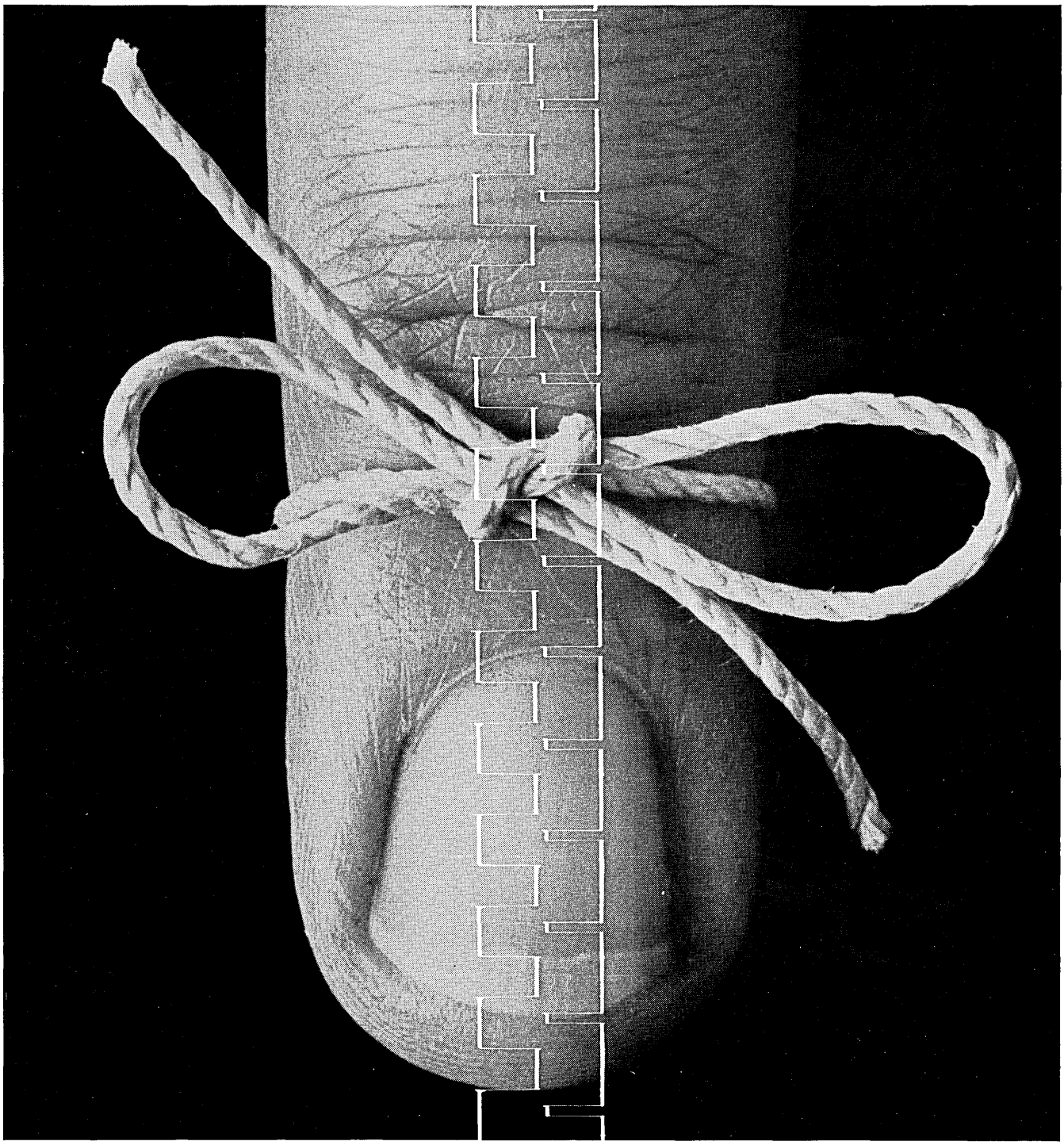
DATAMATION 63®

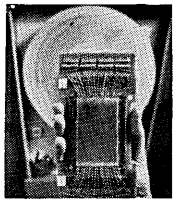
August

EUROPE & THE U.S. . . THE WIDENING GAP



What's the name to remember for memory? **AMPEX**

We have eight lines of ferrite cores so you can string your own arrays. Or we can. We provide virtually all configurations and frame designs. And these we can stack into compact stacks with memory cycles of 1 to 25 microseconds. Then we offer memories—40 different models, in fact. They're off-the-shelf core memories of both coincident current and word select types. They provide random and sequential access operating modes. They have cycle times of 1 to 24 microseconds. And capacities of 128 to 16,384 words. We also have today's finest high- and medium-speed tape transports and tape memory systems—offering complete facility to read, write and check digital data in major computer formats. What about the reliability of this memory line? In a word: Ampex. For more information write to Ampex Corp., Redwood City, California. Term financing and leasing available. Worldwide sales and service.



AMPEX

CIRCLE 1 ON READER CARD

fortran

[illegible]

[illegible]

[illegible]

```
      FUNCTION PATH(L)
      COMMON PATHERROR, LINK
      DIMENSION LINK (−8/+8)
      IF (IABS(L)−8) 3,2,2
2     GO TO PATHERROR
3     PATH=0
      DO 4 K=L+1, −(L+1), −1
4     PATH=LINK(LINK(PATH)+K)
      RETURN
```

[illegible] systems. Our compiler can be implemented on an 8K computer and most 4K computers. Delivery time is six months.

Price list

#100 FORTRAN II compiler .... [illegible]

#101 FORTRAN II loader and system library $10,000

#200 FORTRAN IV compiler $40,000

#201 FORTRAN IV loader and system library $15,000

#202 FORTRAN IV object time debug option .... $ 8,000

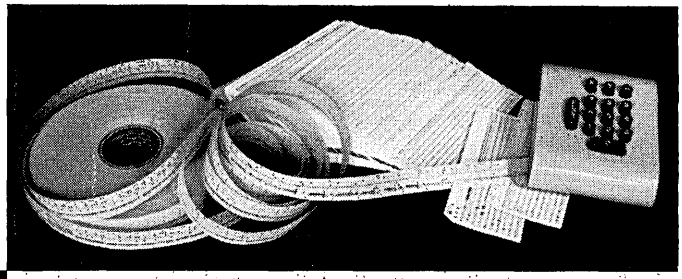
#203 FORTRAN IV extra efficiency option $15,000

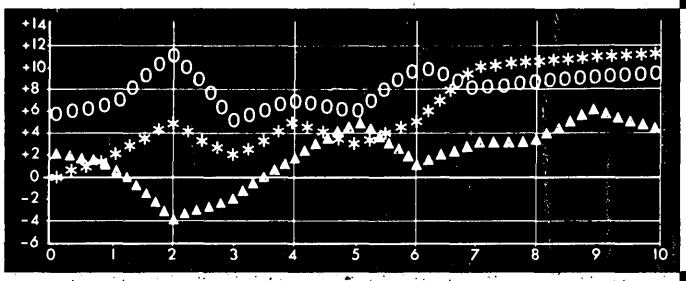
For details see our Compiler Catalog No. 2.

1626 CENTINELA AVENUE INGLEWOOD, CALIF

PHONE: 213 776-3766

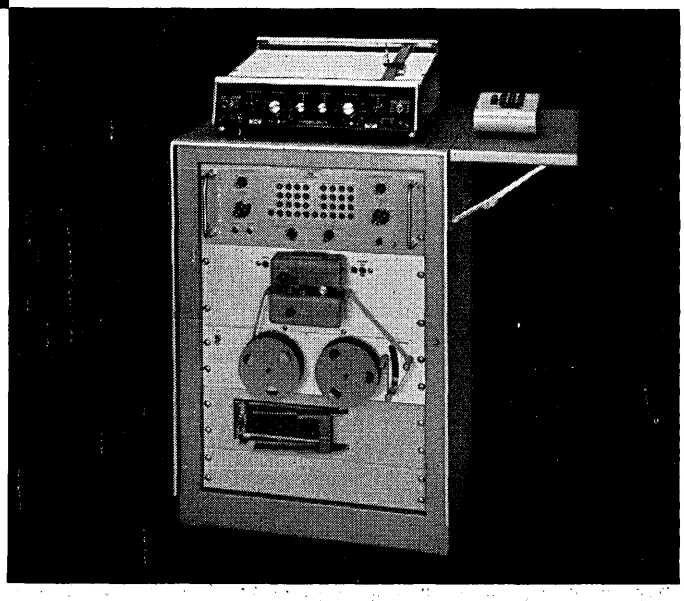
MAKE THIS





EASY TO READ

WITH THIS



FAST LOW-COST DATA PLOTTING

The improved Dymec DY-2030 Series Digital Data Plotting Systems provide economical, time-saving conversion of digital data to easy-to-read X-Y charts. Data stored on perforated tape or punched cards or tabular data entered manually on an accessory keyboard is quickly plotted as meaningful X-Y graphs for easier interpretation, rapid and accurate appraisal, permanent records and presentations. The DY-2030B/D systems incorporate fast, quiet, reliable photo-electric tape readers and accept virtually all standard-format computer tapes, thus minimizing the need for special computer programming. Punched cards may be read on customer-supplied readers and translated to graphical form by the DY-2030A/C Plotting Systems.

These Dymec systems are ideal for rapid translation, conversion and graphical presentation of data in such areas as stress analysis—verification of numerically controlled machine tool program tapes—business situations, profit-loss and trend data—thrust analysis—fluid flow and aerodynamic studies—space vehicle trajectory and orbit information—real-time analog parameters acquired digitally—in any application where large amounts of digital data can be more easily understood in graphical form.

This is what the systems offer: Card, perforated tape or keyboard input • Up to 120 points/min. plotted with tape • Up to 50 points/min. with cards • Zero suppression for convenient placement of plot • Continuously variable scale factor adjustment for maximum image size • Plot accuracy better than 0.15% • Resolution: 4 digits and sign accepted for both X and Y axes. Write or call your nearest Dymec/Hewlett-Packard representative or Dymec for full information.

	2030A	2030B	2030C	2030D
Input	Punched cards	Perforated tape	Punched cards	Perforated tape
Output	11" x 17" plot	11" x 17" plot	30" x 30" plot	30" x 30" plot
Price	$6975	$7975	$11,360	$12,360

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CIRCLE 4 ON READER CARD

The Datanets are here!

G.E.'s flexible new Datanets will speed up your data communications—across the country or across the hall

Whether your data communication problems are in the factory, in a nationwide network, or in the same office, General Electric can help solve them with The Datanets — a complete line of data communication systems.

And G.E.'s new data communication systems—like G.E.'s computers — are compatible. They talk to each other — and to the computers. General Electric's data communication systems and computers use the same peripheral equipment. And when you move up to a more powerful computer, General Electric's data communication system will stay in step.

HERE ARE THE DATANETS:

Datanet-30 communication processor • **Datanet-15** communication controller • **Datanet-600** punched tape terminal • **Datanet-90, -91** magnetic tape terminals • **Datanet-3101** data accumulation system • Plus a wide range of special-purpose controllers and peripherals.

Next step: Ask for the complete Datanet catalog. Write: General Electric Computer Department, Section J-8, Phoenix, Arizona.

Progress Is Our Most Important Product

GENERAL ELECTRIC

CIRCLE 5 ON READER CARD

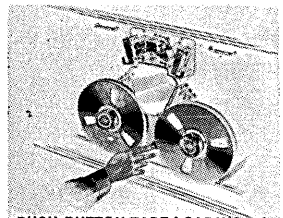
POTTER MT-120:

AN OPEN AND SHUT CASE

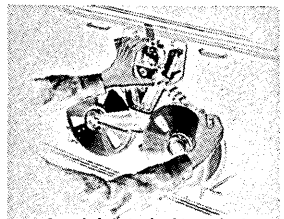
It doesn't require lengthy trial to determine if MT-120 is compatible with your computer system. It is. This highly advanced digital magnetic tape transport features exceptional performance in a COMPLETELY STANDARD, LOW COST PACKAGE. For example, a patented tape handling system* eliminates program restrictions—permits Start/Stop, Reverse/Stop or Forward/Reverse operation at up to 200 commands per second and at tape speeds to 120 ips.

To learn more about the MT-120 and its unprecedented 1-year warranty of reliability, write to our Director of Marketing. We'll send you full specifications, then you can judge for yourself.

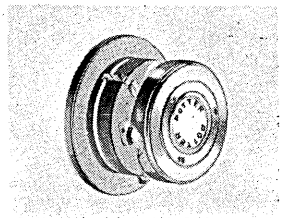
THE MT-120 FEATURES:



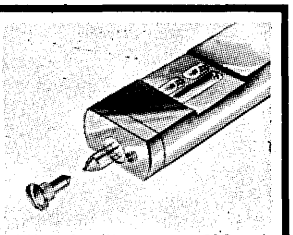
PUSH BUTTON TAPE LOADING initiates automatic electrical retraction of loop control and low-tape sensing arms...



...Special interlocking devices prevent inadvertent arm retraction when reel drive motors are energized.



Potter "quick-lock" NARTB reel hubs and IBM reel hubs are available as standard accessories.



IBM and split-post type EOT and BOT sensing amplifiers are available for positive tape control.

*Potter Patent No. 3,016,207

POTTER INSTRUMENT COMPANY, INC.
MARKETING DIVISION • *151 Sunnyside Boulevard, Plainview, New York*

T.M.

CIRCLE 6 ON READER CARD

DATAMATION 63

the automatic handling of information

volume 9, number 8

Staff

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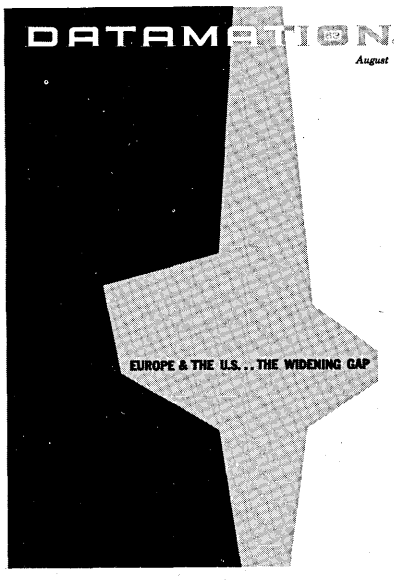

Cover

Despite increasing sales of American hardware in Europe, and regardless of growing alliances between U.S. manufacturers and those abroad, the computer growth curves of the two regions reflect a Widening Gap. It is a subject of concern to Europeans, and of interest to marketing men throughout the world. Cover design is by Art Director Cleve Boutell.

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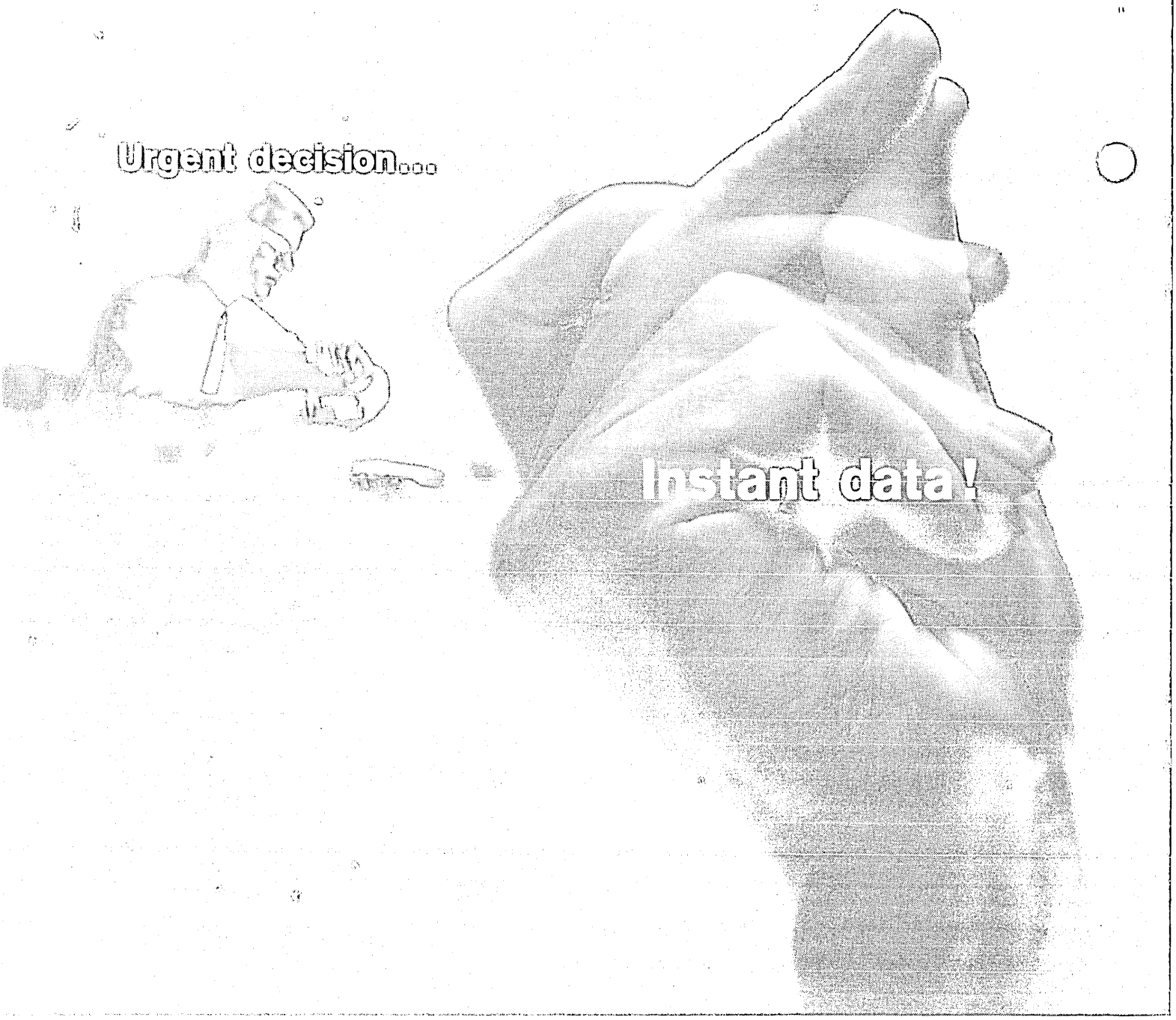

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Stop-watch decisions don't leave you time to dig for data. You need a communications system that moves as fast as your business. That system? **TIES** . . . a vital new RCA development linking multiple locations to a high-speed electronic computer via standard telephone and telegraph lines . . . keeping your home and field offices, stores or plants, in constant, automatic communication.

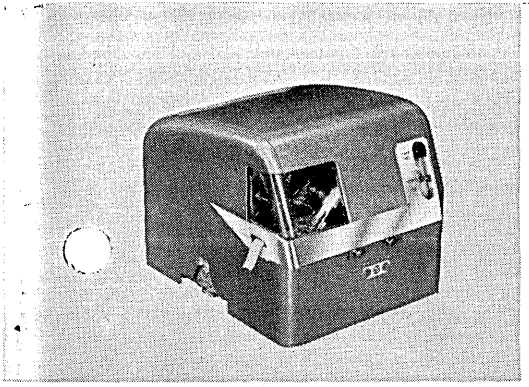
TIES—Transmission and Information Exchange System—speeds handling of customer inquiries and orders. It reduces processing costs. It ends your need for many small tabulating installations, since all processing is consolidated at strategic computer centers.

With **TIES,** as with every area of electronic data processing, the RCA approach is uniquely customer-directed. It starts when your operation is timed-out by RCA on its own computers, and continues as long as you are a customer. Call us—and see!

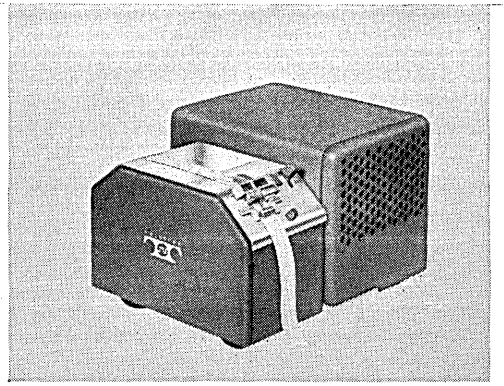
RCA ELECTRONIC DATA PROCESSING, CHERRY HILL, N. J.

The Most Trusted Name in Electronics

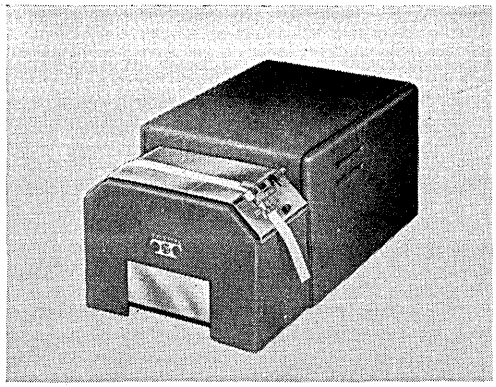
CIRCLE 7 ON READER CARD



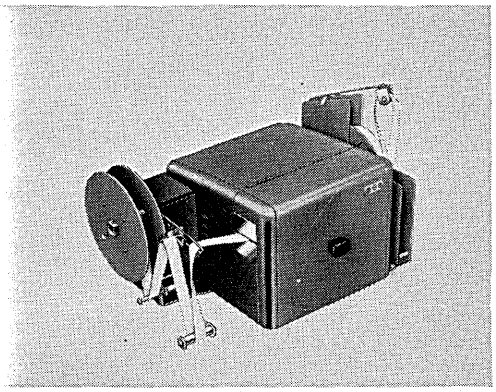
1 Printing Tape Punch (LPR Set), Serial Input, 10 char/sec.



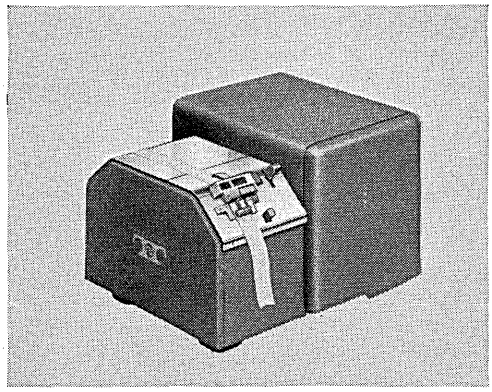
2 Tape Reader (LXD Set), Serial and Parallel Output, 10 char/sec.



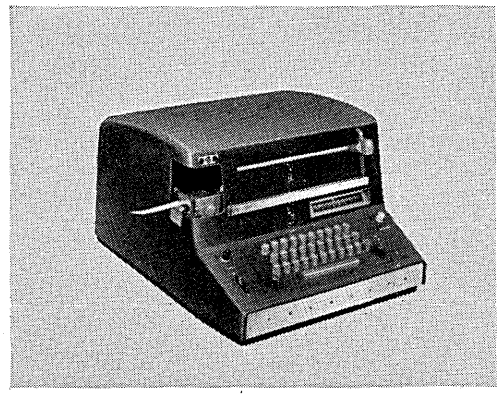
3 Tape Reader (LBXD Set), Serial and Parallel Output; or as Signal Conversion Unit, Parallel Input, Serial output, 10 char/sec.



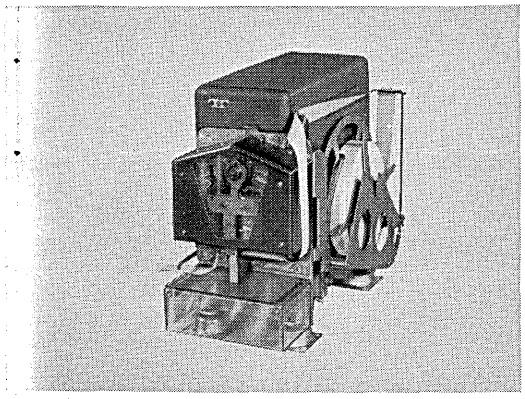
4 Tape Punch (LARP Set), Parallel Input, 20 char/sec.



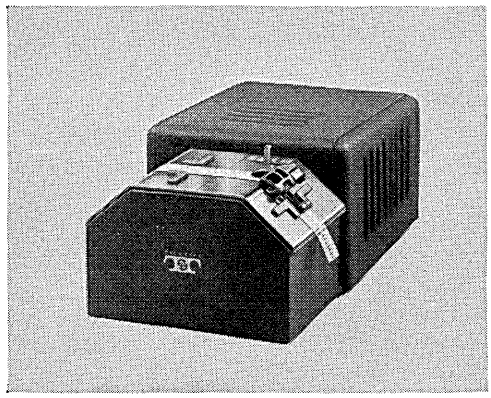
5 Tape Reader (LX Set), Parallel Output, 20 char/sec.



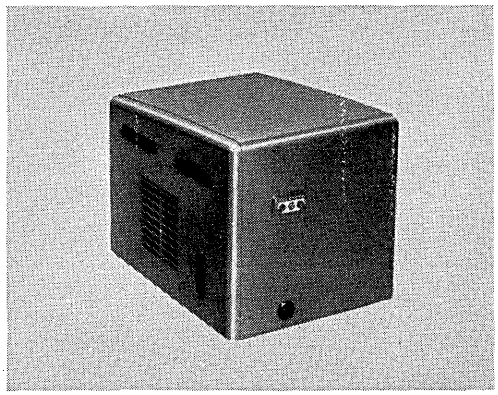
6 Keyboard Tape Punch (LKPE Set), Manual tape preparation.



7 Tape Punch (BRPE Set), Parallel Input, 63 or 110 char/sec.



8 Tape Reader (CX Set), Parallel Output, 60 or 107 char/sec.



9 Signal Conversion Units: Serial-to-Parallel Converter (LRS Set, shown); Parallel-to-Serial Converter (LD Set). 10 char/sec.

Does your data system need punched tape?

If it does, check your specifications against these nine Teletype units.

Then check the price.

Frankly, we think you'll be amazed that equipment with these capabilities will cost you so little.

Choose from models that handle five, six, seven or eight-level tape. They range in speed from 10 char/sec. on the LPR Tape Punch (upper left) to 110 char/sec. on the BRPE Tape Punch (lower left).

Is it a combination set you want? In addition to the units shown, we have gang-mounted punches and readers, code and speed converters, even punch and relay sets. In fact, there are Teletype units available for almost any message and data communication need—whether your system is small and local . . . or large and country-wide.

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This equipment is made for the Bell System and others who require dependable communications at the lowest possible cost.

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CIRCLE 8 ON READER CARD

important DATES

• The second Institute on Electronic Information Display Systems will be held September 16-20 at The American Univ., Washington, D.C.

• The 13th International Management Congress will be held September 16-20 at the Hilton Hotel, New York City. Sponsor is the Comité International de l'Organisation Scientifique.

• The 12th annual Industrial Electronics Symposium will be held September 18-19 at Michigan State Univ., E. Lansing, Mich. Sponsors are PGIE, AIEE, and ISA.

• The 26th annual meeting of the American Documentation Institute will be held October 6-11 at the Pick-Congress Hotel, Chicago, Ill.

• The fourth annual Symposium on Switching Circuit Theory and Logical Design will be held Oct. 7-11 in Chicago, Ill. Sponsor is the AIEE subcommittee on Logic and Switching Circuit Theory.

• The International Systems Meeting will be held October 14-16 at the Hotel Schroeder, Milwaukee, Wisc. Sponsor is the Systems and Procedures Assn.

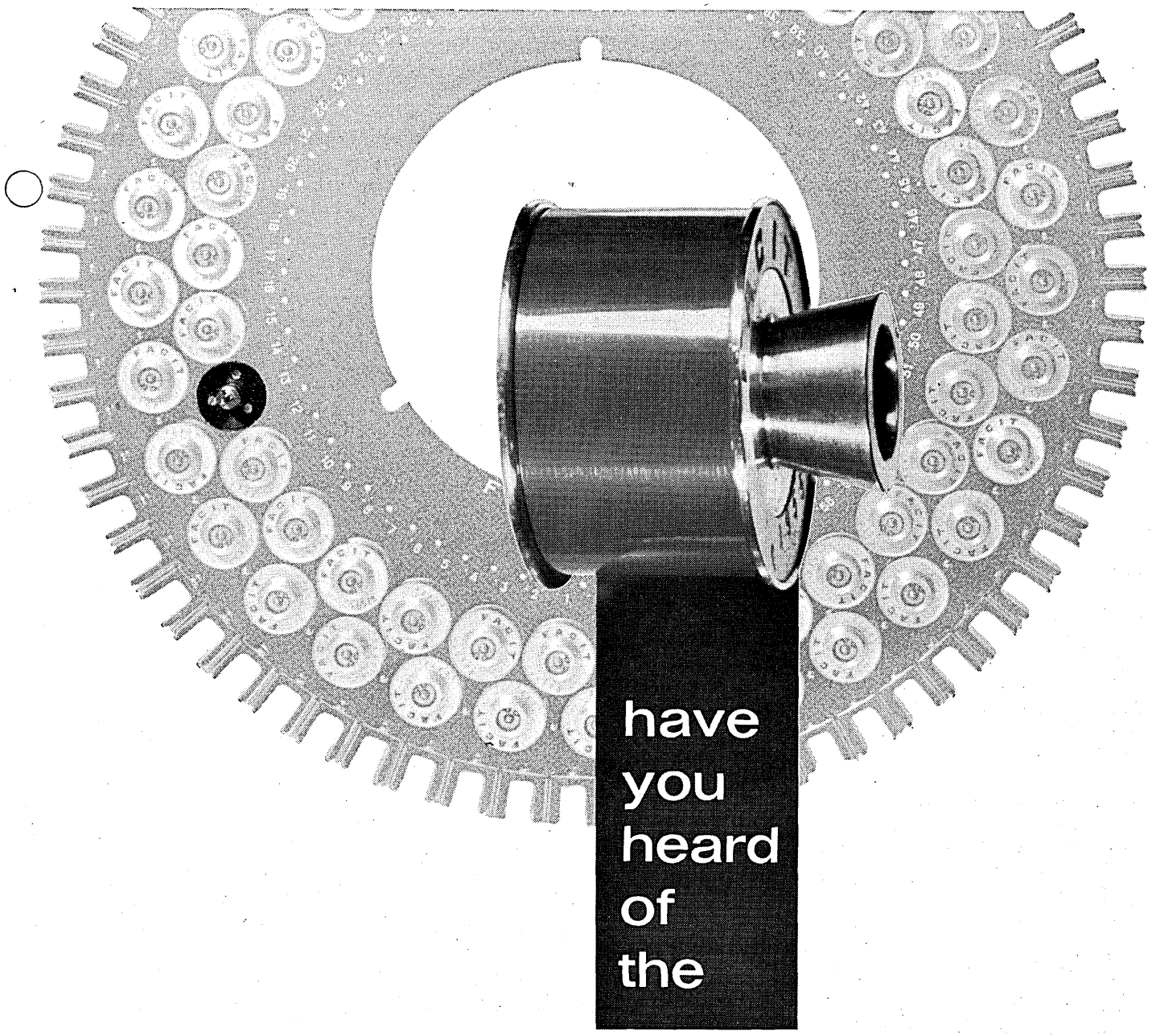
• The annual meeting of the Users of Automatic Information Display Equipment will be held October 15-17 at the Carillon Hotel, Miami Beach, Fla.

• The BEMA (Business Equipment Manufacturers Assn.) Exposition/Conference will be held Oct. 28 to Nov. 1 at the Coliseum, New York, N.Y.

• The 1963 Fall Joint Computer Conference will be held in the Las Vegas, Nev., Convention Center, Nov. 12-14.

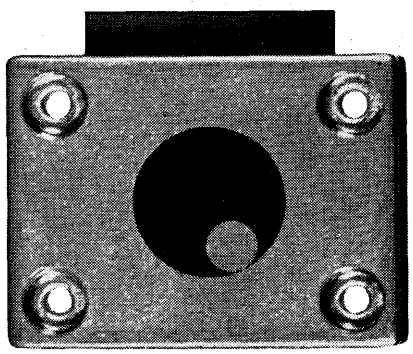
• The annual meeting of the American Mathematical Society will be held January 20-24, 1964, in Miami, Fla.

• The 1964 Spring Joint Computer Conference will be held at the Sheraton Park Hotel, Washington, D.C., April 21-23.



FACIT CAROUSEL

have you heard of a magnetic tape memory that can exist in any room and go on operating month after month with no special treatment – no humidity nor dust control – and still have the reading reliability of a drum memory. If not – then write for information to FACIT, Fack, Stockholm 7, Sweden.



CIRCLE 33 ON READER CARD

letters

information retrieval

Sir:

One statement in Dr. Meneely's letter to the editor (June, p. 12) aroused my interest. The writer said that he found an article on the theory of polar planimeters, in the 11th edition of the Encyclopedia Brittanica, "after weeks of search."

I proceeded from my desk downstairs to the 11th edition's resting place, opened the index to the only reference to planimeters, 4-975d. At this location, in the article on Calculating *Machines*, was a discussion on planimeters. Total elapsed time, "portal to portal," about three minutes.

A cursory examination of the article reveals one more interesting point. The words "polar planimeter" are not found therein nor, indeed, the word "polar." Therefore, a billion-dollar associative memory with the whole 11th edition on it would not have helped the gentleman.

ARNOLD I. DUMEY
Data Handling
Roslyn Heights, New York

cobol revisited

Sir:

Assuming that Mr. Naftaly is not simply crying "Wolf!" at the sight of a domesticated German shepherd, his defense of COBOL (May, p. 24) was convincing and comprehensive; his arguments and statistics show fairly conclusively that COBOL "certainly meets the realistic test — it saves the user money."

However, although Mr. Naftaly proves that COBOL does not itself inherently possess major faults, he does not suggest any reason why it is attacked, except to imply that those who attack it must be ignorant and/or irrational. One of the major reasons for COBOL's current vulnerability surely stems from the inadequacy of the original CODASYL COBOL Manual — something which Mr. Naftaly does not even mention.

Apart from the writing style, which is appalling, the specifications in this manual are absurdly organized, dangerously vague, often meaningless, and sometimes even contradictory. One often has the impression that the proverbial infinite number of monkeys had been supplied with the proverbial infinite number of typewriters. The misleading and contradictory statements about the SYNCHRONIZED clause on pages VI-22 and VI-42, Note 3, are just one example of many that could be quoted.

Since every implementor based his compiler on these specifications, there are as many interpretations of certain areas of the language as there are implementors; any areas not clearly and unequivocally defined were bound to be interpreted in the most convenient way by each implementor. Under these circumstances, lack of commonality, for one thing, was assured from the beginning.

The COBOL working committees have offered clarifications of certain elements in the language; in many cases, however, these clarifications were issued months after each implementor had committed himself to a particular interpretation; very often, the clarifications themselves needed clarifying.

The CODASYL COBOL Manual recommends that "each user recognize his own responsibility to determine that the compiler offered by any manufacturer does in fact implement all of the REQUIRED features to the extent of hardware capability to make it a 'proper' COBOL compiler." How can a user possibly determine anything except that the manufacturer has implemented all of the REQUIRED features? To determine whether they were implemented *correctly*, the user would have to appeal to the same ambiguous source as the implementor.

It is a flattering reflection on the COBOL language and its implementors that, in spite of all these difficulties, manufacturers have produced COBOL compilers which meet Mr. Naftaly's and the user's realistic test.

MARCUS L. BYRUCK
Woodside, California

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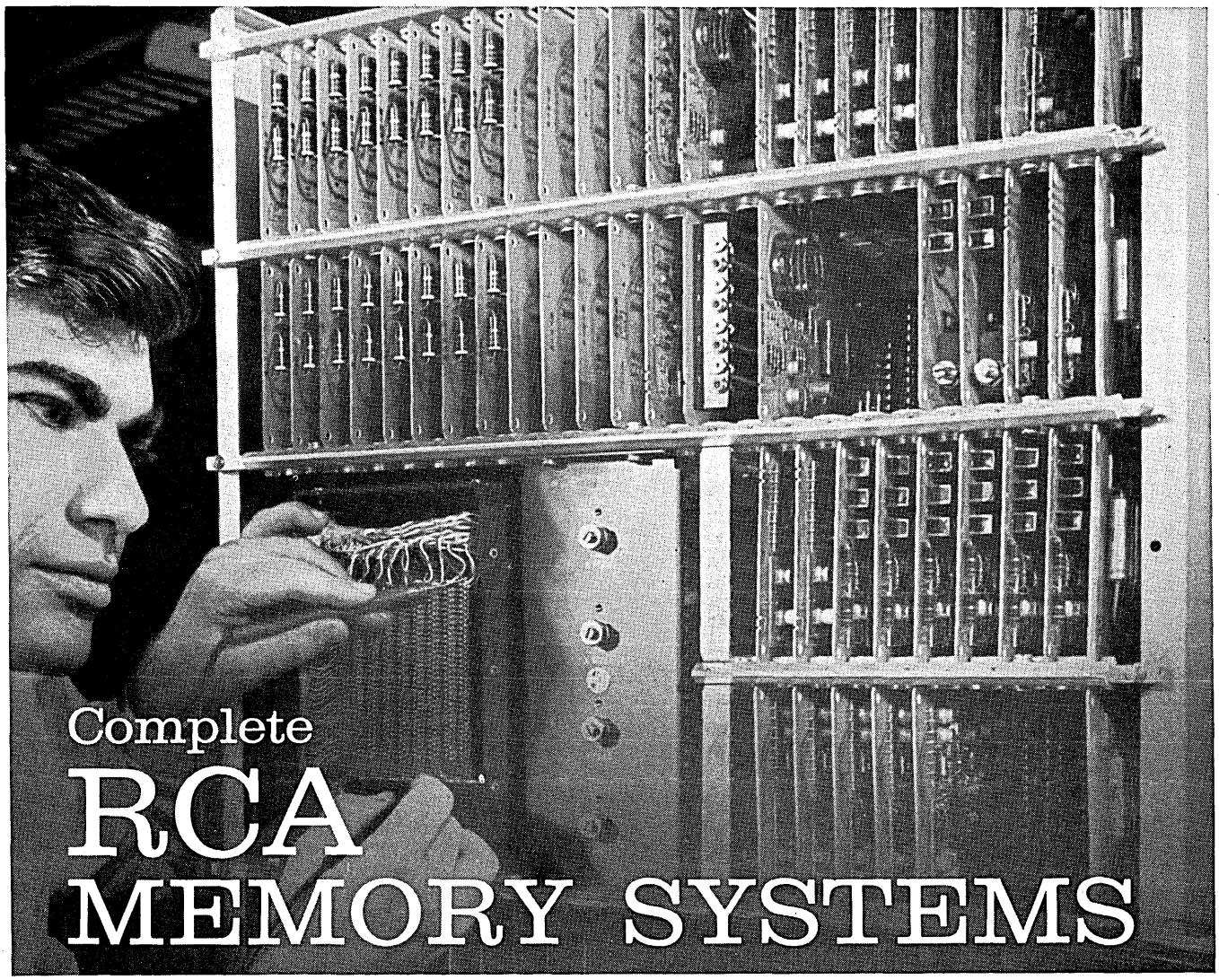
datamation readers are invited to express themselves both on specific contents of an issue and on the information processing field in general. Only letters bearing the writer's name will be considered for publication, although names will be withheld on request. The editors retain the right to edit letters, provided this can be done without changing the meaning.



with specified extra wide safety margins

Standard or custom systems, incorporating RCA ferrite and semiconductor devices, are designed, built, and tested by memory-circuit specialists—at RCA's newly expanded memory products operation in Needham Heights, Mass.

Here is the new answer to memory-system design and production, offering new latitude to the computer engineer, new solutions to your system production problems—complete RCA Memory Systems. Designed and produced by RCA from ferrite cores to entire packaged systems, these precision units are pre-tested to broad operating limits and are delivered ready for immediate use in computer designs.

Here are some of the outstanding features of complete RCA Memory Systems:

- **Specified Wider Margins of Operations**... Up to 8 percent... to cope with broad variations in power levels.
- **Custom Design Service**... RCA's engineering staff will custom-design a memory system to your specifications.
- **Superior Reliability**... Components and circuits proved by the long, dependable service of over 150 systems now in use.
- **Complete Information Retention**... even in case of full power loss.
- **Wide Temperature Range**... 0°C to 50°C.

For Systems Engineering Service—Call your RCA Office. For further technical information on RCA Memory Systems, write Dept. FD8, RCA Memory Products Dept., 64 "A" St., Needham Heights 94, Massachusetts.

STANDARD RCA MEMORY SYSTEMS

Capacity	128 to 32,768 words, 4 to 64 bits per word.
Speed	Complete Read-Write cycle times: 0.375 to 12μsec.
Modes of Operation	Read-Regenerate/Read-Modify/Write Only/Read Only/Master Clear.
Reliability	Acceptance tests made with all power supply voltages varied both plus and minus 8 percent from their nominal values while the system is being temperature cycled.

ADDITIONAL OPTIONAL FEATURES

- Self Checking—with simulated worst-case conditions.
- Information Retention—prevents loss of stored and in-process information in the event of primary power failure.
- Indicator Lights—for memory address register and memory information register.
- Interlace Register—permitting simultaneous read and write operations.

The Most Trusted Name in Electronics

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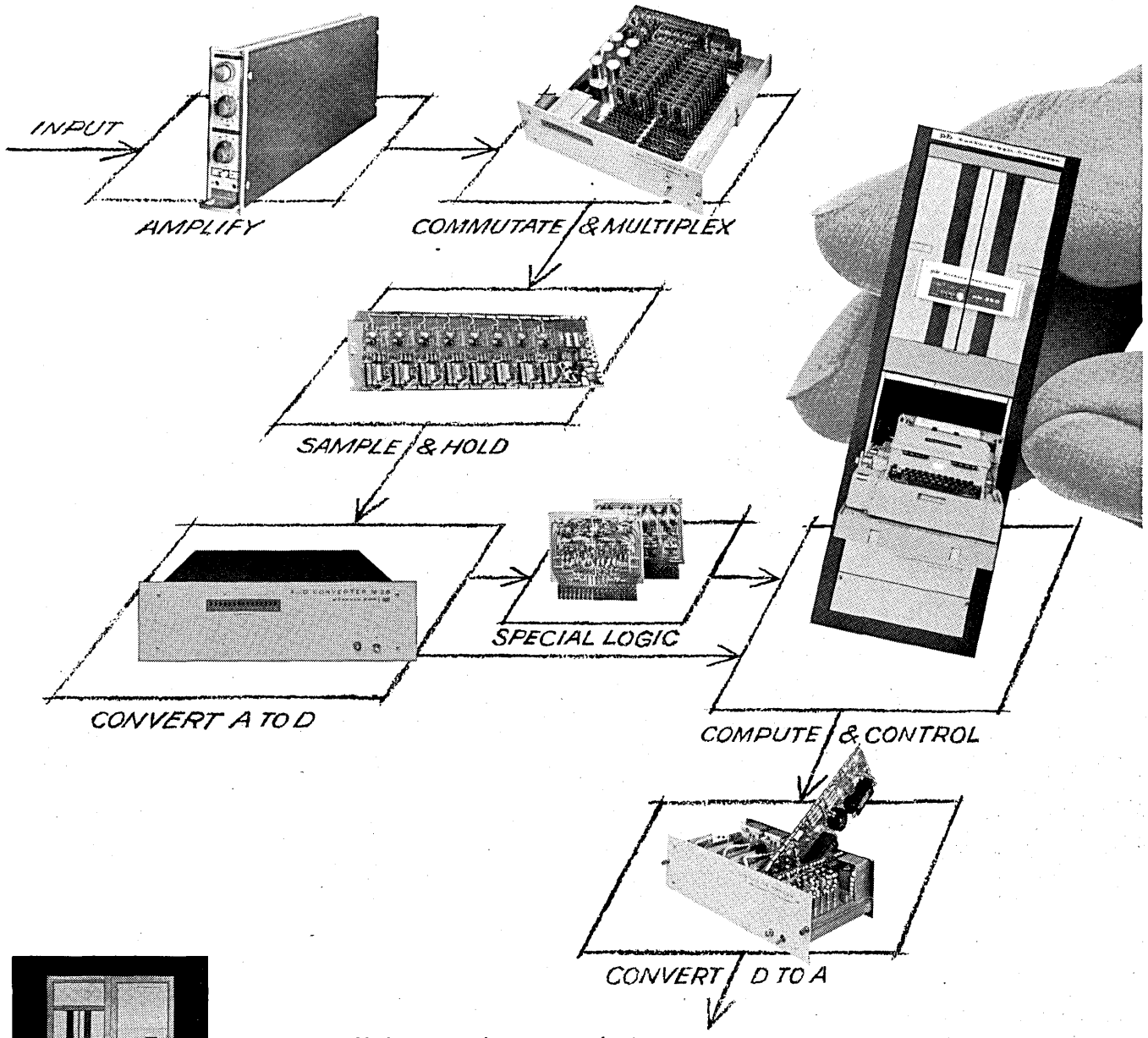
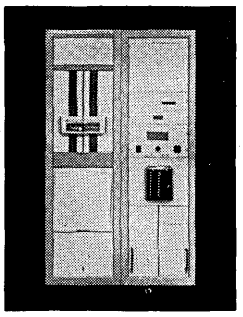
CIRCLE 27 ON READER CARD





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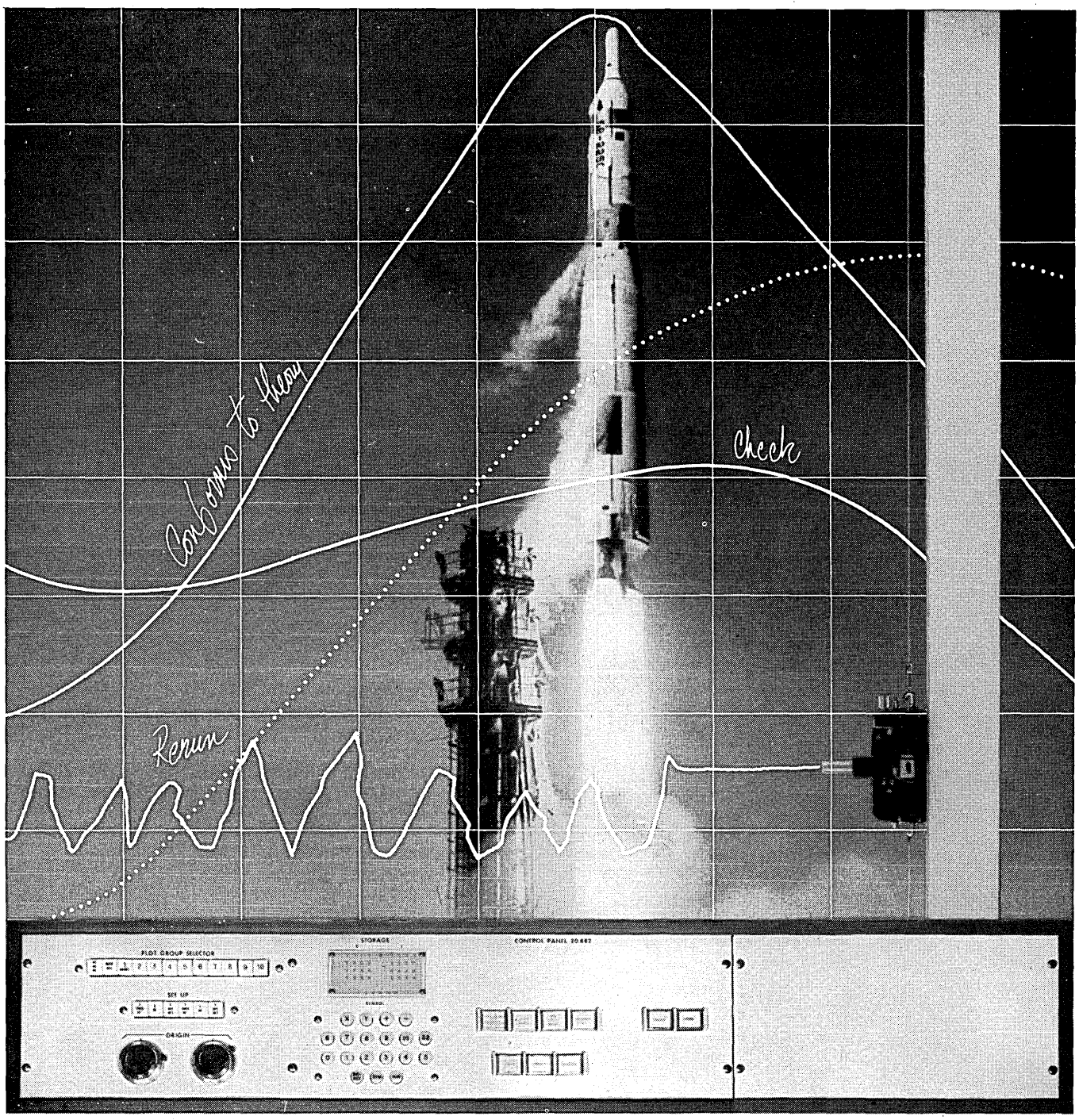

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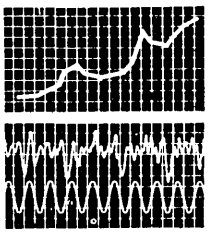

BUSINESS & SCIENCE

EDP BILL PASSES HOUSE; FACES STIFFER SENATE FIGHT

The Brooks bill, moving down well-greased legislative rails, moved out of the House in June after only one hour's debate on the floor. A motion to return the bill to committee was defeated, 258-96. Also beat down: a motion to make competitive bidding on punched card equipment mandatory. The final version of the bill removed operation as a direct authority of GSA and also extends GSA authority to edp systems leased or purchased by contractors, and entirely funded by gov't dollars. Exact nature of GSA authority will not be determined until the bill escapes the Senate--where intensified DOD opposition is expected--and final GSA regulations are issued.

NEW $ = NEW LEASE ON LIFE FOR ASI

Bucked up by a quick injection of Vitamin M, Advanced Scientific Instruments of Minneapolis this month announces a new system, the ASI 2100 (see p. 64). The announcement signals the return from the grave of the two-year-old Minneapolis firm, which only last January was ready to call it quits. Every avenue of salvation had been explored, including--ironically--purchasing look-sees by Autonetics and Bendix.

At this point, riding up like a melodrama hero, came Electro-Mechanical Research, waving a multi-megabuck hypo from its parent firm, Schlumberger...Netherlands-based firm which has been broadening its original petroleum services base with electronics acquisitions, including Daystrom (Feb. '62). Within two weeks of the original contract, ASI was a division of EMR, ready to begin the long climb out of the financial cellar.

Some 60 furloughed employees were rehired, all outstanding debts paid, and new management controls installed. Today, ASI has 125 employees, and expects to double that number by the end of '63. There are now 11 210's installed. Recent orders include Adaptronics, Inc., Beech Aircraft, and a service bureau installation at Electronic Calculating Service in Los Angeles. Current 210 production rate: two a month.

Originally a splinter of the old General Mills computer effort, ASI is in more logical hands with EMR, a 22-year-old firm which specializes in aerospace instrumentation and data handling. Although never publicly announced, EMR's gross is estimated at about 30 megabucks a year. Behind EMR: the 266-megabuck gross of Schlumberger in 1962.

CDC WINS OUT DOWN UNDER

In the same month that it set up its new Australian company, Control Data walked off with the marbles--some $8½-9-million worth--beating out 7 other American and British manufacturers with two orders for multi-computer systems for the Commonwealth Scientific and Industrial Research Organization and the Bureau of Census & Statistics. Each organization will receive a 3600, plus yet-to-be-announced satellites (the new Zeta?)--four for CSIRO and five for BCS. One CSIRO satellite will be located at Canberra headquarters with the 3600; the others will be spotted in Sidney, Melbourne and Adelaide. No physical connection is anticipated right away, according to G. N. Lance, Officer in Charge of the Computing Research Laboratories for CSIRO, a governmental scientific research organization. Final delivery of the CSIRO complex is expected by June '64, with some satellites due earlier. The BCS 3600 will go in before June; satellites are not due before the end of '64. Lance said that his organization expects "considerable" programming support from CDC, which will supply a FORTRAN '63, and, eventually, an ALGOL compiler. The orders were expected to be signed in late July or August.

BRAVE CEIR, A CAUTIOUS BULL

CEIR, bravely taking its medicine, has written off all of its past mistakes in the semi-annual report covering the six months ending March 31. The dose was a whopper: $2,136,272, which includes such misjudgments as STRETCH space committments and the 1604, plus nearly half-a-megabuck in one-time consultant fees (reorganization comes high these days). One bright glimmer: outside of these non-recurring losses, '63 losses for the first six months were some $250K less than last year's same period. And the firm's working capital as of April Fool's day was plus $1,116,300 vs. a minus $310,952 six months earlier. Not included in the report: the company's third quarter --"best in the last three years." Looking like a cautious bull, CEIR plans no more immediate hardware investments, feels that in its current situation lie the germs of order, stability and predictability. In the words of one observer, the company is now in a position to plan to stay alive.

COMMUNICATIONS-ORIENTED SYSTEM FROM RCA

The harsh fact that hardly anybody makes dough building and selling computers doesn't seem to slow the pace of new computer announcements. The latest: RCA's 3301 (three times as fast as the 301?) REALCOM, featuring a 1.75 usec main memory cycle and a 250 nanosecond microferrite 200-character scratchpad memory. Compatible with the 301, the 3301 software includes an I/O controller called the File Control Processor and an executive routine, plus FORTRAN II (IV is coming), and extended '61 COBOL. Straight add time (five digits, memory to memory), is 32 usec; with floating point add (10 digits) taking 9.75 usec. These compare to 189

usec and 168 usec, respectively, in the 301. The word length is variable up to 10 characters. Multiprocessing capabilities include simultaneous compute, I/O and access to disc or tape; optional is a priority interrupt control which provides five-way simultaneity: read, write, compute, communicate and interrupt. Three communications modes include: Communications Mode Control (300 cps max.); Data Exchange Control (266,666 cps); and Single Channel Communications Control (uses six voice grade communication lines, handling up to 40,000 bits per second on a common carrier digital subset). Described as a communications-oriented gp business and scientific system, the 3301 falls between the 301 and the 601 in capability, is price-equivalent to the 501, which, says RCA, it does not replace. Wanta bet?

BACK TO THE WELL FOR BURROUGHS

Burroughs, which has already invested in its edp program to the tune of an estimated 100-150 megabucks, is arranging for more financing, primarily to reduce its current bank debts--$54-million as of the end of May. $25-million in debentures was sold to an underwriting group, and another $17.6 will be raised by an offering of over 740,000 common shares to stockholders at $23.75 each. As of this writing, Burroughs stock is hovering near the year's low of 27½.

PROGRAMMERS-IN-WAITING

The People Problem in dp is being given a boost by pools of parttime programmers, mostly young mothers organized to provide programming service by the hour, day, or you name it. It may become a healthy boost if these so-called pregnant programmers can be pooled in Ann Arbor, Mich., Chicago, San Francisco, and Los Angeles, as presently planned.

In the latter city, a staff of 10 under Ralph Shofner of Advanced Information Systems is available but, as yet, unutilized. Present rate structure is $96 per day for a senior programmer, $78 for a programmer.

Already earning pin money are some 12-14 ladies in Boston suburbs, associated with Mrs. Elsie Shutt of Harvard, Mass. Formerly with Datamatic Corp., Mrs. Shutt charges $12 per hour for an analyst/programmer (equivalent of a masters degree in math plus five to six years' programming experience). A programmer (bachelors in math, three-plus years) costs $9 per hour, and a junior programmer (bachelors, less than three years), $6. A shortage of analysts, Mrs. Shutt says, is slowing staff expansion.

Unlike the Kelly secretarial group, the girls are not guaranteed to be kept busy, but all work is at home except for meetings with the job analyst and debugging. Mrs. Shutt, too, works out of her living room; indeed, the no-overhead operation is, at this stage, necessary for a successful venture, she says. Her only expenses are a parttime secretary and phone calls.

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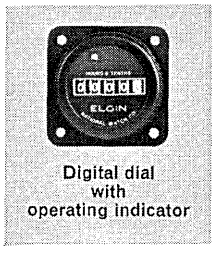

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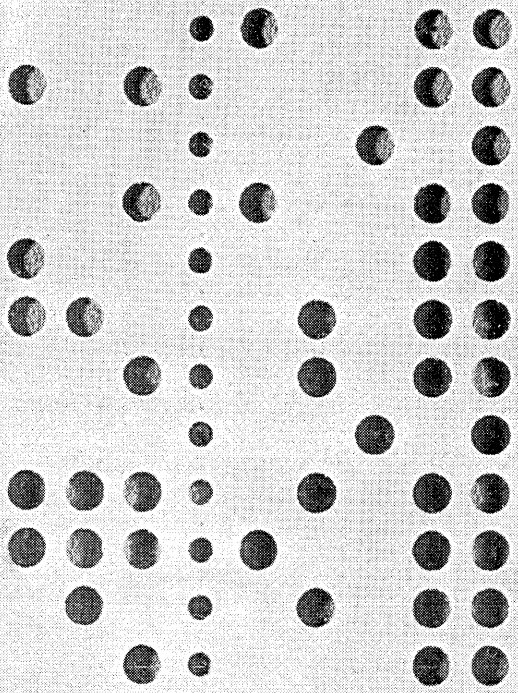
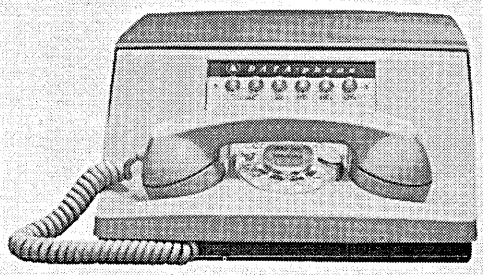


THE LAST WORD



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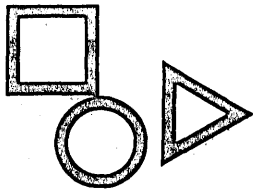


EDITOR'S READOUT

OF MATURITY AND MEATBALLS

Moving with the manic-depressive erraticism of the teenager that it is, that awe-inspiring, exasperating, lovable, dumb organism known as the computer industry ambles sluggishly but inexorably toward adulthood.

As with the human animal, this event is to be viewed with mixed emotions . . . exhilarated relief coupled with nostalgia. With the expectations of more predictable behavior comes a longing for some of the enthusiastic transgressions and digressions of childhood. Most of all, we think the industry will miss its own equivalent of the buffalo, that fast disappearing species known as the individual.

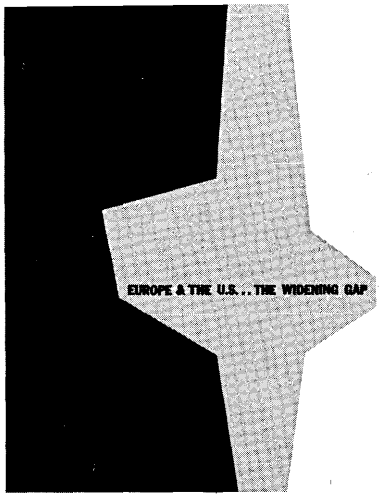
Programmers, especially, are being thought of as rational human beings capable of doing a standard day's work, we understand. The industry is moving swiftly toward the domestication of this once proud, wild animal . . . establishing standard aptitude and selection tests which will surely lead to a neat curriculum formula by which bright-eyed, clean-shaven young men will plod methodically along a well-flow-charted course toward a BS in Computing Sciences, a desk with a graph pad in a windowless room in Podunk or Potts, and a 25-year good conduct pin with three oak leaf clusters.

Engineers, as everybody knows, have already gone this route. A look at today's machines is all the evidence needed . . . the only succinct comment to be made upon the values of this sensible and orderly approach. Someday even the programmers at Rand will shuck their sandals and sport shirts for shoes and Rooster ties. These, of course, are only surface symbols of conformity, not to be confused with the real originality and creativity.

These twin talents, hard to define, are harder yet to detect and predict. They often appear in people not afraid to carp, criticize, complain . . . people driven by a divine discontent, a belief in such old-fashioned values as uncompromising truth. The modern organization chart, revered by meatball manufacturer and user alike as substitute for real authority and responsibility, has few boxes for individuals who know what they are doing, are capable of doing it, and, more important, care . . . want to see it done properly.

Some of these people turn into consultants, a profession to be recommended if you have the will and the nerve to watch others pay plenty of dollars to ignore your advice. Others form a small company of their own . . . then watch it get swallowed by a bigger organization chart, or turn into one.

We'd like to see a computing organization with a floating box saved for a thinker, a person unfettered by standard, traditional ways of looking at problems . . . free of the usual confusions of hard and dotted lines to read, research and think in his own way about real, not artificial, problems. He'd be free, too, to wander into the president's office with ideas, sound and hair-brained . . . and to occasionally get something done. Maybe somewhere this is happening. We'd like to think so. ■



Abhorring the vacuum created by European computer manufacturers' inability to keep up with voracious continental computing needs, American machine makers are moving rapidly into a nearly virginal market. Beachheads have been established and consolidated; the invasion continues in full force. IBM, according to one interested U.S. observer, is taking orders for the 1401 in Europe at the rate of one a day, already has 80% of the market there . . . 90% in some countries. Control Data, stepping up its pace to meet this threat, is accelerating plans to establish manufacturing plants in Europe to augment the recently acquired Netherlands Electrofact facility. Burroughs, although strangely refusing to push its ALGOL-oriented B 5000 in ALGOL-happy Europe, is marketing its 200 series, and has established a subsidiary in Norway. RCA, well established with its marketing agreements with Bull and ICT, has already sold nearly as many 301's in Europe as in the states . . . and without a lot of ugly overhead. GE, with computer department ex-general manager Claire Lasher at the helm of a newly established International operation, is making noises as if it means business overseas to match its runner-up aspirations in this country. Univac and Honeywell are stepping up the pace of their European operations.

shimmering vistas

Triggering all this hyperthyroidism is the same thing that pulled the American 49ers west: the promise of riches in a virtually untapped field. According to a recent report, "Development of the European Computer Market," delivered by the Netherlands Automatic Information Processing Research Centre by the request of the Committee of the European Economic Committee, Europe now stands on the threshold of a decade of computing progress.

The report estimates that, in the Common Market alone, the estimated 985 installations (at the end of 1961) represent only 10% of the total number expected by 1970. This would represent a total EEC investment of $5,800,000,000 ($3.3 billion for equipment and $2.5 billion for preparation, including personnel). But, as the report points out, "The curve of growth is even then considerably less steep than that for the USA in the years 1956 to 1961, so that the present lag of five years will increase to eight and a half years by 1970."

Factors which may alter this estimate: the lack of programmer training . . . plus the possible counterbalancing effect of new hardware/software techniques from traditionally fertile European minds. Datamation's roving Herb Grosch wishes that the U.S. and Europe could exchange educational output for the next few years. "What the U.S. needs," he says, "is a small number of well trained people; Europe needs a great mass of junior-college-type 1401 programmers."

Currently, however, the installation lag is paralleled by a technological gap between the two continents . . . a gap which, in the eyes of one observer, threatens to swamp some European computer manufacturers. Articles by two seasoned European observers probe this problem more deeply in this international issue of Datamation; one of them poses the possibility of a British computer renaissance which may be strong enough to mount a counter-invasion of the U.S. Additional insight into the current European situation is provided by Howard Bromberg's article on standardization, where acceptance of English for COBOL in both France and Germany presages a strengthening of the American invasion. The first of a two-part series on the new American Standard Code for Information Interchange has important international implications. And a reprint from USSR underlines the question mark that shrouds Soviet computing activities. John Diebold reports that Russia has advertised a computer in western Europe; perhaps a technological re-enactment of World War II is in the offing.

THE EUROPEAN COMPUTER SCENE: 1963

nationalism & IBM's competitors abroad

by A. S. DOUGLAS, C-E-I-R (U.K.) Ltd.,
London, England

Criticism of computer developments in Europe is perhaps safer, if not more penetrating, when done from the other side of the Atlantic. *Datamation* recently published a brilliant critique by an American in Europe of the supposed progress in the development of computer languages (February 1963). There are many Europeans and, no doubt, some Americans who would agree with Dr. Grosch's sentiments, but for very different reasons. Whereas the Americans, in agreeing with him, might appreciate the problems involved in operating a large computer and realize that languages, however sophisticated, will not in themselves satisfy their needs, most Europeans would agree with his criticisms largely because they themselves do not see the need for an operating system at all — and feel that the Americans are making altogether too much fuss about the whole thing.

It is perhaps significant that, in discussing the problems of a large concern in the U.K. recently, I was informed that "their computer staff could not see any work in the corporation which could not be coped with on the 1401." No doubt this attitude exists in the U.S. too, but I doubt if it would be expressed without reservations, even in a small organization. In fact, most U.S. firms of the size concerned would already have a more comprehensive system or be using one on a service basis.

European development, of course, is at very different stages in different places, and tends to take on a local, or national, character. For instance, Dutch development has been greatly influenced by the design work of Prof. Van der Poël of the Post Office and Prof. Van Wijngaarden of the Mathematische Centrum, each of whom has been largely responsible for producing successful small machines, the Stantec Zebra and the Electrologica X1, much used locally. In the same way, design work in Denmark has led to the local production of an excellent scientific computer, the Geir, by the firm of Disa Electronics. In both

countries, the use of larger systems has tended to be confined to one or two large firms, such as Shell and Philips.

In Belgium, by contrast, practically no real interest in computing has yet developed, natural conservatism being reinforced by the strong central control of industry by the banks and the Société General. At present, the most powerful computer in the country is a Ferranti Mercury (IBM 1410 class) and that is at the nuclear energy establishment which has strong intra-European connections.

Norway, largely due to the pioneer work of Dr. Jan Garwick of the Atomic Energy Authority, is fairly well advanced in its thinking, and the Regnecentralen, a partly government-supported firm, is shortly to take delivery of a Univac 1107. In Sweden, the Board of Computing Machinery sponsored development of BESK, based on the IAS/Illiac systems, at an early stage, and machines have been made and sold locally by Facit and Saab. An IBM 7090 is installed at the Atomic Energy Establishment. Various British machines are working in industry, several from ICT, and a Ferranti Orion has recently been successfully installed for a large store in Götaborg. Considering the size of the country, this is significant progress, but still not on the scale of, for instance, the U.K.

In Germany, there is a strong feeling that to compete in the U.S. it is necessary to copy U.S. methods, for which there is sometimes an inordinate admiration. Consequently, large and small machines are being installed by U.S. firms, although both France's Bull and British manufacturers, particularly ICT, have obtained some orders. There is something of a struggle going on in the large machine field between IBM and Univac, the latter working hard to get established. At present, honors are about even with at least two 1107's going in shortly, one at Frankfurt and one in Stuttgart, and 7090's already in Munich and Dusseldorf (the latter an IBM service centre), being supplemented by machines at Bonn and at the Badische Anilin und Soda Fabriek at Ludwigshafen. In the data processing field, IBM already has the major share of the market.

The German manufacturers have not really got going yet. The first TR4's are due for delivery shortly by Telefunken, and it is said that Siemens will come into the field soon. A small firm, Zuse AG., has been making small scientific machines for some time, and the Z23, a drum machine of about the IBM 650 class, is much in use in university departments. This machine is unique in having ALGOL as its normal symbolic input, hardware being provided to speed up conversion.

Italy also has its own local manufacturer, Olivetti. The firm has yet to make a real impact with computers outside its country, although its accounting machines with paper tape by-product and equipment for recording factory information on paper tape are both cheaper and better designed than competitive machinery, such as the IBM 357 or the NCR and Burroughs accounting machines. Nevertheless, in spite of the presence of the International Computing Centre in Rome, and Euratom at Ispra, progress in the computer field has been slow. And there is a severe shortage of trained programmers in key areas, such as Milan.

In France, the main local manufacturer, Bull has a strong sales organization but few products of its own to sell in the computing field. However, it is successfully marketing the RCA 301 as the Gamma 30. In this it is meeting some competition from ICT, which has a local sales organization selling the same machine as the ICT 1500! Unfortunately, the Gamma 60, which has many interesting design features, has not been successful in the field and, being a valve (vacuum tube) machine, is by now considered outdated. A new machine, the Gamma 300, will have the unique feature of a 300 card per minute mechanical punch and is a simple and compact system for small data processing jobs. However, Bull has, as yet, no machine to offer on the scale of the IBM 7000 series, and it is therefore not surprising that this market has fallen almost entirely to IBM. Several 7070/4's are installed, plus at least five 7090's and one 7094. The first 7040 is due for delivery shortly, and there are several other large systems on order.

Univac has one order in France for an 1107, from Paris Univ., but has otherwise managed to make little headway there against the European headquarters of IBM World Trade. In Switzerland, however, where Sperry Rand International has its headquarters, although no 1107 is on order, Univac has had more success with the SS-80 than in France. The only large machine there is a 7090 going to CERN in Geneva. Surprisingly, Switzerland leads all European countries on the basis of computers per head of population.

But this sort of statistic can be most misleading (who said, "You can prove anything with statistics?"). The development of work within firms all over Europe has sprung from two main sources, accountants and scientists. In the accountancy field we are really seeing a steady transition from conventional punched card equipment to electronic card-operated computers of the 1401 class. This transition is a direct development from conventional punched card accounting systems, effected largely for the cost savings offered, and makes no real impact on company organization.

The second stage of accountancy development has been begun only in a relatively small number of firms, mostly the larger ones. This involves adding magnetic tapes or disc packs to basic computing units, and requires mechanization of complete office procedures, rather than individual jobs. If only this type of machine is considered, then there is little doubt that the leader in Europe is the U.K., where the nearest approach to U.S. development is taking place.

the british scene

Up until now the U.K. has had too many manufacturers and too many varieties of machines, mostly incompatible with one another. From the U.S., Honeywell, Univac, NCR, CDC, Burroughs and, of course, IBM all have machines installed. Local manufacturers have tended to belong to one of two main lines of development, and have not concerned themselves greatly with the other. Thus, Ferranti and English Electric have built "scientific" machines, LEO and ICT "commercial" machines. Only Elliott tried early to cover both fields with one machine, the 803, carefully aimed at the smallest end of the range and marketed on the commercial side by NCR. The wisdom of this move by a "scientific" firm to cover its weakness in commercial marketing has now been acknowledged by English Electric in merging with LEO who, though without NCR's powerful marketing organization, is nevertheless well established in the commercial field.

The most powerful British competitor to IBM is undoubtedly ICT. It has a marketing organization for punched card equipment in Europe comparable to IBM World Trade, and is still well entrenched in the U.K. despite great strides made by IBM in the 12 years or so since the agreements with BTM (main parent of ICT) were finally terminated, and IBM came to England independently. However, in the computer field at present, ICT is a marketing organization searching for products to market. Somehow it has never been able to create an engineering organization wholly within itself which can design and build a successful computer.

The main product to date, the ICT 1200/1/2, was

designed by Booth of Birkbeck College, London Univ., and is a very simple drum computer – much less powerful than the IBM 650, even. An attempt to build a more elaborate system, the 1400, failed. Since then, cooperation with GEC (not to be confused with GE), a leading U.K. electronics firm, has produced the 1300/1 system which, in various configurations, is capable of competing successfully with the IBM 1400 series. Annexation of the EMI computing team has added the 1100/1 to the ICT range, and marketing arrangements with RCA has given ICT the 301, known as the ICT 1500. Unfortunately, all these machines are competitive rather than complementary, and it is a difficult task for a salesman to decide which to propose for a given job. The lack of a machine more powerful than the 1410 class is becoming an embarrassment and, in addition to improving the power of the 1301 – the new system is to be called the 1302 – there are strong rumors of a merger with the Ferranti computer interests. This would combine a powerful marketing force with two very advanced and powerful computers in the Orion and the Atlas, the former of which is quite suitable for large scale data processing, being slightly more powerful than the 7070/4 system.

The Atlas is, of course, the most outstanding machine under development in Europe. Its internal computing speeds are more than three times those of the 7090, and compare quite favorably with STRETCH. It does not suffer from the drawbacks of the STRETCH system, however, and is likely to have a speed factor of at least three over the 90 on most problems which are not completely tape-bound, even ignoring the savings effected by time-sharing programs. At present, the Manchester Univ. version is working although the performance of the drums is not yet satisfactory, and several tapes have still to be added. Consequently a full test of the supervisory scheme has yet to be made, and thus the whole system cannot yet be said to be fully proved.

An interesting offshoot of the Atlas is being built at Cambridge Univ. This system, which uses Atlas packages and much of the central organization, omits the features of drum storage and replaces these with additional core store. The resulting machine, to be called TITAN (if this is an acronym I don't know what it stands for), will be very powerful but the supervisory scheme will be greatly simplified. The logical design is being done, under the direction of Dr. Wilkes, by W. S. Elliott – who designed much of the Ferranti Pegasus and later directed the IBM World Trade laboratories at Winchester – and Dr. D. J. Wheeler who, besides being one of the pioneers of EDSAC I (completed 1949), has taken part in the design of ILLIAC, EDSAC II and ILLIAC II.

little language rationale

If some rationale is coming into British manufacture (although there are still a few mavericks, such as the AEI 1010), the opposite is happening with respect to computer languages. There is, of course, a strong FORTRAN school consisting entirely of IBM users. As in America, they are all looking at IBSYS and FORTRAN IV and wondering whether (or, rather, when) they should leave the safe haven of FORTRAN/FAP monitor for this brave but as yet uncharted new world. Everyone is hoping that someone else will find the bugs first, and most have too much interest in FORTRAN II to feel happy about the switch yet. The Atomic Energy Administration at Harwell is getting an Atlas, leading to the development of a version of FORTRAN for Atlas because the group currently consists of IBM users. This will be known as HARTRAN, and will have about as many differences from 7090 FORTRAN II as might reasonably be expected on a different machine (say, 7070 FORTRAN). But Atlas sprung from the Mercury stable, and thus must accept Mercury AUTOCODE. This it will already do, and a more extended version is also being designed for use with it. So far, three languages.

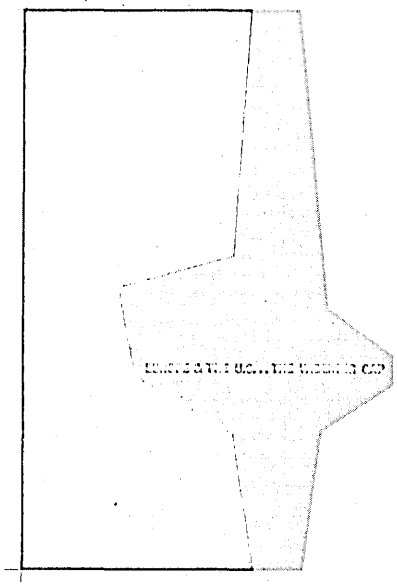
Then, of course, one must these days have ALGOL (unless one is IBM). But ALGOL does not specify an input and output system much, and is not thought to be good for data processing. So we must also have COBOL, and perhaps a new language – let us call it CPL – and NEBULA and LUNACODE and so on. All of these are useful experiments, and it is right that such experimentation should go on. But there will be heavy pressure to settle on a smaller number (perhaps one or two) general languages soon, both because of teaching and of communication difficulties. A more rewarding but less popular research would be to construct more special purpose languages, while thinking more about the fundamentals which are being expressed.

A less diverse approach to languages is being adopted for the English Electric KDF9. This machine which, despite slower computing speeds, is nearly as powerful as the 7090, due to the inclusion of some design features similar to ILLIAC II, is going to several universities and large firms. Two versions of ALGOL are to be supplied, one of which is designed to compile relatively inefficient programs quickly, and the other to compile efficient programs more slowly – an interesting philosophy which could well be carried over to the development of FORTRAN.

In spite of the progress being made in hardware development and the imminence of delivery of the above machines, new IBM orders, and other quite powerful systems such as the Elliott 503 and the LEO III, progress in the use of such systems is not well developed. There are no large scale data retrieval schemes as yet projected in industry on the scale now operating in the U.S. The use of linear programming and economic models and simulators is confined to a few large firms, mostly with U.S. parents, or in industries such as oil where there is a strong U.S. influence. Nevertheless a good deal of ground work is being done, and the visible achievement so far is, like the visible part of an iceberg, only a small part of the body of underlying progress.

The use of PERT networks for planning, production, and construction work is developing rapidly, and the first tentative steps in the use of programs such as PERT COST and RAMPS are being taken. Operational research, far from being esoteric, is becoming commonplace and more widespread. Even economic planning has become respectable at the governmental level with the introduction of NEDC in England. It has, of course, been quite the thing in France for several years – from the formation of the Commissariat au Plan, in fact – but it is new in Britain to contemplate actually doing regularly what that talented amateur, Lord Keynes, used to do from his Bursarial bed in Kings College, Cambridge. Moreover we have actually held conferences on "integrated" data processing although the full significance of this has yet to be understood and is, at present, thought of only as drawing together accounting procedures rather as an integration of all clerical procedures in a firm, including production planning and control, progressing, forecasting of sales, stock control, cost control, and so forth.

We have a long way to go in Europe, by American standards, and our progress is already limited by the lack of trained personnel rather than hardware. But one senses that the management climate is changing rapidly and that most Boards now believe computers are here to stay!



COMPUTERS IN BRITAIN

a startling comeback in the making?

by R. H. WILLIAMS, Computer Consultants Limited, London, England

The computer situation in Britain and in Europe is similar to that in the United States – many computer manufacturers have been disappointed in their expectations, although there have been far fewer retirements, mergers and take-overs than expected. The vast majority have carried on with varying degrees of success. It would, however, be safe to say that many of these are still in the red, but their other activities enable them to continue and we believe that they will continue almost indefinitely, largely for matters of prestige and other internal reasons. The similarity of the situations on the two continents extends to the fact that IBM is also in Europe rapidly collecting most of the new computer rentals and sales. What is different is the volume of installations.

According to our estimates, there are now 574 computers installed in Britain, with another 402 on order. It still appears to us that our projection of some 5,000 computers installed in Britain by 1970 is likely to occur. Very many of the machines installed in the next two years will, however, be built in America, and the number of computers which will be built in Britain is unfortunately, from the British point of view, now reducing drastically.

The largest British punched card manufacturer, ICT, has had several setbacks in its computer development and it would appear that its Board was unprepared for the many changes of approach necessary in dealing with computers. ICT, not quick enough to realize that early machines were almost obsolete as soon as completed, has tried to protect its position by first of all forming ICT which was a merger of the Power-Samas and Hollerith organizations. The company more recently tried to protect its position by buying the computer division of EMI, who had built the Emidec 1100. This computer was the first transistorized data processing system in Europe and is now, of course, the oldest. Some of the EMI engineers were previously ICT engineers and at the time of the take-over left to join other organizations, so ICT profited very little by this move.

The other British computer pioneer, Ferranti, while producing usually first-rate electronic equipment, has a poor appreciation of the strictly commercial use of computers and outsiders have long advocated a merger of ICT and Ferranti. Discussions about this merger have been going on for a long time and rumors at present say it is on the point of being completed. If it is completed, it will be in fact a move of desperation and has less to commend it than it might have had in the early days. A recent Ferranti computer, the Orion, ran into trouble in its development and this has not helped. It is doubtful if many more Atlas will be sold and this computer is still not fully proved.

ICT still has a very efficient office equipment sales force and is now containing its position by selling the RCA 301 computer under the name of ICT 1500. This is a straight sales set-up with the RCA 301 being imported into Britain and the procedure does little to help the British production of computers.

ICT's own computer, the 1202, a tube punched card

machine, is now obsolete and their 1301 and the scaled down 1300 are not conspicuous successes. Indeed it would appear that some previous 1301 customers have changed their minds for ICT 1500's.

conflict in merger

During recent months the Leo organization has merged with English Electric to form a joint computer company. English Electric, after building early valve machines, produced some prototypes which are now appearing as the KDF 6, KDN 2 and the KDF 9 and for which there appears to be the possibility of a future. At the same time, Leo III is now an established machine. We think that both companies will continue to make modest sales with the degree of success in favor of Leo; because they are a smaller computer company, the sales have more effect. We do not feel however that the merger as such will mean that they are likely to sell many more computers jointly than they would have done as individual companies, and the inevitable headaches of merging two organizations may well prove to be a bad thing in the long run. Two people for every executive job is not always a happy situation.

The other British computer manufacturers, among whom are Elliott Automation and A.E.I., have had a modest amount of success. The volume is still small if measured in terms of cash. The Elliott group has an arrangement with NCR whereby the NCR 315 is built in Britain for NCR and sold by NCR. This arrangement is working satisfactorily and makes good sense. Its ultimate success is dependent on the ultimate success of the 315 itself, which has yet no field experience to either prove or disprove its capability. Burroughs and Honeywell are now making slow but sure progress in increasing their efforts in Britain, and Honeywell in particular looks like it's having more success. UNIVAC, after being very much in the doldrums, has now made sales of two of its large computers and is still in the running.

Other organizations, such as De La Rue Bull, are having a small amount of success in Britain. Bull, along with some of its punched card and similar products, sells the RCA 301 under yet another European name, the Gamma 30. This machine is to be built in France as from the Fall of this year by Bull, and one cannot help but wonder if the RCA 301 is now still new enough to justify the setting up of a production line which will not go into full production until early next year.

No IBM computers are at present being manufactured in Britain, nor is their manufacture contemplated. This means a tremendous drain on British currency. One of the great disadvantages of computer development and manufacture in Britain has been the very much smaller volumes involved, as opposed to the volumes in the United States of America, and also the slower tempo of bringing into usage computers. Apart from seven small Bull machines and one small DB40, not a single European computer has been installed in Britain.

Computer Consultants Limited defined the first generation of computers as the valve machines; the second generation as the so-called solid state computer; the third generation as machines built down to a price; and the fourth generation as machines using revolutionary new memory and other techniques. If one bears this in mind, then we cannot help but now draw the conclusion that Britain is losing out, and in fact has lost out, on the production and installation of British first and second generation machines. We feel, however, that in the same way that Britain is making a startling comeback in their aircraft development and production, they will do so in the computer field, if the British computer manufacturers take the initiative and jump a stage to take advantage of their competitors' inherent troubles and limitations from their existing sales position.

There is no question that the price of computers will be reduced by a factor of one in ten and possibly one in twenty in the immediate years to come. This will seriously embarrass those holding the largest share of the cake at the moment and we particularly refer to IBM whose whole economy is geared to the continuance of the existing price structure.

At the moment a magnetic tape unit costs about £10,000 and this is literally the equivalent of two Rolls-Royce motorcars. After making full allowances for development, production and what have you, this is still mad, and the price structure will be bound to be drastically reduced, probably in the first place by big organizations at present having only a small stake.

To our certain knowledge, at least three European computer manufacturers who have strong British connections are actively engaged in planning and developing fourth generation machines. These will be powerful and cheap and can afford to be installed with much less worry because of the fact that there is no large capital sum involved. The sales organizations for distributing these machines are already in existence. The thinking at present is that their initial sales, in order to capitalize on volume production, should be made in America against existing American prices and traditional types of computers.

the approaching trend

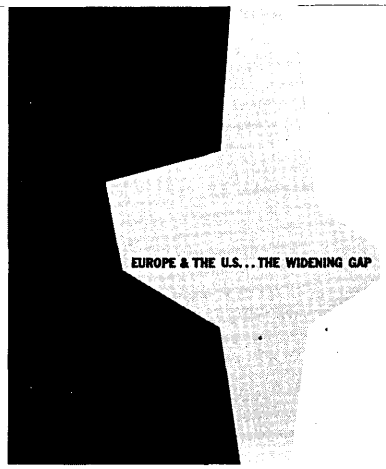
This is a bold line to take and we think will be successful, but it could be dissipated by well-intentioned but ill-informed efforts from the wrong sources. For example, because it has been accused of co-operating very little in the development and usage of computers, the British Government is now at long last setting up yet another committee to do something about it, and this committee is being staffed and guided by people from organizations, some of which are from Government circles, who themselves have failed to do anything constructive in the past with computers and have wasted enormous sums of money.

The trend in Europe and in Britain will undoubtedly be for small, cheap machines in large numbers, operating on traditional systems of decentralization.

At long last there is now coming into being in Britain a healthy nucleus of people, not directly associated with the text-book theorist electronic engineers and mathematicians who have bedevilled the British computer field for so long, but made up of intelligent individuals with sound business background experience, who are quietly running excellent computer installations. They are, without seeking to do so, making their presence felt and there is every indication that under this influence common sense is now being brought to bear at last.

There still exists the problem, however, of a man being given a computer job because he has six years computer experience which few other people have. Very little account is initially taken of the quality of this experience or of the man's own quality. He can do and does do tremendous harm, because far too many Boards can still be blinded by science.

In Britain the universities and technical colleges have little or no facilities for providing real business management training of the kind which is generally available at most American universities, and which in America is taken very much for granted. This training simply does not exist in Britain and considerable interest is now being shown in the establishment of the first computer training college which will offer tuition and a diploma organized on similar lines to the American Data Processing Certificate.



Nowhere does the existence of the Iron Curtain pose more critical problems than in what was once the international realm of science. Information concerning Soviet scientific/technological progress is, to put it mildly, hard to come by. Often what information is available is buried in doctrinaire political gobbledygook. Seemingly straightforward statements such as the following reprint from the May issue of *USSR*—available on American newsstands—must be scrutinized for "party line" thinking . . . a discipline not completely foreign to readers of Western technical-political literature. Because it does represent a crack in the curtain, DATAMATION is reprinting this article as a follow-up to the widely discussed piece by Paul Armer—"Attitudes Toward Artificial Intelligence"—printed in this year's March and April issues.

Of special interest is the article's emphasis upon the firm conviction of the "almost infinite possibilities" of cybernetics. This, coupled with the economic planning capabilities forecast for the Computing Center of the Soviet Union, should give American political and technological leaders occasion for serious thought.

CYBERNETICS . . . A SOVIET VIEW

reprinted from USSR magazine

"All the external manifestations of cerebral activity can be reduced to muscular movements. The musician's hand extracts sounds full of life and passion from a soulless instrument, and stone comes to life under the sculptor's hand. But the hands of the musician and the sculptor are capable of only purely mechanical movements, which, strictly speaking, *can be analyzed mathematically and expressed by a formula.* Therefore, to every naturalist the idea of the machine nature of the brain is a godsend."

These lines appeared exactly a hundred years ago in the Russian medical journal *Meditsinsky Vestnik.* They were from the article "Reflexes of the Brain" by the well-known Russian physiologist Ivan Sechenov. His speculation, which seemed heretical in the past century, has been confirmed only in our time, with cybernetics' moving into the most varied fields of scientific research and practice.

In recent years cybernetics has been debated in Soviet newspapers and magazines, in radio and television broadcasts, not to speak of scientific publications. In this highly controversial discussion on the present and future of cybernetics, the country's leading mathematicians, designers, philosophers, physicists, biologists, medical researchers, economists — in a word, a most representative stratum of people in the various disciplines — took part, at times presenting diametrically opposed views. Perhaps for that very reason the exchange was so useful. It helped to crystallize our conviction of the almost infinite possibilities of cybernetics — this science of optimal, directional control of complex dynamic systems and processes.

Our scientists were not nearly so unanimous when the new science was born. Some hailed the omnipotence of cybernetics and went so far as to say that eventually perfected machines would replace the natural sciences and even man himself. Others rushed to the other extreme, as certain that cybernetics would be limited to technological systems of automatic control, and argued that from the philosophic viewpoint it must be considered a form of modern mechanism.

Now we seem to be done with the period of the "infantile diseases" of cybernetics, when the vague outlines of the new science suggested any number of questionable forecasts. But these erroneous predictions did not seriously retard the development of cybernetics. Suffice it to say that electronic computers appeared in the Soviet Union when the theoretical assumptions of the founders of cybernetics were not yet accepted by scientific authorities, and were even regarded by some as "propaganda for pseudo science."

The sweeping advances of cybernetics in the past 10 or 15 years have not only upset the pessimistic forecasts of

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Valentin Gukov, M.S. (Engineering) science editor of Ogonyok, the illustrated weekly, reviews the opinions of scientists on the future of cybernetics.

the skeptics, they have surpassed even the most daring predictions of the optimists.

This is what a Soviet newspaper wrote on the subject: "If in 1944 someone had told the mathematician Norbert Wiener, who later on was called the father of cybernetics, that in 1962 there would be machine translators, machines which read and write texts, self-teaching machines and, finally, machines which design and reproduce themselves, he would very likely have called that pure day-dreaming."

Indeed, cybernetics poses for us not one or two but a whole series of philosophical questions that border on the fantastic. Can thought be born outside man? Will thinking ever become a machine process? Will thinking machines ever be capable of creativity? Will such machines be more intelligent than man?

The philosophical aspects of cybernetics was the subject of a conference held last summer in Moscow. From 30 cities all over the country came a thousand-odd people representing not only philosophy but also many of the pure and applied sciences. The question of whether or not it was possible to create thinking machines generated the most heated debate. The discussion, characterized by the most unorthodox approaches, by daring hypotheses (some of them completely divorced from reality), and by the inexorable logic of facts, boiled over into the press.

But while the philosophers are still arguing, science and technology have long since come to terms with cybernetics. Having convinced themselves that cybernetics would not displace the other sciences but that it could serve as an immensely productive tool, theoreticians and practical workers in the most diverse areas of human effort adopted it as their own. The results of this alliance were reviewed at last year's meeting of the Biology Department of the USSR Academy of Sciences, which heard 20-odd papers on the subject. Without going into the substance of the problems dealt with in these papers, the general conclusion can be made that biology and cybernetics have found a common language and a common road to research.

At present, every major scientific and industrial center in the Soviet Union is doing work in cybernetics, with thousands of specialists busy on both theoretical and practical research problems. The interesting fact is that it is the most cautious of scientists — the mathematicians — who are most daring in their estimates of the possibilities of cybernetics.

This is what Andrei Kolmogorov, one of the world's leading mathematicians, who has long been working in the field of computing technique theory, wrote in *Nedelya,* the Sunday supplement to *Izvestia*: "Artificial thinking beings are possible. It is not worth arguing whether it is possible to create them in principle." Academician Kolmogorov has said several times that if man succeeds (albeit in the distant future) in creating a computer with a number of cells equivalent to or exceeding the number of our brain cells, the machine would probably not only be capable of independent thinking but even of creative processes.

Another well-known mathematician, Academician Sergei Sobolev, wrote in *Literaturnaya Gazeta*: "Man is the most complex cybernetic machine, with a program built in genetically. The human organism functions like a mechanism; its parts are subject to the same laws of mathematics, physics and chemistry as those of any other machine. From the materialist viewpoint there is no contradiction between the concepts of 'natural' and 'artificial,' just as there is no clear-cut division between them. Is it not a fact that everything made artificially is made out of materials existing in nature, on the basis of the same laws of physics, chemistry, mathematics and other sciences that govern all nature, animate and inanimate?"

Recognizing in principle, like Academician Kolmogorov, the possibility of creating machines that can think and even create, Academician Sobolev says that we already have the prototypes of these machines of the future. Further progress, he feels, is limited only by our present level of scientific and technological development, which for the time being lags far behind our bold visions.

Not all scientists, by far, accept such avantgarde views, but the differences of opinion are not critical. Life itself inevitably narrows the gap between points of view. Investigating the methodological and philosophical concepts and laws that govern the interaction of man and machine working together, Soviet scientists move along different paths but proceed from the common postulate that cybernetics must help increase the efficiency of labor in every field of human endeavor.

Academician Axel Berg, one of the world's leading authorities on electronics and Chairman of the Scientific Council for Cybernetics under the USSR Academy of Sciences, wrote in *Pravda* that the task of this science of optimal control is to "eliminate the need for human labor in situations where the work to be done is either beyond man's strength or detrimental to his health, and to help him work out the best solutions to the complex problems of production, economics and science. Cybernetics cannot 'replace' the thinking man in industry, science or social life, but it can make his work easier and more efficient, can help him to use the full measure of his potentialities and capabilities."

All the differences of opinion as to the future of cybernetic machines aside, there is no denying that they work more quickly than the human brain. Their very invention was due to the fact that man became aware of the shortcomings of his brain. What will the next step be? Will the machine not turn into man's enemy? Will it not eventually push man out of even those fields he intends to reserve for himself? Will the machine not conquer man, reducing him to complete and degenerating idleness?

"I am convinced," declares Academician Vadim Trapeznikov, Director of the Institute of Automation and Telemechanics of the USSR Academy of Sciences, "that 'no' can be the only answer to these questions. I believe that had mankind been offered all the possibilities of modern photography several centuries ago there would have been people fearful that photography would eliminate the artist. In our own times, when sound films appeared, the death of the theater was predicted. I could cite a few more such prophecies. The fears about cybernetics are no more justified. It will not lead to rivalry between machine and man, not to enmity between the machine and its creator, but to cooperation. It will make it possible for man to do more useful work and to do it faster, better, and with less error."

"Faster, better, with less error" — that is the motto of our era. The twentieth century was first called the "Electric Age," then the "Atomic Age." Now more and more frequently it is called the "Age of Cybernetics." So we acknowledge the services of the new science in practically every field of human endeavor.

In the Soviet Union thinking machines have been employed most widely in research, particularly for scientific-technical calculations. They are being used increasingly in automating industry, construction and transport. Next in line is the application of computing and control systems to economic planning and accounting.

With the Soviet economy developing at such a rapid rate we can no longer plan for and administer this intricate economic complex by the old methods. Our planned society opens veritably limitless horizons for the application of

thinking machines to economics. We have in mind cybernetic "economists" and "planners" not only for individual enterprises or industries but for the economy as a whole. And this opens possibilities that defy our present imagination.

Academician Anatoli Dorodnitsyn, Director of the Computing Center of the USSR Academy of Sciences, wrote in *Pravda*: "Assuming a 10 per cent mean annual rate of industrial growth (in 1962 Soviet industry increased its output by 9.5 per cent), the reserves made available by optimum planning would be at least as great. In any case the present, so far scanty, experience has shown that machine-computed plans give us a 10 to 40 per cent saving of labor expenses as compared with plans drawn up, so to say, 'manually.'"

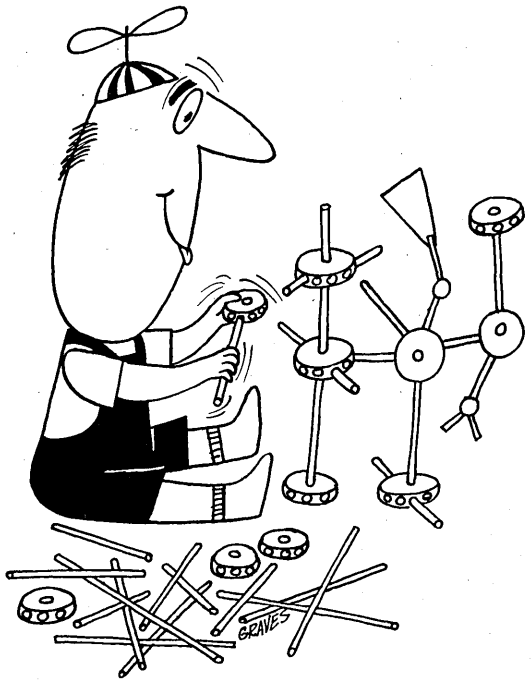
Cybernetics will make radical changes in the entire technology of accounting and planning. It is not simply a matter of replacing the conventional adding machines with electronic computers, as some like to think. Pondering over the not so distant future of Soviet economic management, Victor Glushkov, Director of the Institute of Cybernetics of the Ukrainian Academy of Sciences, wrote in *Literaturnaya Gazeta*: "Big planning agencies will become, in a sense, computing centers linked by a dense network of radio relay lines to factories and economic councils. The very methods of collecting and storing information will change because without the change it will not be possible to use electronic computers. Typewriters will be equipped with coding devices which will turn out information directly in a form convenient for processing on computing machines. And this information, recorded on magnetic tape and punched cards, will be stored in archives. It will then be possible to work out plans down to the most minute detail, and not only for next year or next month but for the next day and, if need be, for the next hour. Then, and only then, will our economy function like clockwork."

Mikhail Rakovsky, Vice Chairman of the State Automation and Machine-building Committee of the Council of Ministers of the USSR, is even more specific in describing the integrated computing system which is taking shape in the Soviet Union. "Factory computing centers," he writes in one of his newspaper articles, "will be tied in with the computing centers of the economic councils. Wires will run from the economic councils to centers in the republics, and from them to the Computing Center of the Soviet Union. This center, with its vast store of information covering the whole country, will literally be capable of comprehending the incomprehensible. The Computing Center of the Soviet Union will be able to solve such national problems of prime importance as current and long-term planning, providing material and technical supplies, and price setting. The prospects for the applications of computer techniques surpass the most daring expectations. In the near future our engineers will create a machine that will be able to compile and analyze an economic plan for the whole country in a few days."

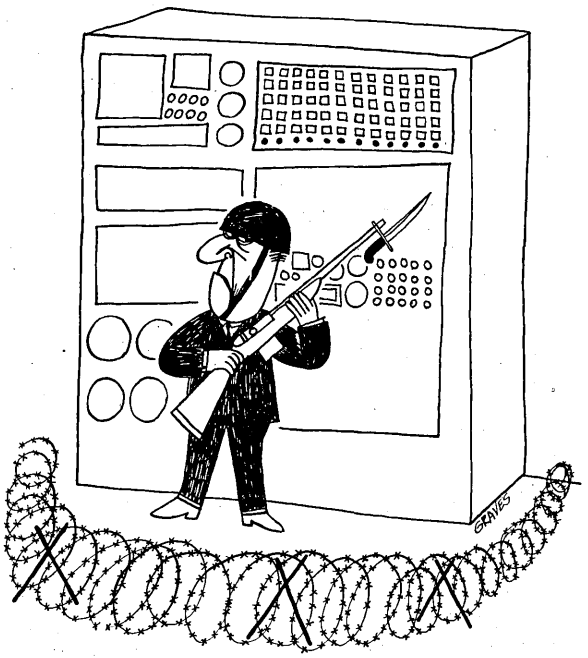
The invention of electronic computers and its significance can be compared with the first time man applied a stick as a lever at the dawn of human history. That opened the way for the development of various mechanisms which infinitely multiplied man's physical power. Computers, in principle, open that same unlimited perspective for multiplying man's intellectual power.

But no matter how "intelligent" these thinking machines are, in the last analysis they remain the creation of man's genius. They cannot therefore be more "intelligent" than mankind as a whole because collective human reason includes everything that man has created to increase his powers. ■

THE FIELD ENGINEER . . .



. . . as seen by management



. . . as seen by the programmer

THE AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE

part one: review and preview

by R. W. BEMER, UNIVAC Division, Sperry Rand Corp., New York, N.Y.

It is very doubtful that Herman Hollerith ever considered, in 1905, that he would have to talk to Jean Baudot. After all, the man was dead. But this is exactly what is happening today in the inevitable marriage of computers and communications systems. The punched cards that Hollerith created must communicate with the punched paper tape of Baudot. The problem is that there is absolutely no logical similarity or relationship between the codes which represent the various letters, digits and other characters.

Hollerith designed his code for a mechanical counting reader. When cards became input to computers, as well as mechanical devices, a code correspondence had to be applied. In forming the IBM binary coded decimal (BCD) code, the 0 to 9 rows on the card were equated to 0000 through 1001, and thus the binary value corresponds to the decimal row value. Two more bits precede these to represent the four "zones" (12, 11, 0 and blank) by 00, 01, 10, and 11, although not respectively and indeed this varies among IBM equipment. Other manufacturers made different assignments in various attempts for internal economies. Assignments even vary among individual customers. Thus although most IBM users have the 12 punch as a plus sign and the 11 punch as a minus sign there are many others to whom the reverse is true.

There is a binary code inherent in the punched paper tape of Baudot, but this depends upon which tracks are made to correspond to which binary positions. Sorry to say, this choice has been made in several ways. Even so, Baudot did not make his assignment on a sequential basis for the digits or letters of the alphabet. Due to the technology of the time, it was done on the basis that the most frequently used characters would be represented by the fewest punched holes, to save wear and tear on the punch dies! To illustrate:

Letter	blank	E	T	A	O	I	N	S	H	R	D	L	U
No. of Punches	1	1	1	2	2	2	2	2	2	2	2	2	3

This should prove that there was never an actual person by that name! Apparently not much was known about digit frequency in those days, for they were assigned:

Digit	0	1	2	3	4	5	6	7	8	9
No. of Punches	3	4	3	1	2	1	3	3	2	2

Such technological conditions are largely removed now, and logical considerations assume commanding importance.

topsy in the information processing field

About four or five years ago many people awoke individually to the fact that we are in an almost impossible jumble in the coding of information. Consider the way it grew from the IBM standpoint, based upon the punched card. First came the digits 0 to 9, with & (or +) and −. So far there is only one problem, the duality of & and + as represented by the 12-punch. Now add zones for the letters. The digits 0 to 9 with a 12-punch mean A to I, with an 11-punch they mean J to R, and with a 0-punch

Mr. Bemer is an alternate member of X3.2, the X3.5 Glossary committee, and AFIP member of the IFIP TC-1 Terminology committee. Before joining Univac, where he is director of systems programming, he was with The RAND Corp. and IBM, and started the computing installation at Lockheed Missiles.

they mean / and S to Z. Simple. But now what? Without using the other combinations of two punches (e.g. 3-6) we move directly to combinations of three punches by adding 8's. This gives such characters as . , * $ @ & and ◇. So far this can be lived with.

Now design the reader on the IBM 702 so that all illegal punch combinations are rejected; that is, only 48 out of the 4096 (2^{12}) possible combinations are legal. Now find out that more codes are needed for tape control in a computer, and so far only 48 out of a possible 64 codes available in a 6-bit character have been used. We try to see what happens for all 4096 combinations, and are surprised to find that the engineer goofed a little — nine supposedly illegal combinations slip by! So 0-2-8 is a record mark and 12-5-8 is a group mark.

On the other side of a high fence (between scientific and commercial computing at that time) the 704 people come up with FORTRAN, which needs the characters ( ) + and =, and certainly does not need % ◇ & and #. Since there are only 48 positions on the type wheels of the 407, a dual assignment is made. This makes it difficult for the installation with both scientific and commercial problems, but they learn to live with it. Along comes the 1401 with its chain printer that has 240 character positions around it, normally in five sets of 48. But it could be in four sets of 60. Because it is to be a satellite machine for many large scale installations, the FORTRAN characters are given their own separate codes for programming convenience. Now we have both dual and individual assignments in the same installation. What confusion!*

Another trouble is that the internal bit assignment for the group mark is 11 1111, and when the code is filled out to the full 64 characters possible it is found that the counting mechanical reader demands that the punch combination for the group mark be 12-7-8, particularly for the 7070 and not 12-5-8 as for the 705. However, the same tape must be capable of being read by both machines.

And so it goes, each mistake by expediency being piled on top of the last one. And so many customers already use these incompatible devices that it just doesn't seem economical to change it now. Or could it be that things will get worse and we will wish we had straightened things out last year before it gets even more expensive?

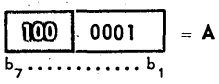
It should not be thought that IBM is the only manufacturer with such problems. UNIVAC had a similar set of problems, particularly with both 80- and 90-column cards. The RCA 501 was designed with an internal code in which the letters and digits were assigned to consecutive binary numbers, a very sensible arrangement that makes data processing much easier. This is because there is something known as a "collating" or "ordering" sequence. If there were not, it would be very difficult to find a word in the dictionary or a number in the phone book. The 501 orders by simple binary comparison, with no extra hardware or wasted time. If this seems only reasonable, remember that IBM does not make any equipment with an internal code corresponding to its collating sequence, contrary to some beliefs. Ordering is done either by special hardware ($75 a month for early 1401's) or by programming, as on the 7090. Figure 2 shows two IBM cards, punched and interpreted. Columns 1 to 64 correspond to the binary sequence 00 0000 to 11 1111, or octal 00 to 77.

Let's see what happened to that 501. The 301 was designed to aim at the extensive punched card business. What could be more natural than to forget the 501 code and adopt the internal code of the IBM 704? Later a translator was built to convert codes in both directions between the 301 and 501. Just one problem, though — any file put in order on the 301 was out of order for the 501, and vice versa. At least without programming or additional hardware. This is hardly a trivial problem. IBM calculated in 1961 (in connection with ASA work) that it might take from $5,000,000 to $30,000,000 of machine time on the fastest computers just to reorder all existing files (as necessary - most would not require it, having only numeric keys) to a new collating sequence. This is the problem IBM faced in participating in code standardization work. If a standard code were to specify the collating sequence to be identical with the binary sequence, it would not match the IBM collating sequence. Makes even a big company stop and think; it might be hard to get the customer to take the broad view of future advantages and foot the bill.

However, occasions do arise when the situation is so muddled that desperate measures must be taken. As an example, Australia will change over to its new unit of currency, the "Royal", in February of 1966. This will replace the old pound and will be divisible into 100 cents,

Figure 1. *American Standard Code for Information Interchange*

Example:



	000	001	010	011	100	101	110	111
0000	NULL	DC_0 ①	♮	0	@	P		
0001	SOM	DC_1	!	1	A	Q		
0010	EOA	DC_2	"	2	B	R		
0011	EOM	DC_3	#	3	C	S		
0100	EOT	DC_4 (STOP)	$	4	D	T		
0101	WRU	ERR	%	5	E	U		
0110	RU	SYNC	&	6	F	V		
0111	BELL	LEM	'	7	G	W		
1000	FE_0	S_0	(	8	H	X	UNASSIGNED	
1001	HT/SK	S_1	)	9	I	Y		
1010	LF	S_2	*	:	J	Z		
1011	V_{TAB}	S_3	+	;	K	[		
1100	FF	S_4	(comma)	<	L	\		ACK
1101	CR	S_5	–	=	M	]		②
1110	SO	S_6	.	>	N	↑		ESC
1111	SI	S_7	/	?	O	←		DEL

= 4 Bit Subset

(*Author's note—I'll take my share of the blame for some of this.)

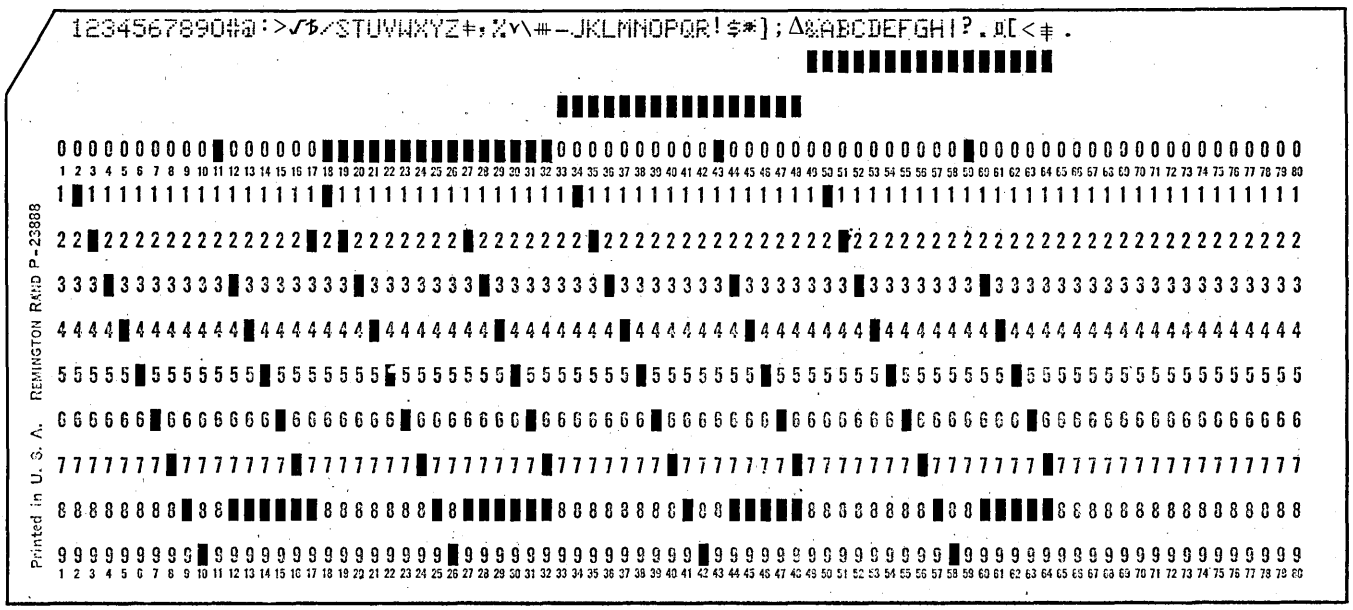


Figure 2

IBM STANDARD BCD INTERCHANGE CODE (1962)

just as the dollar is. In value it will be equivalent to 12 shillings of the pound system and about $1.12 US. Such a serious step will affect almost every area of the economy, from cash registers to coin changers, from education to counting procedures. The Aussies must think it worth it in the long run, however, and even England is now considering a change, perhaps to the decimal florin.

the american standard code

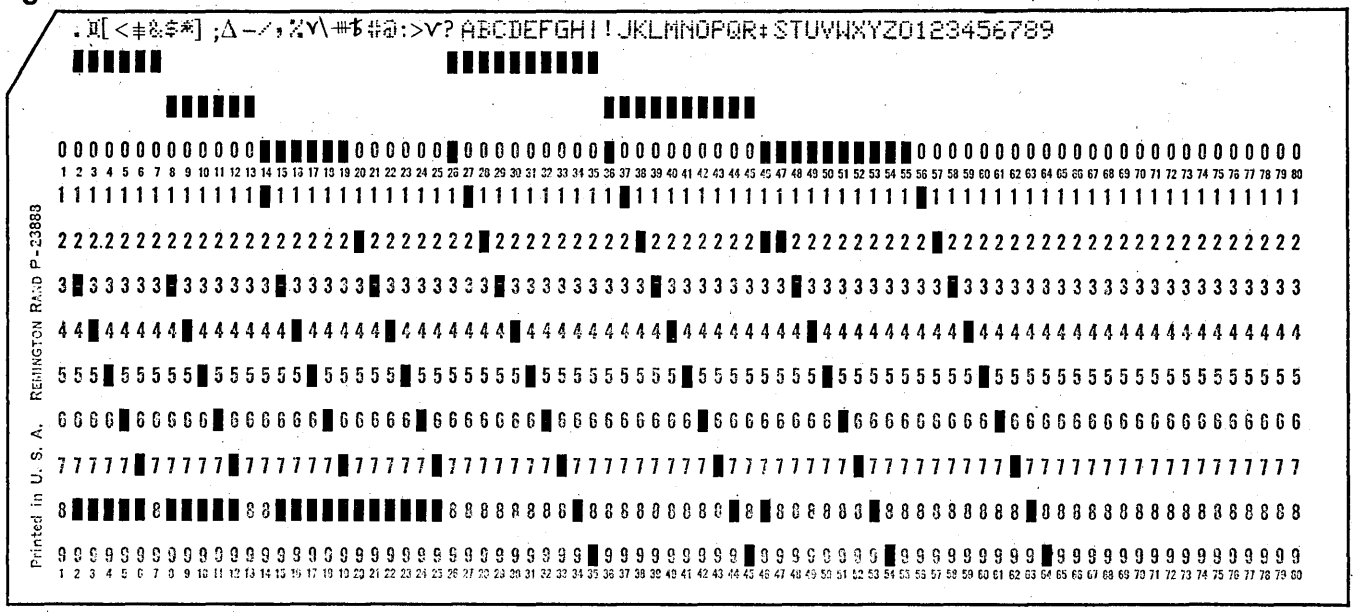
It was in a similar atmosphere of dissatisfaction with any existing system that the new American Standard Code for Information Interchange (ASCII) was developed, becoming an official ASA Standard No. X3.4 on 17 June 1963. The development and standardizing process was lengthy and sometimes turbulent. The important thing was that, as POGO says, "All was given equal chance to discuss and re-cuss." There was plenty of both. The problems of effective standardization are not new to readers of DATAMATION, but the successful adoption of a standard of this magnitude certainly is. Perhaps this success will help to reaffirm some faith in and support of these efforts.

The code was derived by the subcommittee method, one of the three ways by which an American Standard can be achieved, and certainly the most difficult. Whereas most standards are adoptions or reworks of existing practice, this code is a considerable departure from any previous code, although generic similarities to certain predecessors are certainly to be seen. Subcommittee X3.2 was chaired successively by representatives from IBM, Burroughs, and presently the Department of Defense, Navy Management Office. Several independent efforts were started in the 1958-59 period to deal afresh with the code problem. By universal agreement it was impossible to make enough sense out of existing codes; they just did not meet requirements evident at that time, nor did they provide for obvious future requirements. Among the major efforts were those of:

1. The Electronic Industries Association, a body which had produced many previous standards, working originally from a paper tape viewpoint, but later becoming general.
2. IBM, with the 8-bit code for STRETCH, which among other features provided for both upper and lower case alphabets.
3. The Department of Defense (Army Signal Corps)

Figure 2A

IBM STANDARD COLLATING SEQUENCE



which developed and sponsored the Fieldata code. Despite a few drawbacks, this was a great improvement upon existing codes and many of its features are to be seen in ASCII.

4. The British Standards Institution, which also started with the intention of standardizing paper tape codes and

The abbreviations used in Figure 1 mean:

NULL	Null/Idle	CR	Carriage return
SOM	Start of message	SO	Shift out
EOA	End of address	SI	Shift in
EOM	End of message	DC0	Device control ① Reserved for Data Link Escape
EOT	End of transmission	DC1-DC3	Device control
WRU	"Who are you?"	ERR	Error
RU	"Are you . . . ?"	SYNC	Synchronous idle
BELL	Audible signal	LEM	Logical end of media
FE0	Format effector	S0-S7	Separator (information)
HT	Horizontal tabulation	b	Word separator (blank, normally non-printing)
SK	Skip (punched card)	ACK	Acknowledge
LF	Line feed	②	Unassigned control
V/TAB	Vertical tabulation	ESC	Escape
FF	Form Feed	DEL	Delete/Idle

was drawn gradually into the whole data processing field.

5. The SHARE organization, which sought to coordinate their existing IBM equipment.

major features of the code

Let us examine the several salient and sometimes new features of the code and their significance:

1. As yet it is only a reference code. The particular representations in media such as punched cards, punched tape and magnetic tape are not yet defined, although they are perhaps implied in some respects.

2. It is (so far) a 7-bit code, with provision to expand to 8 bits as required. In the 7-bit form, a 6-bit subset of 64 codes is assigned completely to information characters, the other 64 so far are essentially control characters. This separation can be of convenience to equipment designers in the combined data processing and communications field; it also should produce many economies.

3. Although not yet stated in the standard, there is an implied collating sequence that may be used in the straight binary comparison mode. For IBM, which presently collates digits higher than the alphabet, an Exclusive OR device in passive logic can put the digit vector higher than the alphabet. This is no more than the existing device which allows the 709 family to write and read BCD tape.

4. The set can be collapsed in a regularized and prescribed manner, if required, into a 6-bit set for existing 6-bit machines and other equipments, to a 5-bit set for modification of existing Teletype and Telex sets (particularly in Europe), and even to a 4-bit set. This latter is of very special interest, in that it can be used for cash registers and other basically numeric-only devices, but at the same time may be used in the double numeric mode for computers internally (like the 650, 7070 and STRETCH). It is indicated by the offset shaded vector in the diagram of the code. The reason for the offset is that certain nondigit characters of the 4-bit set must collate lower than both digits and alphabet when appearing in ordering keys. The reverse expansion upward is a simple matter of passive logic.

5. Certain replacements (carefully checked out internationally) allow for non-American usage. For examples, the single digits 10 and 11 (sic) for English pence can replace the colon and semicolon in the digit vector, at least until they follow the lead of the Australians; the characters following the alphabet are of relatively low usage so that they may be replaced with the additional letters of expanded Roman alphabets, particularly as used by the Scandinavian countries.

6. The ESCape code (111 1110) provides for 127 alternate sets in the 7-bit set, 255 in the 8-bit set. Some of these sets may have official standing and some may be arbitrarily reserved to certain equipments. An example might be an alternate set with the Roman alphabet replaced by the Cyrillic alphabet, the unreplaced characters remaining unchanged. The ESCape character is usually followed by another code which is devoid of its usual meaning, by virtue of following the ESCape, and indicates which one of the alternate character sets is in force until the next ESCape character is encountered.

7. The two righthand vectors were purposely reserved as the logical places to put a lower case alphabet, if desired for this to be available in a single character mode. For lesser equipments, the upper case alphabet may be used in conjunction with the Shift In (000 1110) and Shift Out (000 1111) characters to produce a lower case facility.

8. Special consideration has been given for the characters required in programming and other special languages. All of the characters of the COBOL set are included. The ESCape characters may be used to shift to one or more special sets containing all of the characters of ALGOL (including the unique lower case alphabet). Other sets may be reserved for special languages of typesetting, information retrieval, graphic design, medical reports, etc. For example, a special set for numerical machine tool control could be an alternate 4-bit subset which is identical with the standard subset in the thirteen characters 0 - 9, decimal point, plus and minus; the other three characters would be replaced by X, Y and Z for axis symbols.

9. Note that many new characters have been introduced in the control area, particularly designed for self-delimiting of streams of characters. These may be hierarchic in nature, used to describe records, fields, subfields and so forth, or they may be syntactic in nature, indicating phrases, sentences, paragraphs, etc.

why a 7-level code?

Actually ASCII is an 8-level code with the eighth bit unassigned as yet. The new A. T. & T. system, supplied with terminal equipment by its subsidiary Teletype Corp., is based completely on eight bits between start - stop pulses. This is not only for future expansion but also for practical operations today. The eighth bit may be used for parity (preferably odd) if desired, and perhaps other uses may evolve. Basically, however, the 8-bit transmission unit was selected because eight is a magic number, being a power of two. In the information theory business there is nothing more economical than a power of two, and A. T. & T. knows it. Economy is important when you are creating a whole new system of this magnitude, and indeed that magnitude may be well up into the billions. There is even provision for an eleventh digit in the direct dialing system so Teletype can tell whether an 8-bit unit (Model 33) is talking to another 8-bit unit or to a 5-bit unit, or vice versa.

Several new computers are now being designed with 8-bit capabilities. At least one model, STRETCH, is in operation. Another is reported to use ASCII internally in

the double numeric mode. In certain 6-bit machines the word is designed to 48 bits to handle either six 8-bit characters or eight 6-bit characters. This code certainly facilitates transmission of pure binary data.

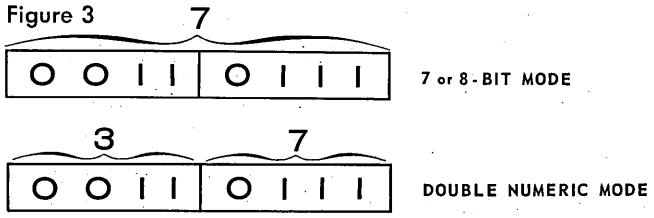
Subcommittee X3.2 appears to have no objection to the eventual assignment of meaning to all of the 256 codes in the 8-bit set. They sensibly avoided trying to be omniscient now and rather made adequate provision for expansion as further developments are made. Besides, they had to consider the Europeans and international standardization work in this area by ISO TC 97 on Computers and Information Processing. This work might not catch up to A. T. & T. for a while. Meanwhile the code will probably have to be adapted to 6-bit systems and even to five bits to work on existing Telex circuits, for the Europeans may not be able to install an entire new system in several countries in less than several years. The ASCII code is certainly set up to reduce the code size as required.

There are many advantages to having more unique codes in the set. There are some still unassigned in the 7-bit set, and of course nothing except a possible parity usage is assigned to the 8-bit set. There are several possible assignments for these spare codes, although none of these have been discussed extensively yet by X3.2:

1. A code which turns parity off and on, or possibly two individual codes, one for each of these two functions. This would facilitate compatibility between equipment using the 7-bit code with parity and other equipment desiring to utilize the full 8-bit set.

2. A code which says "repeat the transmission (it was bad) back to the last S_i code." Presumably this code would be followed by the particular S_i code required. This S_i would be sent back to the transmitting equipment, which would hold it in memory and search backwards along the transmitted stream until a match was found. The transmission would be restarted at that point, both sending and receiving equipment knowing exactly where to pick up again.

Figure 3



3. Codes to ignore normal communications control so that pure binary data may be transmitted without any character meaning. These will have to be handled carefully so that return to the normal transmission mode may be effected. This might have to be done by either timing the binary transmission, sending a predetermined number of 8-bit units with automatic return, or having the receiving device actuate the return through an extra channel.

4. Codes to switch to double numeric (two 4-bit digits within a single character) and back for reasons of economy of transmission in numeric only mode. ■

(Part two of Mr. Bemer's article will be published next month.)

THE CAT COMPUTER

Already enjoying wide acceptance without formal announcement is a multi-purpose on-line CAT Computer of Average Transients. One at Mayo Clinic has participated in a transatlantic experiment, averaging out brain wave signals transmitted from England via the Relay satellite. The results, interpreted and diagnosed, were then sent back by the same route. Present applications are in medical and clinical research.

The CAT 400B is a product of the Mnemotron Div. of Technical Measurement Corp., White Plains, N.Y. The count capacity of the memory is 100K per ordinate, with up to 400 ordinates. The CAT can sum and average responses from four varying inputs on-line, simultaneously calculating and displaying data on a built-in scope. The ability to store averages in successive quarters of memory makes it possible to compare successive runs of averages without interrupting experiments (there is no theoretical limit to the number of responses which may be summed). Averages may be displayed on the 3″ CRT and on an X-Y Plotter Readout. The computer measures about one cubic foot, weighs 38 pounds, and consumes 30 watts. Price is $12K. ■

"eyeball" comes of age

VISUAL INPUT TO COMPUTERS

by Dr. ROGER L. FULTON, Computer Sciences Corporation, El Segundo, California

Input and output have acted as restraining factors in the development and application of computers. As speeds of computation have increased, it has become apparent that the ideal problem, from the standpoint of computer efficiency, is one in which a small amount of input is extensively processed to produce a small amount of output. Unfortunately, the user's needs may be just the reverse; that is, a large input, a small amount of processing, and a large output.

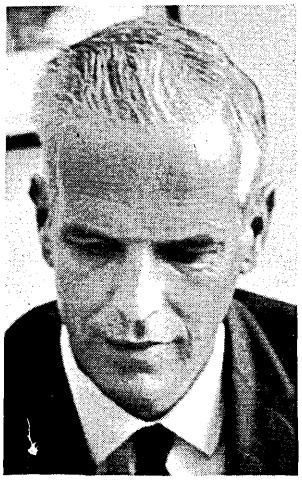
Input and output have been accomplished primarily by punched card, punched paper tape, and magnetic tape. Output has also been accomplished by visual devices such as printers, plotters, and cathode ray tube displays capable of speeds of a few microseconds per point. They are used to put out alphanumeric information on film for rapid electrostatic printing, and they also prepare graphs which make the ever-increasing volume of output comprehensible to the user. Film records of visual display by cathode ray tube are readily available in three dimensions and in color, and some success has been attained in providing these features on the visual scope.

input hardware and software

Recently, the same cathode ray tube used for recorded output has been used as a reader for computer input (Fig. 1). A spot on the tube face is projected through the film to be read, and sensed by a photomultiplier. Since the X Y coordinates of the spot on the tube face are known, the photomultiplier response indicates whether a relatively clear or a relatively black area exists at the corresponding point on the film. It is also possible to project the spot from the tube face onto hard copy and sense the reflected light with the photomultiplier, thus permitting reads of hard copy (Fig. 2).

The computer-controlled CRT reader generates discrete probes, one at a time, and uses the photomultiplier response to determine the next point to be tested. Its spot is guided from point to point by the computer, and though it can be used to scan, this should only be done to locate the beginning of information on film or hard copy.

The cost of this equipment is comparatively low since the same cathode ray tube and camera used for recording can be used for reading film and only a photomultiplier need be added. For opaque reads, a lens system is also required, since the camera lens system cannot be used. Most users will desire an analog-to-digital converter, since it permits the input of shades of gray rather than a single yes-no response at a particular threshold. Many users will also desire a visual scope so that the operator can simultaneously observe the read process and examine looped



A member of the technical staff at CSC, Dr. Fulton has developed input methods for data in the form of fingerprints, stylus trace, and handwriting, in addition to programs and input methods in the areas of meteorology and astronomy. He was formerly with the Univ. of California and the Lawrence Radiation Laboratory.

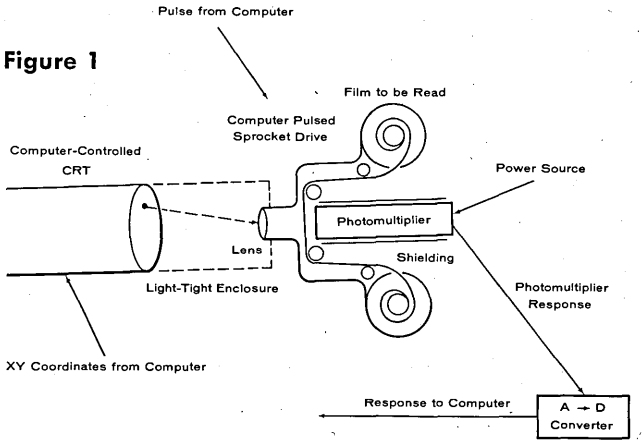
displays of the reads and modify them with the light pen. A basic hardware and software package for users of any machine can be readily prepared.

The lenses, photomultipliers and camera are off-the-shelf items, and the necessary shielding, mounting, light-tight packaging, etc., are relatively simple to fabricate. Exclusive of the cathode ray tube and the computer, a fine film or opaque reader may be obtained for $25,000. The shade option for either should be available for $10,000. General flowcharts which can be readily translated to specific machine language routines are extant.

The computer-controlled CRT reader described above is only limited in speed by the time required to generate successive spots on the cathode ray tube and this time is now measured in a few microseconds. Consistent accuracy to a thousandth of an inch on microfilm is readily obtainable, and greater accuracy is possible. It is often more accurate than traditional operator-controlled devices for visual input, since the accuracy of the operator is often lessened by fatigue.

Visual input has usually been accomplished by such means as offline coordinate measurement with an ordinary ruler, or by operator-controlled readers which project the visual image on a screen and permit the operator to align

Figure 1



A TYPICAL CONFIGURATION OF THE COMPUTER-CONTROLLED CRT FILM READER

cross-hairs and punch a button to output coordinates on punched cards or punched paper tape. A semiautomatic device improves this operation by optically locking onto a line after the cross-hairs have been placed on the line by the operator. It is steered like an automobile down a curve. It has a foot pedal accelerator and puts out a series of coordinates on cards or paper tape. It must be steered fairly accurately or it will lose the line in tight turns. The cathode ray tube computer-controlled reader is at least a thousand times faster than any of the operator-controlled devices described above.

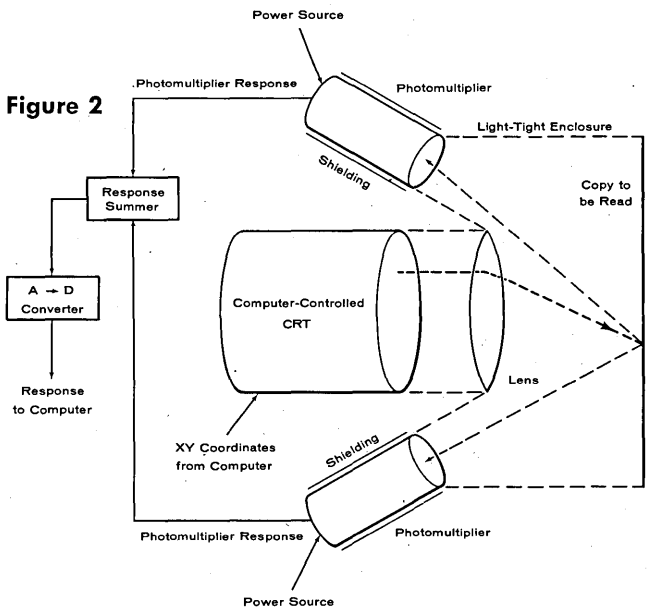
There is also a visual input device which operates in a manner similar to the computer-controlled CRT reader and accumulates photomultiplier responses at an even faster rate. This is known as the flying spot scanner, which sweeps the film or hard copy like a television set and supplies a stream of photomultiplier responses to the computer. However, the flying spot scanner suffers from a severe drawback since it fills even the largest computer memory with responses that must be analyzed by a program very similar to that used by the computer controlled reader in its reading process. There may be cases, however, where this technique is useful.

Although lines on film and hard copy have thickness, the computer-controlled CRT reader, properly programmed, probes only the perimeter of lines, since the interior of a line contains no information. Unlike the flying spot scanner, it never probes or processes any points outside the line. Since the cathode ray tube provides over a million discrete responses which may be expressed in up to 256 levels of gray shade and since film input may run to thousands of feet of high speed camera output in one-inch frames, it is apparent that only the information on the film which is necessary should be read in order to avoid a vast waste of computer time and delay in operations. In reading levels of shade the computer controlled program should follow the interface between shade levels since no information is contained in an area of uniform shade.

Visual reading can be performed efficiently on the smallest computers and the data processed as it is read, or put out in ordered form on magnetic tape (on a shared unit) to a larger computer for processing. If the volume is large, it may be desirable for the smaller computer to read only on command and directly to the memory, discs or drums of the larger computer, or for the larger computer to control the read directly. Experience indicates that installations can satisfactorily combine ordinary off-line operations on a small computer with the visual input operation, but the process is fast enough (with frame advances of up to 15 frames per second) to be compatible with the largest computer operations.

At present, there is also a computer-controlled television camera under development which has interesting possibilities both in visual input to computers and in control of automatic equipment. The small general purpose computer is now so inexpensive that it can be used economically in control of automatic operations, and it has the advantage

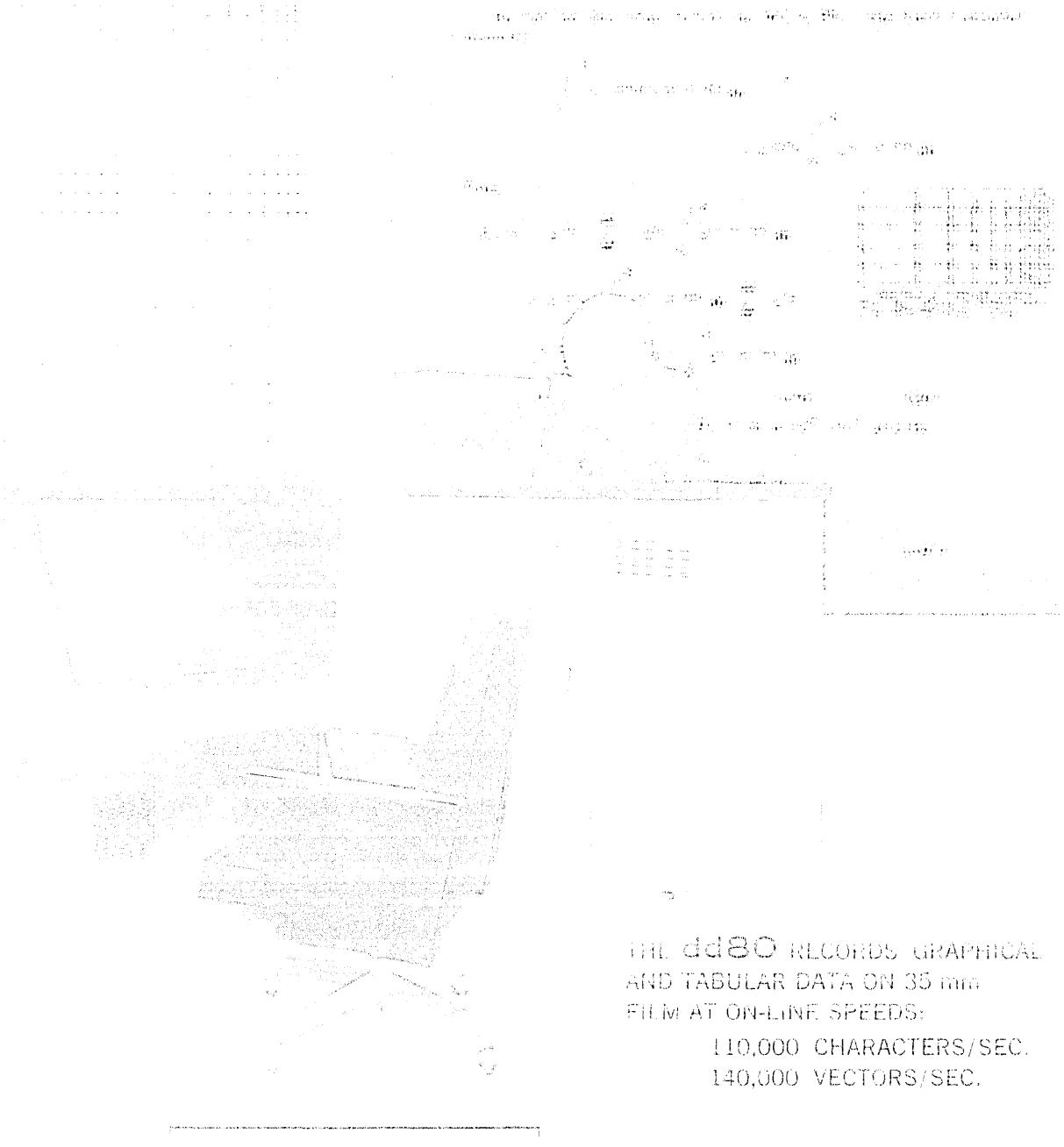
Figure 2



A TYPICAL CONFIGURATION OF THE COMPUTER-CONTROLLED CRT OPAQUE READER

of rapid modification of the stored program to add new operations or alter old ones. A computer-controlled television camera is a general-purpose visual input device capable, when properly programmed, of reading any gauge or instrument panel or observing an experimental situation and, through its computer, controlling it rapidly.

A variety of alphanumeric reading devices have been marketed recently. Some require specially designed character sets, and some require magnetic characters or guide marks. But some can optically read several standard print and type faces with a flying spot scanner, and match electronically to members of the character set with a high degree of speed and accuracy. The difficulties encountered



THE dd80 RECORDS GRAPHICAL AND TABULAR DATA ON 35 mm FILM AT ON-LINE SPEEDS:

110,000 CHARACTERS/SEC.
140,000 VECTORS/SEC.

are primarily those of paper handling and character location in varying formats. The computer-controlled CRT reader can recognize characters by matching the read with members of the character set stored in memory. It is possible that the computer-controlled CRT reader offers the best chance of recognizing constrained and unconstrained handwritten numerics where the match is not to a particular set of characters, but rather to a set of distinguishing limits developed by experience.

applications unlimited

In reviewing applications of the computer-controlled CRT reader, it is almost impossible to find an area in which the device is inapplicable. It has all the functions of the human eye except three-dimensional capability and color vision. It is possible, in conjunction with the light pen and a suitable program, to read to progressively greater levels of detail in an area of interest selected by the light pen. Looped playbacks of the successive reads on a visual scope can be enlarged to reveal discrete points. It is possible to apply the differential principle in reading around curves in order to produce a center line of high quality. It is also possible to recognize patterns of objects, and to combine code-generated pictures, computer-controlled visual input and light pen visual input in a single operation. The recorded output of the computer can be stored on film and read back into the computer visually at any time. Overlays can be quickly accomplished on standard maps by reading the maps with the computer-controlled CRT reader and combining them in memory with elements to be displayed. The result can be put out on film.

Perhaps the most widespread application at present has been in the reading of recorded oscilloscope traces. Events occurring in very short periods of time have been captured on a film record of the oscilloscope face and read by the computer-controlled CRT reader for processing. Since a large number of oscilloscopes are available and records can be made on 35 mm. film or Polaroid for the reader, the engineering applications are widespread and economically feasible.

Another large volume of visual data is recorded by stylus on a moving paper roll and can be read to great detail by the computer-controlled CRT reader. Seismic records for oil exploration, basic research in seismology, or weapons effects can be quickly read in this manner. Aerometer and barometer records in meteorology can be studied over long periods of time. In choosing testing and launching sites, it is often desirable to undertake thorough studies of prevailing wind direction and velocity and the presence of gusts of wind and their magnitude.

High speed photography is a fine instrument for recording events which occur very rapidly, but processing high speed photographic output is extremely difficult unless the computer-controlled CRT reader is used. Typical high speed photography studies lie in the areas of guidance and trajectory of rockets and missiles, the impact of projectiles, explosives studies, and strength of materials studies.

Weather prediction studies have been undertaken with considerable success. The initial conditions at time zero and the boundary conditions twelve and twenty-four hours ahead were read by a computer-controlled CRT reader from large scale weather maps, and fallout predictions were accomplished from the resulting predicted wind field. In the field of fallout prediction, time is of the essence and it is obviously impossible to wait for keypunch operators to produce initial input.

Analog-to-digital conversion has been accomplished by displaying the analog data on an oscilloscope and photographing the result for computer controlled CRT reading. This procedure permits greater supervision of the analog input, and the elimination of faulty portions of the record visually before data is introduced to the computer.

Fingerprint identification is a very real possibility with the computer-controlled CRT reader. The technique might well produce a more complete method of cataloguing and comparing fingerprints automatically and at very high speeds.

Blueprints could be read either as hard copy or on 35 mm. film, and the savings in engineering and architecture, shipbuilding and design, would be enormous, both in time and cost of operations. Automatic milling, which is currently done from punched paper tape produced by computers, might be enhanced by the ability to input drawings to produce the paper tapes that control the milling machines. Printed circuit design from hand drawing through finished product can be fully automated.

Printed and hard-drawn graphs and charts are often difficult to digitize by hand. They present a problem in that the information usually overlaps a grid, but a suitable program can follow the curves through the grid background. A typical application is the reading of graphs of commodity market fluctuations over a considerable period in order to derive principles of market behavior.

The weather satellites of the TIROS, AEROS, and NIMBUS projects will generate vast numbers of photographs of cloud cover in shades of gray. The interfaces between successive gray shades can be followed and digitized with a computer-controlled CRT reader very rapidly. Weather satellite information must be input and processed quickly if it is to be of value in weather prediction. In addition, accumulated records can be read to furnish input to studies of the general circulation problem.

Aerial photographs in large volume are obtained by both military and civilian agencies. Often the information requires counting, measurement, or pattern recognition within the capability of the computer-controlled CRT reader. Once again, only the gray interfaces are digitized.

Several computer programs have been written to permit an operator to perform drafting using the visual scope and the light pen. Subassemblies are displayed and maneuvered into correct position, scaled, rotated, and translated and stored under operator control for film recorded output. The computer-controlled CRT reader enhances this operation by permitting the introduction of photographs and drawings. It is feasible to design television commercials and cartoons in this fashion. The interplay of light pen, film reader, and program-generated design, can produce excellent results if fully exploited.

The computer-controlled CRT reader can also be used as an automatic densitometer. In this manner it can record radiation exposure on film badges and recognize the intensity variations associated with color film and can read banding in spectroscopy.

The celestrial sphere has been extensively mapped photographically by observatories. The results on film or on the plates themselves can be read by a computer-controlled CRT reader, especially in statistical studies of star distribution.

In the field of biology and medicine, work has been done reading encephalograms, taking blood counts to a higher degree of precision, and reading electrocardiograms with the computer-controlled CRT reader.

As the computer-controlled CRT reader comes into widespread usage, applications will undoubtedly be found that cannot be envisioned at present. The reader's use is limited only by the imagination of the user. ■

STANDARDIZATION OF PROGRAMMING LANGUAGES

a clarification of current activity

by HOWARD BROMBERG, RCA/EDP,
Cherry-Hill, New Jersey.

Often the detailed structure of an organization presents unexpected difficulties when attempting to communicate its purposes to the outside world. Because of a strange notation, coupled with expedient mnemonics, as well as complex and overlapping liaison, a description of its technical function and progress is easily lost. Indeed, even a detailed description of excerpts from one meeting[1] out of an annual total of approximately 60 fails to bring sufficient clarity to the overall goal or to describe with any accuracy its current progress. This article, then, is an attempt to explain the notation, describe the various committees and their interrelations and report on the extent of progress made to date.

In the United States the authority for industrial standardization (Figure 1) is the American Standards Association (ASA)[2]. When the requirement for standardization in the area of computers and information processing became apparent, the American Standards Association assumed the U.S. responsibility for conducting such a program. ASA then asked the trade association with the closest relationship to the computer industry and its systems standardization to administrate and direct the program. In this case, the Business Equipment Manufacturers Association (BEMA) was asked to provide sponsorship. ASA then established the X3 sectional committee on standardization of computers and information processing, and BEMA organized it.

Within the X3 sectional committee there are seven sub-committees, each responsible for the conduct of standardization for a particular area of need within information processing. These committees are:

1. Optical Character Recognition
2. Coded Character Sets and Data Formats
3. Data Transmission
4. Common Programming Languages
5. Glossary
6. Problem Description and Analysis
7. Magnetic Character Recognition

Sub-committee X3.4 has as its scope of responsibility, "Standardization of common programming languages of broad utility through standard methods of specification, with provision for revision, expansion, and improvement, and for definition and approval of test problems." X3.4, recognizing the extent of its scope, created six working groups which were to study, investigate and prepare proposals to X3.4 on the following subjects:

X3.4.1 - Language Theory

X3.4.2 - Language Specifications and ALGOL

X3.4.3 - FORTRAN

X3.4.4 - Processor Specifications and COBOL

X3.4.5 - ISO/TC97/SC5 - Secretariat and U.S.A. Participation

X3.4.6 - Programming Languages Glossary

Acknowledging the need for work in the peripheral areas of language theory, language specifications and processor specifications as well as programming languages glossary and participation in international standardization, X3.4 nevertheless has concentrated mainly on the standardization of the three major candidate languages, namely ALGOL, FORTRAN and COBOL. It is interesting to note that the definition, maintenance and standardization of each of these three major languages are all unique. For example, ALGOL is defined by an international body; FORTRAN was initially specified by a private corporation; COBOL is being defined primarily by a voluntary group of domestic computer manufacturers and computer users. Coupled with the fact that there have been no previous ASA attempts at language standardization, either successful or unsuccessful, it appears that the task of standardizing these languages will require different standardization processing procedures for each candidate.

domestic standards organizations

Domestic activity in the standardization of programming languages[7] may be reported in the following areas:

Working Group X3.4.1 - in Language Theory, has been working on the transformation of the terms included in the paper entitled, "Some Base Terminology Connected with Mechanical Languages and their Processors"[6] into glossary form for proposal to Subcommittee X3.5 - Glossary. Within X3.4.1, Working Group A has been established to consider Language Structures. This group has organized a joint conference with ACM entitled, "A Working Conference on Mechanical Language Structures" to be held in Princeton, New Jersey, on August 14-16, 1963. Working Group B has been investigating General Language Specifications and has recently published a collection of papers[3] in the *Communications of the ACM* on the problems of documentation of various program-

Formerly with the Commerce and Navy Departments, Mr. Bromberg is presently administrator, Advanced Programming Languages, RCA-EDP. He is a member of both the planning committee of AFIPS and ASA's X3.4, and chairman of both X3.4.4 and X3.4.5, as well as being chief U.S. delegate to the ISO technical committee on Programming Language Standardization.

ming languages. The third X3.4.1 group is Working Group C on General Processor and Systems Specifications which is preparing a survey questionnaire on terminology for processors and systems.

The X3.4.2 Working Group on Language Specifications and ALGOL has been concentrating primarily on the development of a U.S. position regarding ALGOL. This position, as submitted to the International Standards Organization Subcommittee on Programming Languages[4], stated that the U.S. believes the Revised ALGOL 60 Report to be insufficient as a candidate for an international programming language standard because it (1) lacks defined input-output, (2) lacks a specified proper subset, and (3) leaves major ambiguities unresolved. X3.4.2 has further supported this position by submitting documents through X3.4 to the international subcommittee giving specific examples of the ambiguities resolved, and how a subset could be realized. In addition, two members of X3.4.2 (Ingerman and Merner) have prepared a complete specification of ALGOL in support of the U.S. position, which has been submitted to the International Standardization Subcommittee as a private paper for study and comment. It was simultaneously submitted to X3.4.2 for their review.

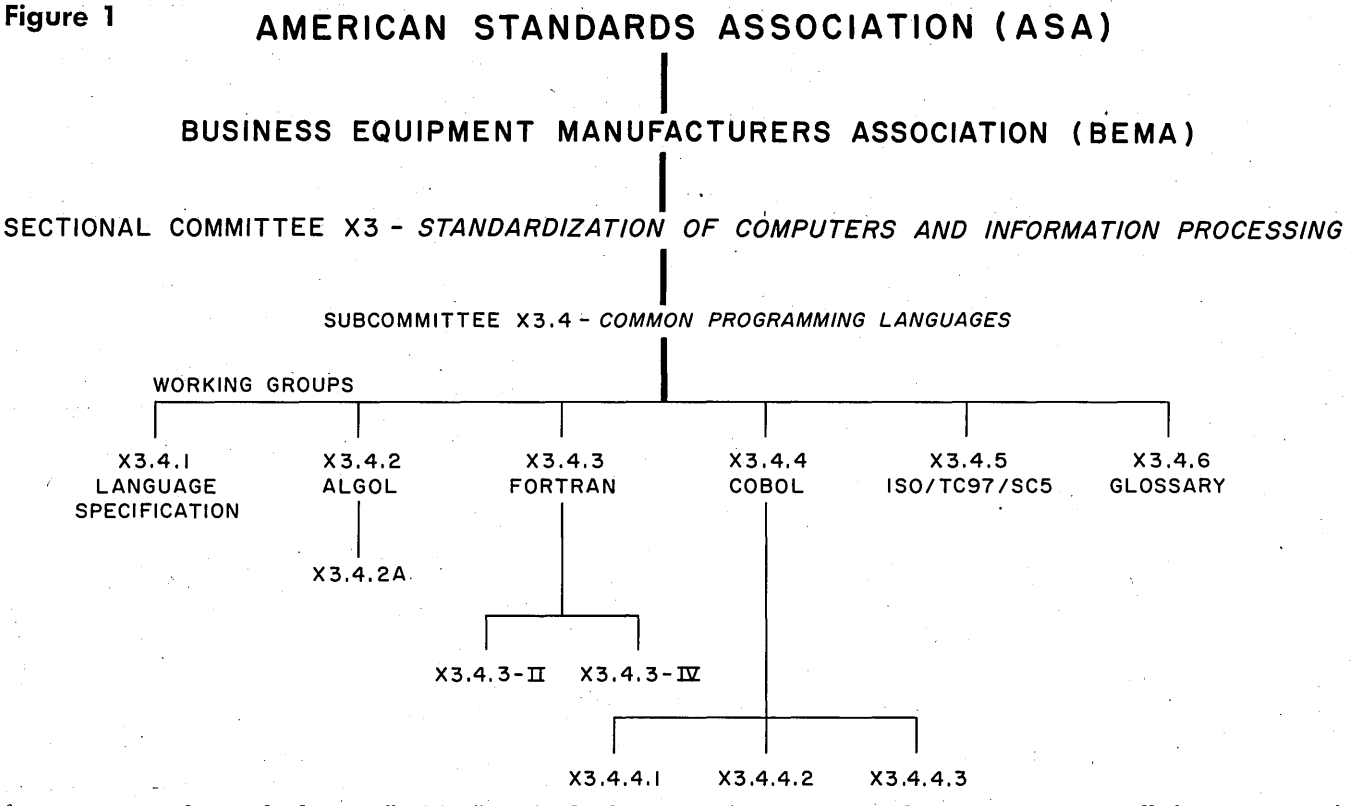
Task Group A has been established within X3.4.2 to draft a potential American Standard ALGOL, as well as to act as an information exchange agency on Revised ALGOL 60 definition and implementation within the U.S. Although it has been the desire of X3.4 to work primarily on the international standardization of ALGOL as conducted through the IFIP Working Group 2.1, and not to work on the development of a national standard ALGOL until the need for such becomes more obvious, the X3.4 organization on the 25th of April passed the following resolutions: (1) "Resolved that X3.4.2 consider ALGOL for international standardization," (2) "Resolved that X3.4.2 consider the international ALGOL effort as a basis for a national standard." Both resolutions were passed unanimously, and provide X3.4.2 the authority to continue their ALGOL studies for international acceptance, and to work for national standardization when and if appropriate. In addition to these ALGOL involvements, X3.4.2 is responsible for the qualification of proposed language standards. They are defining criteria for such, and will apply such to a review of the FORTRAN work which is being done in X3.4.3.

The FORTRAN effort is being conducted in two X3.4.3 - FORTRAN task groups, X3.4.3-II and X3.4.3-IV. Their operating objective is to propose draft FORTRAN standards at two levels such that all FORTRAN II elements are included as a subset within the FORTRAN IV standard. Working drafts of both proposals were completed preliminarily in May 1963 in time to be submitted as working papers for information, study and comment to the International Standardization Subcommittee. It is anticipated that the finished proposal documents will be available by the end of this year.

In the COBOL area X3.4.4 has organized for working purpose into three task groups. The first, X3.4.4.1, is distributing a survey questionnaire on COBOL compilers to determine in detail those features of COBOL that have been included in each domestic implementation. Their second task will be the preparation of an actual draft proposal of the American Standard COBOL specification. Based upon the results of the survey, a decision will be made as to the contents of the first level of COBOL language standardization. An attempt will be made to define the largest practical common denominator of all implemented features, or those features that are soon to be implemented within the current framework of compilers. Hopefully, this first level will coincide with at least the specifications of Required COBOL '61.

The second task group, X3.4.4.2, has established as their goal the creation of a set of programs to analyze the various COBOL implementations in an effort to determine whether or not the various features specified in the proposed standard have, in fact, been included in each particular compiler. These analytic programs, themselves written in a very basic COBOL, are called Feature Availability Routines. They are expressly **not** designed for purposes of testing a compiler on compilation time or efficiency. Rather they are being developed for the sole purpose of determining whether or not standard features

Figure 1



exist in a given implementation.

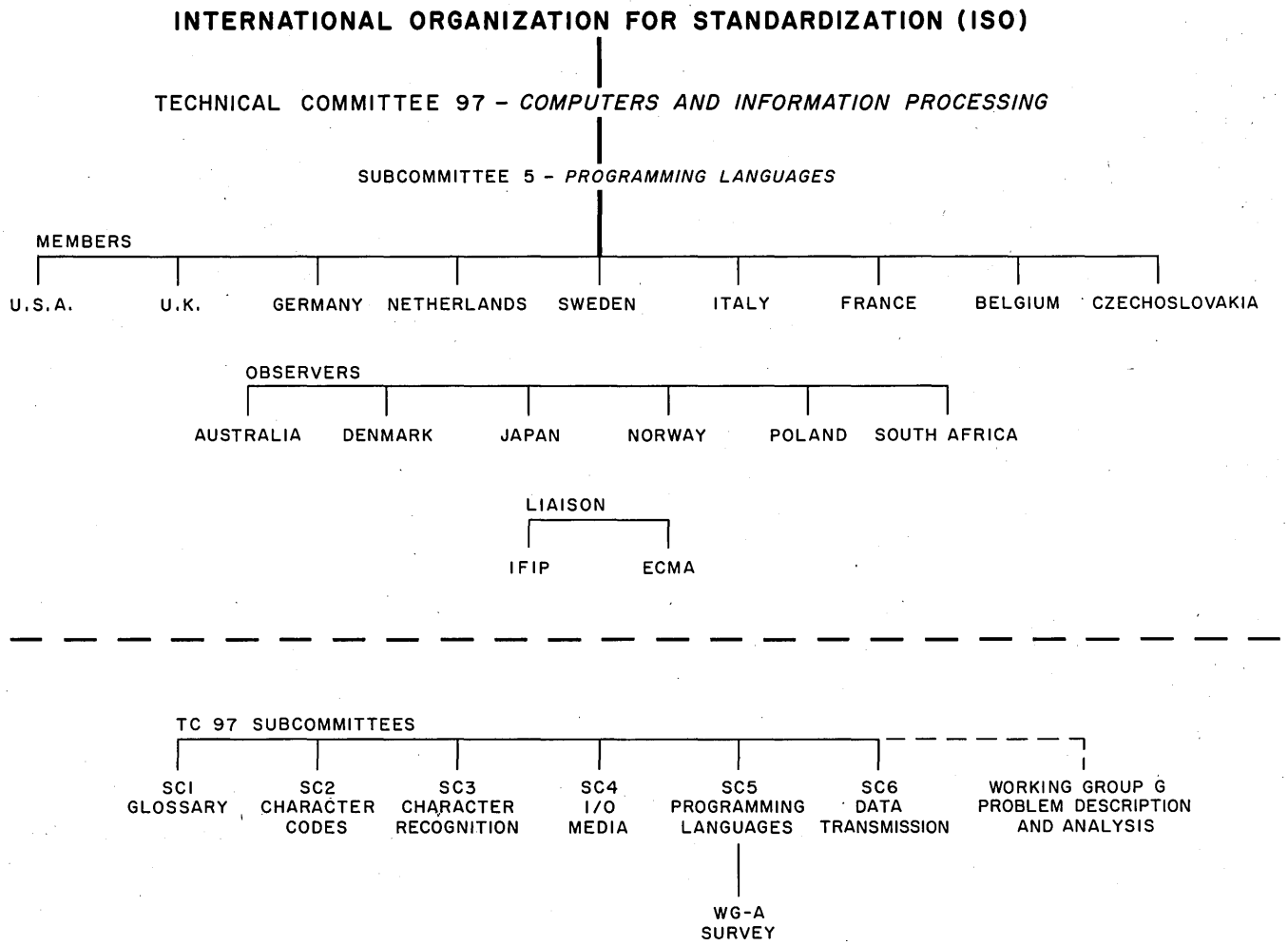
As a second charge X3.4.4.2 is creating a test data generator. This program is also written in a basic COBOL. Upon compilation it will create sets of data for each desired computer format, which when applied to the result of the feature availability test, will give some measure of the commonness of interpretation of particular features. The actual feature testing will not be done in an exhaustive fashion; that is, no attempt will be made to test every single possibility. For example, in order to test an ADD feature, a test will be created that will investigate a one character, five character, and ten character ADD. The in-between tests will not be included in the program for the reason that if one, five and ten are accommodated, one might assume that the two, three, four, six, seven, eight, and nine should also work. Once a given compiler has passed the test of the feature of addition on one, five and ten character data items, the test data generator may then be employed to create sets of data to actually execute the object code which is generated from this Feature Availability Routine.

Subsequently, a comparison of all the ADD tests of the various COBOL implementations should give some basis for determining whether or not identical interpretation of the ADD feature has been applied during each individual implementation. It is also planned that as the standard develops from a COMPACT, or REQUIRED, or Extended COBOL into various higher levels, the Feature Availability Routines will also progress in such fashion to be able to correspond to the full extent of the standard. Each computer manufacturer in the U.S. who is working on a COBOL compiler has promised X3.4.4 sufficient computer time to run these various test programs in order to determine whether or not they work as such, and then how the various COBOL compilers fit the proposed language standard. It is anticipated that the work of both the X3.4.4.1 and X3.4.4.2 task groups will be completed this fall, and that the writing of the proposed American Standard COBOL can then be undertaken.

The final COBOL standardization objective is publication of a COBOL Information Bulletin. Two issues of this CIB have been distributed to date since April 1963. The circulation of the second bulletin is approximately 2000. Included in CIB #2 are reports on the work of X3.4.4, working papers from the various task groups showing their approach and degree of progress, a liaison report from the COBOL Maintenance Committee (which is recognized to be the authority for COBOL development and maintenance), a report from ECMA and ISO on international COBOL activity, as well as a general forum for the COBOL world on activity of general interest. Copies of this bulletin may be obtained from the Editor, X3.4 COBOL Information Bulletin, BEMA, 235 East 42nd Street, New York, N.Y.

The X3.4.5 Task Group has the responsibility of coordinating the U.S. activity in the International Standardization Organization Technical Committee 97 on Computers and Information Processing, Subcommittee 5 work (Figure 2). This is the international group responsible for standardization of programming languages[5]. As the secretariat of this organization, the U.S. has certain administrative duties as well as the obligation to conduct the U.S. working group for the international subcommittee as the member body of this organization. X3.4.5 involves itself in

Figure 2



the planning of SC 5 work, preparation of meetings, and of coordination among the various member countries within the Subcommittee 5. The membership of X3.4.5 includes the members of the ISO/TC97/SC5 USA Secretariat, members of SC5 working group secretariats which are assigned to the U.S., such as the Working Group on Surveys, and the chairman of each X3.4 Subcommittee.

Activity of X3.4.5 is largely devoted to a review of the recent fourth Subcommittee 5 meeting in Berlin. As a result of this meeting, the U.S. has certain commitments on FORTRAN and COBOL, for example, to fulfill. X3.4.5 is the organization which determines and effects U.S. plans to meet such commitments. In addition, the plans and agenda for the next international ISO/TC97 and SC5 meeting, scheduled for May, 1964 in New York City, must be proposed. An additional responsibility of X3.4.5 is the periodic (semi-annual) preparation of the U.S.A. National Activity Report to the International Subcommittee.

The X3.4.6 Task Group is concerned with the concepts of programming language terminology. This group has been reviewing the work of the IFIP Technical Committee #1, and is currently drafting working definitions of terms basic to programming languages based upon the list supplied by the X3.4.1 Working Group.

international standards efforts

Internationally, standardization of programming languages is undertaken under the auspices of the International Standardization Organization (ISO). Within ISO, Technical Committee 97-Computers and Information Processing there are six subcommittees—see pg. 43. They are:

SC1 - Vocabulary
SC2 - Character Sets and Coding
SC3 - Character Recognition
SC4 - Input-Output Media
SC5 - Programming Languages
SC6 - Data Transmission

There is also a working group on problem definition and analysis.

The scope for Subcommittee 5 on Programming Languages is, "Standardization and specification of common programming languages of broad utility, with provision for revision, expansion and strengthening, and for definition and approval of test problems." It is interesting to notice the similarity between the scopes of this international group and ASA X3.4.

recent subcommittee 5 meeting

On June 5, 6, 7, 1963, the fourth meeting of Subcommittee 5 was held in Berlin, Germany. The meeting was divided into three parts each of one day. The first day included reports on national activities from the various member countries present, including France, Germany, Italy, Netherlands, Sweden, United Kingdom, and United States. Reports were also received from the two liaison organizations: ECMA (European Computer Manufactures Association), and IFIP (International Federation for Information Processing). Denmark attended as an observer, but made no report.

The French reported they had prepared a French translation of both ALGOL and COBOL. The ALGOL translation is currently in circulation in France for approval. The document represents a straight translation which is to be used primarily for training purposes, and for promoting the implementation of ALGOL in French language countries. They recommend, however, that English words be used for programming purposes. The French Standardization group has also prepared a draft proposal for standard hardware representation of ALGOL symbols. They reported furthermore, that their COBOL translation has as yet not been published. A working group is investigating the possibility of comparing ALGOL and FORTRAN, as the representatives of scientific programming language, for purposes of determining their features of practical linguistic facility, as well as those features that provide for effective and efficient compilation. For this purpose they prepared a questionnaire which was submitted to many users. The resultant compilation will provide an insight into French opinion on the ALGOL-FORTRAN fusion or one-scientific-language question. Their final concern has been the problem of definition and development of the standardization process, for which they have prepared a document of guidelines for Subcommittee 5.

Germany reported presentation to the German Standardization body of a first draft specification of an ALGOL 60 subset. This supersedes the ALCOR subset which had been previously considered. In addition, Germany is also considering a draft proposal to ISO/TC97 Subcommittee 5 on representation of ALGOL symbols in five-channel paper tape and 80-column cards. Finally, they have prepared an English-German glossary of ALGOL Technical Terms for publication. In COBOL, they have produced a translation of the source language into German. Concerning a German language version of COBOL, it was decided by their standardization group to recommend that COBOL in English be used as the present standard version of the programming language and be the basis for German compilers. In so recommending, it was hoped that this would further the international standardization of COBOL and would influence the adaptation of COBOL to future developments at the domestic expense of forcing German programmers to work in the relatively unfamiliar English. They went on to describe some of the technical advantages of this recommendation such as the avoidance of different syntactical structures, and to discuss some of the disadvantages such as the difficulty of the inexperienced German reader of COBOL programs. They mentioned, however, that a description in German of the intended programming language for standardization will be supplied and that their committee is at present engaged in finding German equivalences for many of the technical terms of COBOL. In conclusion, they stated that they had begun discussion concerning standardization of FORTRAN.

The Italian National Activity Report stated that they are in the process of preparing a survey on programming languages and compilers. This survey will be of the same form as the Subcommittee 5 survey with an additional column reflecting the importance of each particular implementation. The Italian Standardization group is contributing to ALGOL and COBOL through the European Computer Manufacturers Association. Finally, they reported that a translation of COBOL '61 has been completed, and an Italian version of ALGOL '60 is being prepared.

The Netherlands representative stated that they have studied the documents of the October 1962 Paris meeting of Subcommittee 5 and have prepared positions concerning some of these documents. In particular, the Netherlands agrees to all the points of the U.S. position on ALGOL except that they believe that changes should not be made to the revised ALGOL '60 language, but rather should be considered for the next ALGOL specification. They also reported that they would like to see a smaller proposed character set as a minimum ALGOL requirement. Namely, their set would be composed of the letters A to Z, the numbers 0 to 9, space + − * / . , ′ ( ) = and the small 10 which would exchange with currency sign.

Sweden reported that four ALGOL compilers and one COBOL compiler are being constructed. Their standardi-

zation committee is also concerned with the problems of compatibility among the various ALGOL compilers.

The United Kingdom reported the establishment of a Programming Languages Technical Committee, DPE-13, under the British Standards Institute. Its scope includes close liaison with international activities, maintaining a forum for programming languages discussions, and the preparation and distribution of necessary documents for standards. The United Kingdom section of the programming languages survey was updated and received by the U.S. Secretariat of TC97/SC5 Working Group A-Survey. The representatives from the DPE-13 committee are active on both IFIP and ECMA Programming Languages Committees. Various documents have been studied, including the IFIP ALGOL subset, the Revised ALGOL '60 Report, and the Required COBOL '61 document. It is the feeling of the Standardization Committee of the United Kingdom that its activities on current languages should proceed in parallel with work in development of more satisfactory languages. Consequently, the United Kingdom will prepare a document which will define criteria for evaluating programming languages by the end of this current year.

The final National Activity Report, from the United States, was presented as a document entitled, "The U.S. National Activity Report to ISO/TC97/SC5", and will be published in the September 1963 issue of *Communications of the ACM*.

Just prior to this Berlin meeting, several members of the U.S. delegation had the opportunity to visit the National Standards Bodies in Czechoslovakia and Poland under the auspices of the ISO/TC97 Secretariat. The following is a brief synopsis of their report:

czechoslovakian activity report

Currently, there are no common programming languages in active use on computers. Concerning the development of new languages, three separate projects were reported. First, a restricted but useful version of ALGOL 60 is being prepared. Second, there is a research study to design a commercial language based on ALGOL that includes a data division and special operations on a file including sort. Third, there is a compiler under way for a complete ALGOL 60 on a small computer. No current activity on national standards was reported.

polish activity report

The SAKO language is now in use at many Polish computing centers, at some of which it is used exclusively. SAKO is a scientific oriented language similar to ALGOL 58, FORTRAN I and MERCURY AUTOCODE. It has been available for two years.

Concerning the development of new languages, SAKO is being developed in three different but compatible directions, oriented toward mathematical, commercial and logical data processing respectively. Emphasis is being placed upon languages that are easy to learn and efficient to implement. A working group on national standards, in existence for six months, is formulating its opinion regarding possible standard languages. Concerning possible activity in international standards, arrangements were made to include Polish languages in the SC5 survey and a communication channel with CODASYL was arranged.

ECMA report

The European Computer Manufacturers Association presented a report on their three technical committees on languages standardization. TC2 on General Programming Languages has been working on a survey of programming languages, a proposal of methods for describing programming languages, a study of the present needs for programming languages, and the consideration of programming languages in environments such as total operating systems. TC5 on ALGOL has been working on the preparation of an ALGOL subset which includes as many of the characteristics of the proposed IFIP subset as were known. TC6 on COBOL has prepared a translation of the COBOL source language into French, German and Italian. They have prepared the specific graphic symbol requirements for COBOL implementations with resolution of certain conflicting practices. On June 4 in Berlin, ECMA TC6 officials met with the U.S. COBOL Joint Steering Committee* and established contact with both the ASA X3.4.4 Task Group on COBOL standards as well as the CODASYL COBOL Maintenance Committee. This resulted in plans to establish a joint program of work for COBOL standardization with X3.4.4, and for COBOL development and maintenance with the COBOL Maintenance Committee.

The IFIP liaison representative reported that the Revised ALGOL '60 Report has been published in three technical journals. No further action can be reported until after the forthcoming meeting of TC2.1 in September 1963.

SC5 FORTRAN and ALGOL motions

Concerning the IFIP ALGOL report, the discussion of Subcommittee 5 resulted in unanimous approval of the following motion:

"SC5 received with great interest the IFIP ALGOL '60 revised report and deems it a significant contribution to ISO/TC97/SC5 standardization work. However, the committee feels that this document in its present form is incomplete in that standard input-output procedures and specification of a proper subset should be included. Therefore, SC5 invites IFIP to submit at its earliest convenience a more complete document."

Regarding the problem of concurrent consideration of ALGOL and FORTRAN as potential and possibly conflicting standards (each can be used to solve scientific problems), the following resolution was unanimously approved:

"It is premature to decide today which choice we should make between ALGOL and FORTRAN due to the relative incompleteness of both documents presented to Subcommittee 5 and the fact that no criteria for evaluating a standard exists. It is therefore, moved that the two candidate languages in the field of scientific programming be treated in parallel."

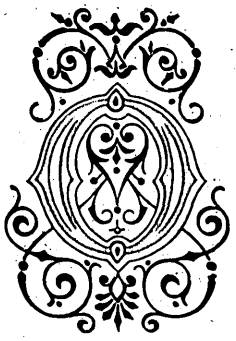
The second day of the Berlin meeting was devoted to ad hoc committee sessions and a meeting of the permanent Working Group-A on Survey.

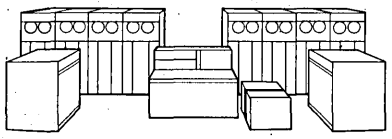
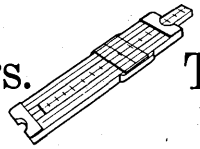
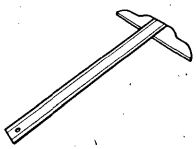
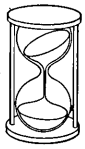
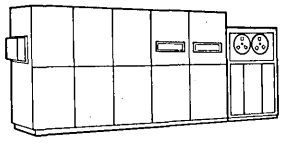
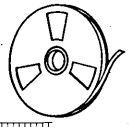
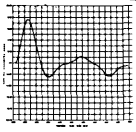
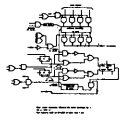
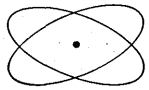
ad hoc reports

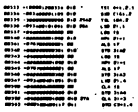
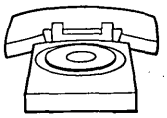
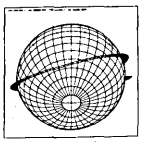
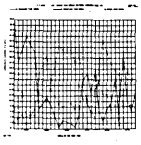
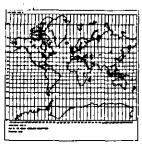
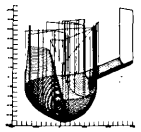
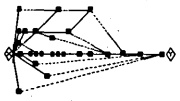
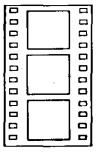
The third day was devoted to the receipt of reports of the ad hoc working groups and action on them. Working Group-A on Programming Languages Survey reported that their basic survey project[8] will be extended in format to include a column of information entitled, "Number of People Regularly Using the Processor" and another entitled, "Date Information Supplied." A questionnaire for this augmented general survey will be prepared for review by Subcommittee 5 at the next meeting. The next project for a Depth Survey of ALGOL, COBOL and FORTRAN was discussed and working papers distributed. Additional work prior to the next meeting of Working Group-A in

*The COBOL Joint Steering Committee was established to promote closer cooperation among the various COBOL interests. Its members are the chairman of ASA X3.4, the chairman of X3.4.4, the Secretary of X3, and the co-chairmen of the COBOL Maintenance Committee.

The machine that helped a computer work for everybody



nce upon a time, a company bought a large-scale digital computer.  It was very useful but - alas! - expensive. It was hoped all departments would benefit, but because the computer-printer generated only row after row of numbers and symbols,  it was used only by the engineers.  They took their armloads of papers to the drafting department  where an army of draftsmen and clerks converted the figures into charts, graphs and drawings. This was expensive and time consuming,  and some charts were needed immediately. Then a bright engineer learned about a new kind of machine called the S-C 4020  that takes the information  from a computer and converts it into curves, graphs  and pictures.  And this machine keeps up with big computers because it prints with electron beams  instead of a hammer or stylus. Of course,

the S-C 4020 prints words and numbers  too, so they got one. The engineers talked  about their versatile new machine, and soon other company departments were using it to solve their problems by transforming numbers into picture form  that everybody could understand and use. The comptroller used the S-C 4020 to draw graphs and charts  for his financial reports. The marketing manager produced sales maps.  The production man used it for tool path  drawings. The planning people used it to update critical path diagrams.  And the S-C 4020 saved space for everybody by storing all kinds of information on microfilm.  (Naturally it prints paper copies, too.) If your computer has a usage barrier, learn how the S-C 4020 can help it to talk in everybody's language. Write to *General Dynamics|Electronics,* Department D-35, P. O. Box 127, San Diego 12, California.

Each of the sample illustrations above were actually produced in less than one-half second on the S-C 4020.

CIRCLE 22 ON READER CARD

May 1964 in New York City will be carried out by correspondence.

The Ad Hoc Working Group on definition of the Standardization Process and Working Group Procedures presented a document report which specified a set of steps involved in the international standardization process of programming languages. One interesting point was the need for the determination of criteria for measuring the adequacy of a language prior to its acceptance as a candidate for international standardization. A resolution assigning responsibility for study and definition of these criteria to the French was passed by Subcommittee 5 and accepted by the French delegation. They are to prepare an expository document for consideration at the next meeting of Subcommittee 5. These criteria should apply to the adequacy of a language to be a candidate for standardization, the adequacy of specifications of the language and the adequacy of the presentation of the specification, particularly as it conforms or should conform to ISO requirements.

The Ad Hoc Working Group on COBOL reported having spent the majority of the time describing and discussing various COBOL activities, including in particular X3.4.4, COBOL Maintenance Committee and ECMA. They recommended to Subcommittee 5 that each national standards body review the COBOL '61. Extended manual, which had been previously supplied, in order to identify conflicts that exist between the report and various national standards practices. Each delegation should come prepared with this information to the next Subcommittee 5 Meeting and, furthermore, should not confuse conflicts or potential conflicts with ambiguities or further developmental work. In addition, the United States was asked to contribute its work on the Feature Availability Routines and Test Data Generator.

The ALGOL Ad Hoc Working Group, under the chairmanship of William Heising of the U.S.A., reported consideration of the private Ingerman-Merner paper on ALGOL, which was presented as an example of current thinking in the United States. Discussions were held on ambiguities, and hardware representation of the ALGOL symbol set.

A major part of the discussion resolved the conflict presented by the U.S. position that the Revised ALGOL 60 report is insufficient for standardization and the IFIP position that Revised ALGOL 60 cannot now be changed. It was unanimously agreed to present the following resolution to Subcommittee 5:

"ISO/TC97/SC5 requests IFIP/WG2.1 to submit to SC5 for its consideration, specification of

(1) An ALGOL subset
(2) Input-Output facilities
(3) Graphics and media codes of ALGOL program symbols for punched cards and 5 to 8-channel paper tape.

The subset requested of IFIP should be so chosen as to allow efficient implementation of the language."

Subsequently, this resolution was unanimously accepted by Subcommittee 5.

The Ad Hoc Working Group on FORTRAN, chaired by W. van der Poel of the Netherlands, presented the final report. Working papers had been distributed to the ad hoc group by the American representatives. These were the papers on the work of the ASA X3.4.3. task groups II and IV. After explanations of this work, two views were developed. The first, that Subcommittee 5 should ask an international body to assume responsibility from ASA for maintenance and development of FORTRAN, was de-

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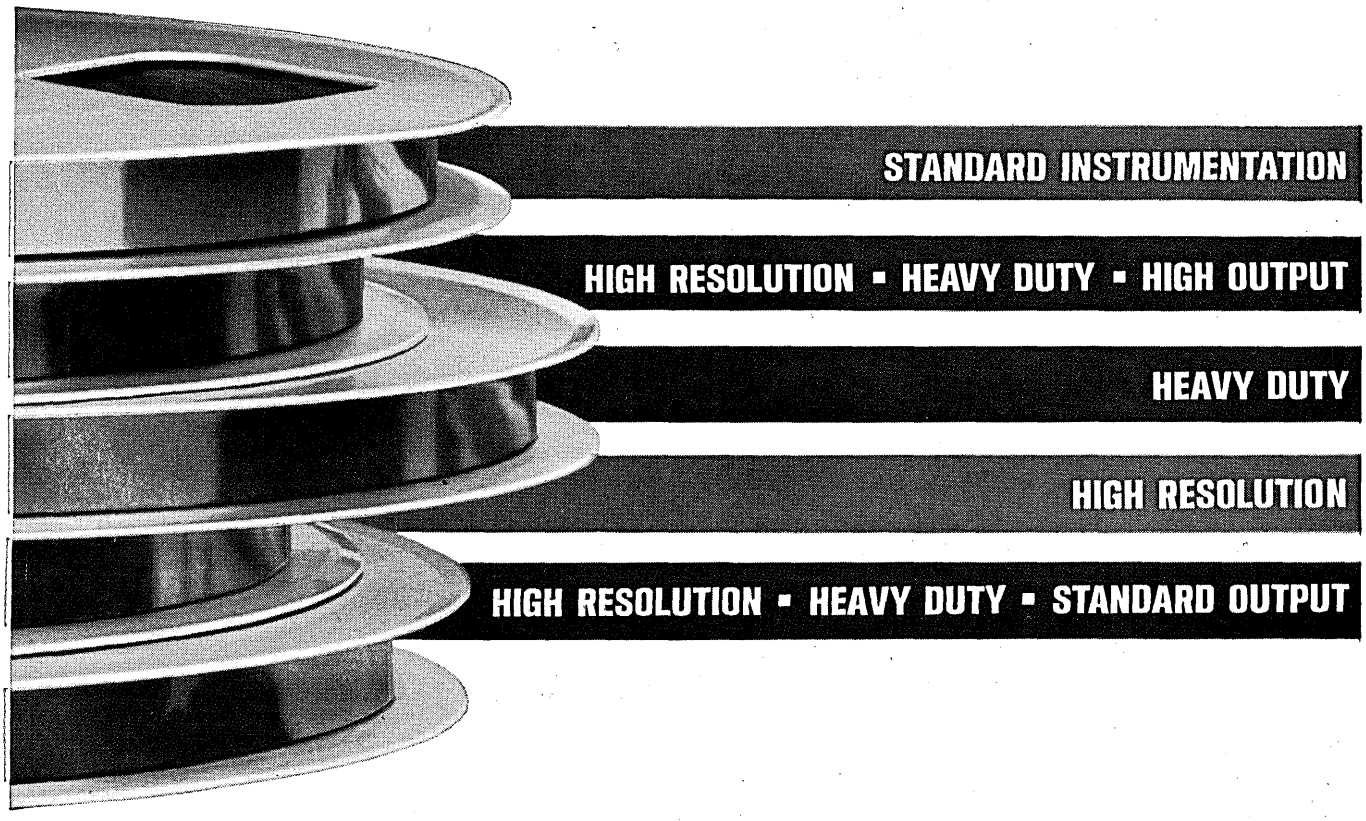

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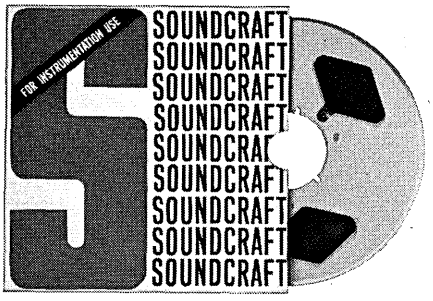

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CIRCLE 23 ON READER CARD

feated by a vote of three in favor, four against, and zero abstaining. The second view, that ASA should go on with their work and ultimately submit their American standard as an ISO draft proposal, was favored by a vote of four in favor, zero against, and three abstaining. No resolutions or recommendations to the full committee were reported.

The date of the next TC97/SC5 meeting was scheduled for May of 1964 in New York City.

anticipated progress

Before adjourning, representatives from the three candidate language development groups and the French delegation were asked to comment on the progress they anticipated being able to make on their assignments.

The representative from IFIP Working Group 2.1-ALGOL said that they have every hope of finishing the subset as well as the hardware representation, but that they are doubtful that work can be finished on input-output prior to 11 January 1964, the cutoff date for mailing documents to Subcommittee 5 for action at the May 1964 meeting.

On FORTRAN, it was stated that X3.4.3 would want to progress through the ASA approval procedure further before submitting a proposal to Subcommittee 5. This could not be realized by the 11 January mailing date. Therefore, at best only a more complete working document will be distributed for Subcommittee 5 consideration in May 1964.

On COBOL, similarly, a more complete working document will be distributed to show the progress and the extent of activity on the specification of COBOL and the test programs.

The French delegation hoped that by the May meeting they will have a definitive document on the criteria for evaluating programming languages for SC5 consideration.

Having described above the activity in language standardization, I sincerely believe it indicates that shortly we shall begin to realize the objectives we have set; namely, proposals for standardization of certain programming languages of wide use. It means that we have learned a great deal about the standardization process for programming languages; that we have learned enough about standardization itself to benefit subsequent work in new language development; that we have shown the practicality of producing, at the same time and through different means, standards proposals which transcend national and even corporate standardization practices; and finally, that we still have a great deal of work ahead of us. ■

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3. "Toward Better Documentation of Programming Languages," *Communications of the ACM*, March 1963, p. 76.
4. "U.S. National Activity Report to ISO/TC97/WG-E," *Communications of the ACM*, February 1963, p. 51.
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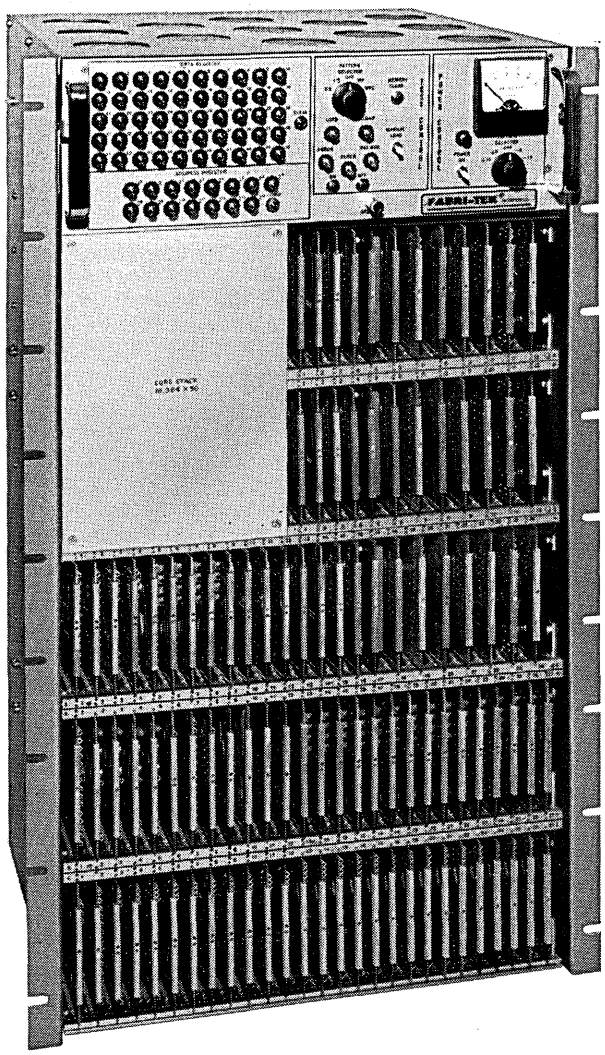
7. "U.S. National Activity Report to ISO/TC97/SC-5," *Communications of the ACM*, September 1963.
8. "Survey of Programming Languages and Processors," *Communications of the ACM*, March 1963, p. 93.



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CIRCLE 20 ON READER CARD

TECHNIQUES IN THE REVIEW OF TECHNICAL PAPERS

offensive and defensive

by D. D. BOURLAND Jr., Booz • Allen Applied Research, Inc., Bethesda, Md.

The operations analyst engaged in large scale studies occasionally finds himself in a situation for which his education in applying scientific methods may be inadequate. It is recognized that "the" problem may have been honestly faced, astutely analyzed, encompassed by an unusually clever model—and then this altogether meritorious work may face the slings and arrows of an outrageous Review.[1]

The Review itself can only be regarded with respect. In this age of dawning automation, the Review begins to approach in sanctity that previously accorded only those symbols associated with Fatherland and Motherhood. This has been forced upon us by cranium-cracking problems which are not necessarily amenable to quantitative methods, but that surely deserve the most high-powered analytical insights which can be mustered. Thus, it increasingly happens that one person or group may produce a study that must be Reviewed by some other semi-independent group or individual. This latter may be either an in-house or out-house (is this the correct phrase?) collection of individuals whose backgrounds hopefully encompass the indicated spectrum of skills.

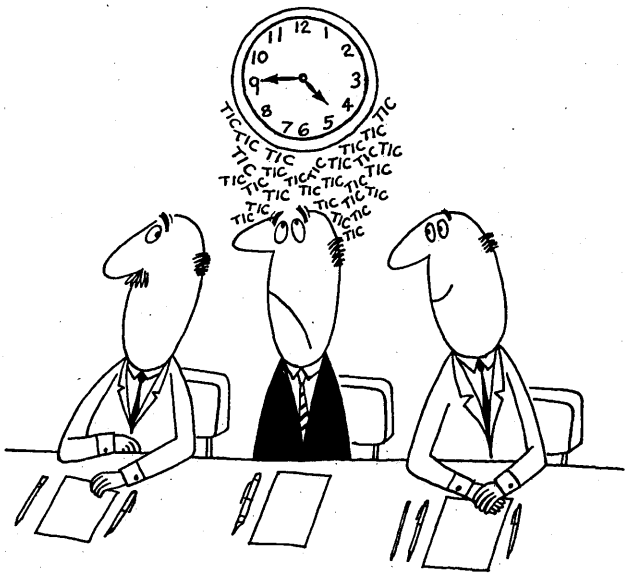
All old hands among us must agree (however reluctantly) that most significant studies, however excellent on their own merits, must be reinforced by an adequate grasp of the political realities of the situation. The first such hurdle—the first acid test—is provided by the Review.

The purpose of this paper is to describe certain particularly useful stratagems that can potentially spell the difference between publication and ignominious withdrawal of a paper. Having experienced both fates on occasion, and having observed others in the process of both, the writer feels qualified to express himself on this topic. After first describing several techniques useful to the author of a technical paper, techniques appropriate for those reviewing the paper will be discussed. Finally, a variety of generally applicable specific devices will be exhibited.

defensive techniques

Perhaps it should be emphasized once again that the writer assumes the paper offered for Review is sound.[2] It is assumed that no willful obscuring of fact, as delightfully described in reference (1) in the bibliography, has been involved; no fallacies of the type witheringly detailed in references (2) and (3) have been committed. Now, let's get this little gem through Review!

Sensitivity to Personal Time Scales. The simplest ground rule is to remember that everyone always wants to go home at about 5 P.M. It has been observed by one of the writer's more experienced associates that reviews which last from 2 P.M. to 5 P.M. would easily have lasted from 9 A.M. to 5 P.M. with no significant difference in contributions by participants, so far as quality of the resultant paper is concerned. Professional technical review participants call this the "Afternoon Effect."[3] We have all frequently noted that, after the initial vitriolic exchanges between the reviewers and the author, comments tend to settle down and become almost constructive until, as 5 P.M. approaches, page after page is left unscathed—even by sarcastic efforts at humor. Obviously, this human tendency is available for exploitation. Since no



[1] Throughout this paper the term "Review" will be capitalized. It seems fitting.

[2] The writer recognizes this to be the weak point in the present paper. Critics will surely ignore this preamble, or suppress it, and interpret this meritorious offering as a compendium of how to get *trash* through a Review.

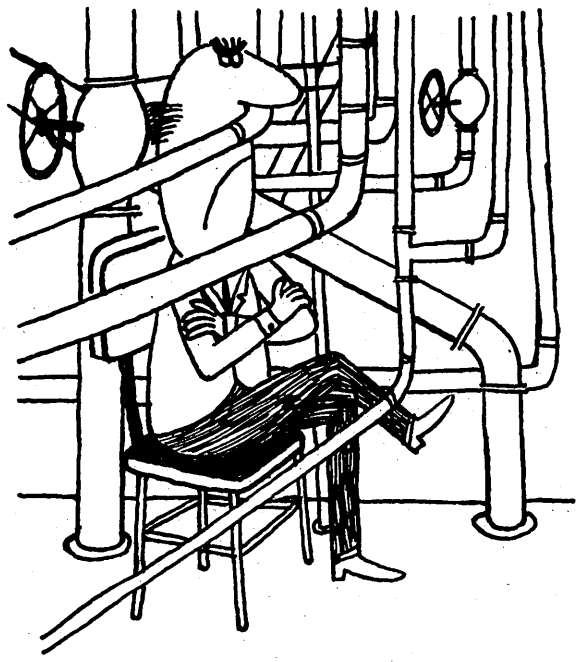
[3] The "Afternoon Effect" seems to be a special case of the processes so outstandingly studied by C. N. Parkinson.

lengthy argument can be uniformly clear and/or forceful, the portions should be distributed with this situation in mind. One caution: beware the "4:45 Alert." At about this time several people are apt to become aware of how much must be accomplished (perhaps 20 pages) in the next 15 minutes. Jarred out of an afternoon's torpor, an otherwise accomodating individual may become exceedingly waspish. One must plan accordingly.

The Brazilian Ploy. Perhaps no more effective technique has been discovered than that which the writer has called the "Brazilian Ploy." Its application extends beyond the Review to conferences in general. However, it reaches its most useful focus at Reviews. The person or group sponsoring the Review is in best position to carry this one off, but steely determination is required. Stated simply, the Brazilian Ploy consists of (i) plying the opposition with coffee (black, if possible), (ii) insuring that one's own side abstains, then (iii) seeing to it that higher authority insists that the requisite unanimity be reached prior to adjourning. An impressive amount of renal force eventually begins to back up one's position. In the limit, only the most jaundiced opposition will be able to hold out.

Airborne Aid. An expert from out of town, recognized to be a particularly thorny individual, may be involved in the Review. When this is the case, it can be advantageous to offer the services of one's secretary in confirming airline reservations, etc. When the departure time of this man's plane becomes known, the whole discussion may be guided into innocuous by-ways while waiting for time to run out on You-Know-Who.

The Boon-docks Ploy. A member of one's own organization may be perceived as a particularly unfortunate hurdle. Careful planning may be able to slip him into a Boondocks Ploy. This is based on the fact that frequently the Review takes place in a room having a table with limited seating, plus chairs hugging the wall. See to it that this misguided colleague gets a chair away from the table. It will be easy to ignore his entreaties for recognition, and he will soon begin to feel like a Second-to-Third Class participant. At best he may even begin to doubt his own suggestions. When possible, out of sympathy for his right

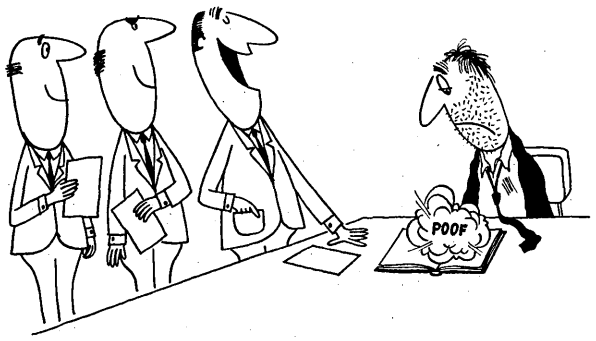


to an opinion, a member of the author's team can be assigned to see that he gets plenty of coffee (cf. Brazilian Ploy).

The Deferred Reply Gambit. This useful technique is available in two sizes. The LARGE sized Deferred Reply Gambit, which has a payoff matrix with remarkable entries, consists of countering criticism by asserting (boldly and if necessary baldly) that the point is adequately covered some 35 pages downstream.[4] This is particularly effective when used with the Airborne Aid described above. Of course, most of the opposition will either have forgotten this particular objection by the time (P+35) is reached or decide to let it go in view of their Personal Time Scales. Now in the HUGE ECONOMY sized Deferred Reply Gambit, the author(s) concede the point, congratulate the critic on his penetrating analysis, and promise to prepare several paragraphs (vaguely) perhaps by next Thursday to take care of the point. In some instances it may even be advantageous to do so.

offensive techniques

Let us turn our attention now to the other side of the problem. One may return from leave and find that he has been scheduled to participate in someone else's Review. This is most apt to fall one's lot when several days behind in one's own portion of the project.

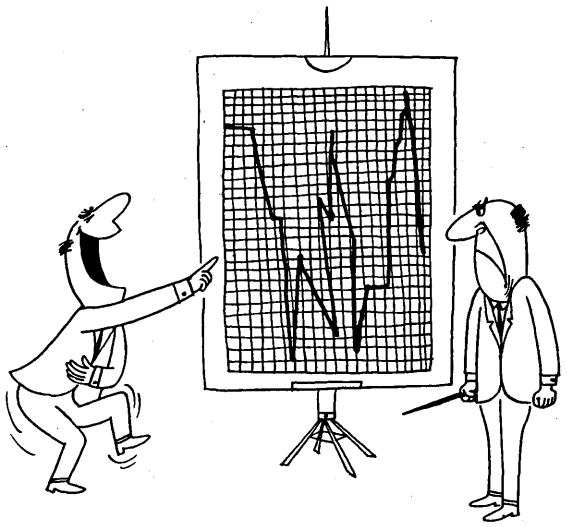


The Team. The Offense may be able to form a team or —more likely—several sub-teams representing the various factions involved. This may be needed to counter the organization of the authors which has been alluded to

[4] Some 14% of those around the table are apt not to have read the paper in its entirety.

above. It has been found useful for Offensive Teams to be set up around a watch bill. The two procedures most often used are (i) Rotational and (ii) Straight Watch. The Rotational Basis consists of assigning members of the team primary responsibility for haranguing the author in 5- or 10-minute periods. This ensures that a fresh member of the Opposition is always alert for such Defensive Techniques as the Deferred Reply Gambit. The Straight Watch Basis divides the expected time duration of the Review (or else the paper itself) into segments placed in one-to-one correspondence with the members of the Offensive Team. This latter generates more heated exchanges than the Rotational Basis, since the probability is higher that the Opposition will have read the paper, at least piecemeal.

Graph Demolition. Perhaps the most effective single technique in Offensive Reviewing is Graph Demolition. Since any graph represents a compromise between quantity of information and ease of comprehension, each graph is vulnerable. For example, one may (properly) object to a graph on the basis that: (i) it contains so



much information on parameter values or environmental conditions, etc., as to present a veritable buzz of confusion; or, (ii) it cannot be understood unless the reader has followed the preceding argument in detail (including the long footnote several pages back); or even (iii) it violates both (i) and (ii). The modification of a graph is serious business, for it usually entails the services of an already over-worked Graphics Section. Most authors would prefer to remove a graph entirely than try to squeeze a change (yet another) out of Graphics.

Gratuitous Demolition.[5] There is available an analogue of Graph Demolition which is applicable to any portion of text—even that which contains the kernel of the argument. The procedure consists of (i) generating a spirited discussion which involves the point in question—this should be easy for most basic issues come ready packed with dissension (unwrap, heat, and serve); then (ii) one magnanimously steps in with the peace-making suggestion, "I really don't see what we are all arguing about. The whole paragraph is gratuitous." Before even finishing pronouncing this magic word (i.e., "gratuitous"), pencils will start scratching out the offending paragraph. Some participants may sneer softly at the author for trying to trap them.

Pre-written Paragraphs. Occasionally one encounters an author who uses a technique which is quite dangerous for his side: "All right, *you* re-write the paragraph!" Since this takes control of the situation out of hands of the presumed author, it was not offered as a recommended Defensive Technique. When an author can be expected to fall into a trap of this kind, however, excellent use can be made of Pre-written Paragraphs.[6] These can be prepared before the Review and, on occasion, may provide a home for an unsupported favorite assertion to which one can allude to bolster an otherwise weak argument in one's *own* future paper! Of course, a more pedestrian use is to support the biases of one's faction against inroads by the opposition. An adroit analyst has been observed to (i) object to a point in some paragraph, (ii) stimulate confused discussion of the issues, (iii) then come crashing through with a seemingly impromptu re-write that he spent 30 minutes polishing on the day before the Review. This can impress the Project Manager (who usually has to sit in on Reviews) no end.

Continued Consideration. One technique[7] which can be particularly effective may be somehow related to continued fractions:

$$\Phi = 1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \ddots}}}}$$

In application it consists of asking the writer "Did you consider . . . ? Well, did you consider . . . ? And did you

consider . . . ? etc." If possible this technique should be used by a team of reviewers; it may then be applied until the writer loses his temper, at which time the faction breaks up.

useful dodges

We turn now to four expressions that can be useful tools (in the sense of wrecking bars), whether one's role is defensive or offensive. They are the verbal equivalents of dividing by zero; they lead to a lot of wheel spinning and, formally speaking, they are general enough to be regarded as undefined.

Semantics. The discussion-quashing assertion that "It's only a matter of semantics" exhibits several important characteristics. Firstly, it illustrates how a term ("seman-

[5] The technique of Gratuitous Demolition was brought to the writer's attention by an observant (and resourceful!) colleague who prefers to remain anonymous.

[6] Some military analysts call this technique "Instant Position Papers."

[7] The writer was reminded of this technique by Mr. Herbert T. Spiro, formerly with the Planning Research Corporation.

tics") can become almost trite through too much handling, while being very rarely understood. Secondly, the quoted sentence shows a region of inadequacy of current information theory, for it supplies an instance of negative information. One might suppose that "It's . . . semantics" would commonly be met by: "Precisely; so let's clarify the semantic issues." Oddly enough, great numbers of people become so mollified by being informed that "It's . . . semantics," that further exploring may actually be frowned upon.

The Panacea. Many an incisive attack has been turned aside by reminding Don Quixote that "After all, this system is not supposed to be a panacea." Since nothing in the real world, by the very definition, could be a "panacea," such a statement is of course safe; but its calming effect can be outstanding. But few more devastating salvos can be fired offensively than to accuse some approach of apparently trying to be a panacea. In the near future p . . . a may become one of a new set of epithets which will fill the void left by four-letter words, now that the latter are well on the way to literary respectability.

Theoretical. Perhaps as a part of our agrarian heritage, many people continue to look down their noses at the mere "theoretical." If a quantity is advertised as being a "theoretical value," few observers will carp if it departs from observed reality by a factor of three (particularly if this is described as being within "only five db of the experimental results"). While one might anticipate fist-shaking denunciations of a theory which produced such bum predictions, this disclaimer is often used without even upsetting anyone's appetite. Could this be a reflection of unconscious concern over what Henry Lewis has called the "Raw Data Flaw"?[8]

Sophisticated. In the late 1940's the writer first became aware of an extraordinary use of the term "sophisticated." It was usually combined with either the term "mathematics" or "techniques" to indicate (i) complexity, or (ii) novelty (in the sense that the material had been published in journals, but not yet in somebody else's book). The wide-eyed innocent then looked in vain, for example, for a result in conformal mapping lounging in a deck chair with a Senior Service cigarette putting a soft haze over the two silver buckets, each containing a pint of vintage champagne! Actually, the methods for eliciting information on muons never really did have anything to do with the proper way to pronounce Albert Camus' last name! But perhaps, in closing, we should not be too harsh on "sophisticated." At least it does not open the door to the poignant Weltschmertz induced by the word "modern" when seen today in a 1916 text.

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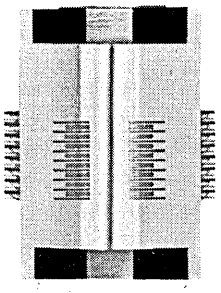
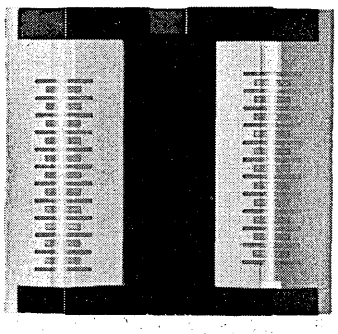
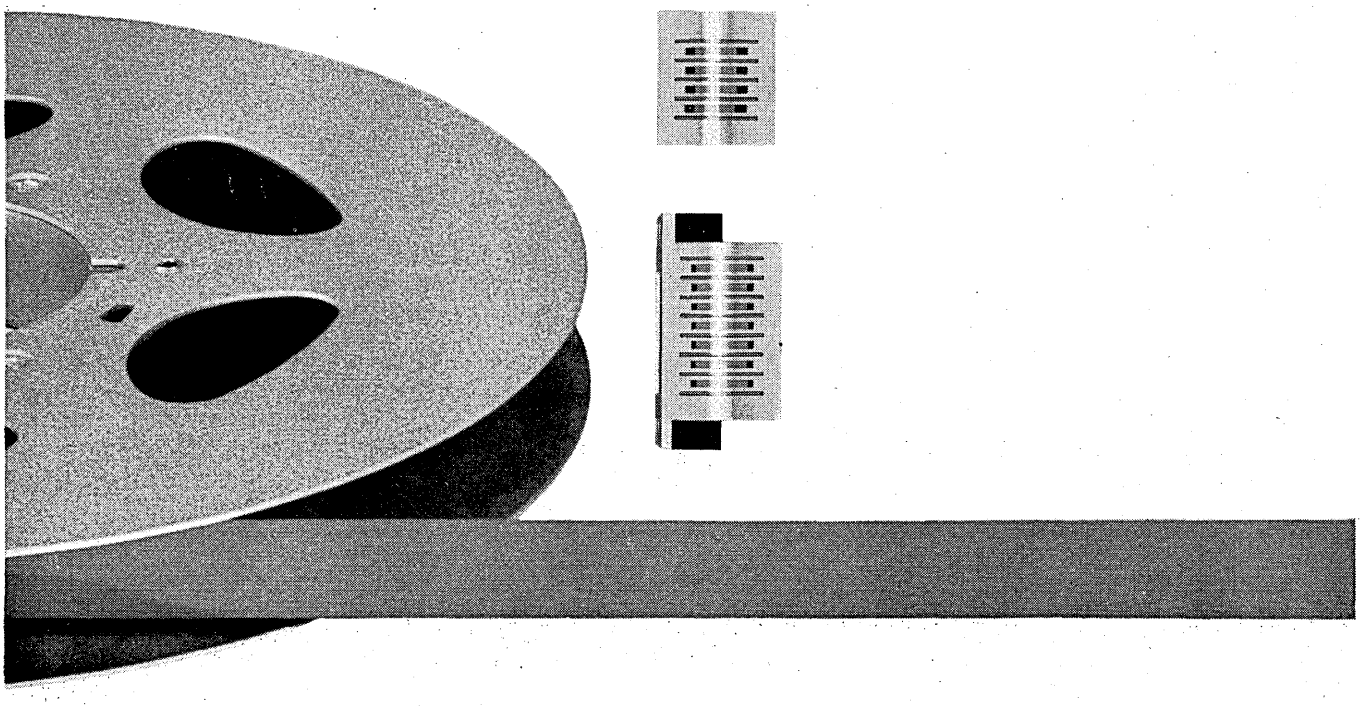
2. Potter, Stephen, *Gamesmanship,* Holt, 1948.
3. Bourland, Jr., D. D., "Non-Decision Theory," Memorandum for the Director of Research, December 1961.

[8] See reference (3).

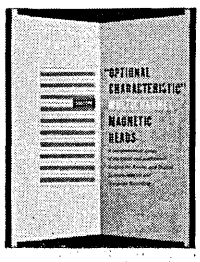
standard heads by Brush fill 90% of all Magnetic Head Applications







Why such an all-out claim? Because only Brush has kept pace with the many design requirements in recording technology. Continuous analysis of current and future trends enables us to maintain a design improvement program incorporating all field-proven advances in our *standard* heads. It's a must . . . to satisfy *all* customer requirements. The result? We've been able to standardize and meet all but a few highly specialized applications. You save engineering and testing time . . . and money. If you're one of the few with a "special" problem, Brush obviously has the engineering capability and manufacturing facilities necessary to fulfill *your* magnetic head application. With both standard and special heads, detailed mechanical drawings and specifications plus actual electrical characteristics are available *before the fact.* You can accurately predict system performance without costly time-consuming tests. *Write now for our design and specification bulletin "Optional Characteristic Heads".*



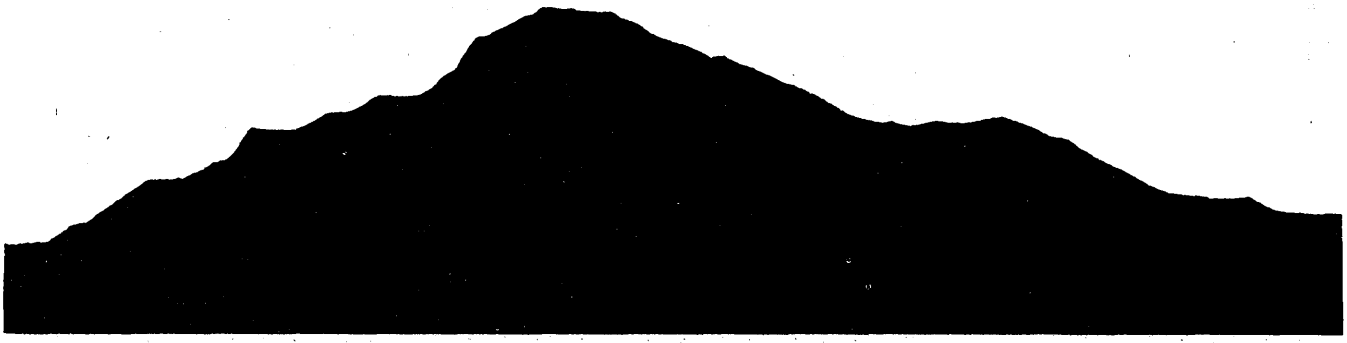
brush INSTRUMENTS
DIVISION OF
37TH AND PERKINS CLEVITE CORPORATION CLEVELAND 14, OHIO

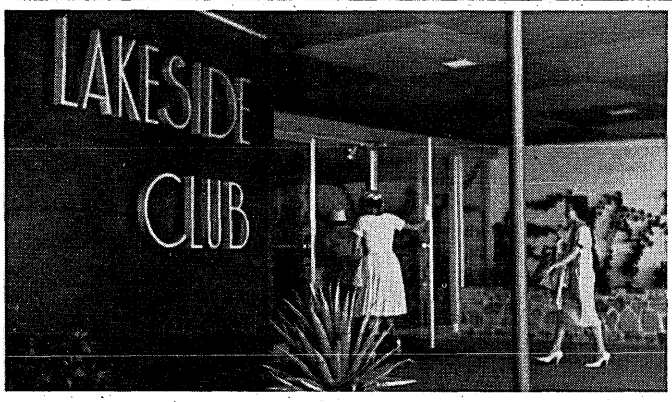
CIRCLE 21 ON READER CARD

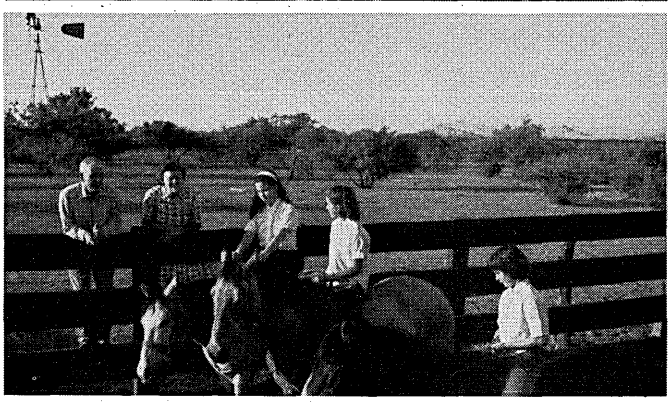
IN THE COOL HIGHLANDS OF SOUTHERN ARIZONA an elite technical team of government and industry specialists is at work applying automatic data processing concepts, techniques and equipment to the needs of the mobile modern Field Army. This program, now beginning its sixth year, is a vital part of the Army's Command Control Information System Project for the 1970's—CCIS-70. TRW has been selected to continue in its role of providing technical assistance to the U.S. Army Materiel Command in support of the CCIS-70 Project at Fort Huachuca, Arizona. Challenging assignments exist in advanced areas such as digital data communications, systems integration, man-machine communications, information retrieval and display, programming techniques and languages, simulation techniques and applications, and integrated system testing under field conditions. Facilities include van-mounted computers developed by the Army for field use, associated system devices, and field communications equipment. We have immediate openings for qualified systems analysts, programmers and test engineers who desire to make a significant contribution to the nation's military capabilities in a stimulating professional environment. At Historic Fort Huachuca and neighboring Sierra Vista, civilian engineers and their families, along with hand-picked Army technical officers and their families, have created an equally stimulating intellectual and social environment. If you would like to join TRW's top-flight technical group at Sierra Vista, contact Robert W. Rogers now at 8433 Fallbrook Avenue, Canoga Park, California. Or phone him collect: Area Code 213, 346-6000. TRW is an equal opportunity employer.

TRW **COMPUTER DIVISION**

Stimulating!







CIRCLE 77 ON READER CARD

CERTIFICATE IN DATA PROCESSING

55 centers to hold exams on November 23

The industry's only certification program for data processing personnel (both tab and computers) will hold its second nationwide examination sessions on November 23 at about 55 test centers in the U.S. and Canada. Colleges and universities in 35 states have been selected to administer the tests. Sponsored by the Data Processing Management Assn., the program is open to all qualified members of the industry. Deadline for application is October 25.

The suspension until 1965 of educational requirements favors an early try for the certificate. Intended to establish a minimum but high level of knowledge and competence, the program's course requirements will serve to guide universities in their formation of dp curriculums — and, hopefully, to guide students who are aiming toward a career in the field. As stated by the DPMA, the objectives are:

1. To establish high standards for dp personnel by emphasizing a broad educational framework and practical knowledge in the field;
2. To develop a method for recognizing a corps of individuals as having professional competence in dp;
3. To lay a firm foundation for the continued growth of the dp field.

Toward this end, both formal education and practical experience will be required of applicants. These include at least three years' experience in one or more punched card and/or computer installations. Until 1965, academic exposure to five required subjects (one year of math, managerial accounting, English, and data processing systems, and a semester of statistics), and eight out of 17 prescribed electives is being waived.

It thus pays for qualified applicants who lack the academic requirements to take the exam before then. Two other reasons to be among early certificate holders: the tests, under constant revision, promise to become more difficult ("Or perhaps I should say more pertinent to the profession," a DPMA executive says). Further, last year's exam took two hours; this year's will require three. An all-day session and sectional tests administered "in a graduated series" over a period of time are being contemplated. Categories covered in the present test are roughly as follows:

Computer concepts and equipment	25 per cent
Unit record concepts and equipment	15 per cent
Related peripheral equipment	5 per cent
General systems concepts and management	25 per cent
Mathematics, statistics, and accounting	30 per cent

This is unchanged proportionally from last year when 687 out of 1,048 applicants passed. The only "grades" are pass or fail, and failure to pass is not reported to an applicant's employer. Covered in the test are the principles of punched card and electronic dp equipment and systems, mathematics (including number systems), statistics, logic, and accounting principles. The four-part, multiple-choice questions require the solving of problems, knowledge of facts, and application of theory . . . but none on specific manufacturers' equipment.

A detailed study guide, available with the application, outlines categories covered, areas not included in last year's test, and a bibliography of recommended books and publications. Additionally, at least one local ACM chapter has held seminars to prepare individuals for the exam.

As reported by R. L. Patrick (*Datamation*, January, p. 27), who survived the two-hour version, "While it's true the test did not measure all that an experienced professional might know on some of the topics, it did determine a minimum level of competence in all the fields that it covered. As such, the man who has never done an application cannot qualify without extensive study. Likewise, the man who is a shift supervisor or group leader and has never opened a technical book or magazine in the past several years is also handicapped . . . Eventually we will see a series of such examinations which are progressively harder and which progressively require more varied and greater experience. Perhaps such a series of examinations will be augmented by a series of specialty examinations at each level whereby the practitioner may obtain an endorsement for his particular technical skill . . ."

Patrick and two others are the first appointments to a five-man Certificate Advisory Council, charged with the responsibility for establishing qualification levels, examination contents, and the cutting (pass-failure) scores. Other appointees are Marvin M. Wofsey of the American Univ., Washington, D.C., and Laurence A. Johnson, American Hospital Assn., Chicago. They will be serving one, two, and three-year terms, assuring an annual turnover. Per-

manent members of the council are the DPMA International president and the vice president for education. All appointees are, themselves, certificate holders.

Other than two "dry runs" for testing purposes, when 249 of 369 applicants received certificates, the exam has been given only once, last December 8. Thus the first official national offering came some two years after the program's initiation by the NMAA (National Machine Accountants' Assn., since changed to the DPMA) Education Committee and 12 dp notables from the business, science, and education fields. It was not until the summer of 1961 that the San Diego State College Foundation, a non-profit research and testing organization, was contracted to prepare the test. This organization continues to update it in consultation with the council and a test committee. The foundation also machine scores the exam.

Given but once a year, the examination carries a fee of $35; for those who fail it, the second trip costs only $20. The fee must accompany the application which, along with the study guide, is available from DPMA International Headquarters, 524 Busse Highway, Park Ridge, Ill., or any local chapter. ■

THE STUDY GUIDE

with recommended reading

The following is only an excerpt from a much more detailed Study Guide available from the DPMA, along with the application and time-and-place information on the test itself. Note that areas not covered in last year's exam appear in the math, accounting, and statistics sections.

automatic data processing equipment

I. Electric Accounting Machines
II. Electronic Computers

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*Gotlieb & Hume, **High Speed Data Processing**, McGraw-Hill, 1958.
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*Martin, **Electronic Data Processing: Introductory**, Irwin, 1961.
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*Van Ness, **Principles of Punched Card Data Processing**, The Business Press, 1962.
Various manufacturers' publications.

computer programming

I. Computer Applications
II. Organization of the DP Machine
III. Man-Machine Communications
IV. Instructions—Card System
V. Methods of Program Debugging
VI. Housekeeping
VII. Loops and Indexing
VIII. Subroutines
IX. Programming a Tape System
X. Macro-Programming
XI. Job Timing
XII. Programming a Random Access Device
XIII. Program Testing

References

Chapin, **Programming Computers for Business Applications**, McGraw-Hill.
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McCracken, **Digital Computer Programming**, Wiley.
*McCracken, **Programming Business Computer**, Wiley.
Manufacturers' programming manuals.

data systems— analysis, design & implementation

I. Function of Systems and Procedures
II. Development and Design of Business Data Processing Systems
III. Implementation of EDP Systems

References

*Gregory & Van Horn, **Automatic Data Processing Systems**, Wadsworth, 1960.
Kaufman, **Electronic Data Processing and Auditing**, Ronald Press, 1961.
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mathematics for data processing

I. Concepts of Notation
II. Number Systems
III. Basic Symbolic Logic
IV. Sets and Boolean Expressions
V. Equations and Inequations
**VI. Functions and Their Graphs
VII. Basic Probability Theory
**VIII. Vectors and Matrices
IX. Basic Operations Research Techniques
**X. Introduction to Differential and Integral Calculus

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Richardson, **Fundamentals of Mathematics**, MacMillan, 1959.
*Young, **Digital Computers and Related Mathematics**, Ginn, 1961.

accounting

I. Basic Accounting Concepts
II. Accrual Concept and the Income Statement
III. Bookkeeping: The Mechanics of Accounting
IV. Accounts Receivable and Fixed Assets
**V. Capital Stock, Surplus, and Bonds
VI. Management's Use of Accounting Information
**VII. Overall Reporting and Analysis: The Funds Flow
**VIII. Overall Reporting and Analysis: Ratios & Percentages
**IX. Challenges to Conventional Accounting Concepts—The Price Level Controversy
**X. Control: General Considerations
**XI. Control: Analysis of Cost Accounting Variances
**XII. Period Planning or Budgeting
**XIII. Project Planning: Relevant Costs

References

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statistics

I. Introduction to Statistics
II. Elementary Probability Theory for Finite Sample Spaces
III. Introduction to Random Variables, Distributions, and Distribution Properties
**IV. The Normal Distribution
**V. Binomial Probability Distribution and Central Limit Theorem Applications

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Freund & Williams, **Modern Business Statistics**, Prentice-Hall, 1958.
Kurnow, Glasser & Ottman, **Statistics for Business Decision**, Irwin, 1959.
Mosteller, Rourke & Thomas, **Probability and Statistics**, Addison Wesley, 1961.
Wallis & Roberts, **Statistics: A New Approach**, Free Press, 1956.

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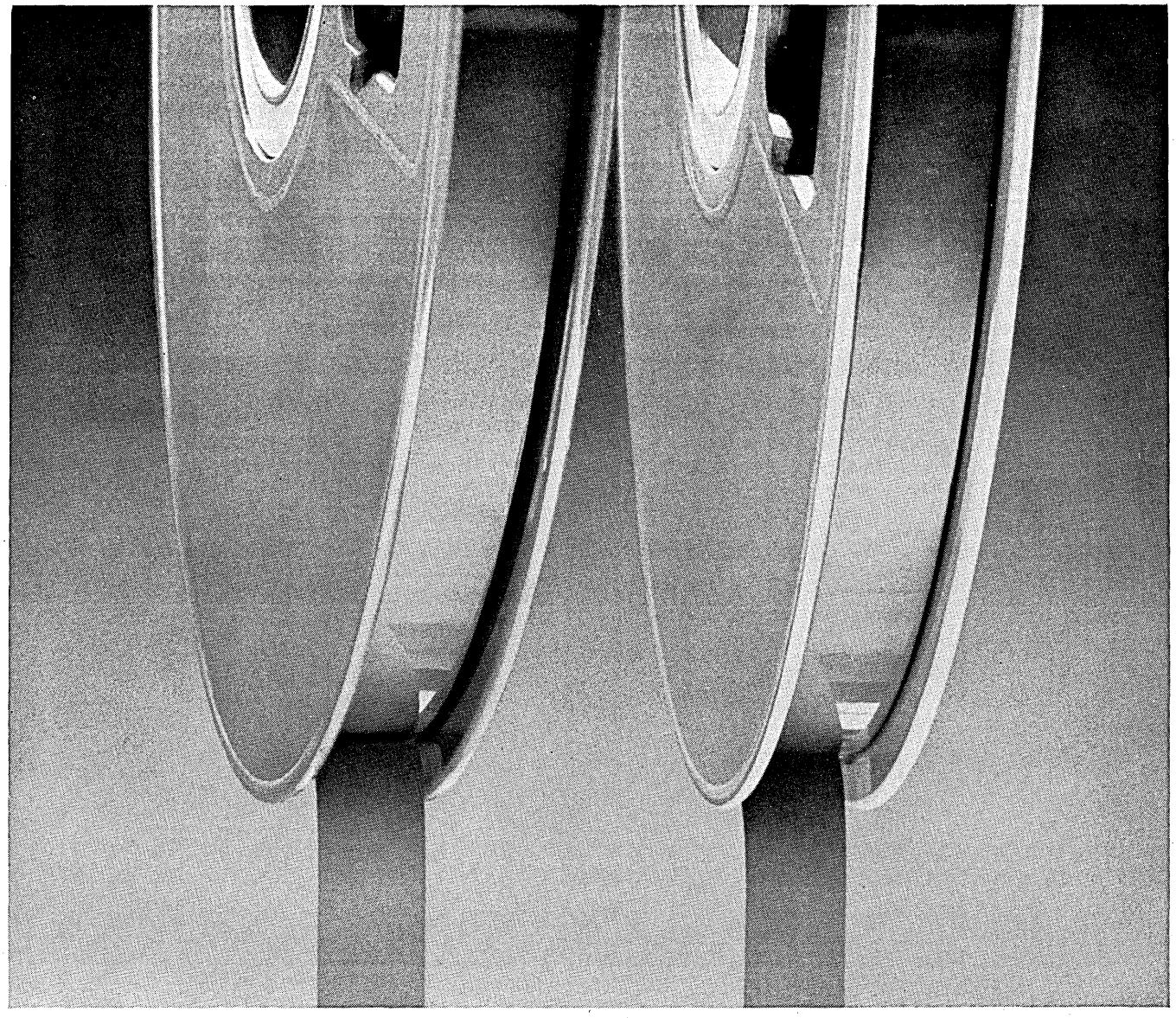
*Particularly recommended
**Areas not covered in examination 1962-1963



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Eight years ago computer tape of Du Pont MYLAR* polyester film appeared on the scene and set new standards of reliability. Naturally enough, people whose needs called for a magnetic tape of highest performance couldn't risk a tape other than MYLAR. ■ Now, other polyester films are beginning to appear. They are not all the same: MYLAR is a polyester film, but other polyester films are not MYLAR. In the past you could safely assume you were getting MYLAR when you specified "polyester base". *Today you cannot.* ■ There's only one way to be sure you're getting the MYLAR you've used and trusted for magnetic tapes of proven reliability: specify **MYLAR** by name. E. I. du Pont de Nemours & Co. (Inc.), 10452 Nemours Bldg., Wilmington 98, Delaware.

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

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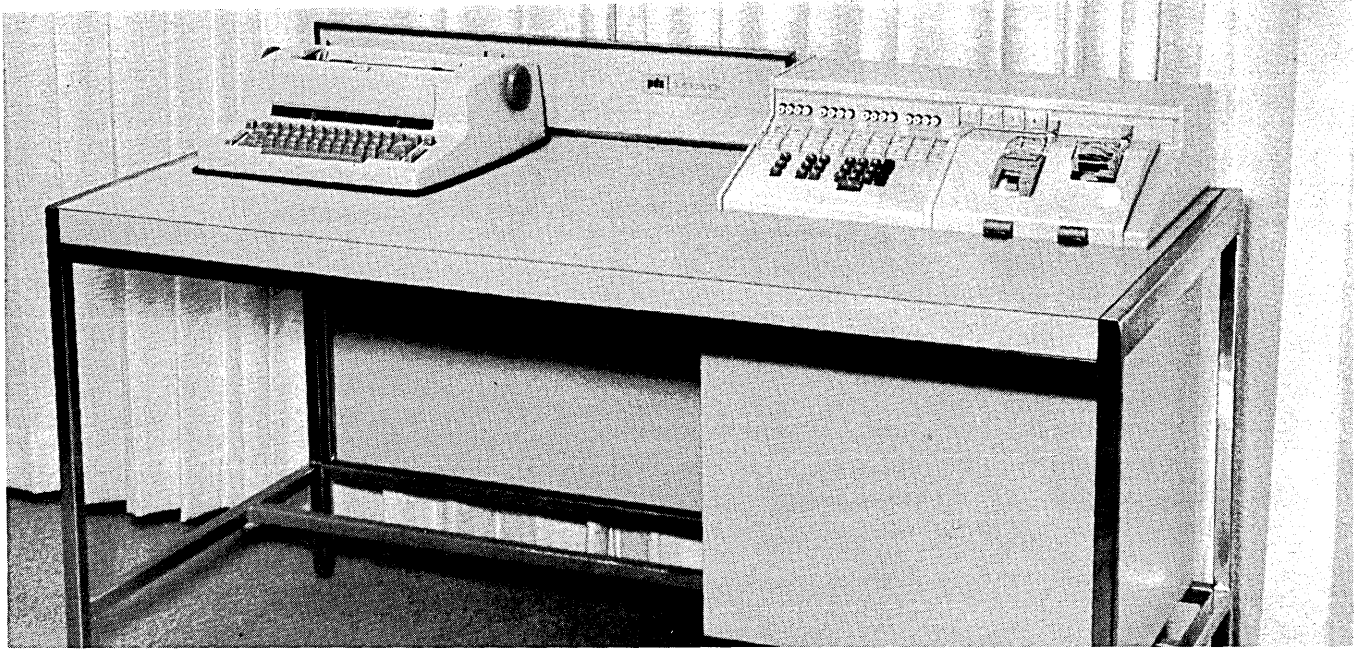
CIRCLE 29 ON READER CARD



THE PDS 1020 first hardware from infant firm

A desk-sized engineering computer, the PDS 1020, has been announced by the year-and-a-half-old Pacific Data Systems Inc., Santa Ana, Calif. A decimal machine, the 1020 has a 1,024-word magnetostrictive delay line memory expandable to 4,096 words. Word lengths are four, eight, and 12 digits plus the sign. Arithmetic speeds are 11.5 milliseconds for add or subtract, and 40 milliseconds for multiply or divide.

The computer consists of a 50 cps paper tape I/O, 15 cps typewriter output, and a keyboard with four branch switches, six keyboard commands (31 machine commands), and 10 macro-command switches. The latter perform such functions as square root, cosine, sine, and logarithm, in addition to the usual arithmetic operations. Operator generated sequences can be stored internally and executed by pushing a single key.

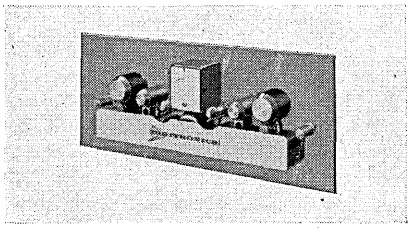
The PDS 1020 sells for $18K, and has an average rental of $835.

Also announced is the PDS 1068, a small scale, gp control computer for data logging, automatic checkout, and control systems. It is a decimal machine with an index register, 31 commands, and parallel I/O. Basic memory is 512 words, expandable to 4,096, with a variable field of four, eight, or 12 digits.

CIRCLE 222 ON READER CARD

...I knew we should have specified a Digitronics photo-electric tape reader

Now look at me. A bill for aspirin like you never saw and a firm resolve to make myself heard. Because we're going to do what we should have done in the first place. Specify a Digitronics Model B3500 High Speed Photo Electric All Solid State Bi-Directional Perforated Tape Reader (*Whew!*) Here's why, for the second time: This model is engineered for accuracy, speed and reliability. It's perfect for digital computers, machine tool controls, ground support equipment and other instrumentation. It has the most advanced tape controls and the ability to read tapes without adjustment—regardless of color. And you get features that aren't found in other commercial units. B3500 is compatible with standard input/output equipment for fully uniform, efficient, integrated systems (even when I *talk* about it, my headache gets better). Beat the high cost of aspirin... give your ice bag to your favorite charity—see your local Digitronics representative for details or write Digitronics Corporation, Albertson, N.Y.



DIGITRONICS

when every bit counts

CIRCLE 30 ON READER CARD

THE ASI 2100

post-merger hardware

The second in a line of gp computers, the 2100, has been announced by Advanced Scientific Instruments, Minneapolis, Minn. The binary 2100 has a memory cycle time of two usec, and an add time of four usec. The 4K, 21-bit word, core memory can be expanded to 8K directly addressable words or, optionally, to 32K words which are program switchable in 4K modules to directly addressable memory and sharable with other 2100's and I/O equipment.

The main frame also has three index registers, indirect addressing, and a character communication channel with assembly register and interface control providing a 500 KC transfer rate. Other standard features include 64 external interrupts, four internal interrupts, priority interrupt with automatic selection of these major levels of program execution, and instructions to facilitate double precision and floating point operations.

Execution times for the 2100 are 32 usec to multiply, and 44 usec to divide. The double precision time is eight usec for a load and 12 usec for a fixed point add. Two usec are required for indirect addressing, a jump command, and each full word I/O communication cycle.

The software, compatible with the ASI 210, includes FORTRAN II and a symbolic assembly routine.

The 2100 can accommodate up to four I/O channels, each with a separate assembly register. Input may be in six-bit characters or 21-bit words. Access is controlled automatically as dictated by the I/O rate of the external device, and is not a programming consideration. Transmission of data fields begins with the most significant character. Under program control, a field may be from six- to 48-bits long, making possible a compatibility with computers having a different word length. Communication rate is 1.75 million six-bit characters per second.

In addition to IBM-compatible tape drives, peripheral equipment includes 100, 200, and 800 cpm card readers, 100 and 250 cpm punch, 200 and 400 lpm printers, paper tape I/O, typewriter, incremental plotter, and A-D and D-A converters.

The price of the 2100 is from $87,800 to $300K, and rents for $2,590 to $7,760. First delivery is scheduled for December 1963.

"Why we chose the NCR 390 Computer."

Bridgeport Metal Goods Mfg. Co., Bridgeport, Conn.

"Even though we are not an industrial giant, compared with many of the firms installing computers today, we had urgent need for what has come to be called a 'total system.' After evaluating the many systems available, we chose the NCR 390 computer as the one most suited to our particular needs.

"With the 390 we are able to continue using hard copy accounting records which have proven to be so essential to us over the years. Of importance, however, is the fact that now these records are also able to store data electronically, and to act as their own input to the computer.

"Basically, our NCR 390 has enabled us to integrate our accounting and reporting procedures. Because of the comparative simplicity of the 390, we have not had to hire professional electronic programmers. We accomplish all systems and programming functions within our own organization.

"In summary, our new tool — the NCR 390 computer — is providing new capabilities, enabling us to do a more efficient accounting job, to upgrade our reporting procedures, and to obtain a significant return on our investment."

William H. Beach

William H. Beach, Vice President & Treasurer

NCR PROVIDES TOTAL SYSTEMS – FROM ORIGINAL ENTRY TO FINAL REPORT – THROUGH ACCOUNTING MACHINES, CASH REGISTERS OR ADDING MACHINES, AND DATA PROCESSING
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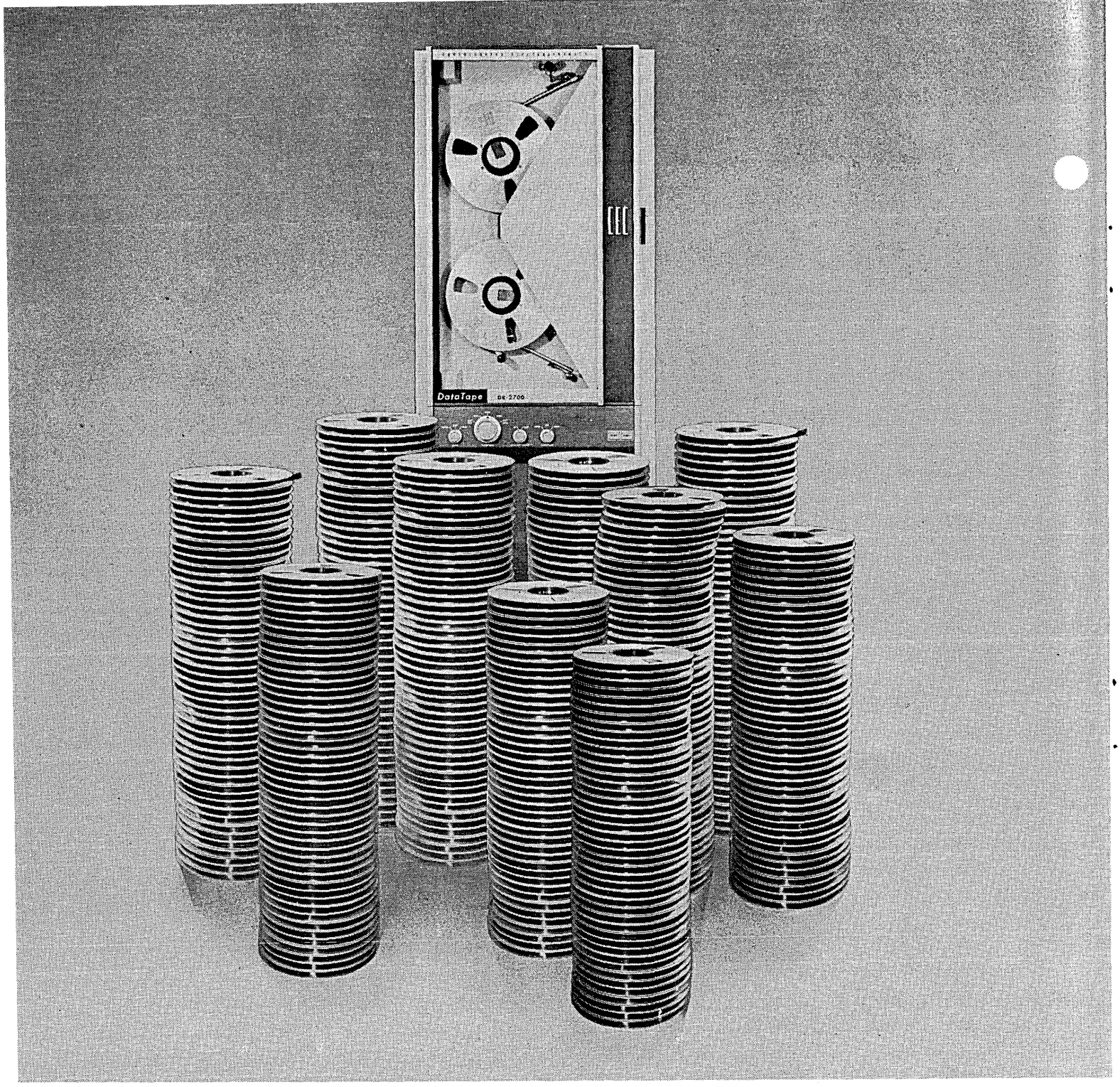
CIRCLE 31 ON READER CARD



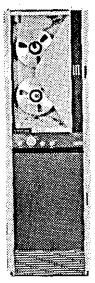
Reel after reel after reel after reel

The CEC DR-2700 Digital Magnetic Tape System keeps on performing

Conceived specifically for critical applications related to peripheral or computer-type digital data recording and recovery, CEC's Vacuum-Buffered High-Performance Digital Magnetic Tape System offers demonstrated reliability and superior ruggedness for a broad range of user requirements.

The DR-2700, designed and produced to commercial specifications, has been chosen for military systems in fixed plant, semi-mobile, even shipboard environments.

Utilizing solid-state components throughout, the DR-2700 offers a wide variety of optional features and accessories, unrestricted program capability, flexibility of mounting, CEC-built magnetic heads, high data transfer rates, and compatibility with IBM and most other computer formats. Want more information? Contact your nearest CEC Sales/Service office (there are 22 coast to coast and overseas) or write for Bulletin CEC 2700-X8.



CEC

Data Recorders Division

CONSOLIDATED ELECTRODYNAMICS

A Subsidiary of **Bell & Howell** • Pasadena, California

CIRCLE 32 ON READER CARD

NEWS BRIEFS

WRU, CARNEGIE TECH GET RESEARCH GRANTS

A $200K grant for research "on information processing psychology" has been received by Carnegie Tech from the National Institutes of Health. To be administered by the school's Drs. Herbert A. Simon and Allen Newell, the research grant involves computer programming in the human thought processes area. Initial study areas include problem-solving, verbal learning, sensory and perceptual processes, language behavior, and psychophysiology.

More than $345K in grants have been awarded to Cleveland's Western Reserve Univ. Center for Documentation and Communications. The major award of $138K from the NIH is to establish a "Facility for Health Sciences Documentation Research." An additional $96K per year for two more years is possible. Alvin J. Goldwyn, associate director of the center, is the principal investigator.

Goldwyn also received $115K from the Office of Education for a two-year study of the storage and retrieval of information from educational media. The assistant director, Mrs. Jessica S. Melton, received $59K from the National Science Foundation for a continuation of her project in automatic indexing of scientific abstracts. Continued mathematical studies of search strategy in IR was made possible by a $32K grant to Dr. William Goffman, staff mathematician, by the Air Force Office of Scientific Research.

AFIPS CALLS FOR PAPERS FOR 1964 SPRING JOINT

A call for technical papers for the 1964 Spring Joint Computer Conference in Washington, D.C., on April 21-23 has been issued. Conference theme will be "Computers '64: Problem-Solving in a Changing World."

Five copies of the complete draft, less than 10,000 words, typed double-spaced, along with a 100-150 word abstract, should be sent to Jack Roseman, Program Committee Chairman, CEIR Inc., 1200 Jefferson Davis Highway, Arlington 2, Va. The deadline is Oct. 25.

COMPUTER CONTROL SYSTEMS TOTAL 350; 4,000 BY '70

More than 350 on-line, process control computer systems operational throughout the world has been estimated, and a total of 4,000 by 1970 has been predicted by Dr. E. M. Grabbe, director, International Computer Operations for TRW Inc., Canoga Park, Calif.

Speaking before the sixth World Petroleum Congress in Frankfurt, Germany, Dr. Grabbe said sales and installations in the U.S. and Canada, combined, total 200, France has 34, the U.K. 22, and Japan 17. The power industry leads in installations (100), followed by steel (59) and chemical (50).

The three leading computer manufacturers, on total installations, are TRW, GE, and IBM, Dr. Grabbe said. TRW leads in the chemical and cement industries, GE in power and steel, and IBM in petroleum and paper .

SUPERVISORY PROGRAMS FOR 1410/7010 ANNOUNCED

A modular package of supervisory programs for the 1410/7010 has been announced by IBM. The operating system includes a monitor control for continuous processing of batched jobs, "substantially faster" FORTRAN and COBOL processors, data transmission supervisor, I/O Control System and facilities to combine separately-compiled components into one program and to integrate the user's programs with those in the system.

The operating system may be generated for either a mag tape or disk-oriented installation. A minimum of 40K positions of core is required for a tape system, and 60K with a disk system. First delivery is scheduled for the first quarter of 1964.

EAI, 3C AGREE TO PRODUCE HYBRID SYSTEM

Agreement to develop and market a hybrid computer, the HYDAC 2400, has been reached by Electronic Associates Inc., Long Branch, N.J., and Computer Controls Co. Inc., Framingham, Mass. The 2400 consists of an EAI 231r-5 analog and a 3C DDP-24 digital computer. Independent use of each system is also claimed.

The DDP-24 is said to provide increased arithmetic operations and facilities for a larger memory over the earlier HYDAC 2000 while, on the analog side, up to 70 per cent greater speed and 30 per cent increased accuracy are claimed. Sales to the aerospace, chemical, and petroleum industry already are reported.

NEWS PUBLICATIONS INSTALL TRANSATLANTIC DATA LINES

Time Inc. and the Washington Post newspaper have announced the transmission of news copy across the Atlantic Ocean. The Time-Life News Service is using a 1,000 wpm Digitronics

RCA DEVELOPS CRYOGENIC THIN-FILM MEMORY

A lab model 16K memory plane in an area smaller than a playing card and 120 millionths of an inch thick has been announced by RCA. It is said to be the first thin-film, superconductive, all-electronic memory. Next stop: refrigerated logic.

While the speed has not been announced, time through the accessing circuitry is reported to be two usec. But the firm's concern is said to be to increase size rather than speed. Initial word size is expected to be 100 bits. Internal speculation is three to six years before the array is commercially available.

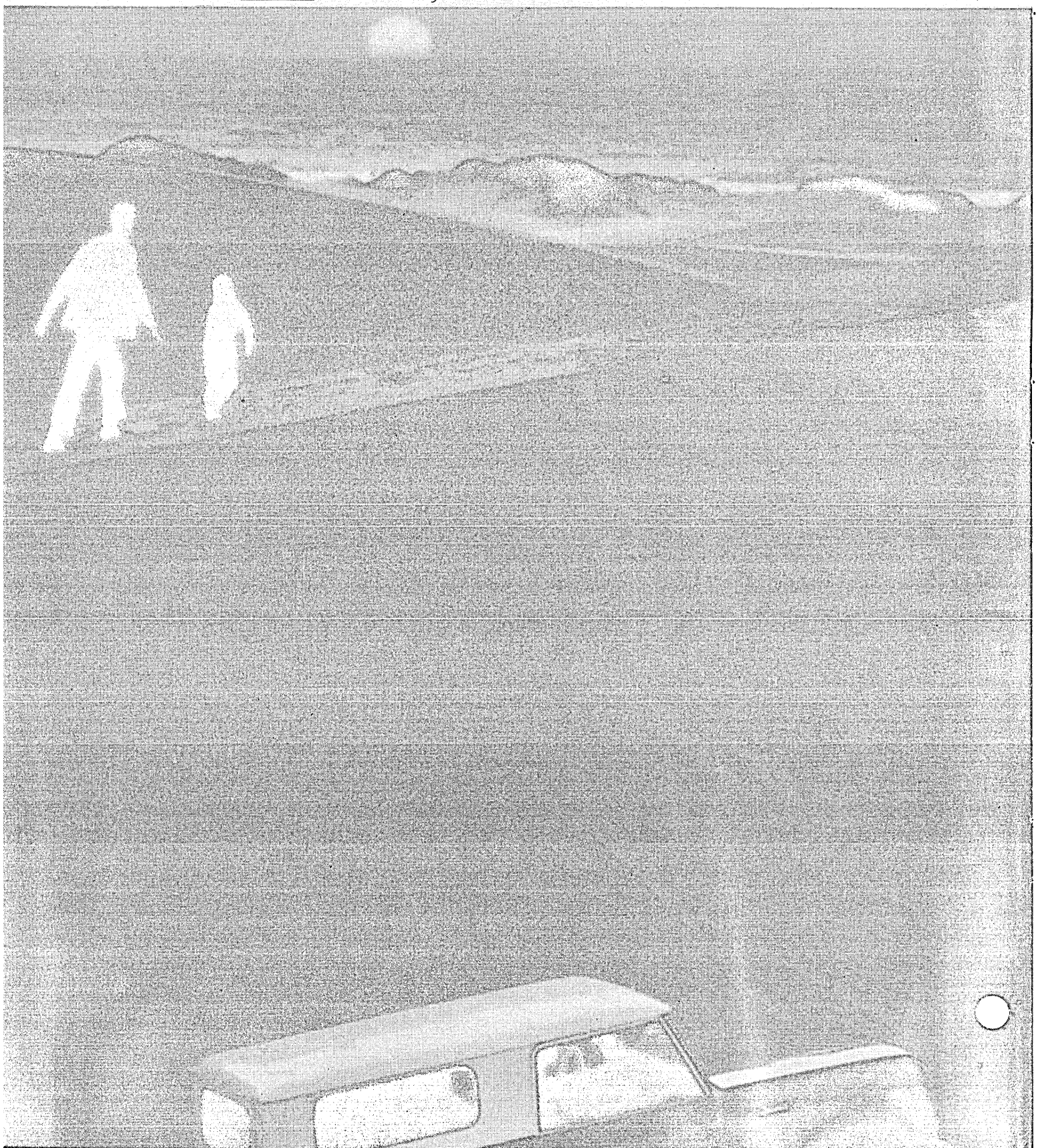
The experimental unit consists of a glass plate two inches square with several thin layers of tin, lead, and silicon oxide. Between the top oxide layers, acting as insulators, are two conducting grids, each of 128 strips of lead. The bottom layer of tin is the memory, formed by the intersections on the grids above. The unit is immersed in a liquid helium bath at close to absolute zero temperature.

A GOOD LIFE--
A GOOD LIVING

YOU CAN HAVE BOTH AT NCR, LOS ANGELES

You make no compromise between career values and living values when you work at NCR Electronics Division. Here, in a facility that has tripled in size in less than three years, you will be part of the group that developed the NCR 315 Electronic Data Processing System and the remarkable CRAM magnetic-card concept in random-access memories. Here you will make original contributions in the most advanced areas of digital technology, creating business systems that will be used in 120 countries. ▫ Even if "career" were all that mattered, you couldn't make a better choice than NCR. ▫ The matchless Southern California location comes to you as a bonus.

NCR



NEWS BRIEFS . . .

Dial-o-verter for transmission from Paris to New York; the Washington Post is sending copy from London to Washington, D.C., at 750 wpm, using Tally Corp.'s Mark 1A and 1B systems.

Data transmission by Time Inc. is over a special transatlantic cable with a D507s paper tape terminal at both ends. The Post's transmission is by Data-Phone; line cost at the previous 66 wpm speed was $3 per minute, increasing to $4.25 for the 11-fold speed increase.

● A large scale, gp, military computer with a scratch pad thin-film memory has been designed and developed by Univac under a BuShips contract. The CP-642B has a 32K 30-bit core memory with a cycle time of four usec and a thin-film control memory of 64 30-bit words with a cycle time of 0.66 usec. The I/O circuits are said to be easily modified to work with standard peripheral equipment for general shore-based applications.

● The British Post Office has ordered two English Electric-LEO III computers to be delivered in 1964, and to be replaced by the faster LEO 326 when this becomes available in 1965. The one "megaquid" (2.8 megabuck) order is reportedly the largest single commercial computer order in the U.K. Initial applications include accounting and inventory processing. The release states: "It is not intended to alter the present arrangements for the generation of numbers for the monthly Premium Savings Bond draws, which will continue to be done by 'Ernie'."

● A system for separating airmail from other classes through the use of special inks on postage stamps is being tested by the U. S. Post Office in Dayton, Ohio, home of National Cash. The NCR sorting device responds to phosphorescent tagging inks with which stamps must be printed, and is attached to automatic cancelling machines presently in use. The sensing device was developed under the Post Office's $300K automation study now in its third year.

● A slow speed digital computer to train military personnel of the Royal Electrical and Mechanical Engineers has been built by the REME's School of Engineering. Known as Addit (Apparatus for Demonstration of Digital Techniques), it is said to cut the instruction period by 50 per cent. Addit consists of panels which can be connected to perform specific functions, and has a paper tape I/O and a teleprinter.

● The Atomic Energy Div. of Babcock & Wilcox Co., Lynchburg, Va., has installed a 32K Philco 211 with 17 mag tape units for engineering applications.

● A $194K grant from the U.S. Office of Education has been awarded to System Development Corp., Santa Monica, Calif., for research in the simulation of a "flexible" school. Objectives are to study new instructional media and educational innovations, characteristics of new educational systems, applications of dp equipment in schools, and to define possible new roles for school personnel.

● A $111K two-year Signal Corps contract has been awarded to the Autonetics Div. of North American Aviation to develop semiconductor diodes of cadmium and telluride — with an eye toward the use of light rays instead of wires to transmit information in electronic circuits.

● Beginning this fall, New York Univ.'s Management Institute will sponsor the Management Information Systems Round Table. Monthly meetings will be held for the exchange of ideas under the coordinator, Charles A. Phillips, director of BEMA's Data Processing Group. Membership will be based upon professional experience.

● The Clary DE-60 computer will be marketed in the U.K. and Sweden by Digital Measurements Ltd. of England. It is the first expansion by Clary's Computer Division into Europe.

● The eighth and ninth airline reservation systems installed by Teleregister Corp., Stamford, Conn., are in operation by Air France in Paris and TWA in New York City. Both use vacuum tube computers of Teleregister design. The Air France system, which was installed and on the air eight months after the contract date, includes two processors, drum storage, and 150 agents' sets. TWA's configuration, said to be the first international reservation system using computers, includes two 16K processors, four drums, and four mag tape drives.

GROWTH AT CONTROL DATA CREATES KEY OPPORTUNITIES

Computer Sales Engineers • Applications Analysts • Computer Time Salesmen
Programmer Analysts • Systems Programmers • Programming Instructors

Because of the worldwide acceptance of Control Data's general purpose and special purpose computer systems, a variety of professional positions must be filled to keep pace with the company's phenomenal growth. If you have experience with computers or in related fields, please examine the following opportunities:

MARKETING — Nationwide Locations

Computer Sales Engineers: Because of expanding activity, openings exist now for persons with digital computer experience in sales, engineering and/or applications programming.

Applications Analysts: Positions require the ability to consult with customers to analyze their problems for computer applications. Experience required in scientific programming for medium or large-scale computers. A knowledge of FORTRAN or other scientific compilers is helpful.

COMPUTER DIVISION — Los Angeles, Palo Alto and Minneapolis Locations

Systems Programming: Increased effort in behalf of Control Data's development of software is creating many opportunities. Participate in the development of advanced programming systems, including compiler development, monitor and executive routines and language analysis. Digital computer experience and a B.S. degree are required.

DATA CENTERS DIVISION — Washington, D. C., Palo Alto and Minneapolis Locations

Sales Representatives: A degree and two to three years' successful data processing sales experience are required. Must have thorough knowledge of computer applications. Will be involved in the sales of programming services and computer time.

Programmer Analysts: You will be analyzing customer problems for computer applications. In addition, you will be involved in sales support work and the preparation of programming proposals.

SEND RESUME TO: H. H. TRADER, CONTROL DATA CORPORATION, 8100 34TH AVE. SO., MINNEAPOLIS 20, MINN.

Please Note: If you plan to be in Denver for the ACM conference, members of Control Data's technical staff will be available for interviews.

CONTROL DATA
CORPORATION

AN EQUAL OPPORTUNITY EMPLOYER

CIRCLE 87 ON READER CARD

Another Seal of Approval

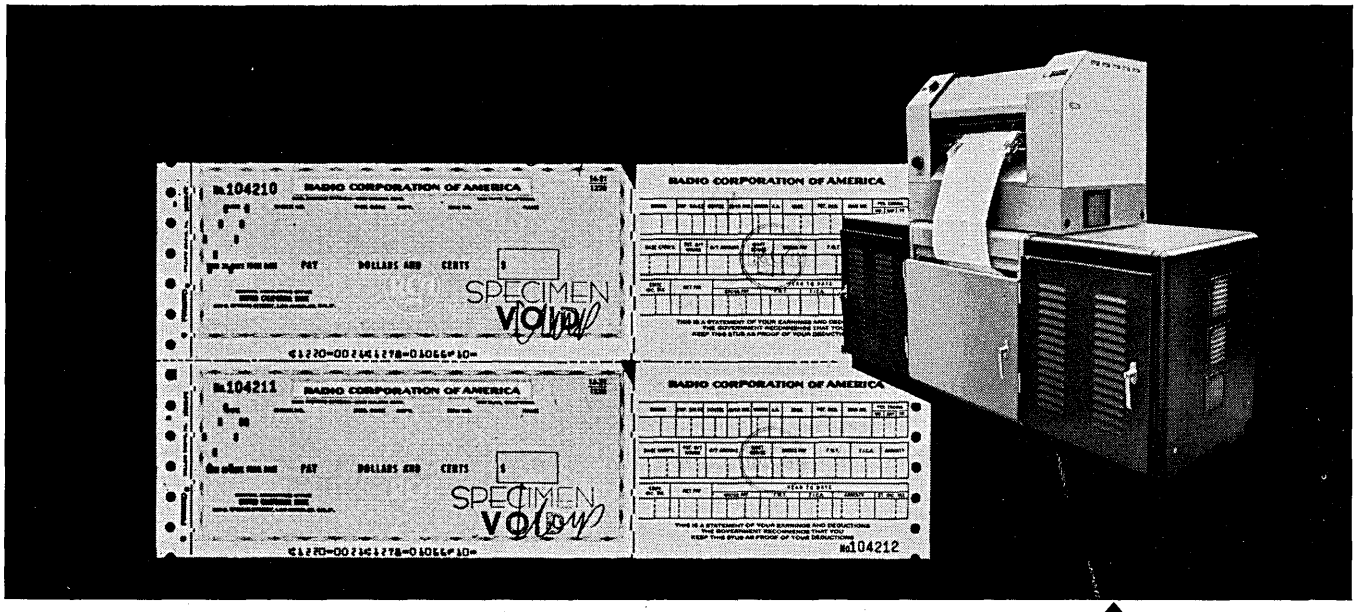
For the only continuous tab card with NO medial waste strips.

RCA, the most trusted name in electronics, processes its payrolls in the Van Nuys, California installation on FORMSCARDS, the most advanced name in continuous tab cards.

RCA reports FORMSCARDS perform with trouble-free efficiency, over the RCA 301 Printer, running at top speed. And the unusual arrangement of the voucher, furnishing exceptionally detailed information on these FORMSCARD checks, illustrates one more unique versatility of this fine product.

We invite you to add your company name to the impressive list of firms who endorse FORMSCARD enthusiastically.

FORMSCARD®



- Available with vouchers of any size at side, top or bottom
- Easily separated manually or on any burster
- Can be part of multiple part sets
- Available pre-punched
- Operate efficiently over any printer . . . at any speed

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Forms inc
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Manufacturers of line-hole continuous business forms. Samples on request—sales representatives in principal cities.

CIRCLE 34 ON READER CARD

DATAMATION'S FEATURE INDEX
JANUARY - JUNE, 1963

The 301 & 1401—A User's Critique pg. 33

by Ed Yasaki

A comparison of the features and drawbacks of these two machines as seen by Richard E. Kurzenknabe of Tabulating Consultants, Inc., a company that employs both the 301 and 1401 in the course of its daily operation.

MAY

Correcting Obfuscations By Ordained Linguists pg. 24

by Stanley M. Naftaly

A COBOL advocate presents a 4½-page examination of COBOL as applied to areas including programming time, compiling time, object program time and response time.

Programming On-Line Systems—Part One pg. 29

by W. L. Frank, W. H. Gardner and G. L. Stock

Systems in which response times are measured in milliseconds and computer systems to which a number of interrogation and display devices are connected are discussed in this survey. Problem characteristics typical of these application areas and programming implications, highlighting hardware features which bear on the efficacy of the programming system are discussed.

Automatic Program Translation pg. 45

by Ascher Opler

Discussion of prospects and problems, including types of translation, the "impossibility" of translation, the "feasibility" of translation, symbolic translation versus code translation and target program efficiency.

JUNE

Educational Data Processing pg. 24

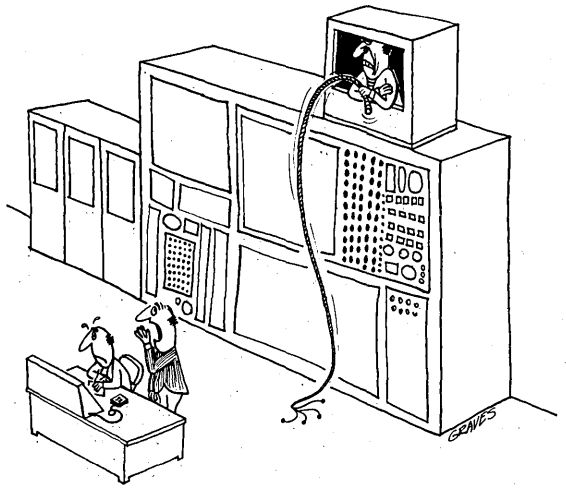
by Ed Yasaki

A summary of a three-day workshop in educational data processing conducted at System Development Corporation.

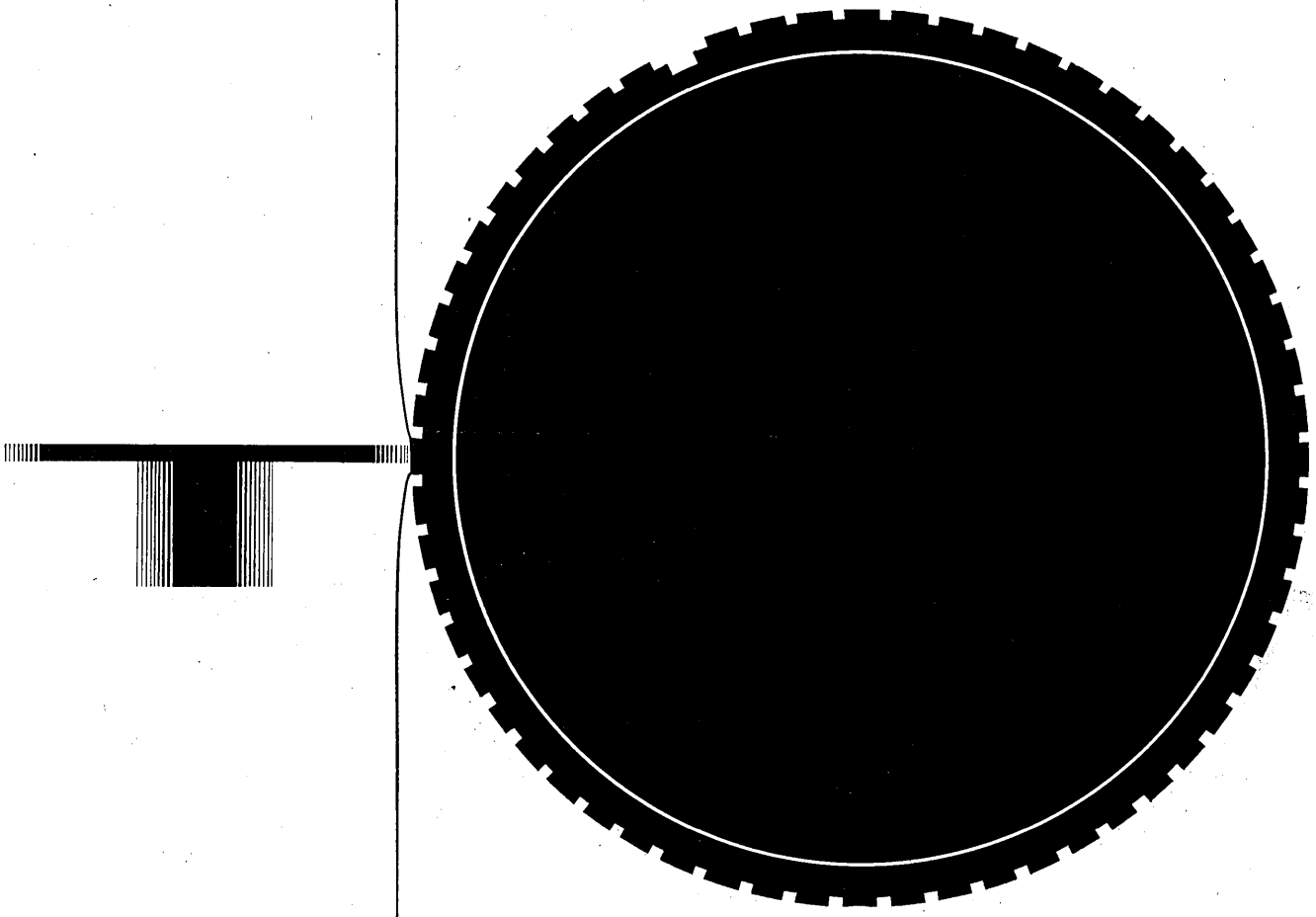
Programming On-Line Systems—Part Two pg. 28

by W. L. Frank, W. H. Gardner and G. L. Stock

Discussion of such on-line system requirements as queue monitoring and scheduling, I/0 monitoring, error detection and system recovery, diagnostics, communication monitoring, and interrupt handling.



"Personally . . . I could do without that new Accessory."



Meet the new, LINE/PRINTER™ *—with just one moving part in its hammer drive!*

Lowest cost/highest reliability; that's the essence of the new, medium-speed LINE/PRINTER by *data products corporation*. No need for hammer adjustment. Ever. Hammer activation is electromechanical, utilizing permanent magnets and a coil (in the tried-and-true tradition of the dc motor), to activate a single moving part: the hammer. Further minimizing maintenance: no troublesome clutches, brakes or mechanical latches in either the hammer or paper advance mechanisms.

More. 300-lines-per-minute rate and standard series or parallel interface, plus associated selection logic,facilitate the dp/p-3300 LINE/PRINTER's application to all medium- and low-speed digital computer systems and permit on-line use with minimal buffering. Other features: 10 characters/inch and 64 character types; up to 132 columns in 12-column increments; 6 lines/inch spacing; and smooth paper feed on forms up to 19 inches wide.

Complementing the DISCFILE,™ LINE/PRINTER is the second in a unified line of technologically advanced data input/output/storage equipments by *data products corporation*. For detailed technical data, write on your letterhead to: *data products corporation*/ Room 833/8525 Warner Drive/ Culver City/ California/ 837-4491.

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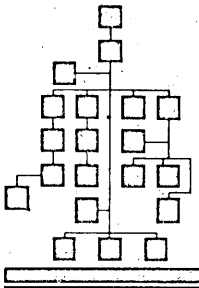


people IN DATAMATION

■ Clarence H. Linder, retired VP of GE in Schenectady, N.Y., has been nominated for the presidency of the IEEE. Walter E. Peterson, president of Automation Development Corp., Los Angeles, has been nominated to be VP. Election results will be announced in November.

■ Luther A. Harr Jr. has been named executive VP for the Teleregister Corp., Stamford, Conn. Before joining the firm in January, he had been director of Univac operations in Europe, Africa, and the Middle East.

■ Richard M. Bloch, formerly director of product planning, has been named VP of Honeywell EDP. He will continue his activity in marketing development.

■ Ralph A. Pfeiffer Jr., formerly manager of market planning at IBM's corporate headquarters, has been named VP of the Data Processing Div. He will direct the marketing of dp systems to the federal government.

A. J. Critchlow, previously with the GE Computer Dept., Phoenix, Ariz., has rejoined IBM as manager of Innovation Products Technology, San Jose, Calif.

■ John B. Lawson, general manager, Aeronutronic Div., has been elected VP of Philco, which recently acquired the former Ford operation as a division.

■ Dr. Irving Wolf has been named manager of Ampex Corp.'s materials research group in Redwood City, Calif. In his newly created post, he will be responsible for research on materials for information storage devices. Dr. Wolf formerly was with GE in Syracuse, N.Y.

■ J. Walker Voris has been named director of data processing at the Univ. of Southern California. The installation includes an H-400 and 800. A C.P.A., Voris had been with the firm of Lybrand, Ross Bros. & Montgomery for 25 years.

I must be getting smarter, Computape.
Suddenly, I can see right through you!

It's the Computron people who are getting smarter, Penelope. This new transparent LEXAN* reel is the most sensational, fabulous, and otherwise terrific thing that's ever happened to computer tape!

You'll have to pardon Computape's exuberance, but he's all wound up about his new LEXAN reel—a very important first in the computer tape field. LEXAN reels cost more than conventional polystyrene reels. They are worth it. Much tougher and stronger. Much higher impact strength. Much more resistance to heat distortion and warpage. Extra fire resistance. (LEXAN is self-extinguishing.) *You just don't get this kind of protection with any other reel of tape.* And by the way — what's wound on the reel is still the same Computape. (556 or 800 bits per inch. No drop-out.) Which is to say, the best there is. Investigate today. Better still, *immediately*.

*REG. T.M. GENERAL ELECTRIC CO.

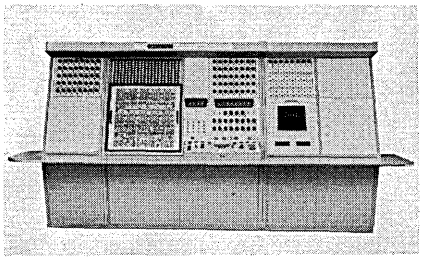
COMPUTRON INC.
122 Calvary Street, Waltham, Massachusetts

CIRCLE 39 ON READER CARD

NEW PRODUCTS

analog computer

The Mark III includes 200 operational amplifiers, 180 pots and 60 multiplier products, and has the capabilities for real time, rep-op, iterative and hybrid

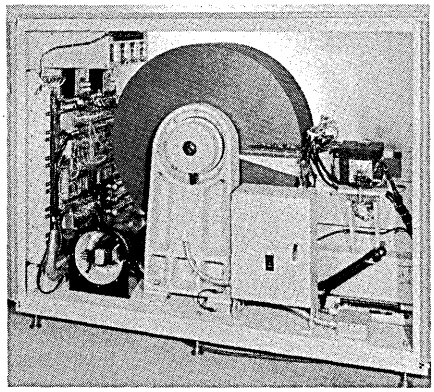


applications. Featured is an all-aluminum five-bay console, prewired for all expansions. COMPUTER PRODUCTS INC., 1717 F Street, Belmar, N. J. For information:

CIRCLE 200 ON READER CARD

disc file

Random access disc file, model 800, has a storage capacity ranging from 20,160,000 bits on a single disc to



161,280,000 bits on the full complement of eight discs. ANALEX CORP., 150 Causeway St., Boston 14, Mass. For information:

CIRCLE 201 ON READER CARD

message traffic control

The 7740 communication control system can direct a broad mix of business information through a network of sending and receiving units scattered across a city or around the world. Cost of the system, including two disc storage drives and an operator's console with printer and keyboard, is $290,000. IBM, DATA PROCESSING DIV., 112 E. Post Rd., White Plains, N. Y. For information:

CIRCLE 202 ON READER CARD

teaching aid

A series of games called WIFF'N PROOF has been developed as an aid to teaching mathematical logic to elementary school students. In the games, propositional calculus is formulated axiomatically in the Polish notation of Lukasiewicz, using the Fitch technique of subordinate proofs. There are a total of 24 different games of widely varied complexity. The kit is available for $6.25. WIFF'N PROOF, Box 71, New Haven, Conn. For information:

CIRCLE 203 ON READER CARD

off-line print station

The LP-1200 can print at the rate of 1,000 lpm from data recorded at 556 bpi. It also sorts random records on tape as a function of a character within the record, will select one of eight vertical format control channels, will check for lateral and longitudinal parity errors and re-read the faulty record seven times; four times at normal threshold level and three times at reduced threshold level. The unit is priced at $60K. POTTER INSTRUMENT CO., INC., 151 Sunnyside Blvd., Plainview, N.Y. For information:

CIRCLE 204 ON READER CARD

mag tape storage unit

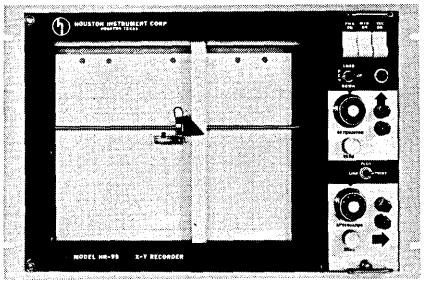
The 382 tape station is a stepped-up version of the Hi-Data mag tape group introduced with the 301 edp system. This multiple mag tape data storage unit is able to read or write for the 301 at the rate of 20,000 cps. RADIO CORPORATION OF AMERICA, 30 Rockefeller Plaza, New York 20, N.Y. For information:

CIRCLE 205 ON READER CARD

x-y recorder

The HR-95T-N x-y recorder has a self-contained null detector, is capable of plotting up to eight points per second. Average plotting is at four points per second. Price of the recorder is $1,525.

NEW PRODUCTS . . .



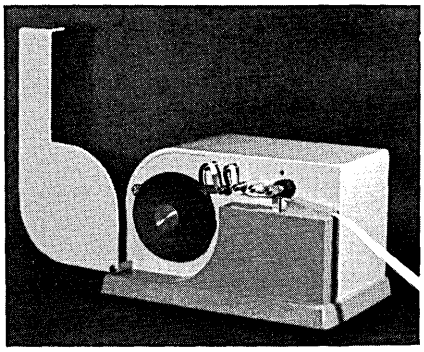
HOUSTON INSTRUMENT CORP., 4950 Terminal Ave., Bellaire 101, Tex. For information:
CIRCLE 206 ON READER CARD

photoreader

Model PTR-80C is a unidirectional photoelectric tape reader which reads chadless tapes synchronously at speeds up to 300 cps. It is priced at $2,077. OMNITRONICS INC., 511 N. Broad St., Philadelphia 23, Penna. For information:
CIRCLE 207 ON READER CARD

electrostatic printer

This printer produces 300 characters per second. FIELDATA or BAUDOT



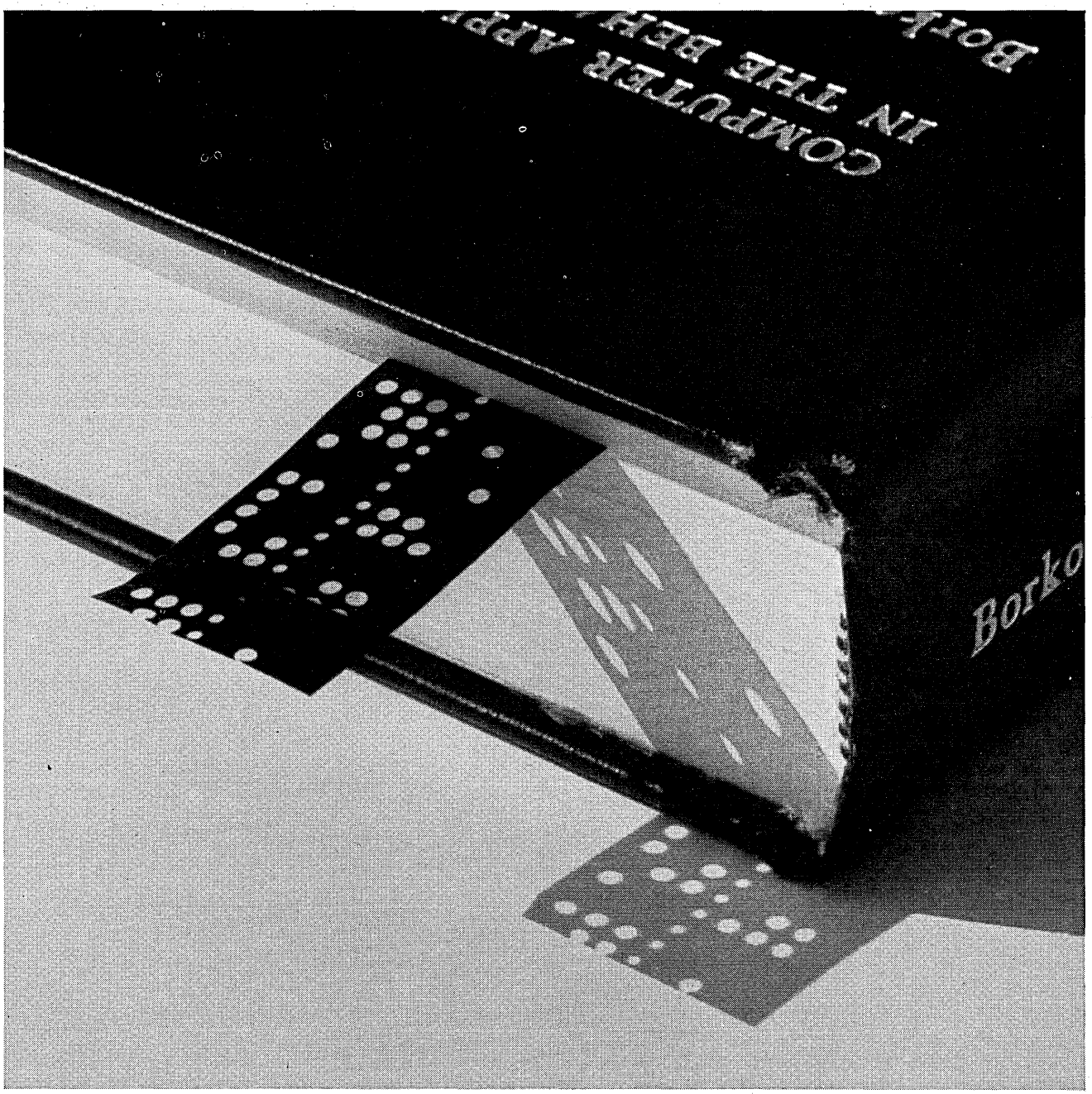
formats can be accommodated. K-R ELECTRONICS, Box 407, Fullerton, Calif. For information:
CIRCLE 208 ON READER CARD

page printers

Models 32 and 33 have been designed for use in private wire or telephone line communications and are able to operate at 100 words per minute. Model 32 utilizes a three-row keyboard and operates on a five-level, standard communications code. The 33 has a four-row keyboard and operates on an eight-level, message and data communications code. TELETYPE CORP., 5555 Touhy Ave., Skokie, Ill. For information:
CIRCLE 209 ON READER CARD

microfilm file

The RADIR microfilm file provides automated storage and retrieval in less than two minutes of any one of



Information Retrieval

Instant Bookmark

The technology of information retrieval is one of the major concerns of SDC. For some time, our Satire system (semi-automatic technical information retrieval) has been capable of quickly pinpointing, at widely separated SDC facilities, desired technical documents and authors' names. Satire can be operated by remote control, the only such system that can be so operated. A still newer SDC development is Protosynthex I, which is a phase of Synthex, our long-range project to teach computers to read and write English. Protosynthex is now able, almost instantly, to find single paragraphs within the complete text of an article or document. Next will come the ability to extract individual sentences and facts. As SDC continues to make noteworthy progress in many areas of information-systems technology, a number of new positions have been created on several of these major projects. Human factors scientists, operations research scientists, systems-oriented engineers, and computer programmers interested in joining this rapidly expanding technology are invited to write Mr. A. I. Granville, Jr., SDC, 2401 Colorado Avenue, Santa Monica, California. Positions are open at SDC facilities in Santa Monica; Washington, D.C.; Lexington, Massachusetts; Paramus, New Jersey; and Dayton, Ohio. An SDC brochure on information retrieval also is available. Requests for this new brochure should be sent to Mr. Granville at Santa Monica. "An equal opportunity employer."

System Development Corporation

SDC

CIRCLE 84 ON READER CARD

21-905

NEW PRODUCTS . . .

850,000 microfilmed documents. The file consists of an encoder unit, an index unit and a microfilm document retrieval/viewer/reproducer. THE HALLICRAFTERS CO., 4401 W. 5th Ave., Chicago 24, Ill. For information:

CIRCLE 210 ON READER CARD

label design templet

This templet can be used to check labels or given areas to determine whether or not the most commonly used stock size labels can be applied, facilitate the drawing of the label and marginal holes from precise positioning of labels on the carrier, determine how many writing lines are available on a label of given depth and determine the number of characters that will fit on a label of a given width. ALLEN HOLLANDER CO., INC., 385 Gerard Ave., Bronx 51, N. Y. For information:

CIRCLE 211 ON READER CARD

circuit tester

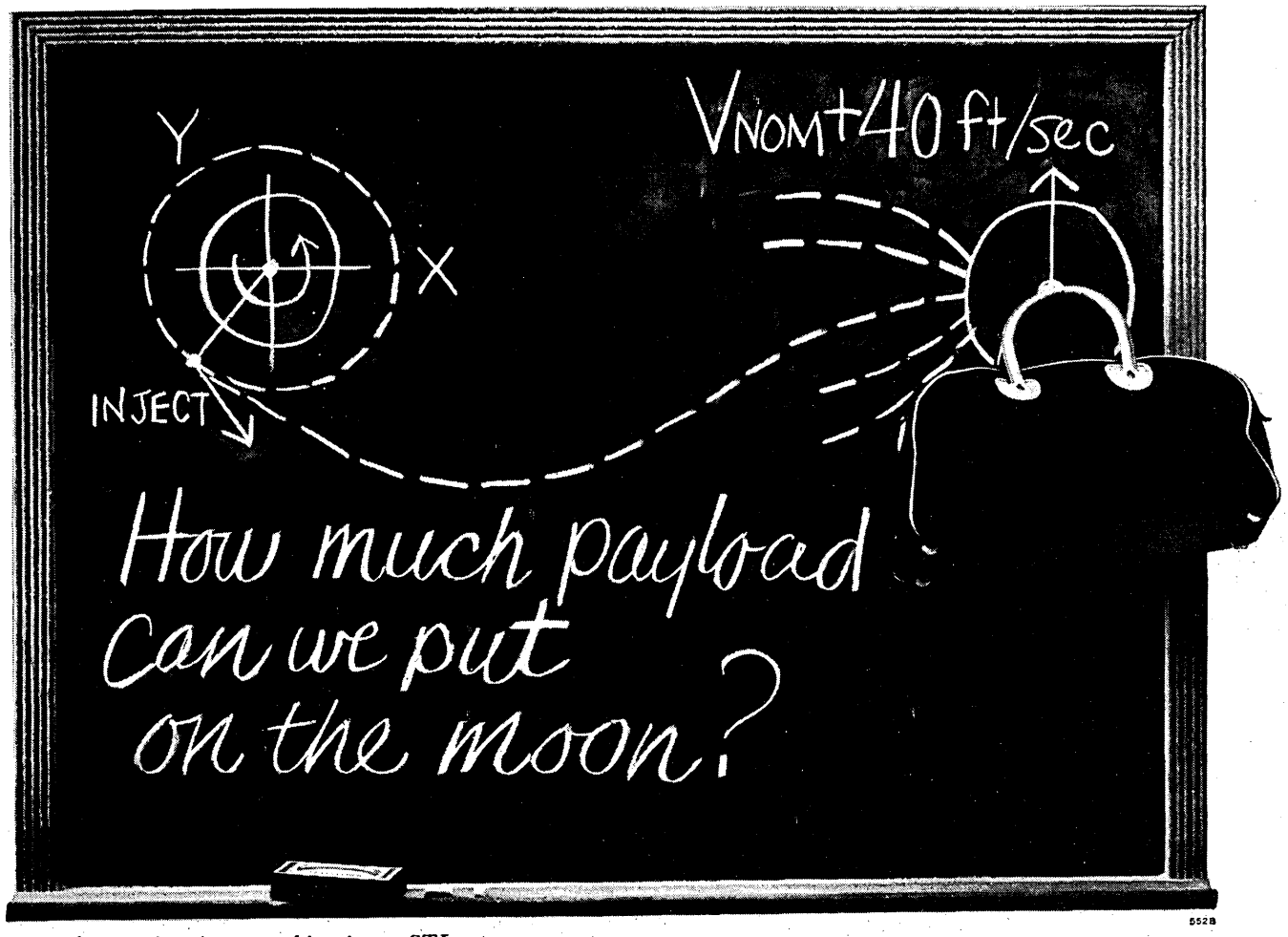
Series 4000 integrated digital circuit tester has been designed to measure functions, voltages and currents of most digital logic devices. Features include drift-free solid state circuitry, plug-in modular programming and a series of optional adaptations. FAIRCHILD SEMICONDUCTOR, 545 Whisman Rd., Mountain View, Calif. For information:

CIRCLE 212 ON READER CARD

card reader

Model 2224 card reader programs any static memory in various automated process batching operations, and in the automated production testing of electrical components and systems. DREXEL DYNAMICS CORP., Horsham, Penna. For information:

CIRCLE 213 ON READER CARD



Another project in space kinetics at STL

To place a payload on the moon involves reconciling a highly complex set of variables. STL seeks to answer the question of payloads through analytical and computational studies of the interrelationships of vehicles, trajectories, and missions. This NASA project is part of STL's continuing investigations into space kinetics.

Computer Programmers, Numerical Analysts and Applied Mathematicians will find interesting assignments in space kinetics at STL's Computation and Data Reduction Center. For So. Calif. openings, you are invited to write Dr. R. C. Potter, One Space Park, Redondo Beach, Calif., Dept. M-8. STL is an equal opportunity employer.

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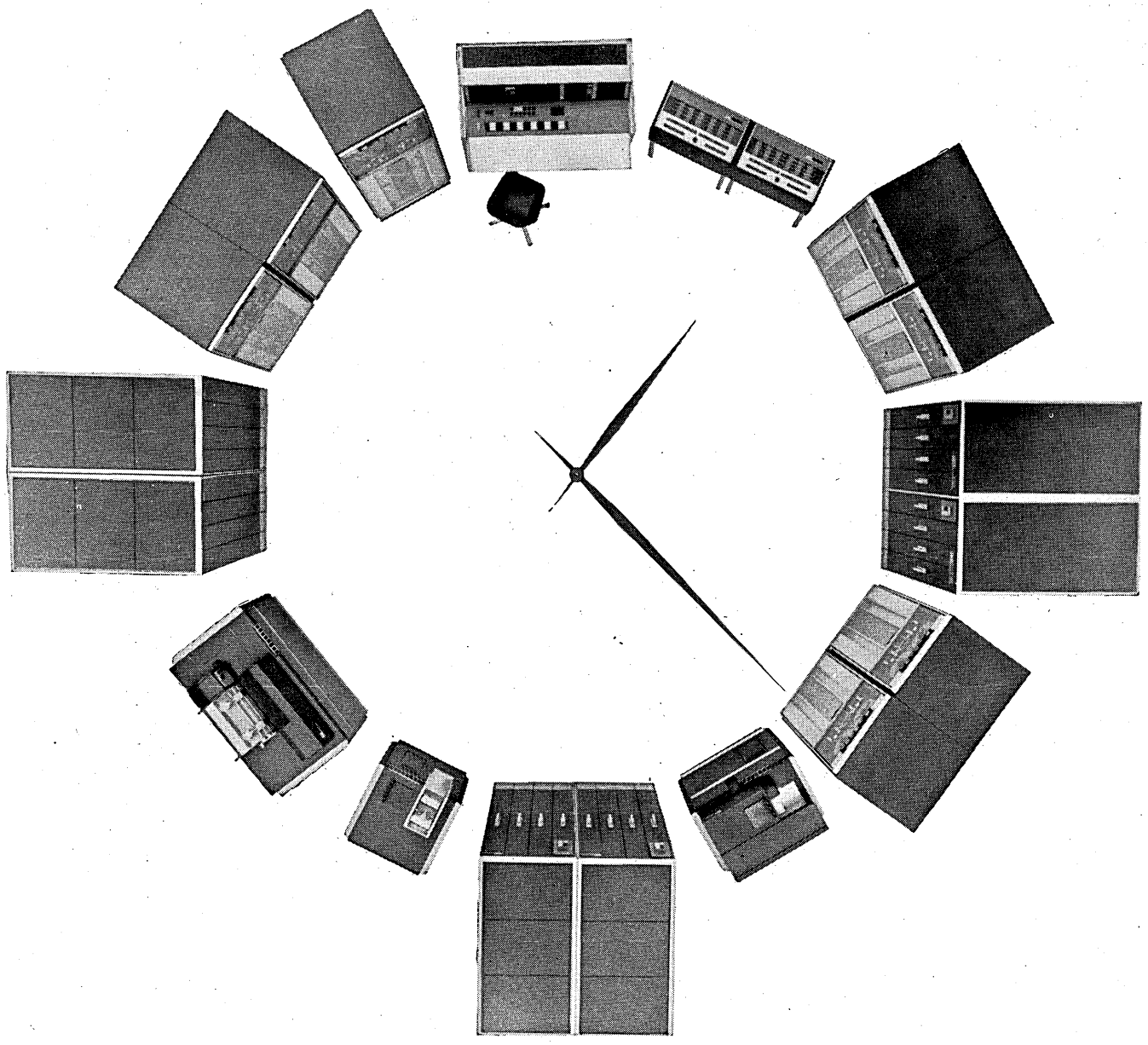

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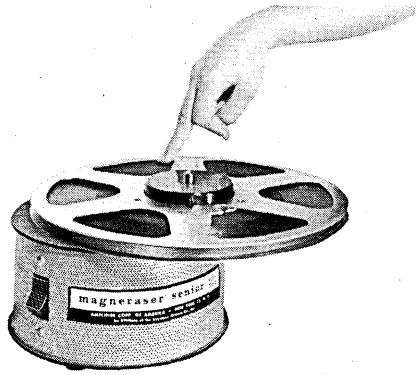
COMPONENT PRODUCTS

bulk tape eraser

The magneraser senior completely erases tapes on the reel with a once-around revolution of the reel, and has been designed for use with audio, com-



puter, telemeter, and machine-control tapes. The eraser is priced at $24.95. AMPLIFIER CORP. OF AMERICA, 398 Broadway, New York 13, N.Y. For information:

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offset plate

This high speed offset plate for high speed printers features a double coating on both sides of the sheet, making both sides usable. The plate can be used for either offset or spirit duplication. R. E. MCGUIRE ASSOC., INC. 461 8th Ave., New York 1, N.Y. For information:

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recording drum

Model 6037 analog magnetic recording drum has a frequency range of five to 2000 cps, and can be applied to signal processing, correlation systems, data storage and signal delay. INSTRUMENT SYSTEMS CORP., 111 Cantiague Rd., Westbury, L.I., N.Y. For information:

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strip chart recorder

Three new accessories have been designed for use with the V.O.M.-5 strip chart recorder. These include a thermo-chart, for measuring temperature of liquids or solids; an event chart for supply of 6V, D.C. power supply for operating the recorder's event marker; and a vari-chart marker for variable span adjustment. BAUSCH & LOMB INC., Rochester 2, N.Y. For information:

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1440 transportation and storage

IBM 1440 disk pack storage and transportation equipment is now available. SYSTEMS SALES CO., 13 Broad St., Binghamton, N.Y. For information:

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computer tape

A heavy duty tape has been added to the extra-length computer audio-tape line. It is stronger than the 1.5-mil polyester films used for standard computer tapes, although the base is thinner. Fifty percent more tape can be stored in the same space using this tape. AUDIO DEVICES, INC. 444 Madison Ave, New York 22, N.Y. For information:

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digital plotters

This new line of digital plotters features a 5′ x 5′ plotting surface. The unit accepts digital data from punch cards or tape and produces an x-y recording of the data on the plotting surface. Points are plotted with an accuracy of ± .002 in. and with a repeatability of ±.0005 in. The unit is priced at $50,000. MAC LEOD INSTRUMENT CORP., 4250 N.W. 10th Ave., Ft. Lauderdale, 10. Fla. For information:

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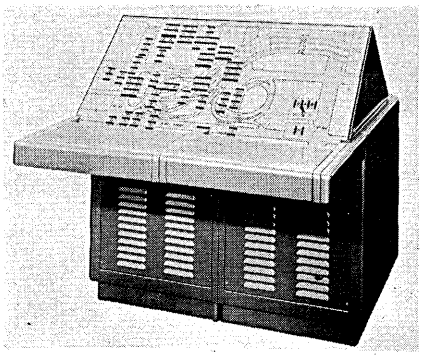
traffic flow automation

Traffic Master TM-6500 traffic signal command and report system is able to transmit up to 200 commands to each of several unattended stations and report the status of 200 on-off conditions at each of these locations.



It can be used to operate traffic stop lights, revolving 3-aspect movable drum signs, traffic barrier gates and audible annunciators. MOORE ASSOCIATES, 893 American St., San Carlos, Calif. For information:

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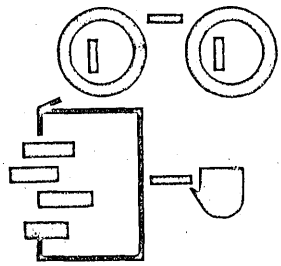

NEW LITERATURE

APPLIED MATHEMATICS: A complete listing of publications in the NBS Applied Mathematics Series—Publications List LP-17—is available. SUPT. OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, Washington 25, D.C. For copy:
CIRCLE 130 ON READER CARD

IMPACT: Implementation Planning And Control Technique, a networking tool based on the PERT technique is described in this brochure. COMPUTER DYNAMICS CORP., 1104 Spring St., Silver Spring, Md. For copy:
CIRCLE 131 ON READER CARD

EUROPEAN COMPUTER MARKET: This report gives a survey of the number and types of computer applications in Europe, the number of computers installed and on order and future developments. The book is priced at $2.50. NETHERLANDS AUTOMATIC INFORMATION PROCESSING RESEARCH CENTRE, Amsterdam, 6, Stadhouderskade, Netherlands.

BIBLIOGRAPHY: A 1954-1961 bibliography on magnetic recordings lists 762 papers and articles from over 120 technical journals, both foreign and domestic. Price of this publication, No. 63-17654, is $2.00. KINELOGIC CORP., 29 South Pasadena Ave., Pasadena, Calif.

TRIM: This eight-page illustrated brochure contains information on a new program package, Test Rules for Inventory Management—the 225 inventory control model. Examples of system decision rules which may be tested and sub-routines which do the testing are listed. GENERAL ELECTRIC CO., COMPUTER DEPT., Phoenix, Ariz. For copy:
CIRCLE 134 ON READER CARD

PROGRAM PACKAGE: A general description, operation, hardware requirements and functional transition of the 225/LGP-30 interpretive simulator are presented in this four-page brochure. GENERAL ELECTRIC CO., COMPUTER DEPT., Phoenix, Ariz. For copy:
CIRCLE 135 ON READER CARD

INFORMATION RETRIEVAL: An illustrated brochure describes and lists the

NEW LITERATURE . . .

features of Keydex, a new information retrieval system. ROYAL MCBEE CORP., 850 3rd Ave., New York 22, N.Y. For copy:
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OSCILLOSCOPE CAMERAS: An illustrated brochure presents the firm's entire line of oscilloscope camera systems and accessories for Polaroid as well as a continuous motion 35mm fast developing film. ANALAB INSTRUMENT CORP., Cedar Grove, N. J. For copy:
CIRCLE 137 ON READER CARD

FIRE PROTECTION: An eight-page booklet presents the latest methods of fire and smoke detection for computer and EDPM installations. PYROTRONICS, 10 Empire St., Newark, N. J. For copy:
CIRCLE 138 ON READER CARD

PRODUCT LINE: This illustrated brochure contains descriptions of the company's line of magnetic record/playback heads. Information includes mechanical tolerances, electrical and performance characteristics and general mount configurations. POTTER INSTRUMENT CO., INC., 151 Sunnyside Blvd., Plainview, N. Y. For copy:
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RECORDER/REPRODUCERS: Two four-page booklets offer descriptions, specifications, illustrations and features of the VR-3300 and VR-2800 magnetic tape recorder/reproducers. CONSOLIDATED ELECTRODYNAMICS CORP., 360 Sierra Madre Villa, Pasadena, Calif. For copy:
CIRCLE 140 ON READER CARD

OSCILLOGRAPH RECORDING SYSTEMS: This 16-page brochure contains a series of applications to show where direct writing recorders can best be applied to obtain best results. Described are recording systems for military, industrial and scientific applications. BRUSH INSTRUMENTS, 37th & Perkins, Cleveland 14, Ohio. For copy:
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CODE BAR SWITCHES & KEYBOARDS: An illustrated brochure catalogs product specifications for decimal, octal, parity and industrial code bar switch models and manual entry, manual entry with clear and remote clear keyboards. COMPUTER CONTROL CO., INC., Old Connecticut Path, Framingham, Mass. For copy:
CIRCLE 142 ON READER CARD

ADVERTISERS' INDEX

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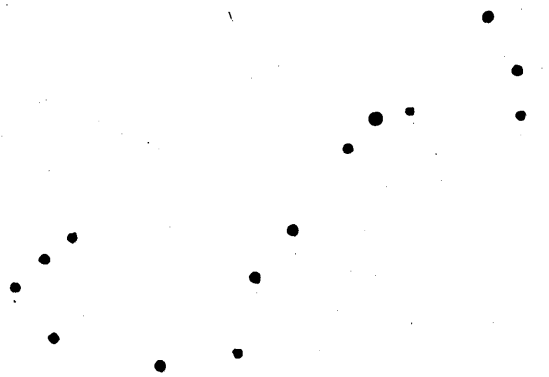

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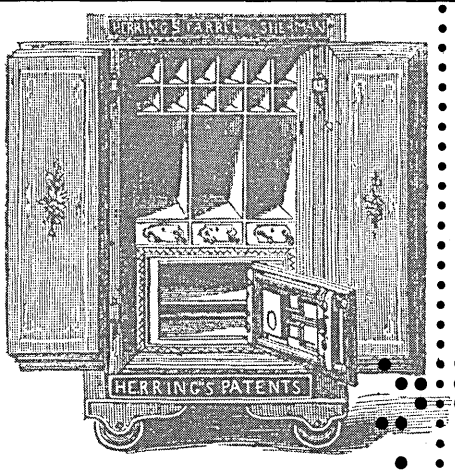

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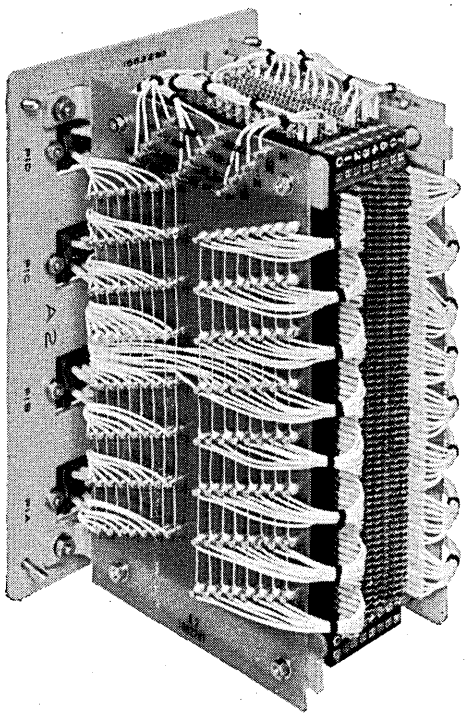

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