COMPUTERS AND AUTOMATION

CYBERNETICS · ROBOTS · AUTOMATIC CONTROL

Vol. 5
No. 8

Aug.
1956

The First in a Series of Announcements on Progressive Expansion of Program and Facilities in Mathematics at the Knolls Atomic Power Laboratory:

GENERAL ELECTRIC'S

KNOLLS ATOMIC POWER LABORATORY

Announces

CONSTRUCTION OF A MODERN CENTER FOR MATHEMATICS

Because we believe that theory is our most powerful weapon in dealing with reality, we are expanding our Mathematical Analysis Program. One of the first elements in this expansion is the creation of a new and modern building for mathematicians and physicists, which will be the center of the Laboratory's efforts to meet by theoretical means the challenges of the nuclear energy field.

We are seeking men with strong mathematical training at all degree levels to participate in this expanding Numerical Analysis Program—a program growing not only in staff, equipment, and facilities, but also in concept and function. They will work in close association with our theoretical and experimental physicists. There are openings in each of the following fields:

RESEARCH IN MATHEMATICAL TECHNIQUES

Numerical solution of the diffusion equation for complicated geometrical arrays taxes even the most powerful electronic computers. Fundamental work in iterative techniques must be carried out.

FORMULATION AND EVALUATION OF THEORIES

Due to the nature of physical situations now being encountered, the rough approximations which were formerly adequate must now be improved. The ultimate test of such improvement is comparison with experiment.

APPLICATIONS TO REACTOR PROBLEMS

A broad program of computational tools for reactor design must be effected incorporating the best available techniques. Strong interests in computation and in machine properties are indicated. The program at Knolls offers the atmosphere, the equipment, the richness of subject matter and the material benefits conducive to a satisfying career in applications of mathematics.

A LETTER TO DR. S. R. ACKER, EXPRESSING YOUR INTEREST, WILL RECEIVE IMMEDIATE ATTENTION.

Knolls Atomic Power Laboratory

GENERAL ELECTRIC

SCHENECTADY, N. Y.

COMPUTERS AND AUTOMATION

CYBERNETICS • ROBOTS • AUTOMATIC CONTROL

Vol. 5, No. 8 August, 1956

ESTABLISHED SEPTEMBER, 1951

ARTICLES

REFERENCE INFORMATION

FORUM

FICTION

Publisher: Berkeley Enterprises, Inc.
Main Office: 815 Washington Street, Newtonville 60, Mass. — Decatur 2-5453 or 2-3928
Editorial Office: 36 West 11 Street, New York 11, N.Y. — Gramercy 7-1157 or Algonquin 5-7177

Advertising Representatives:
San Francisco - W.A.Babcock, 605 Market St., San Francisco 5, Calif., Yukon 2-3954
Los Angeles - Wentworth F. Green, 439 So. Western Ave., Los Angeles 5, Calif., Dunkirk 7-8135
Elsewhere - the Publisher

Subscription rates: in the United States - one year $5.50, two years $10.50; in Canada - one year $6.00, two years $11.50; elsewhere - one year $6.50, two years $12.50

Bulk subscription rates: see page 9 Advertising rates: see page 38

Entered as second class matter at the Post Office, New York, N.Y.

THE EDITOR'S NOTES

ARGUMENT, DISAGREEMENT, CONFLICT AND COEXISTENCE

In this issue we publish the text of the legal complaint by Sperry Rand Corporation against International Business Machines Corporation as entered in court in December 1955. We also publish the legal answer and counterclaim by IBM against Sperry Rand, as entered in court in June 1956. These documents are interesting to read, and they deal with important matters. People in the computer field will watch with even more interest the evidence that will be produced and the development of the case, although of course this information will not appear if, as is more likely, the case is settled out of court.

Publication of these complaints by two of the largest corporations in the computer field against each other, we realize, is to some extent unconventional. It runs counter to a rather deep-seated tendency in any social unit, ranging from the family, or the group of people in any professional field, up to the country as a whole: the desire to gloss over, take little notice of, the seamy side of life, where important socially accepted principles have apparently not been followed. In a newspaper, for example, a frank admission by someone in authority that something has happened in his area of responsibility that should not have happened invites unfriendly and unfair attack. It rarely calls up the more scientific and charitable attitude "He did it and he's sorry; maybe he has learned something."

In spite of the fact that the present conflict deals with the less pleasant side of competition in the computer field, we believe that discussion of it, airing of it, is beneficial and not harmful. Computer people and the public in general, in regard to this and similar questions, cannot make up their minds in a vacuum, without data, without knowledge of things that have actually happened. The texts of the complaints, of course , contain no evidence; it is the evidence to be offered that will be crucial.

In spite of the conflict there is a great unanimity about the way in which the conflict will proceed and will be settled. The procedure is known and agreed on. Employees of the contending corporations will continue to talk amicably to each other at meetings of computer people. The conflict is put into a compartment and localized. Everyone is agreed that no shooting over the argument will occur. The two corporations and everyone else have accepted coexistence as something that will inevitably happen.

In this issue we also publish a computer science-fiction story, "Requiem". It discusses another kind of conflict and pictures another kind of mentality — one which would not accept coexistence even if not to do so meant self-destruction. It also points out some of the logical consequences of computers. Scientists and computer people are not immune from the social consequences of the science and computer knowledge which they discover, and they have a social responsibility for what they find out. And the pursuit of knowledge, the skillful extraction of the secrets of nature, with complete disregard of how these secrets will be used, is just as academic and can well be far more harmful than to spend forty years of one's life in unraveling the grammar of ancient Greek.

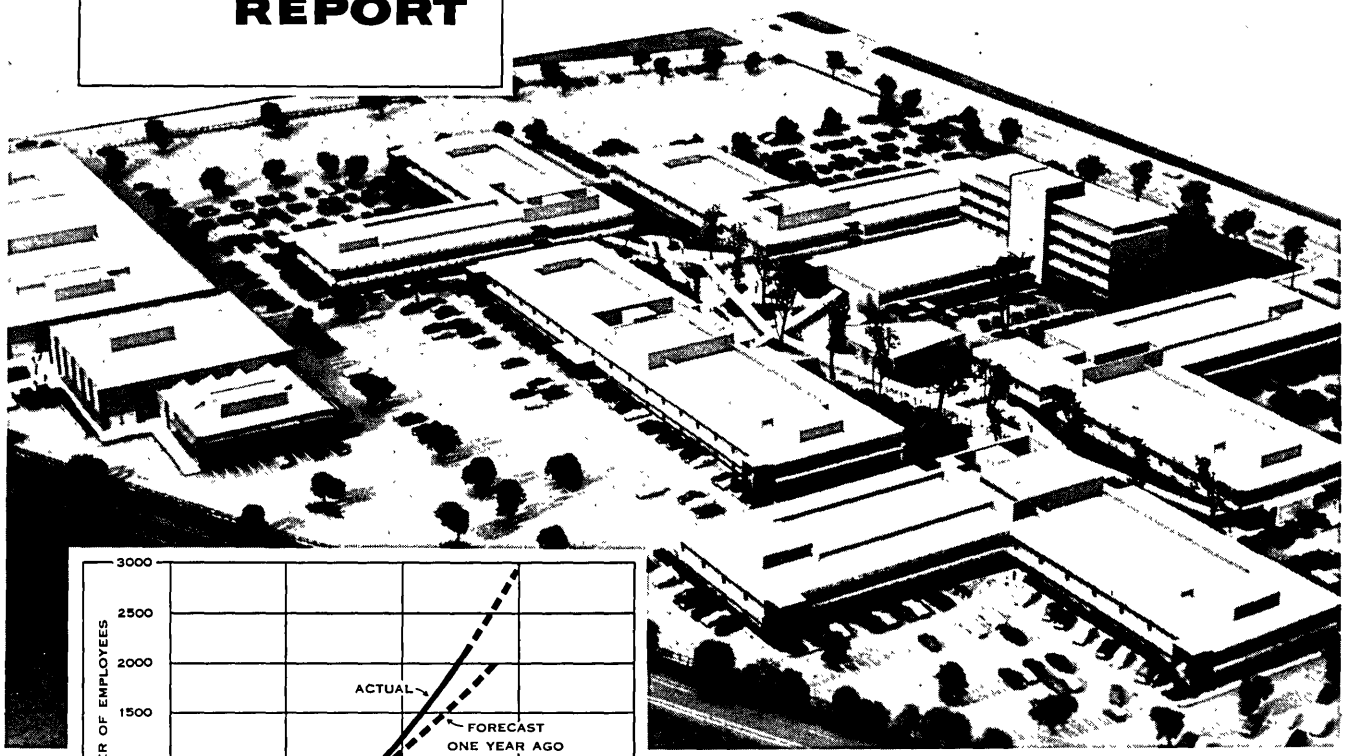
- END -

INDEX OF NOTICES

Address Changes: If your address changes, please send us both your new and your old address, (torn off from the wrapper if possible), and allow three weeks for the change.

PROGRESS REPORT

After Thirty-Four Months...



RESEARCH AND DEVELOPMENT PERSONNEL The above curve shows the growth in Ramo-Wooldridge personnel which has taken place since our Progress Report one year ago. A significant aspect of this growth is the increase in our professional staff which today is made up of 135 Ph.D.'s, 200 M.S.'s and 265 B.S.'s or B.A.'s. Members of the staff average approximately ten years' experience.

FACILITIES Within the past few months, construction has been completed at our Arbor Vitae complex, which now consists of eight modern buildings of 350,000 square feet, four of which are illustrated at the bottom of the page. Nearby is the R-W flight test facility, including hangar, shop, and laboratories, located on a 7-acre plot at International Airport.

To provide additional space for our continuing growth, construction has been started on an entirely new 40-acre Research and Development Center, located three miles from the Arbor Vitae buildings. The photograph above is of a model of the Center, which we believe will be one of the finest research and development facilities in the country. The first three buildings, now under construction, will total 250,000 square feet.

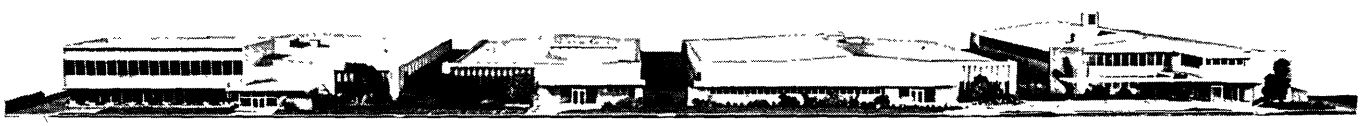
A second major construction program is underway on a manufacturing plant for quantity production of electronic systems. The initial unit of the plant, located on a 640-acre site in suburban Denver, Colorado, will be completed next spring and will contain approximately 150,000 square feet.

PROJECTS Our current military contracts support a broad range of advanced work in the fields of modern communications, digital computing and data-processing, fire control systems, instrumentation and test equipment. In the guided missile field, Ramo-Wooldridge has technical direction and systems engineering responsibility for the Air Force Intercontinental and Intermediate Range Ballistic Missiles. Our commercial contracts are in the fields of operations research, automation, and data processing. All this development work is strengthened by a supporting program of basic electronic and aeronautical research.

THE FUTURE *As we look back on our first three years of corporate history, we find much to be grateful for. A wide variety of technically challenging contracts have come to us from the military services and from business and industry. We have been fortunate in the men and women who have chosen to join us in the adventure of building a company. We are especially happy about the six hundred scientists and engineers who have associated themselves with R-W. Their talents constitute the really essential ingredient of our operations. We plan to keep firmly in mind the fact that the continued success of The Ramo-Wooldridge Corporation depends on our maintaining an organizational pattern, a professional environment, and methods of operating the company that are unusually well suited to the special needs of the professional scientist and engineer.*

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE ST. • LOS ANGELES 45, CALIF.



TWO ELECTRONIC COMPUTERS SHARE A SINGLE PROBLEM

National Bureau of Standards
Washington 25, D.C.

Data-processing shared by two interconnected electronic digital computers has been successfully performed at the National Bureau of Standards. SEAC and DYSEAC, two high-speed computers designed and built at the Bureau, worked cooperatively on a common task to demonstrate program-controlled machine intercommunication in which coordinated programs were read into both machines. The problem simulated a situation where stock transaction reports are tabulated and summarized for fiscal accounting, and then forwarded for posting to inventory control records elsewhere. The experiments were carried out by the Bureau's data processing systems laboratory as part of a cooperative program with the Navy Bureau of Supplies and Accounts to investigate the application of electronic techniques to the problems of supply management. The experiments showed that two digital computers need not have identical operating characteristics to work together, provided that one of them has the necessary control flexibility.

Typical applications of digital computers as data processors involve replacement of many small specialized machines by a single automatic system. However, for massive paper-handling operations, or for large-scale activities requiring the processing of the same data for different purposes at different locations, the use of more than one high-speed data processor may be necessary. For instance, in the far-flung supply organizations of the armed services, expediting flow of information is essential to efficient supply management. Automatic communication between machines has been foreshadowed by direct input and output provisions so that the computer continues with other useful work while transfers of information between it and external devices are in process, and by tape-processing devices where search is under the program control of a computer. In this example, however, the interconnection is between a computer serving as the nucleus of a processing system and other parts of the same system.

Most general-purpose electronic computers employ a generally compatible digital language, can receive and transmit data in the form of electrical signals via standard communication channels over any desired distance, and can alter the course of processing programs in accordance with new or revised information. It should therefore be possible to interconnect two or more general-purpose machines so that they can cooperate on a common task. For example, a versatile large-capacity data-processor at a materiel control center might receive data fed to it automatically by smaller computers located at various supply depots. The supervisory processor (at the center) might so control the system-wide processing that it would accept data from each of its reporting sources in a scheduled sequence but would also be free to accept and handle priority requests for supply action from any of the depots at any time.

For the kind of interaction where both information and exchanges of control are transferred between computers, the question of programmed control versus automatic interruption is particularly important. Programmed control depends to a considerable extent on human anticipation of when and how the interchanges should occur; however, if two or more systems are to interact automatically without human intervention, provision must be made for automatic interruption of a program in process in order to turn to the new information just received from another system. DYSEAC provides such interruption properties.

DYSEAC was designed at the National Bureau of Standards for the Department of Defense to serve as the nucleus of a generalized feedback control network. This computer incorporated a number of operating features enabling it to respond automatically to information from remote external devices. These operating features include manual-monitor facilities, program control flexibility, and special input-output controls. Together they provide DYSEAC with unusual properties of concurrent operation, self-regulation, and interruptibility which enable it to interact effectively with another computer.

During a period of three weeks the two machines, SEAC and DYSEAC, were available for experiments in interconnection. The program chosen for the experiment was a new method of sorting, merging, and posting of records. In the problem, stock transaction reports were tabulated and summarized by SEAC, then forwarded to DYSEAC for posting. In the SEAC program for running this problem, as detail items were identified as belonging to each file section in a scheduled order they were transferred to DYSEAC for posting there. In addition, after each complete set of detail items for a particular file section had been

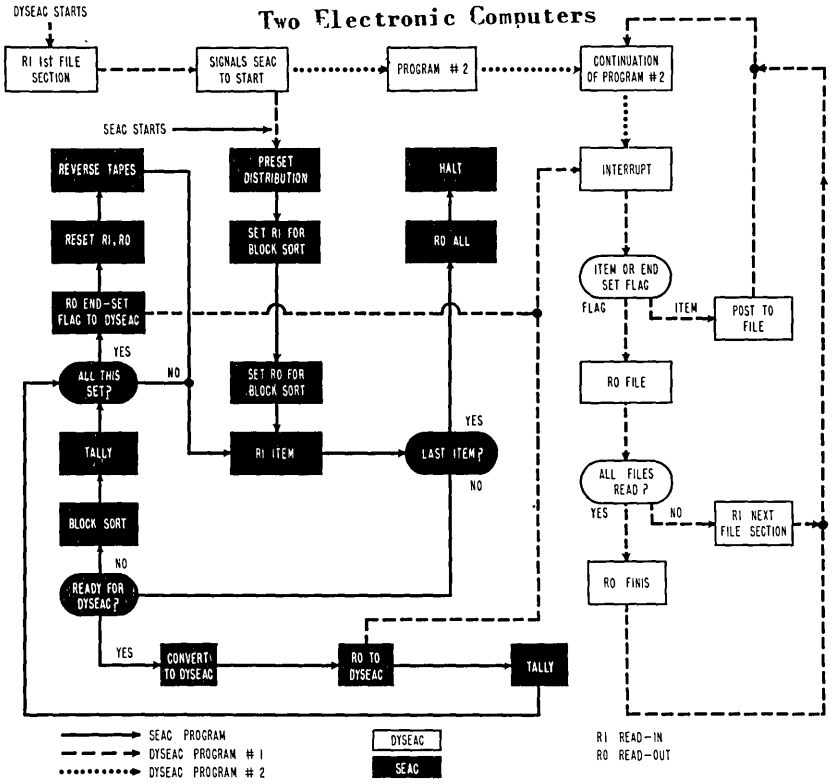


Figure 1 -- Flow diagram of problem shared by the interconnected computers, SEAC and DYSEAC. In this problem, stock transaction reports are tabulated and summarized by SEAC, then forwarded to DYSEAC for posting. Results of this experiment demonstrate clearly the ability of DYSEAC to respond to monitor signals originating in SEAC and to interrupt its program in order to receive and process the detail data from SEAC. DYSEAC worked on an independent sequence of typical machine operations, simulating a concurrent program, while waiting for SEAC to transmit data.

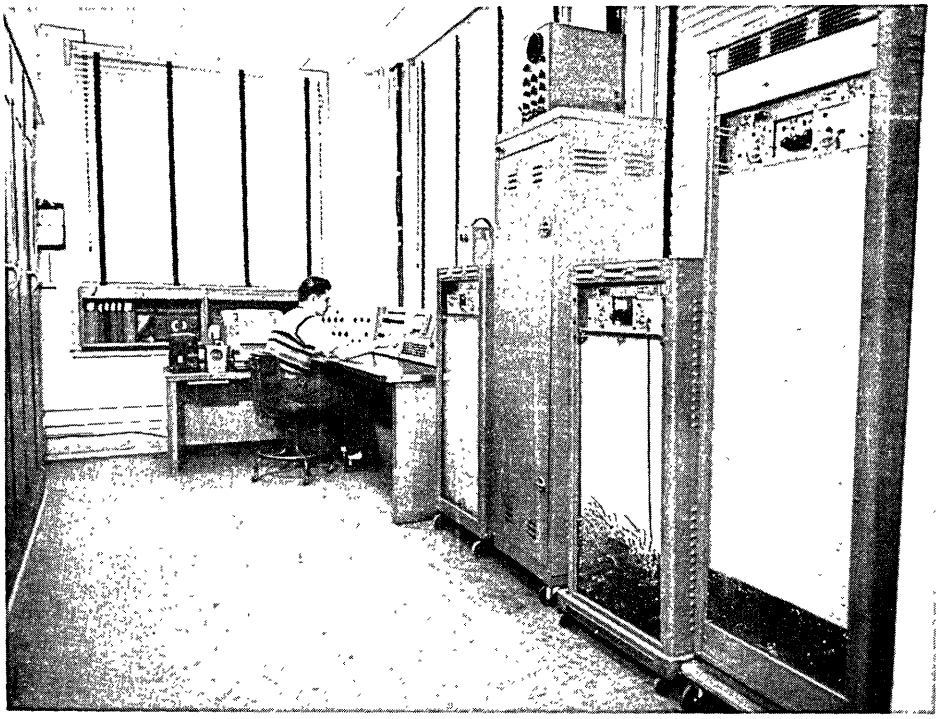


Figure 2 -- SEAC computing room at the National Bureau of Standards. Control console is at the far end of the room, and the computer proper is at the left. To the right are several of the external storage units which store on magnetic tape such information as coded subroutines, instructions to the machine, and numerical data, as well as the entire coded program for a problem and its solution when the computation is completed.

processed, SEAC transmitted a special end-of-set flag to DYSEAC. The coordinated DYSEAC program called for (1) responding to the SEAC transmitted signal, (2) reading-in the message from SEAC, (3) determining whether the message was a detail item or an end-of-set flag, and (4) either tallying the appropriate master file item in the first case, or reading out one file section and reading in the next in the case of the flag.

A cable between the SEAC building and the trailer van housing DYSEAC provided interconnection through a regular input-output terminal of each machine. Information transfers were initiated and terminated by transmission of control signals between the two machines. Whenever a SEAC output instruction called for selection of the particular output used for transmission to DYSEAC, a 62-volt preparatory signal was sent from the SEAC external selector unit to DYSEAC. This signal activated appropriate monitor operations in DYSEAC. As soon as DYSEAC was ready to accept the data, it transmitted a 62-volt signal to SEAC. Only upon receipt of this signal was SEAC able to proceed with its next instruction. In effect, SEAC continued trying to complete this output instruction until DYSEAC signalled readiness to accept the transfer.

This dual machine interconnection utilized both the special program control and the manual-monitor features of DYSEAC. In terms of program control, DYSEAC is a three-address automatically sequenced machine; choice between one of two counters as the source of the address of the actual next instruction is determined by control-code digits in the instruction being executed at any operating time. In addition, a special address-storage register can serve to locate the next instruction when new information or new instructions are to be interpolated into a program that is being processed, as in the case of manual-monitor operations.

Manual-monitor operations are those that are carried out by the machine when certain prespecified conditions arise in the course of the machine's internal program and simultaneously in external switch settings. The switch settings are controlled either by the machine operator or by d-c voltage signals originating in external devices at any distance from DYSEAC. Thus, the machine can monitor its internal program to determine precisely when special operations requested by an external source are to be performed.

If the switch settings that are controlled by d-c voltages from the external device indicate that the device is ready, DYSEAC will then carry out the indicated operation, such as direct loading of one or more memory locations, and select its next instruction from the location specified by the address-storage register. The instruction selected in this manner then indicates in its program-control digits which of the two counters is to be used next. In this way, it can either return DYSEAC to a program that had been discontinued during the interruption or initiate an entirely new sequence of operations.

For the DYSEAC-SEAC interconnection, monitor switch settings were arranged so that upon receipt of the preparatory signal from SEAC, DYSEAC at its next breakpoint read in one information word to a predetermined memory address and took its next instruction from the location indicated in the address storage register. This next instruction was a "file" order which recorded both counter settings, reset the proper counter to the initiation of the routine for the processing of the data from SEAC and transferred control to that counter. Upon completion of the processing of any one set of data from SEAC, DYSEAC would return to the sequence of operations it had been performing immediately prior to each interruption.

When the coordinated programs had been read into both machines, SEAC was set to run but was inhibited by a control signal from DYSEAC. When DYSEAC had completed reading in the first file section and had proceeded to other independent operations, a release of control enabled SEAC to start. As soon as the SEAC-processed data were ready for posting, they were converted to the proper format for DYSEAC, transmitted, and checked by DYSEAC to see whether there had been garbling in transmission. The receipt of data simulating a detail item resulted in a tally count for the appropriate master item in the file section.

Several runs of the shared program were successfully made, and the "posted" file sections were printed out on a DYSEAC magnetic wire cartridge. These results clearly demonstrated the ability of DYSEAC to respond to the monitor signals originating in SEAC and to interrupt its program in order to receive and process the detail data from SEAC. The two machines were thus made to work cooperatively on the common task that involved preliminary processing of data by SEAC, transmission of these data and program information from SEAC to DYSEAC, and further processing by DYSEAC. DYSEAC worked on an independent sequence of typical machine operations, simulating a concurrent program, during the intervals in which it waited for SEAC to transmit data.

Only a limited form of master-slave relationship was demonstrated. Only one of the two machines, DYSEAC, had the flexible system design features that provide for multiple program processing and interruptibility necessary in the interdependent system. However, this

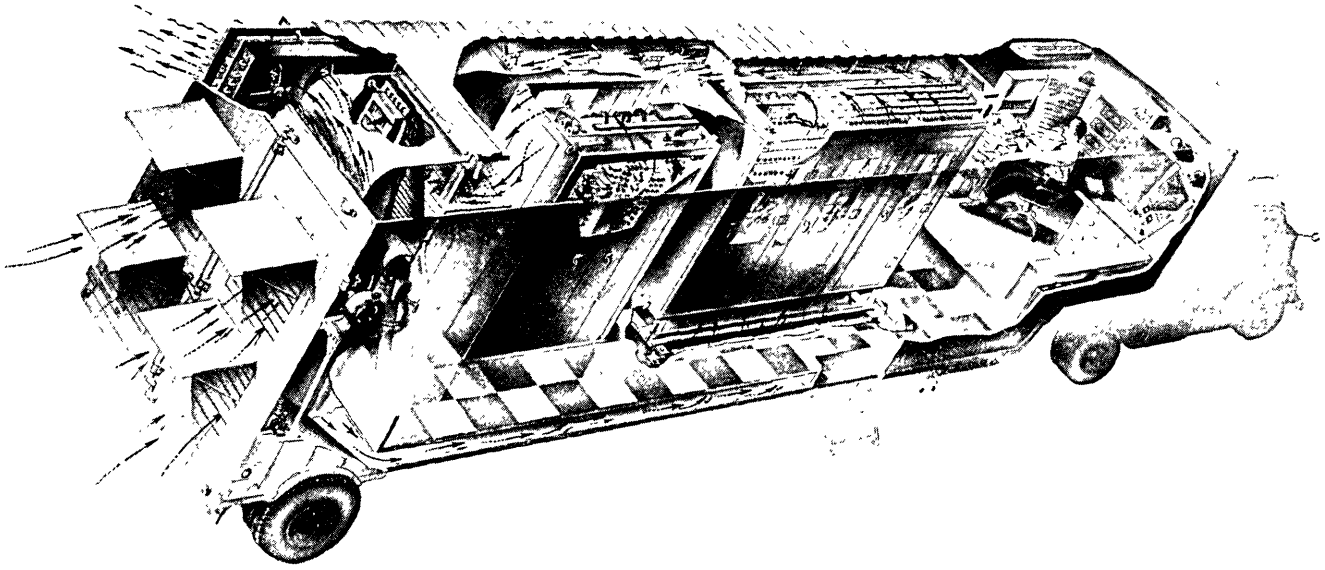


Figure 3 -- Cutaway view of the DYSEAC computer trailer constructed by the National Bureau of Standards. The forward part of the trailer, in front of the drop, contains the control console and the magnetic-wire input-output equipment. The three cabinets in the central portion house the computer itself. Immediately behind these are two additional cabinets which contain the 512-word acoustic delay-line memory. In the rear of the trailer is the air-conditioning equipment.

limited experiment did demonstrate the significant fact that two machines need not have identical capabilities and characteristics in order to share a common data-processing program, provided that one machine has the necessary flexibility. The one machine that is capable of multiple-program processing with interruptibility can receive and process data fed directly to it from one or more external sources and can therefore share its high-speed memory, computing ability, and output facilities with remotely located external devices, including other computers with different characteristics.

For further technical information, see The interconnection of two digital computers, M. E. Stevens, AIEE Conference Paper CP No.55-736 (1955); DYSEAC, the new NBS electronic computer, NBS Tech. News Bull. 38, 134 (Sept. 1954); SEAC, the NBS electronic automatic computer, Tech. News Bull. 34, 121 (Sept. 1950).

- END -

ROSTER OF ORGANIZATIONS IN THE COMPUTER FIELD

(Supplement, information as of July 3, 1956)

The purpose of this Roster is to report organizations (all that are known to us) in the computer field: organizations making or developing computing machinery or data-processing machinery; organizations supplying computing services or consulting services in the computer field; and organizations supplying components or services used in the computer field if significantly related to the field (for example, magnetic drums would be such a component, while octal sockets would not be).

This listing is a supplement to the cumulative edition containing about 370 entries published in the June 1956 issue of "The Computer Directory, 1956", the June 1956 issue of "Computers and Automation". This listing contains only additions or revisions as compared with previous entries.

Entries. Each Roster entry if complete contains: name of the organization, its address / telephone number / description of its main activities, main products in the field, any comments / size (expressed in number of employees), year established, nature of its interest in the computer field, types of activities it engages in. The last four items are reported in abbreviations, which are explained below. In cases where we did not have complete information, we have put down what we have. Entries in this Roster are free.

Accuracy. We have tried to make each entry accurate to the extent of information in our possession. We shall be grateful for any more information or additions or corrections that anyone is kind enough to send us. Although we have tried to be accurate and complete, we assume no liability for any statements expressed or implied.

Abbreviations

The key to the abbreviations follows:

Size
- Ls Large size, over 500 employees
- Ms Medium size, 50 to 500 employees
- Ss Small size, under 50 employees (no. in parentheses is approx. no. of employees)

When Established
- Le Long established organization (1925 or earlier)
- Me Organization established a "medium" time ago (1926 to 1945)
- Se Organization established a short time ago (1946 or later) (no. in parentheses is year of establishment)

Interest in Computers and Automation
- Dc Digital computing machinery
- Ac Analog computing machinery
- Ic Incidental interests in computing machinery
- Sc Servomechanisms
- Cc Automatic control machinery
- Mc Automatic materials handling machinery

Activities
- Ma Manufacturing activity
- Sa Selling activity
- Ra Research and development
- Ca Consulting
- Ga Government activity
- Pa Problem-solving
- Ba Buying activity
  (Used also in combinations as in RMS a "research, manufacturing and selling activity")

*C This organization has kindly furnished us with information expressly for the purposes of the Roster and therefore our report is likely to be more complete and accurate than otherwise might be the case. (C for Checking)

Organization Entry Form

The form to be completed for an entry in the Roster of Organizations follows:

1. Your organization's name?_____
2. Address?_____
3. Telephone number?_____
4. Types of computing machinery or components, or computer-field products and services that you are interested in?

   _____

   _____
5. Types of activity that you engage in:
   ( ) research ( ) other (please explain):
   ( ) manufacturing
   ( ) selling _____
   ( ) consulting

   _____
6. Approximate number of your employees?_____
7. Year when you were established?_____
8. Any comments?_____

   _____

Filled in by _____

Title _____ Date _____

A

Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa. / Cedar 4-0101 / *C
Patchcord programming systems for critical low level circuits, as well as nonshielded systems for analog and digital computing systems, data processing, test equipment, other equipment and devices. Automatic wire terminators, taper pins (single and multiple), capacitors, terminals, connectors, etc. Ls(1600) Me(1941) Ic RMSa

Allegany Instrument Co., Inc., 1091 Wills Mountain, Cumberland, Md.
Computers for ballistic measurements. Ac RMSa

Allies' Products Corp., 1028 Connecticut Ave. N.W., Washington, D.C. / RE 7-0504 / *C
Precision resistor components. Ss(12) Se (1952) Ic RMSCa

American Electronic Mfg., Inc., Instruments Div. of American Electronics Inc., 9503 W. Jefferson Blvd., Culver City, Calif. / Texas 05581 / *C
Precision resolvers, servomotortachometers, resolver amplifiers, and systems. Ms(200) Se(1952) Ic RMSa

Amphenol Electronics Corp., 1830 S. 54th St., Chicago 50, Ill.
Connectors for computer applications: all types.

Armour Research Foundation, Illinois Inst. of Technology, 10 West 35th St., Chicago 16, Ill. / CAlumet 5-9600 / *C
Design and construction of developmental computers, both analog and digital, for special applications only. Digital-to-analog and analog-to-digital converters. Data reduction systems. Magnetic recording. Automatic control machinery. Servomechanisms. Instrumentation. Computing service: analog, digital; have Goodyear Electronic Digital Differential Analyzers. Two Channel Electronic Function Generator, card programmed calculator. Ls (1150) Me(1937) DAISCc RCPa

Automation Engineering Laboratory, One E. Putnam Ave., Greenwich, Conn. / Greenwich 8-2300 /
Designs, engineers, and builds complete automated unit or system. Ic RMCa

Avion Division-Alexandria (formerly ACF Electronics) Div. of ACF Industries, Inc., 800 No. Pitt St., Alexandria, Va. / King 8-4900 / *C
Analog-to-digital encoders, and digital-to-analog decoders. Ms(177) Se(1954) DAc RMSa

B

Basic and Experimental Physics, Box 689, Falmouth, Mass. / Falmouth 2175.
Consulting services in design, development, testing, and applications of digital and analog computer systems. Ss Se DAIc RCPa

Bryant Gage and Spindle Division, Box 620, Springfield, Vt., Division of Bryant Chucking Grinder
Magnetic Drums with speeds up to 100,000 RPM, capacity up to 5 million bits, super-precision bearings. Ms Se Ic RMSa

C

Creed & Co., Ltd., Telegraph House, Croydon, England / Croydon 2121.
Teleprinter equipment for telecommunication. Also input and output equipment specifically intended for association with electronic computers, machine tool, and process control systems. DIc RMSa

D

Daystrom Instrument Co., Archbald, Pa. / Jermyn 1100 / *C.
Digital and analog computers. Magnetic Core and magentic drum storage systems. Servomechanisms./Ls(1000) Se(1950 DAISc RMSCa

E

Edin Co., Inc., 207 Main St., Worcester 8, Mass. / PL 7-8394.
Direct writing oscillograph recorders; high gain D.C. amplifiers; frequency spectrum analyzer. AIc RMSa

Electralab, Inc., Industrial Center, Needham, Mass. / Needham 3-5000 / *C.
Printed circuits; printed assemblies; printed circuit boards with reliable plated-through holes--for computers and other applications. Ms(75) Se(1951) Ic RMSa

Electro Instruments, Inc., 3794 Rosecrans St., San Diego, Calif. / Cypress 806144 / *C
Digital voltmeters; digital ohmmeters, analog-to-digital converters, card converters, frequency counters, X-Y Recorders, go no go systems, automation systems, digital testers, and other digital instruments. Ms(80) Se(1954) Ic RMSa

Electronic Associates, Inc., Long Branch, N.J. / Long Branch 6-1100 / *C
General purpose precision analog computers, special purpose analog computers, analog computer components, digital-to-analog converter, digital plotting system (Dataplotter). Automatic control of all machine tools. Ls (591) Se(1945) DACc RMSCa

F

Fairchild Controls Corp., Components Div., 225 Park Ave., Hicksville, L.I., N.Y., / Wells 8-5600 / and 6111 E. Washington Blvd., Los Angeles, Calif. / RAymond 3-5191 / *C
Precision potentiometers, linear, non-linear, single turn, multi-turn, wire wound and noble metal film; trimmer potentiometers; pressure transducers. Subsidiary of Fairchild Camera and Instrument Corp. Le(1920) Ls(2500, company; 375, this division) Ic RMSa

The Franklin Institute, Laboratories for Research and Development, 20th St. and Benjamin Franklin Parkway, Philadelphia 3, Pa. / LOcust 4-3600 / *C
Digital computing machinery, analog computing machinery, servomechanisms, automatic control machinery, automatic materials handling machinery. Computing service: digital (Univac); analog (AC network analyzer). Fire control

equipment. Special purpose analog computers, large and small scale. Digital computer components. Prototype construction. Ms(325) Se (1946) DASCMc RPCa

Friden Calculating Machine Co., Inc., San Leandro, Calif. / SWeetwood 8-0700 / *C
Desk calculating and adding machines. Computyper for automatic billing. Add-Punch Machine for adding, subtracting, and for recording of integrated data. Ls(2700) Me(1934) Dc RMSa

G

Germanium Products Corp., 26 Cornelison Ave., Jersey City, N.J.
Silicon and germanium transistors for computer and other uses. Ic RMSa

H

N.V. Hollandse Signaalapparaten, Hengelo (O), Netherlands / *C
Radar fire control systems and their computers for different types of armament. Directors, computers, trackers and radar systems for finding targets, then automatically sighting the guns under their control. Ls(1800) Le(1922) DAIc RMSa

Hoover Electronics Co., 3640 Woodland Ave., Baltimore 15, Md. / MO 4-2350 / *C
Analog to digital converter. Digital computers. Sequential test sets and systems for computers, telemetering, and information processing. Ms(60) Se(1952) Dc RMSa

I

International Resistance Co., 401 No. Broad St., Philadelphia 8, Pa. / WAlnut 2-2166 / *C
Fixed variable resistors, hermetic sealing terminals, selenium rectifiers, insulated chokes, molded printed electronic circuits. Ls(2100, including subsidiaries) Le(1924) Ic RMSa

K

George F. Kelk, Ltd., 130 Willowdale Ave., Willowdale, Ont. / BA 5-3391 / *C
Digital plotting equipment. Specialized analog computers. Ss(12) Se(1953) DAc RMSCa

Kleinschmidt, Inc., Deerfield, Ill. / Deerfield 1000 / *C
Page printing read-out devices, tape reading and tape punching equipment. Ls(650) Se (1946) Ic RMSCa

L

Littlefuse, Inc., 1865 Miner St., Des Plaines, Ill./ Vanderbilt 4-1188
Fuses and fuse holders for computer and other uses. Ic RMSa

Litton Industries, Inc., Beverly Hills, Calif., and elsewhere / CRestview 4-7411 / *C
Radar systems with monopulse techniques; countermeasures, inertial navigation, automatic flight control, telemetering devices, communications equipment, instrumentation and test equipment, servomechanisms. New digital differential Analyzer. Portable, electronic scientific computers (digital differential analyzer) and such accessories as graph plotters, followers, tape input and output devices, digital-analog converters, and magnetic drums and heads. Advanced system design and development. Ls(1300) Se(1953) DAICc RMSCa

M

Mack Electronics Div., Inc., 1120 So. 2nd St., Plainfield, N.J. / Plainfield 5-4600
Research facilities in the development of fire control, radar, missile tracking, communications, ultrasonics and other complex developments for industry and the military. Formerly White Industries, Inc., a subsidiary of Mack Trucks, Inc. Ic RMSa

P.R. Mallory & Co., Inc., 40 So. Gray St., Indianapolis 6, Ind.
Transistors, resistors, and capacitors for computer and other uses. Ic RMSa

Markite Corp., 155 Waverly Place, New York 14, N.Y. / Oregon 5-1384
Precision potentiometers for computer and other uses. Ic RMSa

N

National Analysts, Inc., 1015 Chestnut St., Philadelphia 7, Pa. / Market 7-8109 / *C
Consulting and computing service. Punched card machines; large scale general purpose electronic data processing equipment. Ss (25) Se(1943) Ic CPa

O

Ohmite Manufacturing Co., 3601 Howard St., Skokie, Ill. / ORchard 5-2600
Capacitors, computer types; miniature wirewound resistors; etc. Ic RMSa

ORRadio Industries, Shamrock Circle, Odelika, Ala./ SHerwood 5-4621 / *C
Magnetic recording tape for computers and telemetering applications. Ms(75) Se(1946) Ic RMSa

P

Powers-Samas Accounting Machines, Ltd., Powers-Samas House, Holborn Bars, London E.C. 1, England.
Punch card tabulating equipment using small, medium, and standard cards. Agency is Underwood Corp., which SEE. Ls(6000) Le(1916) DIc RMSa

R

Radiation, Inc., P.O. Drawer 37, Melbourne, Fla. / Melbourne 800 / *C / Data processing
Data processing, data conversion, and data reduction equipment; 32 channel digital telemetering system, which includes data collection, processing, and translating equipment for computer. Ms(400) Se(1950) DIc RMSCa

Radio Receptor Co., Inc., 251 West 19 St., New York, N.Y. / Watkins 4-3633
Germanium diodes for computer and other uses IC RMSa

Recording and Statistical Corporation, 100 Sixth Ave., New York 13, N.Y., / WOrth 6-2700 / and elsewhere.
Computing and data processing services using electronic digital computers and punched card equipment of latest types.

S

Servonics, Inc., 834 N. Henry St., Alexandria, Va. / TEmple 6-6800
Precision potentiometers incorporating digital techniques, with high linearity, and extended frequency limits without phase shift, multi-turn but continuous rotation.
Soroban Engineering, Inc., Box 338, Melbourne, Fla./ *C
Data input-output systems; data preparation devices; output tabulating devices; coding keyboards; paper tape readers and perforators; specialized data computing systems and consulting services on all of above. Ss(35) Se(1953) DIc RMSCa
Southern Electronics Corp., 239 W. Orange Grove Ave., Burbank, Calif. / Victoria 9-3193 / *C
Precision capacitors, adjustable capacitors. Ms(60) Se(1951) Ic RMSa
Southwestern Industrial Electronics Co., P.O. Box 13058, Houston 19, Texas
Analog computers and simulators. Ac RMSa
Sylvania Electric Products, Inc., Electronic Systems Division, 100 First St., Waltham 54, Mass./ TWinbrook 3-9200 / *C
Electronic digital computers, special purpose digital data transmission systems. Etched circuits; other computer components. (Includes the Division formerly at 70 Forsythe St., Boston). Ls(27,000 company; 700 this division). Le(1901) DAc RCa

V

Victor Adding Machine Co., 3900 No. Rockwell St., Chicago 18, Ill. / KEystone 9-8210 / *C
Digital computers and related integrated data processing systems. Digit-matic plain or calculating printers. Adding machines, etc. Ls(2200) Le(1918) Dc RMSa

Z

Zuse, K-G., Kreis Hünfeld, No. 69, Neukirchen, Germany / *C
Electronic digital computers. Zuse Model "Z 4", "Z-5" and "Z 11" computers. Ms(90) Se(1949) Dc RMSa

SPECIAL ISSUES OF "COMPUTERS AND AUTOMATION"

The June issue of "Computers and Automation" commencing with June, 1955, is a special issue, "The Computer Directory."

MANUSCRIPTS

We are interested in articles, papers, reference information, science fiction, and discussion relating to computers and automation. To be considered for any particular issue, the manuscript should be in our hands by the fifth of the preceding month.

Articles. We desire to publish articles that are factual, useful, understandable, and interesting to many kinds of people engaged in one part or another of the field of computers and automation. In this audience are many people who have expert knowledge of some part of the field, but who are laymen in other parts of it. Consequently a writer should seek to explain his subject, and show its context and significance. He should define unfamiliar terms, or use them in a way that makes their meaning unmistakable. He should identify unfamiliar persons with a few words. He should use examples, details, comparisons, analogies, etc., whenever they may help readers to understand a difficult point. He should give data supporting his argument and evidence for his assertions. We look particularly for articles that explore ideas in the field of computers and automation, and their applications and implications. An article may certainly be controversial if the subject is discussed reasonably. Ordinarily, the length should be 1000 to 4000 words. A suggestion for an article should be submitted to us before too much work is done.

Technical Papers. Many of the foregoing requirements for articles do not necessarily apply to technical papers. Undefined technical terms, unfamiliar assumptions, mathematics, circuit diagrams, etc., may be entirely appropriate. Topics interesting probably to only a few people are acceptable.

Reference Information. We desire to print or reprint reference information: lists, rosters, abstracts, bibliographies, etc., of use to computer people. We are interested in making arrangements for systematic publication from time to time of such information, with other people besides our own staff. Anyone who would like to take the responsibility for a type of reference information should write us.

Fiction. We desire to print or reprint fiction which explores scientific ideas and possibilities about computing machinery, robots, cybernetics, automation, etc., and their implications, and which at the same time is a good story. Ordinarily, the length should be 1000 to 4000 words.

Discussion. We desire to print in "Forum" brief discussions, arguments, announcements, news, letters, descriptions of remarkable new developments, etc., anything likely to be of substantial interest to computer people.

(cont'd on page 31)

REQUIEM

K. W. BENNETT
Lake Zurich, Ill.

It was one of the two most dangerous desks in the world. Cutter ran his palm gently across its smooth green surface, brushed his fingertips lightly across the big green buttons scattered like organ stops across the desktop. His scrubbed finger traced the letters beneath the buttons. "Moscow" was a big button. Beneath it ranked lesser buttons lettered "Murmansk", "Leningrad", "Baku", and the rest. Then there was a "China" sector with black buttons and an "Indian" sector with buttons that were red and small like beetles. And more, linked with fat armored cables to the ranks of computers that crowded the walls of the room.

Dangerous and clean and beautiful, this desk, like a loaded Luger pistol. And each time he pushed a button, four hydrogen bombs would waken to life in a distant place. A split second they would lie in their dark cradles beneath the mountain ice and windpacked snow, listening to the stream of measured impulses of latest calculation from these computers. Then their tail pipes would spurt comets of flame and they'd howl aloft and be gone at four times the speed of sound through the stratosphere on an invisible guiding arc of computer signals, fantastically rapid and fantastically accurate. When the bombs touched earth again, a city would die. Not bravely, but with completeness.

The alarm bell tinkled softly. It was regulated to tinkle softly to prevent alarming the guardian of the buttons. In accordance with regulations, Joe Cutter extended a hovering hand over the "Moscow" button and with the other unsheathed a loaded .45 Colt automatic and centered its black barrel on the door. The pneumatic door hissed up. A general, the last General, entered, smiling determinedly. Cutter sighed and subsided into a gray little man behind an oversized desk. He touched his helmet in half salutation and reholstered the .45 without getting up. The General closed the pneumatically operated steel slab. Joe caught a remembered glimpse of clothes racks behind the General as the grey steel slab slid down.

The General marched to one of the three fat upholstered chairs. He jackknifed himself to a sitting position with military reluctance.

"Good morning, Cutter," he beamed.

"Good morning, General," said Cutter. The General winced. It wasn't much fun, being the last General, Joe imagined. Like being an extinct species of moose preserved in a zoo.

"Everything all right, Cutter?" the General demanded.

Joe himself winced, this time. The General asked the same question each morning. He had for three years, ever since the computer room and desk installation had been completed following signing of the disarmament pact. And it was a ridiculous question. The nation would be on its knees before anything would be allowed to go awry in this crowded roomful of computers and maps and lethal buttons.

The General rolled on with heavy cheer, "Good, Cutter. Must keep shipshape. Particularly now. If the citizen exchange agreement is a fake, it means the enemy is smoke-screening us for good reasons. Might be the Big Attack."

Cutter wavered between pity and bored dislike. The last General, fending off a disarmed world. For an Army he had Cutter, and his shift-mates, a battery of the greatest electronic brains technology could produce, and a handful of technicians; all carefully buried from the world. A man who'd commanded thousands and tens of thousands. His only visible command at the moment, during this shift, a small ratlike man wearing a steel helmet that was several sizes too large, hunched behind an oversize desk and several rows of gray steel computers that chuckled electronically over the belly warmth of their live circuits. It must seem like commanding a homicidal mouse and a line of pinball machines, Joe decided.

"The Russki's are disarmed, General," Cutter said with gentleness. "And they're sending their top men here to prove faith."

The worn gambit still brought flame to the General's eyes. His raison d'être. The old eagle gaze swept the room, its four grey walls with their charted ballistic curves and maps and alternate attack plans ruled in red and yellow and black lines across the mottled blue of the maps.

"We have a room here 40 miles from Wash-

ington, D.C., Cutter. And we have weapons. You may be completely certain that the Enemy has a similar room. And similar launching sites, perhaps in the Urals, or perhaps in Siberia. But they have them and you can count on it they could blanket us with hydrogen bombs in a split twinkling. As we can them." .

"Intelligence never found their room or their sites, General," Cutter murmured.

"No more than their inspection teams have been able to locate this place — we hope. And what inspection team would dare go slinking through the bedroom of the Vice President's wife looking for a secret room? Faugh! Of course they have a room! An elementary tactic, Cutter."

"Well, General, if the exchange plan goes through, we'll have mass exchanges of peoples between the two countries with voting rights while in residence. Who'd have time to fight? And they'll be sending their top men here -- their leaders. What a struggle they'll have before they'll accept that provision!"

"Any overtures thus far may be a trick, Cutter. A sly trick."

Cutter shrugged and stared at the buttons. Superior or not, he was getting pretty sick of the General.

"Have you dusted, Cutter?" demanded the General.

"Sure," said Cutter, and then remembered to add the "Sir". The General donned a white glove and began poking behind the Number Three reserve computer. Cutter rolled his eyeballs at the ceiling. The alarm bell tinkled. Dynamite Joe Cutter donned his helmet and aimed the .45 at the door, dropping the .45 in the process and picking it up again. The General, watching, winced only slightly. His control was improving, even for a General, Joe decided.

The gray steel slab of door hissed up, revealing a closet interior carpeted with female-type shoes. The President stood among the pumps and sandals. He was a big, silver-haired man and he was smiling. Not a campaign smile, but a deep, happy smile. Joe smiled back. He liked the President. Whatever the guy's position, he really cared for all kinds of people. Little people like Joe. Joe figured the President even liked the General.

The President grinned at the .45. "Don't shoot, Joe," he said. "The Cold War is over. The exchange agreement is signed."

Joe couldn't help the stunned feeling. If they'd signed the exchange agreement, it meant no more wars. Really. No more desk with buttons. No more Dynamite Joe. Back to a $95 a week clerical job.

"Yes! Just like that! They've signed!" The President threw his handful of papers ceilingward and they sailed down like big snowflakes across the floor and over the Number Four reserve computer and even — Joe felt a kind of distaste at the sight — across the spotless desktop. The General departed from a posture of affability and began policing up the sheets of paper in a lost manner.

"It's not a trick," said the President into the silence.

The General was beginning to snap back. "Why not? We can't know until their people begin to arrive here."

"Of course," said the President, "And the first plane load left Kharkov this morning. Their Premier and the Party Secretary are aboard, and it'll be a kind of triumphal tour with stops en route."

The General marched to the President's side in dawning anger.

"That's no proof. We can't deactivate the room. Not yet. The program must run for at least two or three more years before we'll be sure."

"I can't take that chance, Hal," said the President. "If a truce team located this room now, there'd be a five minute war with nothing left standing on either side. I want it eliminated now -- immediately. I'm taking what you military people used to call a calculated risk."

"Calculated risk?" the General's face went turkey color and Joe noted that he was screaming, though in a military manner. "It's calculated insanity! If they've got weapons enough — why if they had two bombers, or two guided missiles, or -- two beanshooters, we'd be helpless. Helpless!"

Joe put his helmet back on. "Now, now, General," he said.

"Take that helmet off, you idiot," snarled the General. "For God's sake, Mr. President, be reasonable."

"We're deactivating this room, General. You are retiring as of today. They've given us their faith. Ye gods, their top men are already on that plane!"

"You've gone mad. This is what they've been waiting for." The General choked and tore at his collar. "Right now, we've got a compu-

(cont'd on page 36)

IBM ELECTRONIC DATA PROCESSING OPERATIONS IN THE MIDWEST

NEIL D. MACDONALD

Following the trend toward the automation of data processing and computing operations, more and more manufacturers, business firms, and scientific organizations are installing electronic data processing systems. Installations of such systems produced by International Business Machines Corporation throughout the country have increased sharply in the last year and a half; such machines are being applied to a wide variety of both scientific and commercial problems. In the Midwest alone, there are nearly a hundred of the company's "electronic giant brains" now at work, with many more on order.

IBM's computers include the large-scale IBM 701, 702, 704 and 705 Electronic Data Processing Machines, and the medium-scale IBM 650 Magnetic Drum Data Processing Machine.

Following are examples of the many fields in which IBM electronic data processing systems are being applied in the Midwest.

INSURANCE

A company that will probably be one of the biggest users of IBM data processing equipment in the fire and casualty insurance industry is State Farm Mutual Automobile Insurance Company of Bloomington, Illinois. This company will eventually use 24 IBM 650 Magnetic Drum Data Processing Machines. State Farm now has two of the machines installed in its home office, one each in two regional offices, and 20 on order for its 12 regional offices throughout the U. S. It is expected that deliveries will be completed in 1957.

State Farm's applications for the 650's include selective underwriting, automatic premium rating, policy reports and internal and external statistics.

The first 650 installed by an insurance company in the Chicago area is at the Zurich-American Insurance Companies. Its initial tasks include consolidation of collection data, and recording and classifying of transactions by branch, agent, and type of insurance. This 650 combines and accelerates operations formerly requiring four separate machines. Its use will be extended to recording of claims and preparation of loss ratios.

The Iowa Mutual Insurance Company, DeWitt, Iowa, uses its new 650, received early this spring, for automatic premium rating of automobile policies. This 650, the first in the fire and casualty field in Iowa, will handle myriads of insurance calculations at high speeds, enabling employees to be assigned to less routine and more creative work. This "electronic clerk" will also do payroll, unearned premium calculation, agents' commission computation and various statistical distribution summaries and analyses. Iowa Mutual plans to extend the machine's activities into the fire, burglary, general liability, and workmen's compensation divisions of the company.

Northwestern Mutual Life Insurance Company of Milwaukee, Wisc., plans to add a 650 to its present line of IBM equipment this summer. Initially the machine will compute annual dividends for more than 1,600,000 policies. Another application will be accounting and calculation of 80,000 mortgage loans, involving monthly payments of principal, interest and taxes.

Employers Mutuals of Wausau, Wisc., is putting a 650 into operation and expects it will greatly facilitate handling of voluminous records and statistics of the insurance business. Two initial applications are automobile policy rating and premium distribution reports.

An insurance company with a decentralized policy of operation, Hardware Mutuals, will begin using a 650 late this year, for premium, loss, and expense distribution figures necessary for internal company reporting, annual statement, tax purposes, and insurance bureau requirements. This company has 14 policywriting offices that send data to the home office in Stevens Point, Wisc., where it is converted to a medium that can be machine processed. Hardware Mutuals does all selling through 675 direct salesmen, and figures for any individual's territory will be obtainable very quickly with the 650.

The Royal Neighbors of America, Rock Island, Illinois, a fraternal life insurance company, uses a 650 to audit 4,700 camp reports per month, involving the processing of about half a million punched cards. Other systems to be converted to machine operation are automatic preparation of bond schedules for the annual statement, valuation of certificate reserves,

calculation of dividends, and the processing of the loan account.

Nationwide Insurance Company has a 650 in operation at its home office in Columbus, Ohio, used primarily to check rates on new policies and to determine rates on renewal policies. This information arrives at the home office via transceiver network from ten regional offices. The transceiver is an IBM machine which makes possible duplication of punched cards over telephone and telegraph facilities. The information received at Columbus is processed in the 650 and returned to the respective region where the results are punched in the same card originally used to transmit the policy information.

An IBM "giant," the 705 Electronic Data Processing Machine, is scheduled for installation this summer at the St. Paul Fire and Marine Insurance Company, St. Paul, Minnesota. The company plans to use the computer for accounting and statistical operations.

HOSPITALIZATION

Michigan Hospital-Medical Service has on order, for its general office in Detroit, a 705 which will be put to work on a gigantic task of up-dating records for 1,350,000 subscribers on a daily basis. Many complicated statistical reports, hitherto unobtainable or prohibitively expensive, will be made available.

MANUFACTURING AND HEAVY INDUSTRY

The International Harvester Company's motor truck division at Fort Wayne, Indiana, recently installed an IBM 705 to serve as a centralized data processor for four plants, including that of the farm tractor division in Louisville, Kentucky. In this installation, tremendous savings in time have been effected on such problems as cam design, bearing load, gas pressure and other engineering calculations.

The West Pullman Works of International Harvester Company, on Chicago's South Side, recently completed a year of 650 operation. Practically every commercial application common to manufacturing plants has been run on this 650 or is planned for the near future. West Pullman Works is part of the company's farm tractor division, manufacturing nine collateral products comprising 25,000 parts, for 29 other Harvester plants and other organizations.

The investigations section of the General Electric Company's aircraft gas turbine division is operating three large-scale IBM computers, one 701 and two 704's, the scientific counterparts of the 702 and 705. The investigations section gives mathematical and computational support to the aircraft gas turbine division of GE, and to all divisions of the company upon request. One of the 704's is at Lynn, Mass., and the other machines are in Cincinnati, where they occupy the country's first permanent industrial building designed solely to house computers. The 701 at Cincinnati will shortly be replaced by an additional 704.

The Evendale Operating Department of General Electric Company's jet engine plant near Cincinnati received delivery of a 650 last February. By March 5 the payroll of two departments had been completely converted from conventional machine accounting procedures to the 650. Other applications are being planned, including general ledgers, budget statements, and production scheduling.

General Electric Company's component motor department in Fort Wayne has a 650 which solves complex motor design problems and handles the weekly payroll and indirect manufacturing expense reports. The computation of 100 motor design variations, completed in three hours, would require more than six months with a desk calculator.

Minnesota Mining and Manufacturing Company will install an IBM 705 at its general office in St. Paul in September of this year. One of its first tasks will be the computation of sales statistics. Other assignments include raw and semi-finished materials inventory, payroll and operating expense reports.

The Magnavox Company, Fort Wayne, Indiana, is processing payroll and labor distribution in one hour and 15 minutes weekly on its 650. A manufacturing requirement computation, requiring 20 hours on conventional accounting machines, was recently done in just one hour, a saving of 95%. Later this 650 will be at work in the realm of higher mathematics, solving problems in the design of transformers, filters, and circuits.

The Bendix Products Division of Bendix Aviation Corporation, South Bend, Indiana, has a 650 on order. An involved factory payroll of 9,000 persons, including incentive, set-up and piece work labor, will be assigned to the 650, which is expected to take about 11 hours a week for the job. Various production control schedules, and machine load and engineering applications are also being programed.

A. O. Smith Corporation will put a 705 into operation in its Milwaukee home office next December. Applications: payroll of 6,500 persons, accounting for manufacturing operations in 10 scattered plants, and production control

functions relating to fabrication of 1,000,000 tons of steel annually.

One of the nation's largest manufacturers of heavy industrial equipment, the Harnischfeger Corporation of Milwaukee, has a 650 on order, to replace its present accounting machines. The new computer will do cost accounting, general and subsidiary ledger accounting, accounts payable and receivable, and a payroll of 6,000.

The Allis-Chalmers Manufacturing Company has an IBM 650 on order for their engineering computing laboratory at West Allis, Wisconsin. Transformer design problems, formerly processed on purchased time on a 650, will be one application, and many other technical problems in machinery product design, research and engineering will be solved.

The 650 at the Columbus, Ohio division of North American Aviation Inc. is used full time for all types of engineering calculations. Here, many engineers are trained in 650 coding, enabling each of them to program his own problems. A group of computer experts is available for consultation with the engineers to review methods of solution prior to processing.

General Motors Corporation's Frigidaire Division at Dayton, Ohio, is speeding up work schedules with two IBM 650's which are used in material requirements planning payroll and labor distribution, and cost of sales accounting. These applications were previously accomplished on conventional accounting machines. Frigidaire is also solving linear equations in research engineering with the 650's.

A 650 has recently been installed at the AC Spark Plug Division of General Motors in Flint, Michigan. It is used to process payrolls and maintain inventory control, and may later be applied to cost control and engineering research.

The Gardner-Denver Company, general offices in Quincy, Illinois, has on order a 650 to be used in complicated accounting and production control problems, and in design and scientific computations.

The first 650 to be delivered in Iowa went to the Collins Radio Company at Cedar Rapids, where it daily balances the manufactured parts inventory, prepares the weekly plant payroll, and analyzes measured work-day performance. Part of the 650's time is devoted to the engineering department, which makes use of analyses of electrical and mechanical networks and statistics.

Caterpillar Tractor of Joliet, Illinois, has a 650 installed and is using the machine to determine net and gross requirements in production planning.

Micro-Switch, a division of Minneapolis-Honeywell Regulator Company, Freeport, Illinois, has on order a 650 which will be used to process payroll, labor distribution, sales analysis, and inventory and production control.

Whirlpool-Seeger Corporation is awaiting delivery of a 650 for its Saint Joseph, Mich., division, and will utilize it to process its gross requirements and payroll.

Kellogg Switchboard Company in Chicago will get a 650 in August, to be used for payroll preparation.

The Solo Cup Company, also of Chicago, will receive a 650 in October. The initial applications will be order writing and payroll.

PUBLIC UTILITIES

Commonwealth Edison of Chicago is operating an IBM 702, the first in the public utility industry. Revenue accounting, including billing, accounts receivable, and credit and collection work, is accomplished on the machine. The utility's operations research group is exploring scientific approaches to management problems such as inventory control, coal logistics, and transformer studies with the aid of the computer. Eventually, the 702 will be replaced by the more powerful 705, and payroll and all other accounting work will be transferred to machine operation.

Detroit Edison Company, serving 1,200,000 customers in southeastern Michigan, is using two IBM 650's for calculation of customer bills and closely related operations, and for engineering and research problems.

Early in 1957 Detroit Edison expects to begin conversion of its entire customer accounting operations to an IBM 705. This will facilitate consolidation of various files pertaining to customers and the integration of customer accounting activities. Customer records will be maintained in the machine, which will analyze accounts for necessary action, render bills, apply payments, and prepare various reports.

EDUCATION AND SCIENCE

Ohio State University at Columbus has installed an IBM 650 as a step in the development of a high-speed electronic computer center. This installation represents the largest electronic digital computer so far available on a college campus in Ohio, and is expected to make substantial contributions in

the field of research and instruction. Work on contracts for research from machine tool and other companies will be another main application for the Ohio State 650.

The numerical analysis laboratory of the University of Wisconsin at Madison has a 650 which is used by most departments of the University of Wisconsin at Madison has a 650 which is used by most departments of the University in a variety of projects, ranging from roll call studies of the United States Senate to an analysis of light curves of eclipsing binary stars. About 100 students at the University are enrolled each year in courses in the theory and use of computing machinery, including the 650.

Cook Research Laboratories, devoted to basic research in physics, general electronics and other scientific fields, has a 650 at Skokie, Illinois, to aid its 250 engineers and 150 technicians, draftsmen, and model makers in the rapid solution of complicated equations associated with their work.

Armour Research Foundation has a 650 at its Chicago computing center. Approximately 90 per cent of the machine's time is taken up by engineering and scientific computation channeled to the computing center from nine Foundation research departments. The primary commercial application is preparation of payroll for the Foundation and the Illinois Institute of Technology, and programs are constantly being created to solve problems in government research projects.

TRANSPORTATION

The installation of a 650 in the Chicago accounting offices of the Illinois Central Railroad last year was a pioneer application of electronic computing to railroading. The 650 is adaptable to solving many railroad problems and enables Illinois Central to get out a complicated train and engine payroll within a few hours. The railroad recently installed a second 650.

The offices of the auditor of expenditures of the New York Central Railroad in Detroit has two 650's, now processing a complex 50,000-employee payroll. Future uses will include distribution of equipment, charges and preparation of accounts, and reports of payroll statistics.

The Rock Island Railroad has ordered two 650's, to be delivered this fall. The machines will go to work on payroll and freight car accounting.

GOVERNMENT

At Wilkins Air Force Depot at Shelby, Ohio, a 650 is being utilized to account for all Air Force property received, stored and shipped by the depot. The machine computes the dollar value of all transactions, the projected fiscal year budget, and estimates the volumes required for various buying programs and reviews the stock position of all items carried. This installation is expected to go on a three shift basis in the near future.

A 650 was placed in operation at the Topeka, Kansas, Air Force Depot last summer. It computes stock levels, predicts future stock needs and prepares inventories.

REFINING

A 650 which is expected to be extremely valuable in certain operations research problems and in engineering and process design studies is on order for Shell Oil Company's Wood River, Illinois, refinery. Plans are under way for processing cost and inventory accounting on the machine in addition to payroll for 4,000 employees at the location.

The Standard Oil Company (Ohio) has a 650 in its Cleveland office, and a 705 is scheduled for delivery in August. The 705 will help company management decide such questions as: where to open new gasoline stations; when to build another refinery; and how much to recommend that the board of directors should pay in stock dividends. It will also solve complicated engineering problems, and turn out in three days sales records that formerly took 27 days to produce. The 650 does many diverse jobs from solving complex chemical engineering equations to processing the company's payroll.

The Ohio Oil Company is operating a 650 at its general office in Findlay. Applications in general accounting include prorating of production expense, estimating of oil and gas reserves, calculation of depletion and depreciation for Federal income tax, and calculation of cash dividends for stockholders. The 650 also aids in processing the employees' savings plan and employees' home loans, and performs highly technical tasks such as determining yields from refinery processes. Eventually, Ohio Oil plans to process a 6,000-person payroll from time cards to checks. Further scientific analyses are also anticipated.

The Pure Oil Company has a 650 in operation at its general office in Chicago. The equipment processes crude oil run tickets from the initial tank gauging data through all calculations to the determination of royalty payments. It also processes the payroll of one of the company's refineries. In addition, the machine works for the research and development laboratories in Crystal Lake, Ill., which communicates its data 50 miles to the general office via IBM transceivers.

(cont'd on page 36)

Forum

COMPLAINT BY SPERRY-RAND CORPORATION IN ANTI-TRUST SUIT BROUGHT AGAINST INTERNATIONAL BUSINESS MACHINES CORPORATION

IN THE UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK

SPERRY RAND CORPORATION, a Corporation, Plaintiff, vs. INTERNATIONAL BUSINESS MACHINES CORP., a Corporation, Defendant.	CIVIL ACTION NO. 106-20

COMPLAINT

Plaintiff, Sperry Rand Corporation, by its attorneys, brings this action against defendant, International Business Machines Corporation, and complains and alleges as follows:

I.
PARTIES

1. Plaintiff Sperry Rand Corporation is a corporation organized and existing under the laws of the State of Delaware and has its principal office in the City of New York, State of New York. It is the successor corporation to Remington Rand Inc., a corporation organized under the laws of the State of Delaware, and the Sperry Corporation, a corporation organized under the laws of the State of Delaware, which corporations were consolidated as Sperry Rand Corporation on June 30, 1955. Since June 30, 1955, the business formerly conducted by Remington Rand Inc. has been and is being carried on by the Remington Rand Division of Sperry Rand Corporation. The Remington Rand Division of Sperry Rand Corporation has a principal office at 315 Fourth Avenue in the City of New York, State of New York. It is engaged, among other things, in the manufacture and distribution of tabulating machines.

2. Defendant International Business Machines Corporation is a corporation organized and existing under the laws of the State of New York with its principal office at World Headquarters Building, 590 Madison Avenue, New York City 22, New York. It, also, is engaged, among other things, in the manufacture and distribution of tabulating machines.

II.
JURISDICTION

3. This action is brought under the anti-trust laws of the United States and the jurisdiction of this court is invoked under Sections 1 and 2 of the Act of July 2, 1890, commonly known as the Sherman Antitrust Act (26 Stat. 209, 15 USC §§ 1 and 2); Sections 3, 4 and 16 of the Act of October 15, 1914, commonly known as the Clayton Antitrust Act (38 Stat. 731, 737; 15 USC §§ 14, 15 and 26); and the Act of June 25, 1948 (62 Stat. 931, 28 USC § 1337).

III.

4. The tabulating industry embraces (a) the manufacture of tabulating machines which functionally depend on punched holes in cards or paper tape or magnetic spots on plastic or metallic tape, (b) the distribution of such machines to government and business organizations, (c) the repair and maintenance of such machines, (d) the manufacture and distribution of repair and replacement parts for such machines, and (e) the use of tabulating machines for the sale of tabulating service both to users and nonusers of tabulating machines.

5. Tabulating machines are devices for recording on a unit or continuous basis, verifying, and automatically converting, classifying, computing, reproducing and printing alphabetic and numeric accounting and statistical information, as hereinafter described, by controlled mechanical, electrical or electronic means: The source data to be recorded is reduced to coded punched holes in cards or paper tape, or to coded magnetic spots on plastic or metallic tape which are read by the machines and influence the automatic machine processes.

6. The principal tabulating machines are:

(a) a manually or automatically operated recording punch whose principal purpose is to transcribe source data onto tabulating cards or paper tape in the form of punched holes; or a manually operated keyboard unit whose principal purpose is to transcribe source data onto plastic or metallic tape in the form of magnetic spots;

(b) a manually or automatically operated verifier whose principal purpose is to check the accuracy of the transcription of data onto tabulating cards or paper tape in the form of punched holes or onto plastic or metallic tape in the form of magnetic spots;

(c) a converter whose principal purpose is automatically to translate data either to or from punched holes in cards or paper tape or magnetic spots on plastic or metallic tape;

(d) a sorter whose principal function is automatically to assemble punched tabulating cards in desired classes or sequences;

(e) a collator whose principal function is automatically to match or merge separate sets of punched tabulating cards;

(f) a calculating punch whose principal function is automatically to perform addition, subtraction, multiplication or division or any combination of such operations;

(g) a reproducing punch whose principal function is automatically to duplicate data or record summary data in the form of punched holes in tabulating cards;

(h) a printer whose principal function

is automatically to summarize and record on paper data which is stored in the form of punched holes in tabulating cards or paper tape or in the form of magnetic spots on plastic or metallic tape; and

(i) a general or special purpose digital computer, activated by punched holes in tabulating cards or paper tape or by magnetic spots on plastic or metallic tape, which by electronic means performs any, some or all of the functions performed by the machines described in subparagraphs (b) through (h) hereof.

There are variations of the principal tabulating machines as well as auxiliary machines and attachments which are used to perform special functions. These principal machines or some variation thereof, together with auxiliary machines and attachments, are used in groups, combinations or systems to obtain accounting and statistical results.

7. The tabulating machines described in paragraph 6 hereof perform their automatic functions mechanically, electrically or electronically, or by combination thereof. Mechanical tabulating machines perform their automatic functions primarily by mechanical action, and derive source data from punched cards under control of small pins which penetrate holes in the cards. Electrical tabulating machines perform their automatic functions primarily under electrical control, and derive source data from punched cards under control of electrical circuits which are completed by brushes that penetrate holes in the cards. Electronic tabulating machines perform their automatic functions primarily by electronic componentry and circuitry control, and derive source data from punched holes in tabulating cards or paper tape or from magnetic spots on plastic or metallic tape under control of circuits which are completed by brush or photo-electric cell sensing or by magnetic reading-recording heads.

IV.
DEVELOPMENT OF THE INDUSTRY

8. Electrical tabulating machines were invented about 1880. The first commercial electrical machines computed numerical information only and were used initially by the government in the preparation of the Census of 1890. In this period the machines could not print, but could merely compute and indicate numerical data.

9. The first commercial mechanical tabulating machines were capable of printing, as well as computing, numerical data. They were initially used by the government in the preparation of the Census of 1910 and were first used by private industry about 1913. They were applicable to substantially the same uses as electrical tabulating machines, which, about 1923, were also improved to print numerical data.

10. About 1932 electrical and mechanical tabulating machines were further improved to enable them to print alphabetical as well as numerical data. This development expanded their basically statistical and accounting functions and made them capable of preparing and addressing detailed billings, policy notices, and stockholders' forms, and of preparing entire statistical, planning and accounting reports. As thus improved, tabulating machines enable large governmental and business units to carry on numerous transactions requiring communication among themselves and with others and to collect, analyze and disseminate automatically and expeditiously the great masses of information necessary for efficient business operations.

11. Until the early 1930's the tabulating cards most commonly used with both electrical and mechanical tabulating machines were 45-column cards. They were uniform in size and were printed on one side with numerals uniformly spaced and arranged in 45 columns. Source data was transcribed to all 45-column cards by punching round holes in accordance with a single hole code. The cards could be used interchangeably with either electrical or mechanical tabulating machines. As a result, it was possible to replace any machine in one installation by a corresponding machine from the other type of installation; it was also possible to replace an entire installation of tabulating machines; whatever the replacement, the 45-column cards served equally as well for the new tabulating installation.

12. After the development of alphabetical tabulating machines in the early 1930's, cards of larger capacity were needed. Cards with a capacity of 80 columns became those most commonly used with electrical tabulating machines, manufactured by defendant, and cards with a capacity of 90 columns became those most commonly used with mechanical tabulating machines, manufactured by plaintiff. The shape of the hole punched in 80-column cards for use in electrical tabulating machines was made rectangular, whereas round holes continued to be punched in the 90-column cards used with mechanical tabulating machines. As a result of these changes neither type of punched tabulating cards could be used interchangeably in both electrical and mechanical tabulating machines.

13. Because of these and other differences between 80-column and 90-column tabulating cards, a tabulating machine capable of use in one tabulating installation cannot be substituted for a similar machine in the other tabulating installation. Only an entire installation of the tabulating machines using 80 or 90-column cards can replace an installation using 90 or 80-column cards. When one installation has been replaced by the other, and it is desired to prepare reports based upon the cards used with the prior installation, the data recorded on such cards must be transferred to a new set of cards either manually or automatically by means of a converter.

14. In recent years the development of electronic tabulating devices and components and the resultant increase of processing speed and capacity has necessitated the development and use of punched paper tape and plastic and metallic tape which supplement or supersede punched cards for recording data and for influencing the automatic tabulating machine processes. Source data is stored in a continuous manner on paper tape in the form of coded punched holes, or on

plastic or metallic tape in the form of coded magnetic spots. Various codes may be utilized depending on the number of information channels contained on the tape and on the particular electronic tabulating machine in connection with which it is used. The data so stored on tape, when read by the electronic tabulating machines, influence the automatic processes and thereby achieve results identical with those obtainable by the use of data stored on punched cards.

15. From 1935 to date there has been a great increase in the use of tabulating machines. Along with the growth of business and governmental units, there has developed a greater need for collecting, collating and communicating information. This need has been filled, in part, by tabulating machines which are continuously being adapted to new uses. The experience of business and governmental units has proved that tabulating machines are of vital importance to the solution of control and planning aspects of economic, administrative, materiel and personnel problems. This is especially true among such organizations as large public utilities, banks and life insurance companies, manufacturing and publishing concerns, and agencies of federal, state and municipal government, including law enforcement, tax collecting and old age assistance agencies.

IV.
INTERSTATE TRADE AND COMMERCE INVOLVED

16. Defendant manufactures electrical and electronic tabulating machines at its factories in Endicott, Poughkeepsie and Kingston, New York. It manufactures repair and replacement parts for its tabulating machines at such factories and reconditions its tabulating machines at these and other locations throughout the United States. It or a predecessor corporation has been engaged in the manufacture of electrical tabulating machines since 1905. It has been engaged in the manufacture of electronic tabulating machines since 1952.

17. The tabulating machines and repair and replacement parts manufactured by defendant move in interstate commerce from its factories in the State of New York to the places of business of users located throughout the United States. Such movement is effected either directly or by distribution through defendant's approximately 300 so-called sales offices throughout the United States, or its approximately 500 maintenance and repair service offices throughout the United States.

18. Defendant has not sold and will not sell its tabulating machines to anyone. It maintains, and for many years has maintained, the policy of leasing its tabulating machines to users. No person may use defendant's tabulating machines unless they are leased.

19. Defendant now owns, and for more than ten years preceding the filing of this complaint, has owned substantially all of the electrical tabulating machines in the United States. Defendant now owns a major portion of all the electronic tabulating machines in use in the United States. The electrical and electronic tabulating machines owned by defendant and presently in use in the United States comprise over 90% of all tabulating machines now in use in the United States.

20. The annual rental received by the defendant for use of its tabulating machines is presently in excess of $200,000,000. In the intervening years between 1950 and the filing of this complaint there has been a steady and continuing increase in the annual rentals received by defendant amounting to approximately 20% per annum more than the rentals received by it during each preceding year. During the period from 1948 to 1950 such annual rental amounted to more than $100,000,000.

21. Plaintiff manufactures mechanical, electrical and electronic tabulating machines at its factories in Ilion and Elmira, New York, Philadelphia, Pennsylvania, and St. Paul, Minnesota. It manufactures repair and replacement parts at such factories and reconditions its tabulating machines at these and other locations throughout the United States. It or a predecessor corporation has been engaged in the manufacture of mechanical tabulating machines since 1911, and of electric and electronic tabulating machines since 1947.

22. Tabulating machines manufactured and sold or leased by plaintiff now comprise and for more than ten years preceding the filing of this complaint have comprised less than 10% of all tabulating machines in use in the United States.

23. The total annual revenue received by plaintiff from the lease and sale of its tabulating machines is presently less than $17,000,000. In each of the years 1948 to 1950 its annual revenue from the lease and sale of tabulating machines was substantially less than $10,000,000. While there has been a small annual increase in plaintiff's revenues from the lease and sale of tabulating machines between 1950 and 1955, plaintiff's relative position in the tabulating machine industry during this period has been constantly decreasing.

24. Plaintiff's tabulating machines are offered to users throughout the United States in competition with the defendant's tabulating machines. Plaintiff's tabulating machines, however, are and since 1934 have been sold or offered for sale, as well as leased or offered for lease, to users or potential users of tabulating machines. Users may purchase or lease plaintiff's tabulating machines as they so choose.

VI.
VIOLATIONS AND EFFECTS THEREOF

25. For many years, and within the applicable statutory period of limitation of actions (15 USC § 16) — beginning six years prior to the filing on January 21, 1952, of the complaint of the United States of America against defendant in the United States District Court for the Southern District of New York (Civil Action No. C-72-344, still pending):

(a) Defendant has, as also charged by the United States of America in said complaint, wrongfully and unlawfully entered into contracts or combinations in unreasonable restraint of the hereinbefore described interstate trade and commerce in the manufacture, distribution, lease and

sale of tabulating machines and of repair and replacement parts for use in such machines, in violation of Section 1 of the Sherman Antitrust Act, 15 USC § 1, and to the injury of the public generally and of the plaintiff in particular;

(b) Defendant has, as also charged by the United States of America in said complaint, wrongfully and unlawfully attempted to monopolize, monopolized, and is continuing to monopolize the hereinbefore described interstate trade and commerce in the manufacture, distribution, lease and sale of tabulating machines and of repair and replacement parts for use in such machines, in violation of Section 2 of the Sherman Antitrust Act, 15 USC § 2, and to the injury of the public generally and of the plaintiff in particular, and

(c) Defendant has leased and entered into contracts for the lease of tabulating machines and of repair and replacement parts for use in such machines, on the condition, agreement, or understanding that the lessee thereof shall not purchase, lease or use tabulating machines manufactured by plaintiff or any other competitor of the defendant, and shall not use or purchase or lease for use in tabulating machines of defendant repair and replacement parts manufactured by plaintiff or any other competitor of the defendant, the effect of which has been substantially to lessen competition and to tend to create a monopoly in the interstate trade and commerce in the manufacture, distribution, lease and sale of tabulating machines and of repair and replacement parts for use in such machines, in violation of Section 3 of the Clayton Antitrust Act, 15 USC § 14, and to the injury of the public generally and of the plaintiff in particular.

26. Defendant has consistently and without deviation adhered to a policy of leasing rather than selling its tabulating machines. This policy has been adopted and adhered to with the purpose or effect of preventing lessees of defendant's machines from purchasing or leasing plaintiff's tabulating machines.

27. Defendant has leased its tabulating machines on condition that the lessee agree to lease and use only tabulating machines manufactured by defendant and not to lease, purchase or use tabulating machines manufactured by others. The purpose or effect of such leases has been to prevent lessees of defendant's tabulating machines from leasing or purchasing tabulating machines manufactured by plaintiff.

28. Defendant has refused to permit tabulating machines manufactured by others to be used in conjunction with its tabulating machines or to permit attachments manufactured by others to be placed on its tabulating machines. The purpose or effect of such refusals has been to prevent lessees of defendant's tabulating machines from leasing or purchasing tabulating machines or attachments manufactured by the plaintiff.

29. Defendant has offered or given to users or prospective users interested in purchasing or leasing plaintiff's tabulating machines preferential treatment including, but not limited to, rebates, furnishing tabulating machines without rental during peak periods, waiver of extra shift charges, reduction of rentals during slack periods, giving free trial uses for extended periods of time. The purpose or effect of such preferential treatment has been to prevent such users or prospective users from leasing or purchasing tabulating machines manufactured by plaintiff.

30. Defendant has systematically acquired developments, inventions and patents made or owned by others relating in any way to tabulating machines (1) that might form the basis for a competing full line of tabulating machines, or (2) that might possess present or future nuisance value against actual or potential competitors, or (3) that might be of any possible present or future value to defendant in its own tabulating machines or in those of actual or potential competitors. The purpose or effect of such acquisitions has been to prevent plaintiff from acquiring such patents or to discourage plaintiff from manufacturing competing tabulating machines.

31. Defendant has opposed the issuance to plaintiff and others of patents relating to electrical or electronic tabulating machines by systematically engaging in interference proceedings in the United States Patent Office. The purpose or effect of such opposition has been to prevent, hinder or delay plaintiff and others in processing patent applications relating to such tabulating machines.

32. Defendant has utilized patents to fence in and block off plaintiff and others. The purpost or effect of such utilization of patents has been to prevent or impede plaintiff from manufacturing competing electrical and electronic tabulating machines.

33. Defendant has refused to grant licenses under its patents relating to electrical and electronic tabulating machines, except to lessees of its machines or under onerous conditions, including grant backs. The purpose or effect of such refusals has been to prevent plaintiff from acquiring patents or rights under them.

34. Defendant has preempted the services of inventors active in fields in which inventions may be useful in the manufacture of tabulating machines by employing such inventors on a long term exclusive retainer basis. The purpose or effect of such conduct has been to preclude the employment of such inventors by plaintiff.

35. Defendant has entered into contracts, agreements or understandings with persons or independent organizations engaged in electrical and electronic research or development whereby defendant obtains exclusive rights to discoveries or inventions relating to or useful in the development or manufacture of electrical or electronic tabulating machines or components thereof. The purpose or effect of such contracts, agreements or understandings has been to deprive plaintiff of access to such discoveries or inventions.

36. Defendant has refused to permit its

tabulating machines to be used for experimental purposes. The purpose or effect of such refusal has been to prevent plaintiff from developing new or improved tabulating machines.

37. Defendant has stressed or used its monopoly position and its high percentage of the market to persuade prospective users that its tabulating machines are superior to plaintiff's. The purpose or effect of such conduct has been to induce such prospective users not to lease or purchase plaintiff's tabulating machines.

38. Defendant has stressed or used its monopoly position and its extensive installations of tabulating machines in identical or similar industries to persuade prospective users that it has greater experience in resolving the tabulating problems of such industries. The purpose or effect of such conduct has been to induce such prospective users not to purchase or lease plaintiff's tabulating machines.

39. Defendant has stressed or used its monopoly position and its extensive installations of tabulating machines in all areas of the country and all segments of the economy to persuade prospective users that standby equipment will be available in the event of a breakdown of tabulating machines leased by such prospective users. The purpose or effect of such conduct has been to discourage such prospective users, especially in areas in which few or none of plaintiff's tabulating machines are in operation, from purchasing or leasing plaintiff's tabulating machines.

40. Defendant has persuaded users or prospective users of tabulating machines to transmit or receive data on punched tabulating cards to or from suppliers, customers, trade associations, rating bureaus, banks, governmental agencies or others as a means of exchanging information, compiling statistics, fixing rates or otherwise assimilating or using such data and, in conjunction therewith, has stressed or used its monopoly position and its extensive installations of tabulating machines to influence such users to standardize on defendant's tabulating machines. The purpose or effect of such conduct has been to induce such users not to purchase or lease plaintiff's tabulating machines.

41. Defendant has offered to lease and has entered into agreements to lease tabulating machines of a type or model which is not yet in production and for which it is not ready to commence production. The purpose or effect of such conduct has been to induce prospective users not to purchase or lease tabulating machines presently being manufactured by plaintiff.

42. Defendant has offered or agreed to make delivery of tabulating machines on or before a date on which it could reasonably expect to make such delivery and in some instances has agreed to pay substantial liquidated damages for failure to make such delivery. The purpose or effect of such conduct has been to induce prospective users not to purchase or lease tabulating machines manufactured by plaintiff.

43. Defendant has maintained and operated more than 75 service bureaus in the principal cities of the United States. The purpose or effect of maintaining and operating these service bureaus has been to preempt the available demand for tabulating service by nonusers of tabulating machines and by users of defendant's tabulating machines who require additional tabulating service at times of peak loads and on other occasions, thereby limiting the market for lease or sale of plaintiff's tabulating machines.

44. Defendant has refused (1) to make separate charges for rentals, maintenance, service, and repair or replacement parts, and instead has included them in its regular rental charge, (2) to sell its repair or replacement parts to independent service or repair organizations or men, (3) to furnish its manuals or books of instructions relating to the operation, maintenance or repair of its tabulating machines to independent service or repair organizations or men, and (4) to permit independent service or repairmen to attend its training or service schools. The purpose or effect of such refusals has been to discourage and prevent the development and growth of competing organizations for servicing and maintaining tabulating machines, thereby preventing the purchase or lease of plaintiff's tabulating machines by prospective users in areas in which, due to the limited number of plaintiff's tabulating machines in use, it is not economical to maintain a repair or service organization solely for plaintiff's tabulating machines.

45. Defendant has made misrepresentations favorable to the tabulating machines it manufactures and unfavorable to the tabulating machines manufactured by the plaintiff. The purpose or effect of these misrepresentations has been to induce prospective users to use tabulating machines manufactured by the defendant and not to use tabulating machines manufactured by plaintiff.

46. Defendant has tampered or interfered with the efficient normal operation of tabulating machines manufactured by the plaintiff. The purpose or effect of such conduct has been to discourage users of tabulating machines manufactured by the plaintiff from continuing to use them and to induce such users to use tabulating machines manufactured by the defendant.

47. Defendant has induced users or prospective users by threats, express or implied, or other form of coercion, to lease tabulating machines manufactured by the defendant and not to lease or purchase tabulating machines manufactured by the plaintiff.

48. Defendant has refused or threatened to refuse to continue to purchase supplies from a user or prospective user of tabulating machines, unless it in turn uses tabulating machines manufactured by the defendant and refuses to use tabulating machines manufactured by the plaintiff.

49. Officers, directors or employees of defendant have served as officers, directors or employees of, or consultants to users or prospective users of tabulating machines. The defendant has caused or permitted such persons so

to serve with the purpose or effect of inducing such users to use tabulating machines manufactured by the defendant and not to use tabulating machines manufactured by the plaintiff.

50. Officers, directors, employees or consultants of users or prospective users of tabulating machines have served as officers, directors, employees or consultants of defendant. The defendant has caused or permitted such persons so to serve with the purpose or effect of inducing such users to use tabulating machines manufactured by defendant and not to use tabulating machines manufactured by plaintiff.

51. Officers, directors, employees or consultants of defendant have served as experts on boards or panels established for the purpose of evaluating the needs of actual or prospective users of tabulating machines, or of determining the capacity, quality, suitability or value of tabulating machines with reference to such needs. Defendant has caused or permitted such persons so to serve with the purpose or effect of inducing such users to use tabulating machines manufactured by the defendant and not to use tabulating machines manufactured by the plaintiff.

52. Officers, directors, employees or consultants of defendant have participated with governmental agencies in the preparation of bids, plans and specifications for tabulating machines to be procured by governmental agencies. Defendant has caused or permitted such persons so to serve with the purpose or effect of causing the tabulating machines manufactured by defendant to be favored, thereby precluding the use of tabulating machines manufactured by the plaintiff.

53. Defendant has induced engineering consultants, accounting firms, management counsellors and others similarly situated, to recommend to their clients the use of tabulating machines manufactured by defendant and not to recommend the use of tabulating machines manufactured by plaintiff.

54. Defendant has pursued and continues to pursue the practices, activities, conduct and policies alleged in paragraphs 26 through 53, inclusive, among other things, in furtherance or effectuation of the violations of law alleged in paragraph 25 hereof.

55. As a proximate result of defendant's hereinbefore described unlawful activities, the public has been deprived of the benefits of free and unrestrained competition in the manufacture, distribution, lease and sale of tabulating machines and repair and replacement parts for such machines, and the plaintiff has suffered damage to its business and property in the sum of $30,000,000. Furthermore, defendant's unlawful activities will continue to the further damage of the public and of plaintiff unless enjoined.

VII.
RELIEF

WHEREFORE plaintiff prays:

1. That the court adjudge and decree that defendant has substantially lessened competition and has unreasonably restrained, has attempted to monopolize and has monopolized interstate trade and commerce in the manufacture, distribution, lease and sale of tabulating machines and repair and replacement parts for such machines in violation of Sections 1 and 2 of the Sherman Act and Section 3 of the Clayton Act;

2. That an injunction issue restraining defendant, its officers, directors, employees, agents, representatives and successors from unreasonably restraining and from attempting to monopolize and monopolizing the hereinbefore described trade and commerce and from engaging in the unlawful practices alleged in paragraphs 26 through 53, inclusive;

3. That the court enter such further orders as may be necessary and appropriate in order to dissipate the effects of the violations herein complained of and to restore free and open competition in the manufacture, distribution, lease and sale of tabulating machines and repair and replacement parts for such machines;

4. That a judgment be entered in favor of the plaintiff in the sum of $90,000,000, being, in accordance with applicable provisions of law, three times the amount of its damage;

5. That the court allow, and that the defendant be required to pay, the full costs of this suit, including as a part thereof a reasonable fee for the services of plaintiff's attorneys; and

6. That the plaintiff be granted such other, further and different relief as the nature of the case may require and as may seem just and appropriate to this court.

Francis J. McNamara
315 Fourth Avenue
New York 10, New York
Attorney for Plaintiff

Bergson & Borkland
World Center Building
Washington 6, D.C.

Frost & Towers
Southern Building
Washington 5, D.C.

Frank C. Sterck
1615 L Street, N. W.
Washington 6, D.C.

Of Counsel

Forum

ANSWER AND COUNTERCLAIM
BY INTERNATIONAL BUSINESS MACHINES CORPORATION IN
ANTI-TRUST SUIT BROUGHT BY SPERRY RAND CORPORATION

IN THE
UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF NEW YORK

SPERRY RAND CORPORATION, a Corporation,
Plaintiff,
--against--
INTERNATIONAL BUSINESS MACHINES CORPORATION, a Corporation,
Defendant.

CIVIL ACTION NO. 106-20

ANSWER

Defendant answers the complaint herein as follows:

1. States that it is without knowledge or information sufficient to form a belief as to the truth of each and every averment contained in the last sentence of paragraph 1 of the complaint.

2. Denies each and every averment contained in the last sentence of paragraph 2 of the complaint; and further answering avers that defendant is engaged, among other things, in the manufacture and distribution of punched card accounting machines and electronic data processing machines.

3. Denies each and every averment contained in paragraph 3 of the complaint, except that the complaint purports to bring this action under the antitrust laws of the United States and purports to invoke the jurisdiction of this court under the Acts averred in said paragraph.

4. Denies each and every averment contained in paragraph 4 of the complaint; and further answering avers that there is not any industry which properly can be denominated "the tabulating industry" as averred and defined in said paragraph.

5. Admits the averments contained in paragraph 5 of the complaint, except denies that the machines described in said paragraph are tabulating machines; and further answering avers that the machines described in said paragraph are types of punched card accounting machines or electronic data processing machines.

6. Admits the averments contained in paragraph 6 of the complaint, except denies that the machines described in said paragraph are the principal tabulating machines; and further answering avers that the machines described in said paragraph are types of punched card accounting machines or electronic data processing machines.

7. Admits the averments contained in paragraph 7 of the complaint, except denies that the machines described in paragraph 6 of the complaint are tabulating machines, and that the machines described in paragraph 7 of the complaint are mechanical tabulating machines, electrical tabulating machines and electronic tabulating machines; and further answering avers that the machines described in paragraphs 6 and 7 of the complaint are punched card accounting machines or electronic data processing machines which perform their automatic functions mechanically, electrically or electronically, or by combination thereof, as described in part in said paragraph 7.

8. Admits the averments contained in paragraph 8 of the complaint, except denies that the first commercial electrical tabulating machines computed numerical information; and further answering avers that the first commercial electrical tabulating machines could only count, add and indicate numerical data.

9. Admits the averments contained in paragraph 9 of the complaint, except denies that the first commercial mechanical tabulating machines were capable of computing numerical data, and except states that it is without knowledge or information sufficient to form a belief as to the truth of the averment that the first commercial mechanical tabulating machines were first used by private industry about 1913; and further answering avers that the first commercial mechanical tabulating machines could only count, add and print numerical data.

10. Denies each and every averment contained in paragraph 10 of the complaint, except that, upon information and belief, mechanical tabulating machines were improved to enable them to print alphabetic as well as numerical data after which electrical tabulating machines were likewise so improved, and except that these and other developments expanded their basically statistical and accounting functions and made them capable of preparing and addressing detailed billings, policy notices and stockholder's forms, and of preparing entire statistical, planning and accounting reports; and further answering avers that the aforesaid developments so altered the utility and use of tabulating machines that they were in fact accounting machines and accordingly they became known as and are more properly described as punched card accounting machines, and the machines known as tabulating machines have become practically obsolete.

11. Denies each and every averment contained in the fourth and fifth sentences of paragraph 11 of the complaint, except that: 45-column cards manufactured for use with electrical tabulating machines could be used interchangeably with either electrical or mechanical tabulating machines; as a result, it was possible to replace any machine in an electrical tabulating machine installation by a corresponding machine from the other type of installation; and it was also possible to replace an entire installation of electrical tabulating machines.

12. Denies each and every averment contained in paragraph 12 of the complaint, except that: in the early 1930's cards with a capacity of 80 columns became those most commonly used with the

electrical punched card accounting machines manufactured by defendant and cards with two decks, one upper and one lower and each with 45 columns, or a total capacity of 90 columns, became those most commonly used with mechanical punched card accounting machines; the shape of the hole punched in 80-column cards used with defendant's machines, of practical necessity, was rectangular; round holes continued to to be punched in 90-column cards; and the two types of cards could not be used interchangeably in electrical and mechanical machines.

13. Denies each and every averment contained in the first and second sentences of paragraph 13 of the complaint, except that because of these and other differences between 80-column and 90-column cards, a punched card accounting machine capable of use in one punched card accounting system cannot be substituted for a similar machine in the other punched card accounting system.

14. Denies each and every averment contained in paragraph 14 of the complaint, except that: in recent years the development of electronic devices and components and the resultant increase of processing speed and capacity has encouraged the development and use of specialized plastic and metallic tape and the use of punched paper tape to supplement or supersede punched cards for recording data and for influencing the automatic processes of electronic data processing machines; source data is stored in a continuous manner on paper tape in the form of coded punched holes, or on plastic or metallic tape in the form of coded magnetic spots; various codes may be utilized depending on the number of information channels contained on the tape and on the particular electronic data processing machine in connection with which it is used; the data so stored on tape, when read by the electronic data processing machines, influence the automatic processes and thereby achieve results identical with those obtainable by the use of data stored on punched cards.

15. Denies each and every averment contained in paragraph 15 of the complaint, except that: from 1935 to date there has been a great increase in the use of punched card accounting machines and, more recently, electronic data processing machines; along with the growth of business and governmental units, there has developed a greater need for collecting, collating and communicating information; this need has been filled, in part, by punched card accounting machines and electronic data processing machines which are continuously being adapted to new uses; and the experience of business and governmental units has proved that punched card accounting machines and electronic data processing machines may be utilized in the solution of control and planning aspects of economic, administrative, materiel and personnel problems.

16. Denies each and every averment contained in paragraph 16 of the complaint, except that defendant manufactures punched card accounting machines and electronic data processing machines at its factories in Endicott and Poughkeepsie, New York, and electronic data processing machines at its factory in Kingston, New York, and manufactures repair and replacement parts for said machines at such factories and reconditions said machines at Endicott, Poughkeepsie and other locations throughout the United States, and that it or a predecessor corporation was engaged in the manufacture of electrical tabulating machines beginning in 1905, has been engaged in the manufacture of punched card accounting machines since the early 1930's and has been engaged in the manufacture of electronic data processing machines since 1952.

17. Denies each and every averment contained in paragraph 17 of the complaint, except that the punched card accounting machines and electronic data processing machines and repair and replacement parts manufactured by defendant move in interstate commerce from its factories in the State of New York to the places of business of users located throughout the United States, and that such movement of machines is effected either directly or by distribution through defendant's 182 branch sales offices in the continental United States, and such movement of parts is effected additionally by distribution through defendant's 74 service sub-offices in the continental United States.

18. Denies each and every averment contained in paragraph 18 of the complaint, except that defendant for many years has maintained the policy of leasing its punched card accounting machines and electronic data processing machines to users.

19. States that it is without knowledge or information sufficient to form a belief as to the truth of each and every averment contained in paragraph 19 of the complaint; and further answering avers that the machines manufactured by defendant are not and properly cannot be denominated "tabulating machines".

20. Denies each and every averment contained in paragraph 20 of the complaint, except that: the annual rental received by defendant for use of its punched card accounting machines and electronic data processing machines is presently in excess of $200,000,000; in the intervening years between 1950 and the filing of the complaint herein there has been a continuing increase in the annual rentals received by defendant; and during the period from 1948 to 1950 such annual rental amounted to more than $100,000,000.

21. States that it is without knowledge or information sufficient to form a belief as to the truth of each and every averment contained in paragraph 21 of the complaint.

22. States that it is without knowledge or information sufficient to form a belief as to the truth of each and every averment contained in paragraph 22 of the complaint.

23. States that it is without knowledge or information sufficient to form a belief as to the truth of each and every averment contained in paragraph 23 of the complaint.

24. States that it is without knowledge or information sufficient to form a belief as to the truth of each and every averment contained in paragraph 24 of the complaint, except that plaintiff

offers punched card accounting machines and electronic data processing machines, as well as other machines, to some users in the United States in competition with defendant's punched card accounting machines and electronic data processing machines.

25. Denies each and every averment contained in paragraph 25 of the complaint.

26. Denies each and every averment contained in paragraph 26 of the complaint, except that defendant usually has leased rather than sold its punched card accounting machines and electronic data processing machines.

27. Denies each and every averment contained in paragraph 27 of the complaint.

28. Denies each and every averment contained in paragraph 28 of the complaint, except that defendant's lease agreements with its lessees pertaining to defendant's punched card accounting machines or electronic data processing machines have provided as follows: Prior to May 17, 1950, said lease agreements provided that no alteration in or attachment to defendant's machines were to be made by the lessee without the prior consent of defendant; from May 17, 1950, to November 19, 1954, defendant's said lease agreements provided that alterations in or attachments to defendant's machines might be made upon prior written notice to defendant, unless the alteration or attachment would interfere with or affect the operation or maintenance service of the machine or the primary purpose for which it was designed or would infringe patent rights; and from and after November 19, 1954, defendant's said lease agreements provided that alterations in or attachments to defendant's machines might be made upon prior written notice to defendant.

29. Denies each and every averment contained in paragraph 29 of the complaint.

30. Denies each and every averment contained in paragragh 30 of the complaint.

31. Denies each and every averment contained in paragraph 31 of the complaint.

32. Denies each and every averment contained in paragraph 32 of the complaint.

33. Denies each and every averment contained in paragraph 33 of the complaint.

34. Denies each and every averment contained in paragraph 34 of the complaint.

35. Denies each and every averment contained in paragraph 35 of the complaint, except that defendant has entered into contracts with persons or with organizations engaged in electrical and electronic research or development whereby defendant was to obtain exclusive rights to discoveries or inventions relating to or useful in the development or manufacture of electrically actuated punched card accounting machines or electronic data processing machines or components thereof resulting from work to be performed by such persons or organizations and paid for by defendant pursuant to said contracts.

36. Denies each and every averment contained in paragraph 36 of the complaint, except that until May 1950, defendant's lease agreements with its lessees were terminable by defendant if the leased machines were used for any purpose not disclosed to defendant before the use was made or if the leased machines were used for experimental work, except that such agreements with the United States Government did not contain a cancellation clause but provided that the leased machines would not be used for experimental purposes.

37. Denies each and every averment contained in paragraph 37 of the complaint, except that defendant has truly stated to interested prospective users facts with respect to the use of its punched card accounting machines and electronic data processing machines by others.

38. Denies each and every averment contained in paragraph 38 of the complaint, except that defendant has truly stated to interested prospective users facts with respect to the use of its punched card accounting machines and electric data processing machines in identical or similar industries.

39. Denies each and every averment contained in paragraph 39 of the complaint, except that defendant has truly stated to interested prospective users facts with respect to the installation of its punched card accounting machines and electronic data processing machines in certain areas of the country.

40. Denies each and every averment contained in paragraph 40 of the complaint, except that defendant has made known to users or interested prospective users of punched card accounting machines and electronic data processing machines the advantages of transmitting or receiving data on punched cards to or from suppliers, customers, trade associations, rating bureaus, banks, governmental agencies or others as a means of exchanging information, compiling statistics, fixing rates or using such data, and, in conjunction therewith, has truly stated to such users or prospective users facts with respect to the use of its punched card accounting machines and electronic data processing machines by others.

41. Denies each and every averment contained in paragraph 41 of the complaint, except that defendant has offered to lease and has entered into agreements to lease punched card accounting machines and electronic data processing machines of a type or model which was not yet in assembly line production.

42. Denies each and every averment contained in paragraph 42 of the complaint, except that defendant in one instance agreed to pay substantial liquidated damages for failure to make delivery on or before specified date; and further answering avers that delivery in the said instance was made before the date specified therefor.

43. Denies each and every averment contained in paragraph 43 of the complaint, except that defendant has maintained and operated more than 75

service bureaus in the principal cities of the United States.

44. Denies each and every averment contained in paragraph 44 of the complaint, except that defendant has not made separate charges for rentals, maintenance, service, and repair or replacement parts with respect to the lease of its machines.

45. Denies each and every averment contained in paragraph 45 of the complaint.

46. Denies each and every averment contained in paragraph 46 of the complaint.

47. Denies each and every averment contained in paragraph 47 of the complaint.

48. Denies each and every averment contained in paragraph 48 of the complaint.

Denies each and every averment contained in paragraph 49 of the complaint, except that: officers of defendant have served as directors of users or prespective users of punched card accounting machines and electronic data processing machines; directors of defendant have served as officers or directors of users or prospective users of such machines; employees of defendant have served as directors of users or prospective users of such machines; and officers and employees of defendant have consulted with users or prospective users of punched card accounting machines and electronic data processing machines in the normal business course of promoting the efficient use of defendant's machines.

50. Denies each and every averment contained in paragraph 50 of the complaint, except that: officers of users or prospective users of punched card accounting machines or electric data processing machines have served as directors of defendant; directors of users or prospective users of such machines have served as officers and directors of defendant; and consultants to users or prospective users of such machines have served as consultants to defendant.

51. Denies each and every averment contained in paragraph 51 of the complaint, except admits that employees of defendant have served on boards or panels established for the purpose of evaluating the needs of actual or prospective users of defendant's punched card accounting machines or electronic data processing machines to assist such actual or prospective users in determining the capacity, quality, suitability or value of defendant's machines with reference to such needs, and states that it is without knowledge or information sufficient to form a belief as to the truth of the averments concerning consultants to defendant.

52. Denies each and every averment contained in paragraph 52 of the complaint.

53. Denies each and every averment contained in paragraph 53 of the complaint.

54. Denies each and every averment contained in paragraph 54 of the complaint.

55. Denies each and every averment contained in paragraph 55 of the complaint.

For a Defense to Plaintiff's Asserted Claims that it has been Prevented, Impeded or Discouraged from Manufacturing Competing Tabulating Machines, Defendant Avers:

56. As hereinafter set forth in Paragraphs 60 through 64, which are hereby adopted as part of this defense with the same force and effect as if repeated in full herein, plaintiff and its predecessor corporation, Remington Rand, Inc., in the manufacture of numerous punched card accounting machines and electronic data processing machines, have made and plaintiff is making willful, wanton and deliberate infringing use of inventions embodied in Letters Patent to which defendant was and is lawfully vested with all the right, title and interest.

COUNTERCLAIM

For a Counterclaim against plaintiff, defendant avers as follows:

57. Defendant is, and at all times hereinafter mentioned was, a corporation organized and existing under and by virtue of the laws of the State of New York, with its principal office at World Headquarters Building, 590 Madison Avenue, in the City and State of New York, and it is engaged, among other things, in the manufacture and distribution of punched card accounting machines and electronic data processing machines.

58. Plaintiff is a corporation organized and existing under and by virtue of the laws of the State of Delaware with its principal office in the City and State of New York. Its predecessor corporations, Remington Rand, Inc., and the Sperry Corporation were both corporations organized and existing under and by virtue of the laws of the State of Delaware, and they were consolidated as Sperry Rand Corporation on June 30, 1955. Since June 30, 1955, the business formerly conducted by Remington Rand Inc. has been and is being carried on by the Remington Rand Division of Sperry Rand Corporation. The Remington Rand Division of Sperry Rand Corporation has a principal office at 315 Fourth Avenue in the City and State of New York.

59. This Counterclaim arises under the Act of June 25, 1948, c. 646, 62 Stat. 931, Title 28 U.S.C. Section 1338, and the patent laws of the United States for infringement by plaintiff and its predecessor, Remington Rand Inc., of the United States Letters Patent hereinafter identified, which acts were committed within the jurisdiction of this Court, as well as elsewhere throughout the United States.

60. The United States Letters Patent set forth in paragraph 61 hereof were duly and legally issued on the respective dates set forth therein and defendant is vested with all right, title and interest in and to said Letters Patent and has been so vested since the date of the grant thereof or has been and is vested with all claims

for profits and damages for past infringement thereof.

61. Without license or permission and in violation of defendant's rights under the Letters Patent set forth in this paragraph, plaintiff and its predecessor corporation, Remington Rand Inc., upon information and belief, after the grant of said Letters Patent and before the filing of this Answer and Counterclaim, and within six years next prior thereto, with full knowledge of said Letters Patent, have infringed and plaintiff is continuing to infringe said Letters Patent by unlawfully manufacturing, using, selling or leasing machines, apparatus or devices embodying the inventions of said Letters Patent, to defendant's injury and damage. Said Letters Patent are as follows:

Number of Patent	Inventor	Title	Date of Issue
2,045,434	Bryce	Record Controlled Accounting Machine	June 23, 1936
2,045,435	Bryce	Record Controlled and Record Making Accounting Machine	June 23, 1936
2,045,436	Bryce	Accounting Machine	June 23, 1936
2,062,117	Bryce	Record Controlled Accounting Machine	Nov. 24, 1936
2,097,145	Daly	Record Controlled and Record Making	Oct. 26, 1937
2,106,476	Bryce	Accounting Machine	Jan. 25, 1938
2,120,228	Bryce	Accounting Machine	June 14, 1938
2,131,226	Kolm	Tabulating Machine	Sept. 27, 1938
2,138,337	Bryce	Accounting Machine	Nov. 29, 1938
2,147,067	Thomas	Accounting Apparatus	Feb. 14, 1939
2,174,683	Bryce	Accounting Apparatus	Oct. 3, 1939
2,178,951	Bryce	Multiplying Machine	Nov. 7, 1939
2,189,024	Bryce	Sorting Machine	Feb. 6, 1940
2,189,025	Carroll	Paper Feeding Device	Feb. 6, 1940
2,237,335	Bryce	Multiplying Machine	April 8, 1941
2,244,242	Buhler	Printing Machine	June 3, 1941
2,271,248	Bryce	Calculating Machine	Jan. 27, 1942
2,271,249	Bryce et al.	Multiplying and Accounting Machine	Jan. 27, 1942
2,340,800	Doty	Record Controlled Perforating Apparatus	Feb. 1, 1944
2,340,801	Doty et al.	Record Controlled Perforating Apparatus	Feb. 1, 1944
2,359,670	Page	Record Controlled Machine	Oct. 3, 1944
2,364,202	Ford	Record Controlled Machine	Dec. 5, 1944
2,379,828	Rubidge et al.	Record Controlled Machine	July 3, 1945
2,402,988	Dickinson	Accounting Apparatus	July 2, 1946
2,402,989	Dickinson	Accumulating Apparatus	July 2, 1946
2,411,645	Whetstone	Card Filing or Grouping Apparatus	Nov. 26, 1946
2,514,035	Dickinson	Electronic Accounting Apparatus	July 4, 1950
2,531,885	Mills et al	Paper Feeding Device	Nov. 28, 1950
2,534,232	Cleeton	Trigger Circuit and Switching Device	Dec. 19, 1950
2,580,740	Dickinson	Accounting Apparatus	Jan. 1, 1952
2,616,626	Lake et al.	Calculator	Nov. 4, 1952
2,624,507	Phelps	Electronic Calculating Machine	Jan. 6, 1953
2,624,508	Dickinson et al.	Electronic Dividing and Multiplying Apparatus	Jan. 6, 1953
2,687,086	Beattie et al.	Record Controlled Line Pringing Machine	Aug. 24, 1954
2,708,722	Wang	Pulse Transfer Controlling Device	May 17, 1955

62. Upon information and belief, plaintiff and its predecessor corporation, Remington Rand Inc., have infringed and plaintiff is infringing the Letters Patent hereinabove set forth in paragraph 61 by manufacturing, using, selling or leasing the following machines, apparatus or devices (denominated in accordance with the number or name designated by plaintiff for each such machine, apparatus or device), among others: the Univac; the Univac I; the Univac 60; the Univac 120; the Univac Scientific (ERA 1103); the Univac High Speed Printer; the 308-5 Tape-to-Card Converter; the 309 Printing Multiplying Punch; the 315 Collating Reproducer; the 318 Card-to-Tape Converter; the 319 Numerical Collator; the 330-2 Calculating Punch; the 409-2R Punched-Card Electronic Computer; the Model 3 Tabulator; the Multiplying device Series 450 for the Model 3 Tabulator; and the Model 3 Tabulator Automatic Carriage.

63. Defendant has complied with the requirements of Title 35 U.S.C. Section 287 with respect to each of the patents set forth in paragraph 61 hereof.

64. The aforesaid infringements of defendant's Letters Patent by plaintiff and plaintiff's predecessor, Remington Rand Inc., have been willful, wanton and deliberate and with full knowledge of defendant's said Letters Patent and defendant's rights in the premises and defendant has been, and unless enjoined by the Court will be, irreparably injured thereby.

WHEREFORE, defendant demands judgment dismissing the complaint herein, together with its costs and disbursements, and it prays for judgment:

(a) declaring that all the Letters Patent set forth in the Counterclaim herein are good and valid in law and that defendant is vested with all the right, title and interest in and to said Letters Patent;

(b) declaring that said Letters Patent have been and are infringed by plaintiff, and that such infringement has been and is willful, wanton and deliberate;

(c) restraining and enjoining plaintiff, its successors and assigns, its agents and attorneys, its servants and employees, and all others acting by or under its direction and authority, permanently and during the pendency of this action, from making or causing to be made, using or causing to be used, selling or causing to be sold, leasing or causing to be leased, or contributing to the making, using, selling or leasing of machines embodying the inventions of said Letters Patent and each of them or from infringing or contributing to the infringement of said Letters Patent in any way whatsoever;

(d) directing an accounting by plaintiff to defendant with respect to damages sustained by defendant, including profits realized by plaintiff from its infringing acts as aforesaid;

(e) for damages sustained by defendant;

(f) awarding treble the damages sustained by defendant, or such other increased amount of damages as to the Court shall appear to be just and proper within the provisions of the laws of the United States in such case made and provided;

(g) for the costs of the Counterclaim, including defendant's reasonable attorneys' fees; and

(h) for such other and further relief as to the Court may seem just and proper.

June 6, 1956

Davies, Hardy & Schenck,
Attorneys for Defendant,

by John W. Burke, Jr.
A member of said firm,
One Wall Street
New York 5, N.Y.

Cravath, Swaine & Moore
15 Broad St.
New York 5, N.Y.

Covington & Burling,
701 Union Trust Building,
Washington 5, D.C.

Olwine, Connelly & Chase,
270 Park Avenue
New York 17, N.Y.

Cooper, Dunham, Keith & Dearborn,
233 Broadway
New York 7, N.Y.

Campbell, Brumbaugh, Free & Graves
90 Broad St.
New York 4, N.Y.

Of Counsel.

- END -

MANUSCRIPTS
(cont'd from page 13)

Payments. In many cases, we make small token payments for articles, papers, and fiction, if the author wishes to be paid. The rate is ordinarily ½¢ a word, the maximum is $20, and both depend on length in words, whether printed before, whether article or paper, etc.

- END -

NEW PATENTS

RAYMOND R. SKOLNICK, Reg. Patent Agent
Ford Inst. Co. Div. of Sperry Rand Corp.
Long Island City 1, New York

The following is a compilation of patents pertaining to computers and associated equipment from the Official Gazette of the United States Patent Office, dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention.

May 15, 1956: 2,746,016 / Vernon Dale Schurr, Linfield, Pa. / One half to Paul Glenn, Pottstown, Pa. / A highly stable electronic amplifier.

May 22, 1956: 2,746303 / William E. Pollack, Sun Valley, Calif. / Librascope, Inc., Glendale, Calif. / A sine-cosine mechanism.

2,746,318 / Judson E. Benjamin, White Plains, N.Y. / General Precision Lab., Inc., N.Y. / A rotational storage device.

2,747,028 / Calvin M. Clark, Fullerton, Calif./ California Research Corporation, San Francisco, Calif. / An amplifier circuit of a push pull connected cascade stage.

2,747,109 / Joseph Montner, Whittier, Calif./ North American Aviation, Inc. / A magnetic flip-flop.

2,747,110 / John Paul Jones, Pottstown, Pa. / Burroughs Corp., Detroit, Mich. / A binary magnetic element coupling circuit.

May 29, 1956: 2,747,796 / Omar L. Patterson, Media, Pa. / Sun Oil Co., Philadelphia, Pa./ A computing circuit for performing multiplication and division.

2,747,797 / James O. Beaumont, Los Angeles, Calif. / Hughes Aircraft Co., Del. / An optical binary protractor for converting the magnitude of the rotational angle of a shaft into a binary digital number having a plurality of digits.

2,748,338 / James W. Williamson, Cleveland, Ohio / — / A phase converter.

June 5, 1956: 2,748,485 / William H. Newell, Mount Vernon, N.Y. / Sperry Rand Corp., Del./ A navigational computer for determining the coordinates of present position.

2,749,034 / Frederic C. Williams, Trimperley, and Tom Kilburn, Davyhulme, Manchester, Eng./ National Research Development Corp., London, England / An electronic circuit for adding binary numbers.

2,749,035 / John W. Gray, White Plains, N.Y. / General Precision Lab., Inc., N.Y. / A navigator for continuously indicating the pro-

(cont'd on page 33)

per heading of a vehicle in traversing a great circle course over the earth's surface from a known point of departure to a known point of destination.

2,749,036 / Richard E. Langworthy, Cuyohoga Falls, Ohio / Goodyear Aircraft Corp., Akron, Ohio / A means for preventing computing errors in a multiple potentiometer computing element.

2,749,037 / George R. Stiblitz, Burlington, Vt. / — / A computer of the digital type in which the two binary digits are represented by plus-minus and minus-plus voltage couples respectively and in which computation takes place in a series of steps each characterized by the flowing of a binary number digit by digit from one storage device to another.

2,749,038 / William F. F. Martin-Hurst, Cefn Coed, near Merthyr, Tydfil, Wales / Teddington Aircraft Controls Lim., Cefn Coed, near Merthyr Tydfil, South Wales / An apparatus for computing the product or ratio of two variables.

2,749,437 / William G. Pan, Cambridge, Eng. / Pye Lim., St. Andrews, Eng. / A trigger circuit.

2,749,439 / Frederic Calland Williams, Timperley, Tom Kilburn, Davyhulme, Manchester, and Geoffrey Colin Tootill, Hollinwood, Eng. / National Research Development Corp., London, Eng. / An electronic information storage device.

2,749,451 / Robert P. Talambiras, Cambridge, Mass. / Sperry Rand Corp., Del. / A flip-flop circuit.

2,749,538 / Benjamin Cooper, Brooklyn, N. Y., Albert F. Hohmann, Teaneck, N.J., and Joseph S. Wapner, Brooklyn, N.Y. / Benjamin Cooper, Brooklyn, N. Y. / A digital converter.

2,749,540 / Willy Pouliart, Antwerp, Belgium / International Standard Electric Corp., N.Y. / An electric device for recording, in a binary scale of notation, a number represented in another scale of notation by a plurality of digits.

June 12, 1956: 2,750,109 / John O. Lewis, Woodside, N.Y. / Flowflax Corp., N.Y. / An apparatus for integrating a variable against time.

2,750,110 / Henry G. Och, Short Hills, N.Y. / A computer circuit adapted to determine the root mean square deviation from a desired mean.

- END -

BOOKS AND OTHER PUBLICATIONS

(List 19, Computers and Automation , Vol. 5, No. 8, August 1956)

This is a list of books of articles, periodicals, papers, and other publications which have a significant relation to computers and their applications and implications, including automation, and which have come to our attention. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / a few comments. If you write to a publisher or issuer, we would appreciate your mentioning the listing in "Computers and Automation".

Shannon, Claude E. and John McCarthy, editors, and 13 authors / Automata Studies / Princeton Univ. Press, Princeton, N.J. / 1956, photooffset, 285 pages, about $6?

This is a profoundly interesting book. Although many of the papers are advanced and mathematical, anyone should find that the initial pages of many of the papers are understandable and thought-provoking. The preface begins "Among the most challenging scientific questions of our time are the corresponding analytic and synthetic problems: How does the brain function? Can we design a machine that will simulate a brain?" The contents consist of thirteen papers: I, Finite Automata — papers by S. C. Kleene, John von Neumann, James T. Culbertson, M. L. Minsky, and Edward F. Moore; II, Turing Machines — papers by Claude E. Shannon, M. D. Davis, John McCarthy, and K. de Leeuw with 3 more authors; III, Synthesis of Automata — four papers, one by W. Ross Ashby, one by D. M. MacKay, and two by Albert M. Uttley.

Householder, Alston S. / Principles of Numerical Analysis / McGraw Hill Book Co., 330 West 42 St., New York 36, N.Y. / 1953, printed, 274 pages, $6.00.

This book considers "the solution of finite systems of equations, linear and nonlinear, and the approximate representation of functions." The material "was assembled with high speed digital computation in mind, though many techniques appropriate only to 'hand' computation are discussed ....The effective use of digital computers "depends on a more profound understanding of the mathematics of the problem, and a more detailed acquaintance with the potential sources of error, than is ever required by a computation whose development can be watched step by step as it proceeds. ...Chapters: The Art of Computation; Matrices and Linear Equations; Nonlinear Equations and Systems; The proper Values and Vectors of a Matrix; Interpolation; More General Methods of Approximation; Numerical Integration and Differentiation; The Monte Carlo Method. The author is a member of the Oak Ridge National Laboratory and head of the group in charge of the Oracle, and its staff of mathematicians. This is an excellent book and should be "within reach of one who has had a course in calculus".

Alexander, S. N., and other members of the Electronics Division and Applied Mathematics Division, National Bureau of Standards/ Computer Development (SEAC and DYSEAC) at the National Bureau of Standards / Department of Commerce, National Bureau of Standards, Washington, D.C. / Jan. 1955, photooffset, 146 pp., $2.00 (from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.)

This volume presents 8 reports on various parts of computer development at the National Bureau of Standards. This development has included the design and construction of two computers (SEAC and DYSEAC), components research and development, and various technical and advisory services by the Electronics Division; and research in numerical analysis in relation to the design and construction of another computer (SWAC) by the Institute of Numerical Analysis. Such topics as systems development, engineering development, design, construction, and maintenance of computer equipment are covered. The introduction summarizes the history of this effort in the Electronic Computers Laboratory of the Electronics Division.

Peek, R. L., Jr., and H. N. Wager / Switching Relay Design / D. Van Nostrant Co., Inc., Princeton, N.J. / 1955, printed, 478 pp, $9.50.

The authors are two Bell Telephone Laboratories engineers, and the book is based on texts used over 35 years in training courses in that organization. The contents of the book are: Part I, Fundamentals of Switching

(cont'd on page 36)

PUBLICATIONS ON SYMBOLIC LOGIC

P 5: BOOLEAN ALGEBRA(THE TECHNIQUE FOR MANIPULATING 'AND', 'OR', 'NOT', AND CONDITIONS) AND APPLICATIONS TO INSURANCE; also DISCUSSION. Reprint. Explains in simple language: what Boolean algebra is; how to recognize the relations of Boolean algebra when expressed in ordinary words; and how to calculate with it. Contains problems, solutions, comments, discussion.
....$ 1.50

P14: CIRCUIT ALGEBRA — INTRODUCTION. Explains simply a new algebra (Boolean algebra modified to include time) that applies to on-off circuits, using relays, electronic tubes, rectifiers, gates, flip-flops, delay lines, etc. Covers both static and sequential circuits. Applications to control, programming, and computing. Problems and solutions involving circuits.
....$ 1.90

P16: SYMBOLIC LOGIC — TWENTY PROBLEMS AND SOLUTIONS. Report. Contains twenty complete problems and solutions in Boolean algebra and other parts of symbolic logic, some by Lewis Carroll and John Venn (out of print), and others new. Guide to using symbolic logic in actual situations.
....$ 1.80

P13: A SYMBOLIC ANALYSIS OF RELAY AND SWITCHING CIRCUITS. Reprint of the classic paper by Claude E. Shannon, mathematician and scientist, published 1938 in the Transactions of the Amer. Inst. of Electrical Engineers, and long out of print. The first application of Boolean algebra to relays and other on-off circuit elements.
....$ 0.60

- -

GUARANTEED OFFER. YOU CAN SEE THEM FOR THE ASKING — WHY NOT TAKE A LOOK?

Edmund C. Berkeley and Associates,
815 Washington St., R168,
Newtonville 60, Mass.

Please send me publications circled:

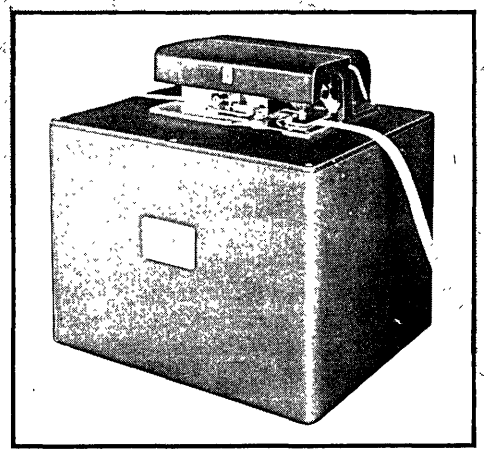
P5 P13 P14 P16

I enclose $_____in full payment. (Add 10¢ per item to cover cost of handling and mailing.) If in good condition, returnable in seven days for full refund. My name and address are attached.

FERRANTI

HIGH SPEED TAPE READER

...handles punched tape data at electronic speeds



The Ferranti High Speed Tape Reader accelerates to full speed within 5 milliseconds and stops within 3 milliseconds. It has been in use at leading computer installations for over two years and has achieved a sound reputation for simplicity and reliability in regular operation.

FAST (1) Mark II model reads at speeds up to 200 characters per second, and stops the tape from full speed within a character position — within .03 inch. The tape is accelerated to full speed again in 5 milliseconds and the following character is ready for reading within 6 milliseconds of rest position.

(2) Mark IIA model reads at speeds up to 400 characters per second, and stops within .1 inch.

VERSATILE Both models read either 5 level, 6 level or 7 level tape by simple adjustment of an external lever.

SIMPLE The tape is easily inserted without complicated threading. Lap or butt splices are taken without any difficulty. The same tape may be passed thousands of times without appreciable tape wear. The optical system has no lenses or mirrors to get out of alignment. Friction drive is independent of sprocket hole spacing.

LARGE OUTPUT Amplifiers are included for each channel, including a special squaring circuit for the sprocket hole signal. Output swing between hole and blank is greater than 20 volts.

Dimensions: 9" x 11½" x 11¼" **Weight: 37 lbs.**
For use with long lengths of tape up to 1000 feet, spooling equipment operating up to 40 inches per second for take-up or supply is available separately.

FERRANTI

FERRANTI ELECTRIC, INC.

30 Rockefeller Plaza New York 20, N. Y.

REQUIEM
(cont'd from page 15)

ter room and a desk. They've got a computer room and a desk. It's the perfect Balance of power. If anybody starts anything, the whole mess is wiped out, them and us, and both sides know it. If you eliminate our computer room, you destroy our power to retaliate. And that means you destroy the Nation!"

The General ran out of wind again and banged his fist on the desk for emphasis.

As if to mirror his warning, the big alarm bell over the maps began whirring. A new bell with an urgent, strident tone. The computers awoke, red lights flashing, and grumbled musically as they began sending out their invisible streams of information broadcast to faroff sites. The General, the President, and little Joe Cutter froze, jaws agape, ears straining for the approaching sound of an incoming alien hydrogen warhead. Little Joe Cutter said it finally, and his flat voice was soft, but it was the requiem for mankind.

"General," he said in slow disgust, "You just slammed your big, fat, dumb fist on the Moscow button."

- END -

IBM
(cont'd from page 19)

MAIL ORDER AND DEPARTMENT STORES

Montgomery Ward & Company operates a 650 at its Chicago headquarters, preparing profit and loss statements for each store, district, and region; profit and loss budget reports; computations of store managers' extra compensation; and other computations. Inventory by lines of merchandise by store is in the last stages of programming for conversion to machine operation.

COMMUNICATIONS

Four IBM 650's are installed in the general office of Illinois Bell Telephone Company, Chicago. The machines process company payroll for the entire state of Illinois, including executive, monthly, semi-monthly, bi-weekly, and weekly payrolls. In property and cost accounting, the 650's are used for distribution and summarization of labor and related expenses and material costs. Eventually, Illinois Bell plans to solve traffic and engineering problems with the machines.

- END -

BOOKS
(con'd from page 34)

Relay Design, Chapters 2 to 5, Mechanical Requirements for Relays, Statics of Electromagnets, Dynamic Performance in Operation and Release, Relay Design: Part II, Analytical Background for Switching Relay Design, (Chapters 6 to 12) Spring Design, Relay Vibration, The Magnetic Field of Electromagnets, The Magnetic Circuit, Analysis of Magnetization and Pull Relations, Dynamics of Electromagnets, The Magnet Coil. This is a useful and authoritative book for those concerned with this subject.

Brown, R. Hunt / Office Automation / Automation Consultants, Inc., 1450 Broadway, New York 18, N.Y. / 1955, photooffset, looseleaf, 283 pp. $12.50 updating service, $25 a year.

Contains: Commercial Section I: Automation, Benefactor of Man, or Progress without Fear (Chap. 1 to 8). "Hardware" Section II: New Machines for Office Automation and How You can Use Them (Chap. 9 to 29). Accounting Section III: The New Methods and Procedures (Chap. 30, 31). Sociological Section IV: Humanities of Automation (Chap. 32 to 38). Scientific Section V: The New Techniques (Chap. 39 to 44). Developmental Section VI: Applications "Just Around the Corner" (Chap. 45 to 48)

ROBOT SHOW STOPPERS

Did you see our story in Life Magazine, March 19, pp 173-176 ?

From time to time you may need to help organize a display in a business show including some device that you hope will "STOP" every person attending the show and make him notice your display — a device which may be called a "SHOW-STOPPER".

In addition to publishing the magazine "COMPUTERS AND AUTOMATION", we have for six years been developing and constructing "ROBOT SHOW-STOPPERS", small robot machines that respond to their environment and behave by themselves. Two of them are:

RELAY MOE: A machine that will play the game Tit-Tat-Toe with a human being, and either win or draw all the time, or (depending on the setting of a switch) will sometimes lose, so as to make the game more interesting for the human being (was at the I.R.E. Show, in Guardian Electric's exhibit; see picture in Life Magazine);

SQUEE: An electronic robot squirrel that will hunt for a "nut" indicated by a person in the audience, pick it up in his "hands", take the nut to his "nest", there leave it and then hunt for more nuts (see picture in Life Magazine);

Besides these we have other small robots finished or under development. These machines may be rented for shows under certain conditions; also, modifications of the small robots to fit a particular purpose are often possible.

To: Berkeley Enterprises Inc.,
815 Washington St., R168
Newtonville 60, Mass.

Please send us more information about your ROBOT SHOW STOPPERS. The advertising application we have in mind is:_____

From: (Organization)_____

(Address)_____

(Filled in by: Name, Title, Date)_____

ADVERTISING IN "COMPUTERS AND AUTOMATION"

Memorandum from Berkeley Enterprises, Inc.
Publisher of COMPUTERS AND AUTOMATION
815 Washington St., Newtonville 60, Mass.

1. What is "COMPUTERS AND AUTOMATION"? It is a monthly magazine containing articles, papers, and reference information related to computing machinery, robots, automatic control, cybernetics, automation, etc. One important piece of reference information published is the "Roster of Organizations in the Field of Computers and Automation". The basic subscription rate is $5.50 a year in the United States. Single copies are $1.25, except June, 1955, "The Computer Directory" (164 pages, $4.00). For the titles of articles and papers in recent issues of the magazine, see the "Back Copies" page in this issue.

2. What is the circulation? The circulation includes 2400 subscribers, (as of July 10; over 300 purchasers of individual back copies; and an estimated 3000 nonsubscribing readers. The logical readers of COMPUTERS AND AUTOMATION are people concerned with the field of computers and automation. These include a great number of people who will make recommendations to their organizations about purchasing computing machinery, similar machinery, and components, and whose decisions may involve very substantial figures. The print order for the July issue was 2800 copies. The overrun is largely held for eventual sale as back copies, and in the case of several issues the overrun has been exhausted through such sale.

3. What type of advertising does COMPUTERS AND AUTOMATION take? The purpose of the magazine is to be factual and to the point. For this purpose the kind of advertising wanted is the kind that answers questions factually. We recommend for the audience that we reach, that advertising be factual, useful, interesting, understandable, and new from issue to issue. We reserve the right not to accept advertising that does not meet our standards.

4. What are the specifications and cost of advertising? COMPUTERS AND AUTOMATION is published on pages 8½" x 11" (ad size, 7" x 10") and produced by photooffset, except that printed sheet advertising may be inserted and bound in with the magazine in most cases. The closing date for any issue is approximately the 10th of the month preceding. If possible, the company advertising should produce final copy. For photooffset, the copy should be exactly as desired, actual size, and assembled, and may include typing, writing, line drawing, printing, screened half tones, and any other copy that may be put under the photooffset camera without further preparation. Unscreened photographic prints and any other copy requiring additional preparation for photooffset should be furnished separately; it will be prepared, finished, and charged to the advertiser at small additional costs. In the case of printed inserts, a sufficient quantity for the issue should be shipped to our printer, address on request.

Display advertising is sold in units of a full page (ad size 7" x 10", basic rate, $190) two-thirds page (basic rate, $145), half page (basic rate, $97), and quarter page (basic rate, $55); back cover, $370; inside front or back cover, $230. Extra for color red (full pages only and only in certain positions), 35%. Two-page printed insert (one sheet), $320; four-page printed insert (two sheets), $590. Classified advertising is sold by the word (60 cents a word) with a minimum of 20 words.

5. Who are our advertisers? Our advertisers in recent issues have included the following companies, among others:

Aircraft-Marine Products, Inc.
American Bosch Corp.
Ampex Corp.
Armour Research Foundation
Arnold Engineering Co.
Automatic Electric Co.
Bendix Aviation Corp.
Cambridge Thermionic Corp.
Epsco, Inc.
Ferranti Electric Co.
Ferroxcube Corp. of America
General Electric Co.
Hughes Research and Development Lab.
International Business Machines Corp.
Lockheed Aircraft Corp.
Lockheed Missile Systems
Logistics Research, Inc.
The Glenn L. Martin Co.
Monrobot Corp.
Norden-Ketay Corp.
Northrop Aircraft, Inc.
George A. Philbrick Researches, Inc.
Potter Instrument Co.
Ramo-Wooldridge Corp.
Reeves Instrument Co.
Remington Rand, Inc.
Republic Aviation Corp.
Sprague Electric Co.
Sylvania Electric Products, Inc.

Did you see our story in Life Magazine, March 19, pp 173-176 ?

MAKE YOUR OWN BABY GENIUS COMPUTERS WITH

GENIAC

Electric Brain Construction Kit No. 1

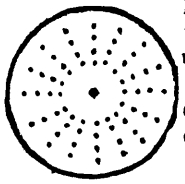


Diagram of the versatile multiple switch, which can be assembled to make any switch combination from 16 decks of 2 positions, to 2 decks of 16 positions.

This kit is an introduction to the design of arithmetical, logical, reasoning, computing, puzzle-solving, and game-playing circuits. It is simple enough for intelligent boys to assemble, and yet is instructive to computer men because it shows how many kinds of computing and reasoning circuits can be made from simple components.

With this kit and 64-page manual, you can easily make over 30 small electric brain machines that exhibit intelligent behavior. Each runs on one flashlight battery. All connections with nuts and bolts; no soldering required. Price, $17.95 (add 80¢ for shipment in U. S. west of Mississippi, $1.80 for shipment outside U. S.). If not satisfactory, returnable in seven days for full refund.

A few of the machines you can make: Logic Machines: Reasoning, Syllogism Machine, Intelligence Testing. Game-playing Machines: Nim, Tit-tat-toe. Arithmetic Machines: Adding, Subtracting, Multiplying, Dividing, Carrying, etc. Cryptographic Machines: Secret Coder and Decoder, Combination Locks. Puzzle Machines: The Space Ship Airlock, The Fox Hen Corn and Hired Man, Douglas Macdonald's Will, The Uranium Ship and the Space Pirates..

--------Mail this Request--------
or a Copy of It

Berkeley Enterprises, Inc.
815 Washington St., R168
Newtonville 60, Mass.

Please send me Geniac Kit No. 1 and Manual. Price, $17.95 (add 80¢ for shipment in U. S. west of Mississippi, $1.80 for shipment outside U. S.) I enclose _____ in full payment. (If in good condition, it is returnable in seven days for full refund.) My name and address are attached.

ENGINEERS

***ARMA** announces*

INERTIAL NAVIGATION

development program for an advanced Air Force missile

Inertial Navigation offers the most advanced concept in guidance, requiring no terrestrial source of energy or information, no earth-bound direction once the ultimate destination is selected. It offers the most promising solution of the guidance problem for the long-range missile.

While the principles are simple, the realization involves advanced creative engineering. ARMA's many successes in the creation of precision instruments and systems for navigation and fire control, especially precision gyroscopic reference systems for all applications, fit it uniquely for a major role in this advanced area.

The height of imaginative resourcefulness and engineering skill are required to create the degree of precision—hitherto unattained—in the components essential to the guidance of advanced missile systems—the gyros, accelerometers, and computer elements. Miniaturization must be coupled with extraordinary ability to provide utmost accuracy under conditions of extreme velocities, temperatures, and accelerations.

There's significant scientific progress to be achieved at this leadership company and individual renown to be won, by engineers associated with ARMA's Inertial Navigation Program. Many supplementary benefits make a career here doubly attractive. ARMA engineers are currently working a 48 hour week at premium rates to meet a critical demand in the Defense Dept's missile program. Moving allowances arranged.

Salary — up to $15,000
(Commensurate with experience)

Send resume in confidence to:
Manager of Technical Personnel, Dept. 674

ARMA

Division of American Bosch Arma Corporation
Roosevelt Field, Garden City, Long Island, N. Y.

Immediate openings for Supervisory and Staff positions as well as for Senior Engineers, Engineers, and Associate Engineers, experienced in:

Systems Evaluation
Gyroscopics
Digital Computers
Accelerometers
Telemetry
Guidance Systems
Reliability
Stabilizing Devices
Servomechanisms
Automatic Controls
Thermodynamics
Environmental Research
Weight Control
Transformers
Production Test Equipment
Standards

APPLIED MATHEMATICIAN

to $11,500

In this stimulating

Missile Test Project

You will be challenged by the research and theoretical studies involved in acquiring data from high velocity missiles being fired over the world's longest test range. Ph.D. degree plus several years' experience in work related to above, required.

Join a scientific team at top level in this unprecedented work with one of the nation's largest corporations. Ideal living and working conditions on Florida's Central East Coast.

TO ARRANGE CONFIDENTIAL INTERVIEW

Send resume to Mr. H. C. LAUR, Dept. N-14G
Missile Test Project
P. O. Box 1226
Melbourne, Florida

ADVERTISING INDEX

The purpose of COMPUTERS AND AUTOMATION is to be factual, useful, and understandable. For this purpose, the kind of advertising we desire to publish is the kind that answers questions, such as: What are your products? What are your services? And for each product, What is it called? What does it do? How well does it work? What are its main specifications?

Following is the index and a summary of advertisements. Each item contains: Name and address of the advertiser / subject of the advertisement / page number where it appears / CA number in case of inquiry (see note below).

READER'S INQUIRY

If you wish more information about any products or services mentioned in one or more of these advertisements, you may circle the appropriate CA Nos. on the Reader's Inquiry Form below and send that form to us (we pay postage; see the instructions). We shall then forward your inquiries, and you will hear from the advertisers direct. If you do not wish to tear the magazine, just drop us a line on a postcard.

READER'S INQUIRY FORM

Paste label on envelope: ↓ Enclose form in envelope: ↓

4¢ Postage Will Be Paid By ---

BERKELEY ENTERPRISES, INC.
38 East 1st Street
New York 3, N. Y.

BUSINESS REPLY LABEL
NO POSTAGE STAMP NECESSARY IF MAILED IN U.S.A.

FIRST CLASS
PERMIT NO 1680
Sec. 34.9, P. L. & R.
NEW YORK, N. Y.

READER'S INQUIRY FORM

Name (please print).....

Your Address?.....

Your Organization?.....

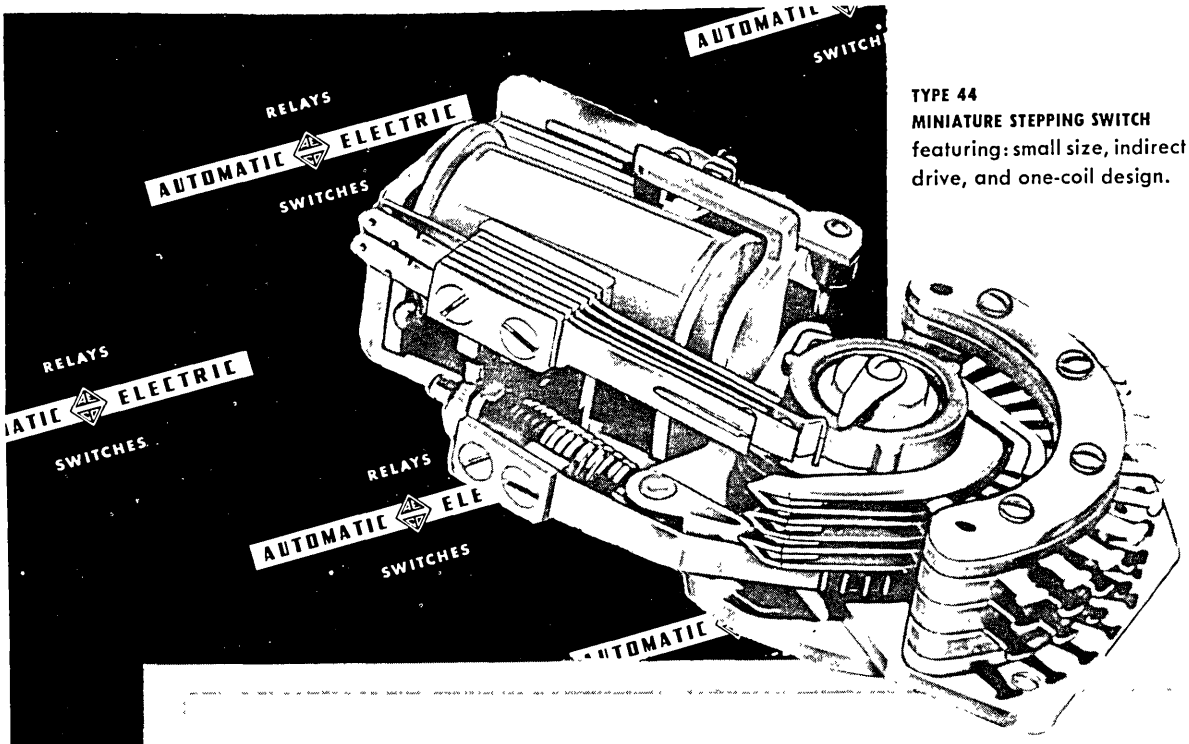
Its Address?.....

Your Title?.....

Please send me additional information on the following subjects for which I have circled the CA number:

1	2	3	4	5	26	27	28	29	30	51	52	53	54	55	76	77	78	79	80	101	102	103	104	105	126	127	128	129	130
6	7	8	9	10	31	32	33	34	35	56	57	58	59	60	81	82	83	84	85	106	107	108	109	110	131	132	133	134	135
11	12	13	14	15	36	37	38	39	40	61	62	63	64	65	86	87	88	89	90	111	112	113	114	115	136	137	138	139	140
16	17	18	19	20	41	42	43	44	45	66	67	68	69	70	91	92	93	94	95	116	117	118	119	120	141	142	143	144	145
21	22	23	24	25	46	47	48	49	50	71	72	73	74	75	96	97	98	99	100	121	122	123	124	125	146	147	148	149	150

REMARKS:



TYPE 44
MINIATURE STEPPING SWITCH
featuring: small size, indirect drive, and one-coil design.

Well-Adjusted

for a long, active life

200,000,000 operations, with little or no adjustment!

This rugged little stepping switch is racking up an outstanding service record in countless operations. It's Automatic Electric's Type 44 Miniature Stepping Switch, now going into more products than ever before!

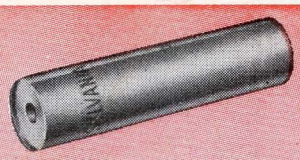
Its cost-reducing features are impressive. One-coil design eliminates a separate release coil. Indirect drive gives smooth, high-speed stepping. There's no wiper "double loading" or galloping. Here's the first compact, lightweight switch for 10-, 20- or 30-point operations. Use any dc voltage up to 110 (with rectifier, up to 115 volts, 60 cycles, ac).

To improve your products without raising costs, get the full details on Type 44 and Automatic Electric's *complete* line of stepping switches. Write to: Automatic Electric Sales Corporation, 1033 West Van Buren Street, Chicago 7, Illinois. In Canada: Automatic Electric Sales (Canada) Ltd., Toronto. Offices in principal cities.

AUTOMATIC ELECTRIC

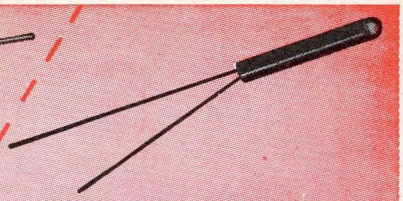
Originators of the dial telephone • Pioneers in automatic control

GENERAL SYSTEM

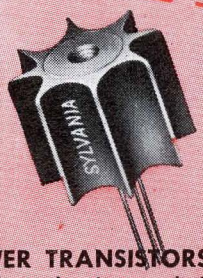


TRIPOLAR CRYSTAL DIODES
For your microwave applications, first diode to provide a simplified approach to front-end design in broadband microwave circuitry.

V.L.I. DIODES
For computer applications, very low impedance diode capable of high forward conductance with excellent stability and fast recovery time.



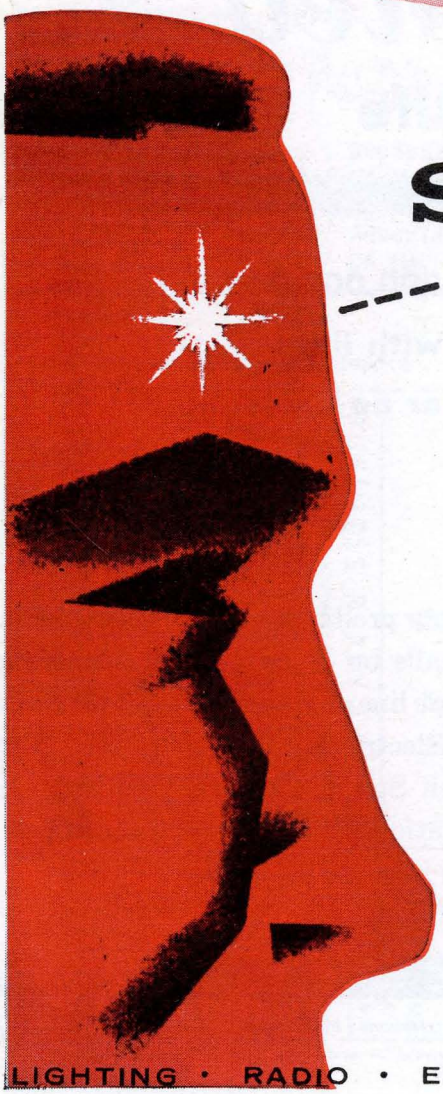
IN77A PHOTODIODE
Combines high sensitivity with compact design. Covers the visible spectrum and extends to the infrared region.



POWER TRANSISTORS
Low thermal resistance design offers dissipation up to 4 watts with heat sink. Current gain is as much as 3½ times more than comparable types. Both 30 and 60 volt versions are available.

HIGH FREQUENCY TRANSISTORS
NPN high frequency transistors built to high standards of uniformity. Feature low collector capacitance and ease of neutralization in rf and if circuits.

HIGH GAIN AUDIO TRANSISTORS
One of the standards for low frequency, high gain applications.



Semiconductors

created with your product in mind

Each of these semiconductor developments was created to introduce improvements in the product you're designing, whether it's a simple transistorized radio or a complex computer system. Whether it calls for higher transistor power ratings or faster diode recovery time.

Since producing the first commercially available germanium diode in 1942, Sylvania has maintained its semiconductor leadership by meeting the needs of designers with imaginative, new semiconductor applications.

Consult with Sylvania for your needs. A new plant at Hillsboro, N. H. is devoted exclusively to the manufacture of semiconductors to provide you with production quantities. Write for technical data.

SYLVANIA®

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., Montreal

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY