-800/1800, and requires 16K words of core. Input can be cards or tape. HONEYWELL EDP., Wellesley Hills, Mass. For information:

CIRCLE 202 ON READER CARD

punched tape unit

The 6090 is a bidirectional handler for five- through eight-level tapes, paper or Mylar. Speed with 10½-inch NAB reels is 1,000 cps. DIGITRONICS CORP., Albertson, N.Y. For information:

CIRCLE 203 ON READER CARD

process control computer

The GE/PAC 4060 is a large-scale machine capable of operating in temperatures from 31 to 131°F without air conditioning. Storage is from 4-64K (24-bit) words of two and/or five-usec core, and 16-256K words on a drum. Add time with the faster cores is four usec, and there are up to 2,000 interrupts. Software includes FORTRAN II and a process assembler. GENERAL ELECTRIC PROCESS COMPUTER SECTION, Phoenix, Ariz. For information:

CIRCLE 204 ON READER CARD

typewriter/punch

The 5000 SDW produces paper tape or edge punched cards as a byproduct of typing source documents. Maximum keyboard speed is 25 cps, and tape regeneration speed is up to 50 cps. ROYAL McBEE CORP., New York, N.Y. For information:

CIRCLE 205 ON READER CARD

magnetic drums

Models D50, D500, and D5000 have capacities from 100,000 to 80-million bits phase modulation, in diameters from three to 18 inches and lengths of one to 36 inches. All diameters have 40 tracks/inch. Coating is nickel-cobalt plate, and heads are 0.0001-inch from surface, regardless of speed. MAGNE-HEAD DIV., GENERAL INSTRUMENT CORP., Hawthorne, Calif. For information:

CIRCLE 206 ON READER CARD

tape drive

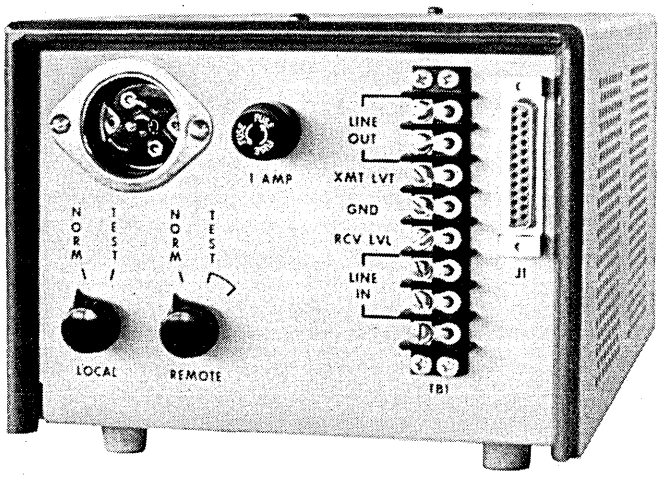
The 601 uses vacuum columns and photoelectric monitoring, runs mag tape at 37.5 ips. Recording densities are 200 and 556 bpi, and transfer rates are 7,500 and 20,850 cps. CONTROL DATA CORP., 8100 34th Ave. So., Minneapolis, Minn. For information:

CIRCLE 207 ON READER CARD

tape-to-tape converter

Off-line unit performs mag tape formatting and control functions, may also be linked to communications lines handling digital data. Input data source is a tape cartridge that re-

$400



New DATA PUMP upsets every idea you've ever had about data set cost

Originally, this high performance-low priced data set was designed by us for use in our own system. Since then so many users of data sets have asked us to make it available to them that we've gone into production.

Although the price is far below anything on the market today (and even lower for quantity orders), DATA PUMP performance is comparable to the best in its speed range (1,200 bits per second). We've proved this to ourselves by using it on our nationwide Stockmaster market information network. On the other hand, DATA PUMP's $400 price is so low for its performance we knew you'd insist that we prove it to you. To do this we've prepared a detailed brochure—"The Inside Story on DATA PUMP." Write for your copy today to Dept. 51.

ULTRONIC SYSTEMS CORPORATION

7300 N. Crescent Blvd., Pennsauken, New Jersey Tel. 609-NO 3-0712

CIRCLE 35 ON READER CARD

quires no threading. LUFKIN RESEARCH LABORATORIES INC., 210 W. 131 St., Los Angeles, Calif., 90061. For information:

CIRCLE 208 ON READER CARD

code translator

Model five converts any five-bit to any other five-bit code at rates from DC to 500 KPPS. Expansion allows eight to eight-bit conversion. Patchboard enables external programming, and unit has own power supply. INFORMATION STORAGE SYSTEMS INC., Pompton Lakes, N.J. For information:

CIRCLE 209 ON READER CARD

tape drives

The 660 has vacuum capstans and no vacuum columns, is the firm's first internal peripheral development. Bit densities are 200, 556, and 800 bpi, and respective transfer rates are 30, 83, and 120KC. GENERAL ELECTRIC COMPUTER DEPT., Phoenix, Ariz. For information:

CIRCLE 210 ON READER CARD

speech, data transmission

The 5249A is a panel which allows transmission of both data and speech over a single carrier channel or cable pair normally used for speech only. Separation between voice and data is better than 50 db. Unit is 1¾-inch high, fits 19-inch rack. LENKURT ELECTRIC CO. INC., 1105 County Rd., San Carlos, Calif. For information:

CIRCLE 211 ON READER CARD

cathode ray tube

The ETC M1192 is a single-gun unit with a round, seven-inch, optically flat faceplate with a useful scan area of 6½ inches. Center spot diameter is 25 mils at 13.5 KV (160 foot lambert) operation, approaches five mils at lower level brightness. ELECTRIC TUBE DIV., GENERAL ATRONICS CORP., 1200 E. Mermaid Lane, Philadelphia, Pa. For information:

CIRCLE 212 ON READER CARD

tabular cost curves

Cost improvement curve tables, computed on a 7090, are for application of cost control and cost projection techniques to procurement, planning, scheduling, budgeting and estimating functions. Six volumes cover range from 51-99% in increments of 1%, and both the straight line unit and straight line average curves are arranged in one presentation. Developed by Northrop Corp. WESTERN PERIODICALS CO., 13000 Raymer St., North Hollywood, Calif. For information:

CIRCLE 213 ON READER CARD

printer forms

Continuous stock forms are for the IBM 1443 printer. Sizes are 13⅝ x 11 inch and 16 x 11 inch, both available in one through eight parts. STANDARD REGISTER CO., Dayton, Ohio. For information:

CIRCLE 214 ON READER CARD

data terminal

The 8030 is a communications processor capable of operating with various peripheral devices, also performs media conversion tasks. CONTROL DATA CORP., 8100 34th Ave. So., Minneapolis, Minn. For information:

CIRCLE 215 ON READER CARD

storage tube

The 221 is a single-gun recording storage tube system for buffer storage or time-sharing display applications. It has an 800 Kc deflection bandwidth.

and resolution of 1,000 lines across the diameter of a stored picture. IMAGE INSTRUMENTS INC., 2300 Washington St., Newton Lower Falls, Mass. For information:
CIRCLE 216 ON READER CARD

instrument cart

Model A-462 has a 24½ x 19-inch top, six grounded outlets, four-inch casters, and truck lock. Options include shelf kit, blower cooling, removable hinged door at rear. ANETSBERGER BROS. INC., 180 No. Anets Dr., Northbrook, Ill. For information:
CIRCLE 217 ON READER CARD

core memory

The TCM-35 is a coincident current unit with 1.4 to two-usec full cycle, 1.2-usec maximum half cycle, and 750-nsec maximum access times. Capacity is up to 8K (up to 36-bit) words. COMPUTER CONTROL CO. INC., Old Connecticut Path, Framingham, Mass. For information:
CIRCLE 218 ON READER CARD

blip tracker

The Video Processor is an electronic radar watcher, replacing the human operator. Using digital computer techniques, it detects electrical impulses caused by a radar return, and notes a signal's strength and recurrence to determine a target's presence. SPERRY GYROSCOPE CO., Great Neck, N.Y. For information:
CIRCLE 219 ON READER CARD

drum memory

The IRM 216 has a capacity of two million characters (14 megabits) and an average access time of 7.5 msec. The drum, measuring 11 inches in diameter by 4½ inches, is reportedly replaceable in less than a minute. Each unit contains interface controller. ADVANCED MEMORY SYSTEMS INC., 1718 Barrington Ave., Los Angeles, Calif. For information:
CIRCLE 220 ON READER CARD

core stack

The FC 2001 has a switching speed of about 0.30 usec at moderate drive currents, and is for use in memories with a 2½-usec cycle time at 650 milliamp drive current. Other planes and stacks are for two, five, and seven-usec operation, have a capacity of 64 to 4096 (two to 64-bit) words. BURROUGHS ELECTRONIC COMPONENTS DIV., Plainfield, N.J. For information:
CIRCLE 221 ON READER CARD

tape container

For shipping or storing mag tapes, polystyrene boxes reportedly maintain near-room temperatures for more than two hours in extremes of −70° to +170F . . . for longer under lesser extremes. Each Memo-Foam holds five 10½-inch reels. MEMOREX CORP., 1180 Shulman Ave., Santa Clara, Calif. For information:
CIRCLE 222 ON READER CARD

display-driving disc

The 7-13 has one seven-inch disc with a capacity of 130,000 bits and an average access time of nine msec. The unit has high playback, low write current and low head inductance characteristics. Other configurations with up to four discs are available. COMPUTER MEMORIES CORP., 13432 Wyandotte St., North Hollywood, Calif. For information:
CIRCLE 223 ON READER CARD

high speed printer

The S-C 4400, a computer microfilm printer, capable of printing 62,500 alphanumeric characters per second, also translates digital signals into words, numbers and symbols. Output is recorded automatically, a page

at a time, on either 16mm or 35mm microfilm, coded for information retrieval systems. STROMBERG-CARLSON DIV., GENERAL DYNAMICS, San Diego, Calif. For information:

CIRCLE 224 ON READER CARD

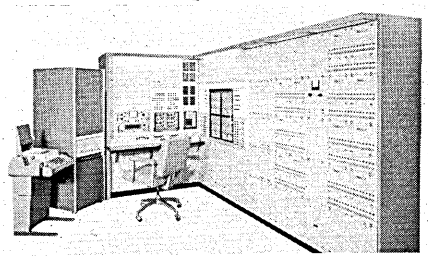
high speed forms cutter

BOWE 210 performs six basic cutting operations individually or in combination. Interchangeable circuit program card permit switching in seconds from one type form to another. AMERICAN PERMAC, INC., Merrick, N.Y. For information:

CIRCLE 225 ON READER CARD

digital analog control unit

High speed digital control unit for the AD-256 is provided by Digital



Equipment's PDP-5. Designated Stored Program Output Setup Equipment (SPOUSE), it features 4096-word random access core memory. APPLIED DYNAMICS, INC., Ann Arbor, Mich. For information:

CIRCLE 226 ON READER CARD

sort routine

Polyphase 3-tape sort routine (3SORT) for the IBM 1401's series uses four-tape configuration. It will process variable-size records, blocked or unblocked, with an n character sort key. The user need only specify the key size, and input and output buffer size in EQU statements to the 700-card source program—then assemble it to create the 150 card object deck that automatically exits to the next program. PHILIP HANKINS & CO, INC., Arlington, Mass. For information:

CIRCLE 227 ON READER CARD

perforator tape

"Mylar" reinforced, opaque perforator tapes include thickness from .0043″ to .0015″ ±, suitable for both photoelectric and electro-mechanical readers. Available in 11/16″, to 7/8″ and 1″ widths ±.003″, in a full range of standard colors to Fed. Std. "595"; wound on 2″ I.D. cores in measured lengths without splices. ARVEY CORP., Chicago, Ill. For information:

CIRCLE 228 ON READER CARD

binder cover

One-piece binder cover designed for binding marginal punched data processing surveys, reports, and summar-

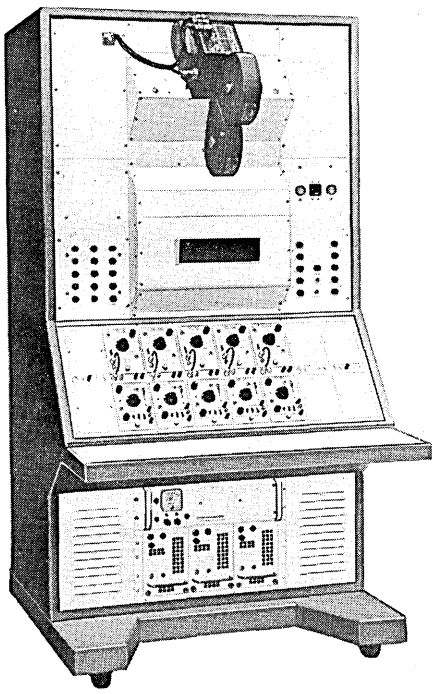
NEW PRODUCTS . . .

ies is available for most sheet sizes with a binding capacity up to ½". F. H. EBERSOLD INC., Chicago, Ill. For information:

CIRCLE 229 ON READER CARD

crt photographer

The 409A is a multi-channel photographic recording oscilloscope system for five-trace CRT presentations on continuous motion film. It uses a five-gun unstaggered CRT with a five-lens turret-beam splitter struc-

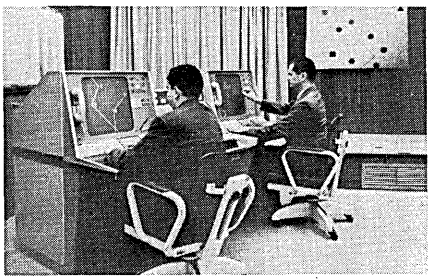


ture. DATA INSTRUMENTS DIV., WHITTAKER CORP., 9229 Sunset Blvd., Los Angeles, Calif., 90069. For information:

CIRCLE 230 ON READER CARD

display system

Dynamic Computer Display system (DCD) includes console and CRT. Desired information appears as black and white display on the face of the



tube and may be in the form of alphanumeric characters or symbols, charts and graphs or combinations of all elements. INTERNATIONAL TELEPHONE & TELEGRAPH CORP., New York, N.Y. For information:

CIRCLE 231 ON READER CARD

When reliability counts, count on MYLAR®!

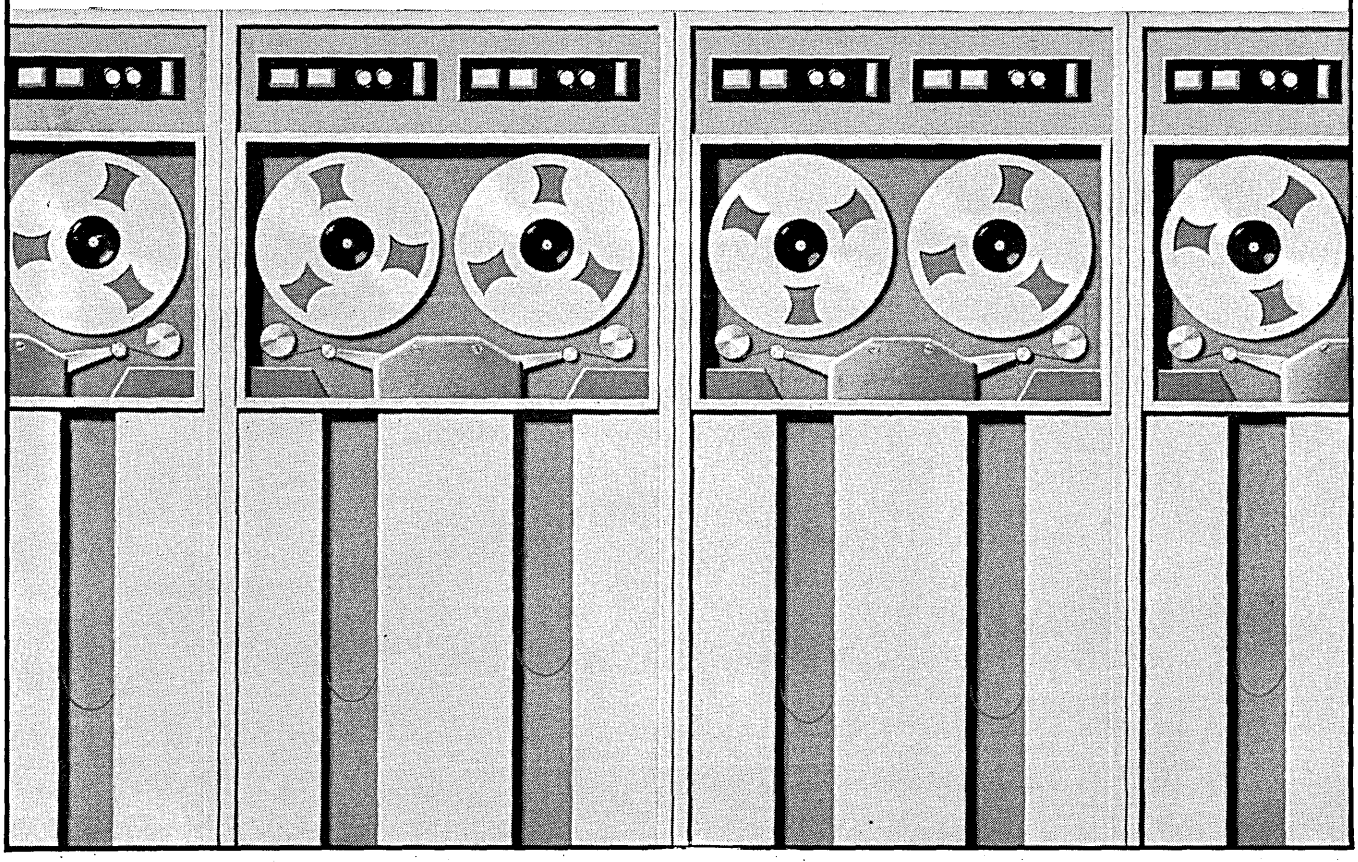
When you are recording or processing data, you want to be able to depend on your tape without worrying about it. If your tape is on a base of "Mylar"*—you can! "Mylar" is strong (a tensile strength of 20,000 psi). "Mylar" is stable (unaffected by temperature or humidity changes). "Mylar" is durable (no plasticizer to dry out or become brittle with age). "Mylar" is proven in use (a ten-year record of successful performance). When reliability counts, count on "Mylar".

*Du Pont's registered trademark for its polyester film.

DU PONT
REG. U. S. PAT. OFF.

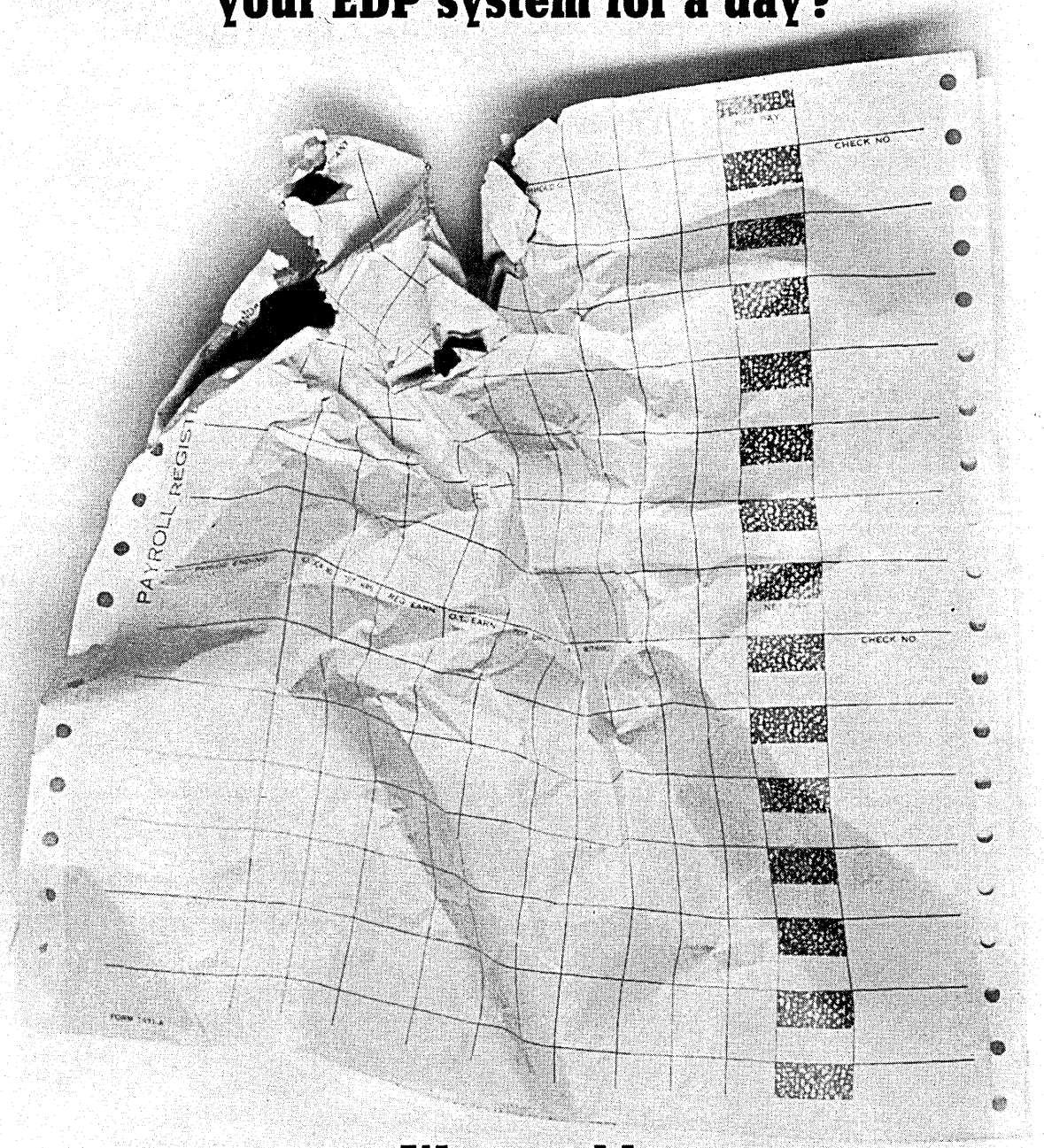
only DU PONT makes MYLAR® POLYESTER FILM

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



CIRCLE 40 ON READER CARD

Who'd have thought one perforation flaw could tie-up your EDP system for a day?



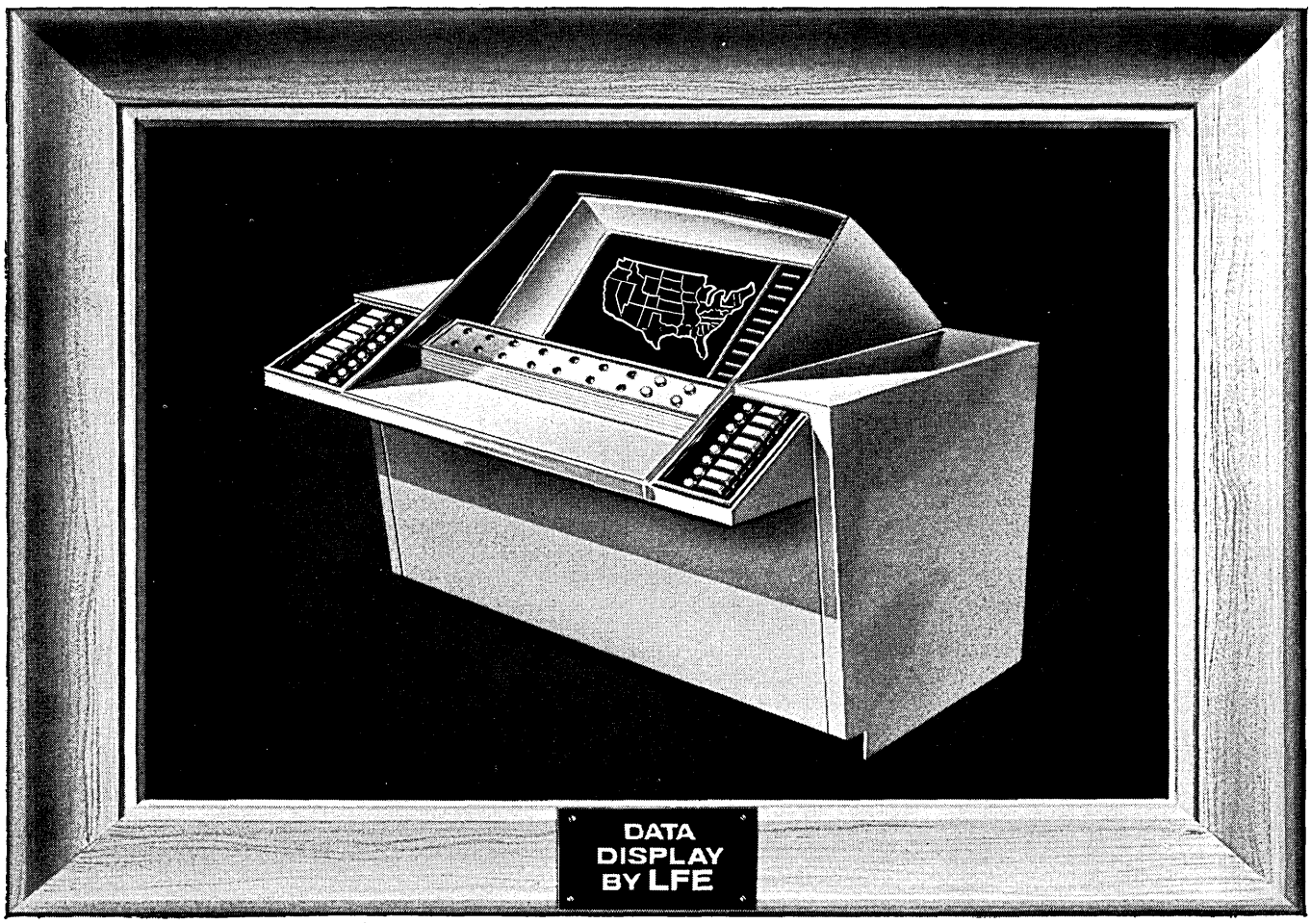
We would.

Because we've seen perfs separate when they were supposed to hold. And hold when they were supposed to separate. But that's because they weren't Machine Mated like those from Standard Register. Our forms (including the perfs) are designed for your system — as dictated by end use and subsequent handling operations. Tailored to meet the high-speed printer's requirements — and yours. Machine Mated forms cover the full range of sizes, plies, carbons and fastenings to give you consistent, trouble-free performance. No one can match the quality of Machine Mated forms. And we guarantee this quality in writing. (No one else does.) So tell us what type of EDP system you have. And we'll see that you get a free Machine Mated Forms Specification Chart to help you get more trouble-free work out of it. Just call our local representative or write us at Dayton, Ohio 45401.

MACHINE MATED™ FORMS BY STANDARD REGISTER

CIRCLE 41 ON READER CARD

ADVERTISERS' INDEX



Brightest picture in data display . . . in computer and data processing systems

for flicker-free display, flexibility, speed, capacity, reliability

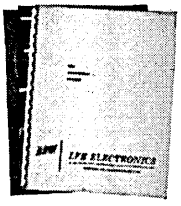
For systems engineers concerned with NOW — for instant display of digital data — LFE makes the finest, most sophisticated data display systems and modules. Here is modular construction designed to interface with your computer, data processing equipment or data link for high speed presentation of data in clear, bright, flicker-free images.

Alpha-numeric characters, arbitrary or abstract symbols, schematics, graphs, charts, maps — LFE Displays can handle them all. **Speed?** As many as 8,000 characters displayed at a time at 60 non-flickering frames per second — called at a touch, on a standard cathode ray tube.

This is possible because of the SM 2A Character Generator — a solid state unit which makes character strokes in .08 microseconds, 25 stroke characters at 500,000 characters per second. Plug in cards allow the changing of characters — simple resistor gating means anyone can change, design, and make characters.

LFE modules include 3" to 23" indicators, vector generators, background overlay projectors, rotary, core and delay-line memories, large group projectors, cursors, input/output logic, keyboards, hard copy units for ten second, full size copies, all elements to construct a display system for you. Most important, we can supply knowledgeable systems engineering.

Now in final development: even more advanced, all solid state display panels. Each one a real advance in the state-of-the-art.



Write now for full technical data.

LFE

INFORMATION SYSTEMS

LFE ELECTRONICS

A DIVISION OF LABORATORY FOR ELECTRONICS, INC.

1075 COMMONWEALTH AVENUE • BOSTON 15, MASS.

CIRCLE 42 ON READER CARD

Continued from page 19...

NEW DISPLAY FROM BUDD

A real-time, computer-driven, electro-optical display system which uses a CRT and photochromic material for a projection display unit has been developed by the Information Sciences Center of the Budd Co., McLean, Va. The center has developed the system in-house. It will be demonstrated at the SID show and will be marketed to government agencies. The system is capable of both alphanumeric and point and line plotting, using a projection light source independent of the CRT, and has no mechanical elements.

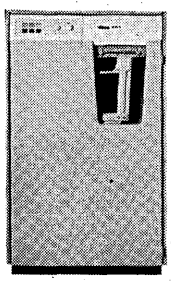
ARMY CONTRACT TO UNIVAC

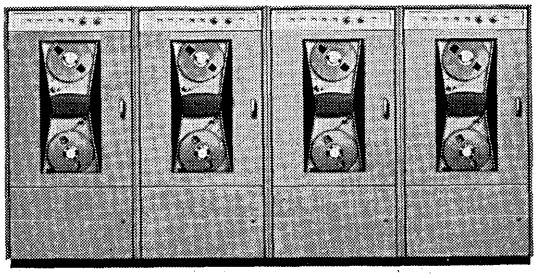
Univac has received a $2.7-million contract to computerize the Army War Room information system. Driving displays and plotters will be two Univac 1218 computers, acquiring, processing, and storing data from the Army's world-wide operation. June of 1965 is the target date for the full system operation.

RUMORS AND RAW RANDOM DATA

IBM has cut extra-shift rentals on its edp systems from 40% to 30% of first shift rates . . . and Honeywell is allowing total rental for the first two years to apply toward purchase instead of just first shift rental . . . Meanwhile, GE is offering a ''one-class-fare'' plan for its 600's — one price, no matter how many shifts the machine is used. . . Digitek stirred up fairly good interest at SHARE with its FORTRAN IV compiler announcement. One side effect: a rump session on copyrighting of programs. Consensus: it's a significant development. At the same SHARE meeting, the organization decided to open membership to all 360 mod 50-and-up users...That B 5500 FORTRAN will be a translator similar to a 11 translator which has been working effectively on 5000's in the field . . . Latest estimate of 1401's installed and on order: 13,000. ... An SDS 9300/92 & two Beckman 2200 analogs will form a hybrid to be installed at NASA Houston, after an initial warm-up by a temporary 920/2200 system which will then return to SDS for use as a training and demo system. . . . Look for Control Data to establish a subsidiary soon in South Africa . . . Fred Brooks, one of the key members of the 360 development team, is leaving IBM to head up the Univ. of North Carolina's info processing dept. Professor Brooks will work part-time at IBM this coming academic year. . . . The Univ. of New South Wales (Australia) has ordered a 360. ... A peripheral-gear manufacturer will enter the mass random-access memory race soon. . . . The Third Australian Computer Conference (May '66) is looking for good papers. For info contact Datamation editorial offices. . . . The Data Transmission Group will hold a November meeting to review current and blue sky gear for data collection, conversion, storage & retrieval, display and transmission. Secretary of the group is Gus Perlman, Innovation/Development, Pacific Palisades, Calif. . . . Add to the confusing list of edp titles: ''Systems Coordinator.'' The state of Oregon will pay $915-1110 for a good one. . . . Newest definition of an elephant: a mouse built to military specs. . . . Two independently ''computed'' estimates agree: some $67-million/year is now being spent on programming research.

Why use one CRAM unit for linear programming?





(Four or five magnetic tape files will do the job almost as well.)

It's true. There are other general-purpose computers which can solve both your business and scientific problems. But the NCR 315 can meet your Linear Programming needs with just one magnetic card file (CRAM). Other systems can require as many as five magnetic tape files to equal CRAM'S speed in coping with linear program parameters. (300 constraints; up to 1500 variables)

Why? Because CRAM's random access capabilities enable the programmer to bring variables into main memory instantly—without the many lengthy tape searches required with conventional tape-drives.

Whatever your primary need for a computer, check the advantages of NCR Linear Programming. It has solved such diverse management problems as cut and trim in paper box construction, the most economical blend for sausage, and the most efficient route for ships carrying cargo from port to port. For a general-purpose computer to handle both your business and scientific problems, you'll like the NCR 315 with CRAM.

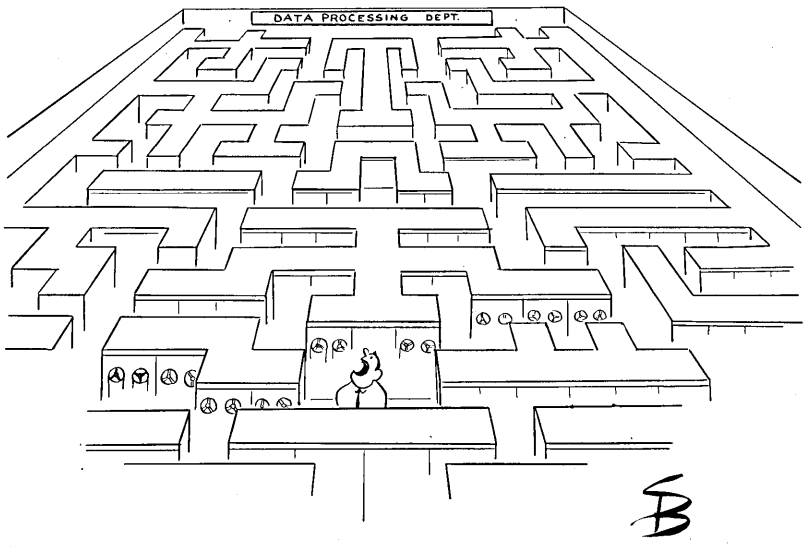
You can obtain complete details from your local NCR representative. Or write to NCR, Dayton, Ohio 45409.

NCR

BE SURE TO VISIT THE NCR PAVILION AT THE NEW YORK WORLD'S FAIR.

THE NATIONAL CASH REGISTER COMPANY ®

CIRCLE 43 ON READER CARD



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A complete and comprehensive listing of outstanding positions, at salaries from $6,000 to $30,000 with over 300 select East Coast Companies from Maine to Florida in the field of:

DATA PROCESSING

Our professional staff combines Customized Service with technical know how to insure for you maximum career development in the following areas:

- MATH ANALYSIS
- PROGRAMMING
- OPERATIONS RESEARCH
- LOGIC DESIGN
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- SYSTEMS DESIGN
- INFORMATION RETRIEVAL
- COMPUTER SALES ENGINEERS

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ELECTRICAL ENGINEERS

Melpar's expanding Advanced Computer Laboratory has senior and intermediate level openings for Electrical Engineers having backgrounds and interests in the following areas:

Systems Design

Development and analysis of complete digital computer system requirements for command and control applications. Requirements include experience in the analysis of real-time man-machine systems.

Programming

Symbolic and machine language programming of real-time computer-controlled man-machine systems. Requirements include experience on CDC 160, CDC 160A, DDP 24, PB 250, PB 440, SDS 910, or SDS 920 series equipments.

Logic Design

Design, development, and system integration of interface and special-purpose computer equipments. Requirements include experience with solid-state digital logic circuits and computer interface equipments.

Machine Intelligence

Formulation and analysis of adaptive logic and pattern recognition systems based on biological prototypes. Requirements include advanced degree and three or more years of experience in these or related fields.

For further details write in confidence to:

MANAGER, Professional Placement

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Falls Church, Virginia
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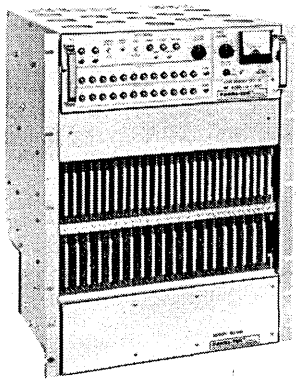
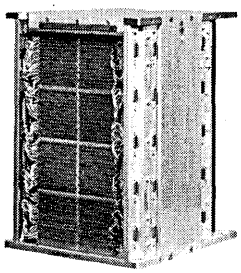
an equal opportunity employer

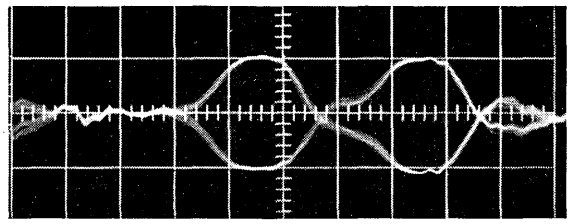
CIRCLE 78 ON READER CARD

1,500,000-bit "scratch pad"?

Here's a Fabri-Tek memory system approaching "scratch pad" speed but with full memory capacity. It has a 1-usec cycle time and a 450-nsec access time. Coincident-current memory organization takes advantage of all the component economies inherent in this type of system. All silicon semiconductors plus the well-known Fabri-Tek maintenance features result in exceptional reliability and maintenance ease. The Fabri-Tek HIPAC stack is one of the reasons for the high speed and wide operational margins of this system. HIPAC stack density and circuit design result in much higher switching speeds at moderate drive currents. Delay per bit is phenomenally low (approx. 10 psec.). This oscillogram shows all 1's being read and restored. Scale is .1 usec per division. With this new Fabri-Tek Series MF 1-usec Memory System you can do anything you're doing now — but do it faster and more economically! For Radar data processing — cut down the number of components and solve real-time problems with greater savings in time and equipment. Where computer time is money — get more for your dollar! For more information on the Fabri-Tek Series MF 1-usec Memory System, phone, write, or wire Robert E. Rife, Fabri-Tek Incorporated, Amery, Wisconsin. Congress 8-7155 (Area 715), TWX: 715-292-0900.

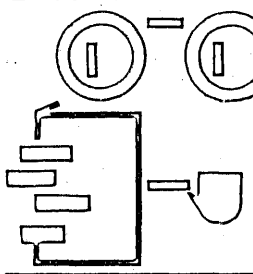






FABRI-TEK®

CIRCLE 44 ON READER CARD



NEW LITERATURE

PROGRAMMING SYSTEM: Booklet describes technique designed for NCR 315 and gives six steps in setting up a program. NATIONAL CASH REGISTER CO., Dayton, Ohio. For copy:

CIRCLE 130 ON READER CARD

RESEARCH REPORT: "Automation of Library Circulation Records," explains 1401 system which eliminates manual files. Available for $.50. OFFICE OF TECHNICAL SERVICES, U.S. DEPT. OF COMMERCE, Wash., D.C. 20230.

SOFTWARE: Two 28-page bulletins are available. One describes the EASY-TRAN symbolic language; the other, TIPTOP II, describes the H200 ¾ inch mag tape I/O software. HONEYWELL EDP, 60 Walnut St., Wellesley Hills, Mass. For copy:

CIRCLE 131 ON READER CARD

MAILING COSTS: 12-page booklet shows how costs can be reduced by using dp. Photos show how address data can be stored, retrieved and printed out onto wide forms across in horizontal sequence for automatic imprinting. CHESHIRE, INC., Mundelein, Ill. For copy:

CIRCLE 132 ON READER CARD

MESSAGE SWITCHING: Principle elements and operations of CDC 8050 are outlined. CONTROL DATA CORP., 8100 34th Ave. South, Minneapolis, Minn. For copy:

CIRCLE 133 ON READER CARD

GOV'T REPORT: "Toward Better Utilization of Scientific and Engineering Talent, a Program of Action" is the result of a two-year study conducted by privately supported, non-government committee. NATIONAL ACADEMY OF SCIENCES, 2101 Constitution Ave., Wash., D. C. For copy:

CIRCLE 134 ON READER CARD

COMPACT COMPUTER: Performance, organization, console, machine language and peripheral equipment of DSI 1000 are outlined in 12-page brochure. DATA SYSTEMS, INC. 20535 Mack Ave., Grosse Pointe Woods, Mich. For copy:

CIRCLE 135 ON READER CARD

TYPESETTING GLOSSARY: Written in layman's language, 50-page book includes more than 400 descriptions of modern typesetting terms. Available for $7.50. COMPOSITION INFORMATION SERVICES, Director, 1605 N. Cahuenga Blvd., Los Angeles, Calif.

MEMORY SYSTEMS: Bulletin contains features and specifications of 52.05 and 52.06 memory systems and comprehensive block diagram and description of the logic circuitry. FERROXCUBE, Saugerties, N.Y. For copy:

CIRCLE 136 ON READER CARD

FIRE PROTECTION: 30-page book gives revised standard for protection of computers. Available for $.60. NATIONAL FIRE PROTECTION ASSN., 60 Batterymarch St., Boston, Mass. 02110.

TAPE READERS: Rack mounted units, designed for simple installation or original equipment where automatically programmed operation is required, are described. ROYAL McBEE CORP., 150 New Park Ave., Hartford, Conn. For copy:

CIRCLE 137 ON READER CARD

USED COMPUTERS: Reprints available on the development of the market, its effect on computer upgrading and replacement policies and lease-purchase decisions by major corporations. INFORMATION PROCESSING SYSTEMS, INC., 200 W. 57 St., New York. For copy:

CIRCLE 138 ON READER CARD

PAYROLL PLAN: Six-page folder describes computer service for automatic payroll preparation. RESEARCH CALCULATIONS, 200 Boylston St., Chestnut Hill, Mass. For copy:

CIRCLE 139 ON READER CARD

NEW LITERATURE . . .

DESK-SIZE COMPUTER: Key specification features, operation codes, description of general uses and prices of HW-15K are discussed in 6-page catalog. H-W ELECTRONICS, INC. 14 Huron Dr., Natick, Mass. For copy:
CIRCLE 140 ON READER CARD

TELETYPE EQUIPMENT: Models 32, 33 and 35 and Telespeed 1,050 wpm tape-to-tape sets and their applications are discussed in non-technical pamphlet. TELETYPE CORP., 5555 Touhy Ave., Skokie, Ill. For copy:
CIRCLE 141 ON READER CARD

TECHNICAL BOOKS: 92-page catalog describes books in fields including operational research and programming. Gives brief descriptions, contents, prices and ordering information. ADDISON-WESLEY PUBLISHING CO., INC. Reading, Mass. For copy:
CIRCLE 142 ON READER CARD

DO-IT-YOURSELF: 24-page catalog describes manuals, courses and kits for circuit design, network analysis, programming and displays. TESLA RESEARCH FOUNDATION, P.O. Box 11275, Phoenix, Ariz. For copy:
CIRCLE 143 ON READER CARD

COURSES: Catalog lists summer courses and schedules up to Sept. 30, 1964, for the Institute of Advanced Technology. C-E-I-R, INC., 1 Farragut Square, S., Wash., D.C. For copy:
CIRCLE 144 ON READER CARD

ANALOG COMPUTER: Booklet describes desk-top machine which solves up to nine simultaneous linear questions through iterative technique plus oscilloscope display. The computer gives an accuracy of 0.2 percent for solution of the major variable. DP-846 is available for $.50 from OFFICE OF TECHNICAL SERVICES, U.S. DEPT. OF COMMERCE, Washington D.C. 20230.

TRANSMISSION TERMINALS: Features of the 8030 terminals—including mag tape, printer, typewriter, card read/punch units, and the 8092 Teleprogrammer (control center) are described in four-pager. CONTROL DATA CORP., 8100 34th Ave. So., Minneapolis, Minn. For copy:
CIRCLE 146 ON READER CARD

EDP SYSTEMS: 24-page booklet describes operating specifications, features, configurations of 301 systems. RCA ELECTRONIC DATA PROCESSING, RCA-Cherry Hill, Camden, N.J. For copy:
CIRCLE 147 ON READER CARD

SORTER: Model 1500 electronic data sorter is described in six-page brochure. ASTRODATA, INC., 240 E. Palais Rd., Anaheim, Calif. For copy:
CIRCLE 148 ON READER CARD

NUMERICAL CONTROLS: 12-page brochure describes two two-axis and three-axis NC-220 series of control systems adaptable to many types of machine tools, and said to be compatible with NAS 943 specifications. HUGHES AIRCRAFT CO., INDUSTRIAL SYSTEMS DIV., P.O. Box 90904, L.A., Calif. For copy:
CIRCLE 149 ON READER CARD

PERT COST: Introductory text describes management computer-centered tool for preparation of project schedules and costs. *An Introduction to PERT Cost*, AD 600 184, is available for $2.75 from U.S. DEPT. OF COMMERCE, Washington, D.C. 20230.

in London

COMPUTER TYPE-SETTING CON-FERENCE

The virtually unlimited potential of computers in the printing and publishing industry commanded the interests of delegates in an unprecedented fashion in the first world-wide computer typesetting conference held July 6-9 at London University, sponsored by the Institute of Printing Limited.

More than 275 delegates attended from 20 countries, including 15 Americans, and a large group representing manufacturers of computers and peripheral equipment from the U.S., England and France.

The London Conference confirmed *beyond doubt* that automatic typesetting by computer programing is inevitable and offers revolutionary opportunities for a better, faster and more economically produced end product.

Wide-ranging technical problems remain, conference discussions disclosed. The need for universal codes, tapes and machine language is obvious. The human element concerning union attitudes and job retraining must be resolved. Yet, not the slightest doubt exists whether the printing industry *should* integrate computer typesetting systems into its plants. Printers *must* find ways to use computers to their advantage or face a real danger that composition will be taken away from them. The burning question is *how* to go about it.

For one thing, computers will radically alter, if not erase, traditional systems of reproduction, since a computer is not *patched* into an existing

system; rather a system entirely new in concept must be structured *around* the computer.

Successful computerized typesetting techniques have been relatively few in number. In use are several justification and simple hyphenation systems satisfactory for newspapers, but not sufficiently sophisticated for book composition. Computer printout speeds of 8-10 lines/per/second are practicable, but below graphic arts quality and versatility. Computer programs for printers are virtually non-existent. No book has been set successfully by computerized composition techniques. On-line computer typesetting equipment is a long way off. No off-line computer typesetting equipment will be available for delivery in less than two years.

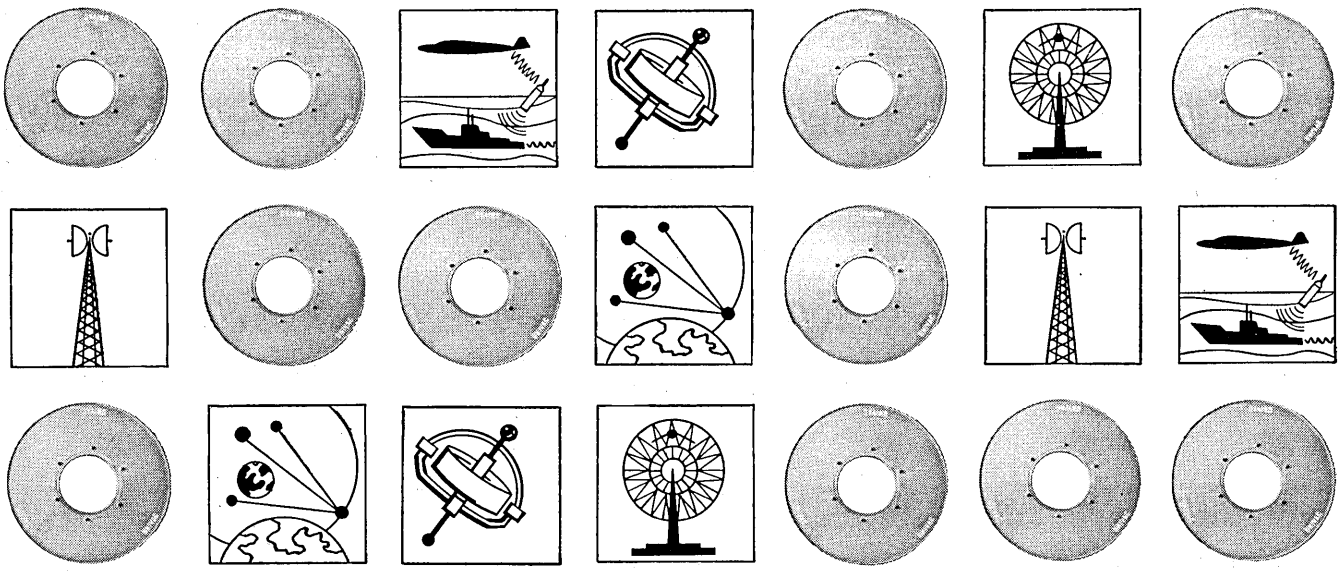
Yet the printing industry moves boldly ahead with a vast investment in time and money to explore potential systems.

More than 70 computerized typesetting systems by 10 different manufacturers have been installed in some 30 book, periodical, and composition plants; and in 31 newspapers. Most were installed during the past 18 months. Special-purpose computers represent more than half of these, a slight lead that is expected to continue over the more versatile but more expensive general-purpose computer.

Computers provide an enormous impetus to technological progress in the printing industry. The breakthrough in computerized typesetting is well-timed, for computer control of typesetting will be essential when the next generation of high-speed photocomposing machines is operational. Firms both inside and outside the industry are engaged in the crash development of more sophisticated peripheral equipment needed to make on-line computerized typesetting systems possible.

Printers hesitant to take the plunge will find solid comfort in one indisputable fact; those who install the first computer systems may have the disadvantage of having to do the pioneering, but they also will reap the advantages of achieving significantly lower costs and better overall operations at an earlier date than their contemporaries.

Hugh W. Swofford



NON-COMPUTER FACES IN A COMPUTER CROWD

It all depends on how you look at them. If you view the staff at UNIVAC-Twin Cities on the basis of disciplinary background only, you may be surprised to find that non-computer people are showing up here in greater and more significant numbers every year! ▪ The reason is that UNIVAC teams are working on large-scale defense systems which are computer-based, but not computers *exclusively*. One system, for example, incorporates IR sensors, IG subsystems, CW radars and microwave communication links. At its heart is a computer... in fact, several computers. ▪ A brief survey of UNIVAC projects offering special challenge to both computer and non-computer engineers would include advanced Nike work (we're writing the specs for a multi-processor system with a capacity 100 times greater than any single real-time computer in use today) — NTDS, an evolutionary system moving toward assuming more local and tactical shipboard functions — ballistic missile mid-course and re-entry guidance systems. Also; advanced studies in associative memories and learning techniques and many others. ▪ Whatever *your* specialty, you can count on exposure to a broad spectrum of defense technologies at UNIVAC-Twin Cities. Current opportunities are at all levels; managerial appointments are open in almost every category as well.

COMPUTER SYSTEMS DESIGN & ANALYSIS requiring background in one or more of these areas: data transmission, real-time command/control systems, data display systems, computer systems simulation, system optimizing techniques, operations analysis, digital servo control, logic design philosophy.

AEROSPACE SYSTEMS ANALYSIS & DEVELOPMENT of design criteria, requiring background in inertial platforms, microwave communications, vehicle sensors, radars (CW, Pulse) or sonar.

ADVANCED DEVELOPMENT & ELECTRICAL ENGINEERING in data technology. Thin film technology, ferro magnetic investigations, mass storage devices, advanced packaging concepts, circuit design, logic design, memory development, semiconductor devices, micro-electronic logic circuits.

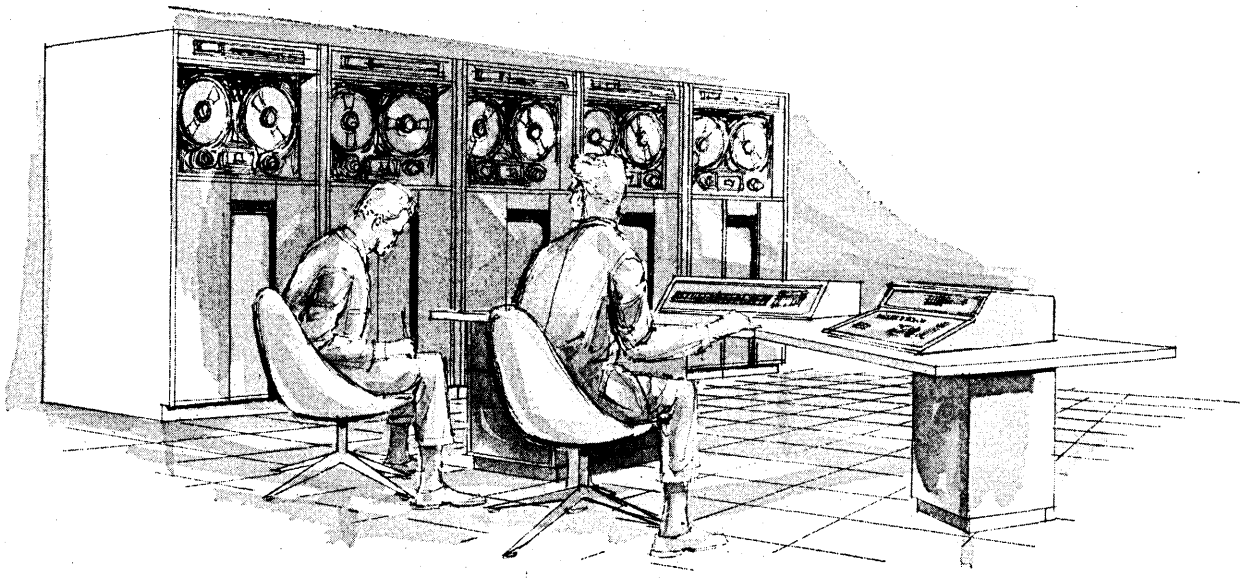
SCIENTIFIC PROGRAMMING/ANALYSIS. Programming conceptual computers; multi-processor systems; compiler and machine language development; scaling problems; engineering design problems; trajectories; system integration; radar systems and performance analysis; trajectory analysis, guidance equations, simulation.

For more information or to apply, write to Mr. R. K. Patterson, Employment Manager, Dept J-12, UNIVAC Division of Sperry Rand Corporation, Univac Park, St. Paul 16, Minnesota. An Equal Opportunity Employer.

UNIVAC

DIVISION OF SPERRY RAND CORPORATION

Add all the facts



...Then see the results you get with MAC Panel Computer Tape.

The results are obvious: no loss of information due to drop-outs; no down-time because of oxide build-up on heads. Or, to be positive about it, a reliable, complete recording and playback of information. The reason is simple, too. It's because assured performance is manufactured right into every inch of MAC Panel's heavy-duty computer tape. It starts with the selection of the Mylar web, continues through the critical MAGNE-FLO coating process, the four-zone drying stages and the ultra-sonic cleaning. You might think it ends after a rugged testing phase, but you'd be wrong. Your assurance of top quality never ends. But, do some adding yourself. Your MAC Panel representative will help you check the results.

MAC PANEL COMPANY MAC PANEL **High Point, North Carolina**

Representatives throughout the United States, Canada, Latin America and Europe

CIRCLE 45 ON READER CARD

Continued from page 21 . . .

WANTED: PATENT FOR HANDLING PATENTS

The House subcommittee on Census and Government Statistics headed by Congressman Arnold Olsen (Dem., Mont.), which has been holding extensive hearings on the paperwork peril, stumbled across the need for an inventive approach to a paper problem in, of all places, the Patent Office. New patent applications, many of them telephone-book thick, are being submitted to the patent office at a rate of better than 80,000 annually. The Commerce Department Agency, which remains a quill-pen, green-eyeshade operation in many respects, is hard-pressed to determine which claims are new and which duplicate those already on file. Information retrieval is clearly called for, but there are problems. First assistant patent commissioner Edwin Reynolds told the Olsen subcommittee his office had been working on a mechanized search plan for 10 years but less than 1% of the patents on file have been adapted to it. It's proven too tough, said Reynolds, to devise any means of classifying mechanical inventions that would lend itself to machine search. Any enterprising IR man who could figure out an answer to the Patent Office's dilemma, can be reasonably certain of not having too much trouble in getting a patent on it.

POLISHING THE BRASS

"I wish I had taken this course two years ago." These rueful words were spoken by a recent graduate of the Department of Defense Computer Institute, perhaps reflecting on an unfortunate procurement decision. The Institute, launched last April, has been conducting generals, admirals and Defense Department civilian employees of comparable exaltation on week-long tours of the great world of computer technology. Thus far, some 70 high-ranking DOD officials have taken the course successfully and more or less painlessly, even though the Institute's Spartan regimen calls for 14-hour days, 7:30 a.m. to 9:30 p.m. Reaction among graduates has been enthusiastic, reports Captain H. S. Foote, USN, Institute Director, who also doubles in brass as commanding officer, Naval Command Systems Support Activity.

The Institute, located at the Navy Yard Annex in the District, plans shortly to offer a two- to four-week course for colonels, Naval Captains and DOD civilians of like rank. The hope is that by exposing military executives to this concentrated computer lore, they will be enabled to make better use of EDP gear in their operational duties, understand the trade-offs involved in writing specifications, make better decisions relating to equipment procurement. Curriculum for the week-long course is necessarily bareboned but does include do-it-yourself computer programming, hands-on time on a training computer and a walk-through of the computer-related management sciences. Currently, Institute instructors are drawn mostly from outside academic and industrial sources.

FEDERAL COMMISSION ON AUTOMATION, TECHNOLOGY CREATED

President Johnson has given his OK to H.R. 11611, creating a 14-member National Commission on Technology, Automation and Economic Progress. The bill is the culmination of several legislative efforts seeking to cope with automation-related problems. The Commission, abetted by a Federal Interagency Committee, will look into the parameters of technological change and report back to the President by the end of next year.

Sometimes we have to watch our language.

(Especially when engineers visit our labs.)

There tends to be a lot of computer language bouncing around Xerox these days. Some people might jump to the conclusion that we're going into the computer business. That's not exactly true.

There's a simple answer to why all the talk about information storage and retrieval, communications theory, bandwidth compression, transmission, digital analysis, coding, and the rest. It is all related to Graphic Communications. Can you see where we're going? There's ample room for some canny computer-based systems people to join us.

Write us about what you've done in the field and we'll try to pinpoint your most promising opportunities at Xerox today. Address your letter or resume in strictest confidence to Mr. Robert Conboy, Xerox Corporation, Dept. DA-9, P. O. Box 1540, Rochester, New York 14603.

XEROX

An Equal Opportunity Employer

Find out where people live. How much they make. What they wear. Even details like who buys which brand of peanut butter.

Now that used to be the market profile.

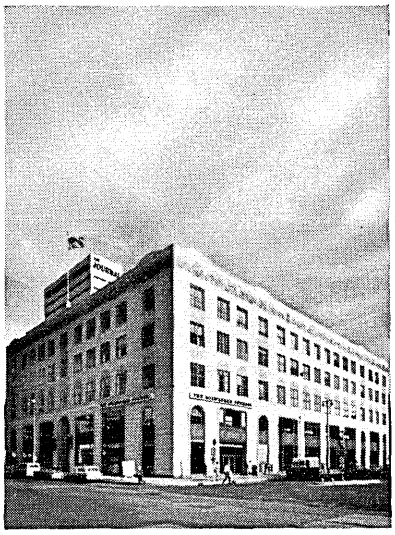
For 41 years The Milwaukee Journal had gone around asking questions. Getting revealing answers.

And they came up with demographs that more than met the needs of those years. Income, age, education, occupations, and area breakdowns.

But the Journal wasn't satisfied. They wanted to provide sophisticated marketers with in-depth analyses of the Milwaukee marketplace. So they turned to SBC whose IBM computers allowed them to go far beyond their former demographs and dig real deep into the subtleties. Use all the potential.

As in the Peanut Butter Profile.

In addition to income, occupation, education, family size, and age, the new Profile has such



The Milwaukee Journal

data as the major interests of women peanut butter purchasers: barbecues, gardening, going to the movies, and reading a book all the way through. Peanut butter buyers buy more popular records than classical and prefer fishing to collecting stamps or playing golf.

More importantly the Profile tells the peanut butter marketer how much people spend for groceries and where they spend it.

Profiles like this are prepared for all major product categories from automobiles to baby food.

SBC's experience in Survey Data Processing helps The Milwaukee Journal provide its advertisers with a comprehensive analysis of the Milwaukee market.

SBC knew exactly what The Milwaukee Journal wanted. And did it. Fast. What can we do for you?

Linear programming, Survey Data Processing, Numerical Control, Statistical analysis, Systems programming, Computer time rental, Customized Computer programming... there are so many ways SBC's Computing Sciences Division can help you. Let us know.

SBC
The Service Bureau Corporation
Computing Sciences Division
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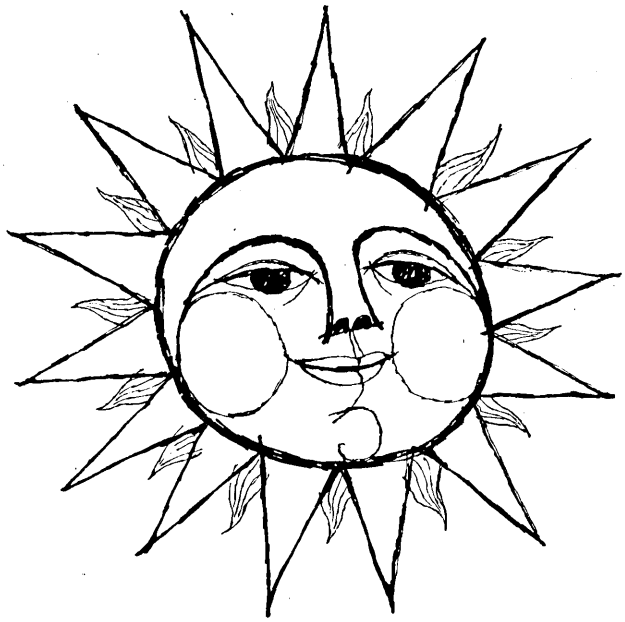

There's a place in the sun for everyone!

Are you satisfied with yours?

You are the one with a rare combination of professional data processing background and as yet haven't found a home.

You are the man who has held jobs, but as yet hasn't established a career. You have demonstrated ability in the areas of Scientific or Military Systems Analysis or Programming, or Programming Development, but as yet have not had the full opportunity to challenge your best efforts.

What is your next step?

Wander around aimlessly knocking on doors? Shoot a broadside of letters to a miscellaneous group of companies hoping at least one will hit the target? Talk endlessly with employment services obviously not familiar with the field?

Or would you play it smart and go to a specific group of professional consultants who have the experience and understanding of data processing necessary to find a position equal to your specific capabilities?

Then quit spinning your "electronic" brainpower! We're computer people, too. Every member of the edp staff has extensive "hands on" data processing experience which permits knowledgeable understanding of your career objectives.

There's a place in the sun for everyone! Let edp personnel find yours.

Write in confidence—outlining your experience, education and objectives to Donald D. Coghlan.

edp personnel, inc.

230 N. Michigan Ave. Chicago, Illinois 60601
Phone 782-0857

CLIENT COMPANIES ASSUME OUR CHARGES

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APPLIED MATHEMATICAL SCIENTISTS

The increased applications of large scale computers (Burroughs 5000) to solve technical and business problems has created two new positions in our Company. Applicants must be candidates for or have PhD degrees in applied mathematics or engineering and have appropriate computer experience.

SENIOR MATHEMATICIAN: As head of a small math group in our computer center, this man will act as a corporate mathematics consultant and perform math research. Problems will involve the use of numerical analysis, operations research and other advanced statistical techniques.

NUMERICAL RESEARCH SPECIALIST: This position requires a recent graduate for our newly created Gas Supply Research group. Emphasis is on research and development of new math techniques utilizing the computer as a research instrument. Typical problems will deal with transient flow, linear programming, systems optimization with special emphasis on numerical analysis.

As a medium sized non-defense firm, Northern is a rapidly expanding gas transmission company diversifying into petro-chemicals and related fields. Excellent salaries are provided in an atmosphere emphasizing personal initiative and professional growth. Interested applicants are invited to send complete resumes and salary history to Thomas P. Vaaler,

NORTHERN NATURAL GAS COMPANY

2223 Dodge Street • Omaha, Nebraska

An Equal Opportunity Employer

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SENIOR EDP PROGRAMMERS

Openings exist in Material and Manufacturing Inventory Control and AFSC Pert/Cost and Pert/Time. Must be capable of doing both systems design and implementation as well as programming.

Two or more years of experience in programming IBM 7074 or similar equipment is required, plus the ability to program in COBOL. Please send detailed resume, including salary requirements, to Mr. B. L. Dobler, Chief of Professional Placement and Personnel, Dept. 130-90, General Dynamics/Astronautics, 6000 Kearny Villa Road, San Diego, California 92112. An Equal Opportunity Employer.

GENERAL DYNAMICS / ASTRONAUTICS

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EXPERIENCED PROGRAMMERS

room for achievement at IBM®

Opportunities:
New concepts in programming languages—exploratory research and development of machine-independent languages for scientific and commercial applications. R & D of ways of easily defining a number of varying special application areas: investigation of the nature of programming languages, their specifications, form and meaning, their essential syntax and semantics; comparative analysis and evaluation of language features; development and documentation of language standards.

Advanced programming techniques—research and development in such areas as: new compiler techniques, operating systems, symbolic debugging of source language programs, non-numeric algebraic manipulations in computers, information retrieval systems, and time-sharing systems.

Business-oriented programming—advanced development of sorting techniques, merging, report generators, and file-maintenance programs.

Qualifications: a bachelor's or advanced degree—at least one year's advanced programming experience.

Additional information: the art of programming at IBM is exceptionally challenging. Liberal company-paid benefits include relocation expenses. These opportunities are located mainly in Poughkeepsie, a suburban environment about 70 miles from New York City. Other programming facilities are located in White Plains, N.Y., New York City and Boston, Mass. IBM is an Equal Opportunity Employer.

If interested, please write, outlining your experience and qualifications, to: **James D. Baker, Dept. 701W IBM Corp., P. O. Box 390, Poughkeepsie, N. Y. 12602.**

COMPUTER ENGINEERS:

AMPEX HAS SOME VERY GOOD CALIFORNIA OPENINGS

THE JOB: supervising the conception, analysis and experimentation of new high-speed servo mechanisms and control devices, electro-mechanical accessing digital memories, or advance circuit designs for feedback amplifiers and control electronics. **REQUIREMENTS:** degree in electrical engineering, physics, or engineering physics; an almost fanatical desire to conceive, design and develop your ideas into working models. Openings at Redwood City, near San Francisco, Culver City, near Los Angeles. Note: nearly all of our multi-million dollar development programs are company sponsored. **WRITE TO:** Office of Scientific Placement, Ampex Corporation, 9920 West Jefferson Blvd., Culver City, Calif. An equal opportunity employer.

AMPEX

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openings for computer salesmen and application programmers

PROBLEM SOLVERS
(Not Just Order Takers)

. . . . . THAT'S THE CLOSEST DESCRIPTION YET OF

computer salesmen and applications programmers
AT GENERAL ELECTRIC

The problem solvers

The problems these people are concerned with are customer problems — in areas bearing strongly upon profitability.

IT'S THE SALESMAN'S responsibility to determine—and analyze—all operational areas where G.E. computers and peripheral equipment can streamline an individual customer's business, whether he's a manufacturer, utility, insurance company, wholesale/retail distributor, state or local government agency, bank, transportation or other firm.

IT'S THE APPLICATIONS PROGRAMMER'S responsibility to design the program packages required to solve the individual problems of the customer company.

The year just past has demonstrated notable achievements by G.E. marketing teams in this area of customer-problem discovery and solution. The good news is spreading. New customers are knocking on our doors in substantial numbers. We need to recruit and train new salesmen and programmers to serve them.

HOW ABOUT YOU? DOES THIS INTEREST YOU?
ARE YOU QUALIFIED?

Qualifications in general include thorough understanding of the capabilities of computer systems, and broad knowledge of the spectrum of problems of modern-day commercial and industrial establishments. In addition we expect backgrounds of the following caliber:

1. FOR SALESMEN: Minimum of 3 years actual experience in computer sales or sales of large, complex systems, plus a bachelor's degree in Math, Physics, Engineering or Business Administration.
2. FOR APPLICATIONS PROGRAMMERS: 3 years programming work with internally stored program computers utilizing tape/disc readout systems; systems design; assembly programs; debugging. Technical or Liberal Arts Education.

Appointments open at locations across the country.

Please write full details, including salary requirements and geographical preference, to: Mr. K. L. Hill, Administrator, Professional Placement, General Electric Co., Computer Dept., Room 1056-I, P. O. Box 270, Phoenix, Arizona

GENERAL ELECTRIC

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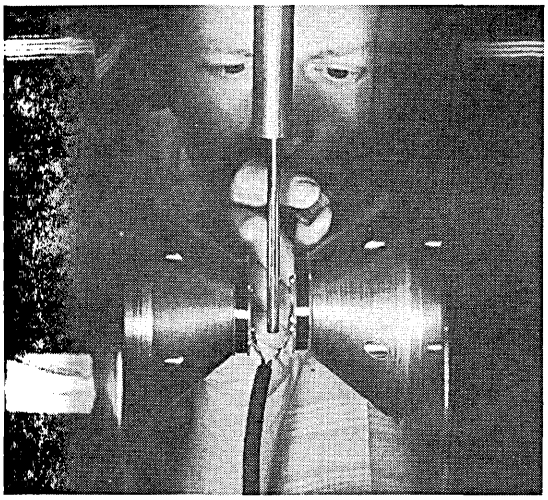
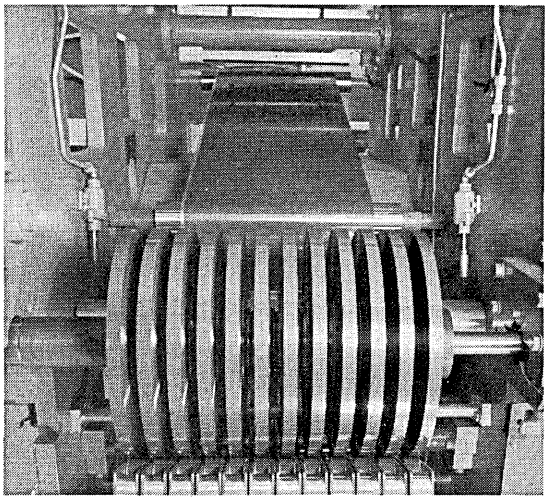
4 WAYS TO IMPROVE COMPUTER TAPE

(And how Memorex did it!)



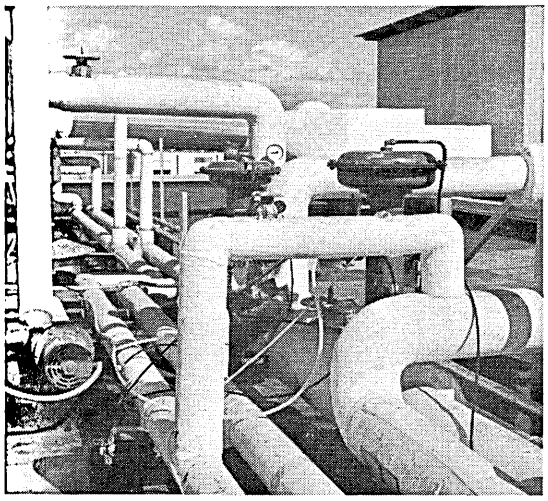
Exercise greater quality control.

The Memorex-designed Vibrating-Sample Magnetometer (VSM) tests basic characteristics of oxide raw material and precise concentration of oxide particles in the tape coating. Extra tests of this kind guarantee the improved performance and reel-to-reel uniformity of Memorex computer tape.



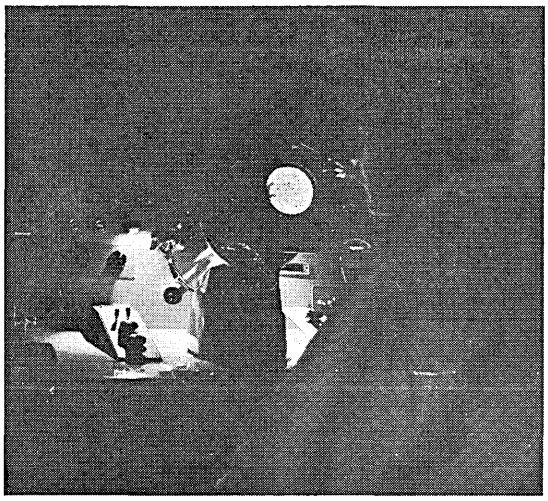
Employ advanced production techniques.

Specially constructed equipment — used to slit Memorex computer tape from jumbo rolls — produces tape with clean, straight edges free from ripples and ridges. A new slitting technique is but one of seventeen manufacturing improvements made to insure superior performance of Memorex tape.



Use a superior production facility.

A conspicuous aspect of the Memorex plant is the complex system of air filtration, humidification, dehumidification, heating and cooling. The unusual high-purity system, equal to that used in pharmaceutical processing, provides a contaminant-free environment — prerequisite to production of improved error-free tape.

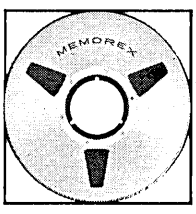


Apply research in depth.

Research in oxide, coating materials, and tape-making processes has equipped Memorex with a fund of **new** technology. Combined with manufacturing competence, this fundamental knowledge is manifest in Memorex computer tape by freedom from dropouts, longer life, and improved uniformity and reliability of performance.

Memorex tape is premium tape. No need to pre-check it. You can place Memorex computer tape directly in service — reel after reel.

Memorex certification means what it says: Memorex computer tape <u>is</u> error-free. Extra care, extra steps and scrupulous attention to every detail make it that way. We know the importance to you of having a tape you can depend on.



Are you on our mailing list to receive the Memorex Monograph Series of informative technical literature? Write 1172 Shulman Road, Santa Clara, California

MEMOREX

PRECISION MAGNETIC TAPE

CIRCLE 2 ON READER CARD

Ferrite Technology → Cores → Memory → Systems →

There is a logical direction at Ferroxcube, one development leading to the next.

A wealth of experience in ferrite technology is our heritage. It enabled us to enter the memory field in a meaningful way with the innovation of the 30 mil core. Stringing them into planes proved a fascinating discipline and led us to devise a way of commercially wiring 20 mil cores. In recent years we have strung more 20, 30 and 50 mil cores than any other non-captive maker.

Yet this is not the end-all in cores. Soon we intend to offer 14 mils as a practical item.

Stringing planes, dip-soldering them, you might say mass-producing them, led us right into stacking them. Today, our new stack facility is producing many units for customers in the computer industry.

And so, to a family of systems. Ferroxcube started with a 10 microsecond system and now offers 5 and 2 microsecond systems for delivery.

Come see us at the Fall Joint Computer Conference. We'll have these interesting systems there.

We also will have 14 mil cores on hand. The booth will be well-lit. If you peer intently you may be able to see them.

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