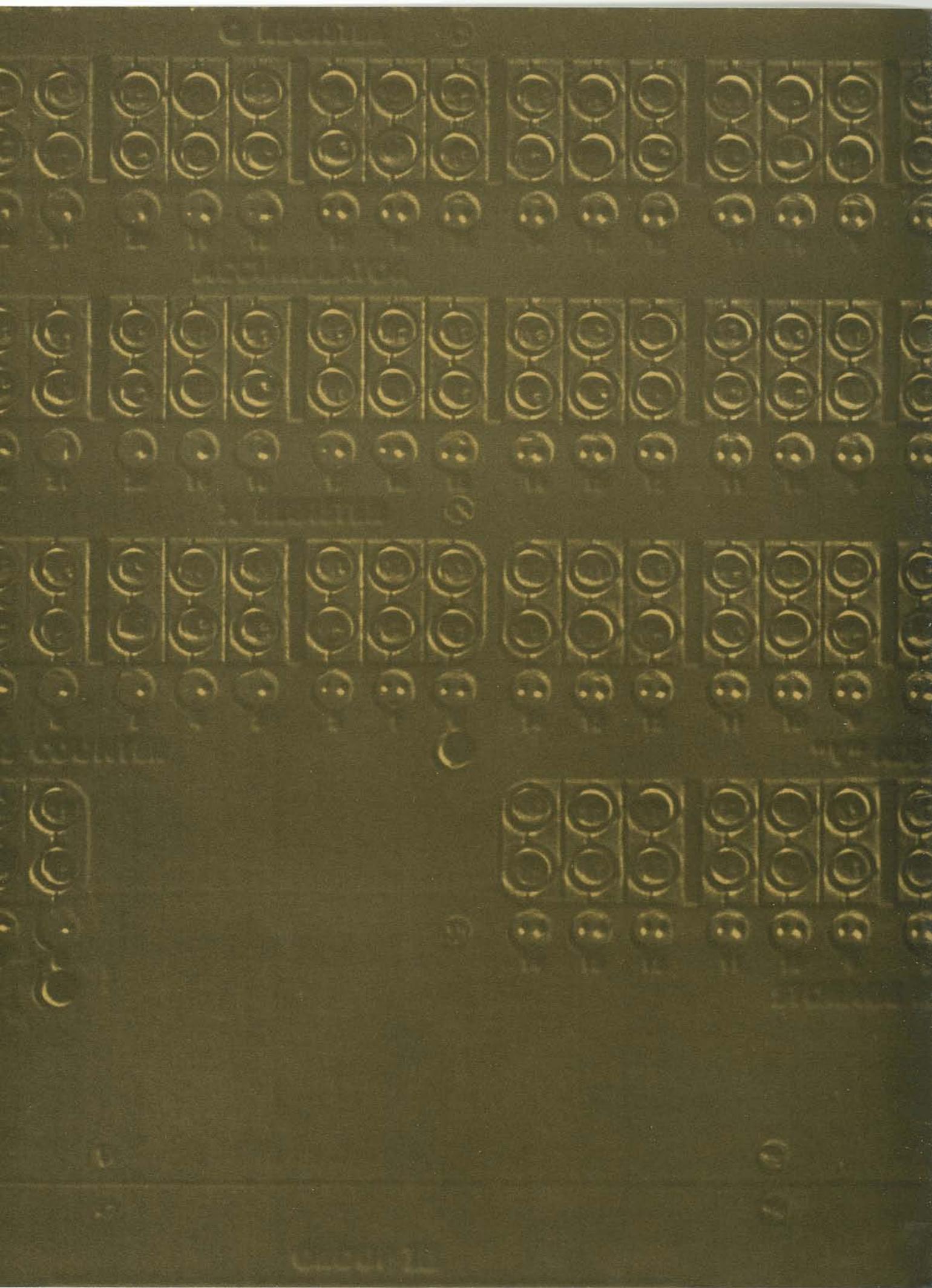
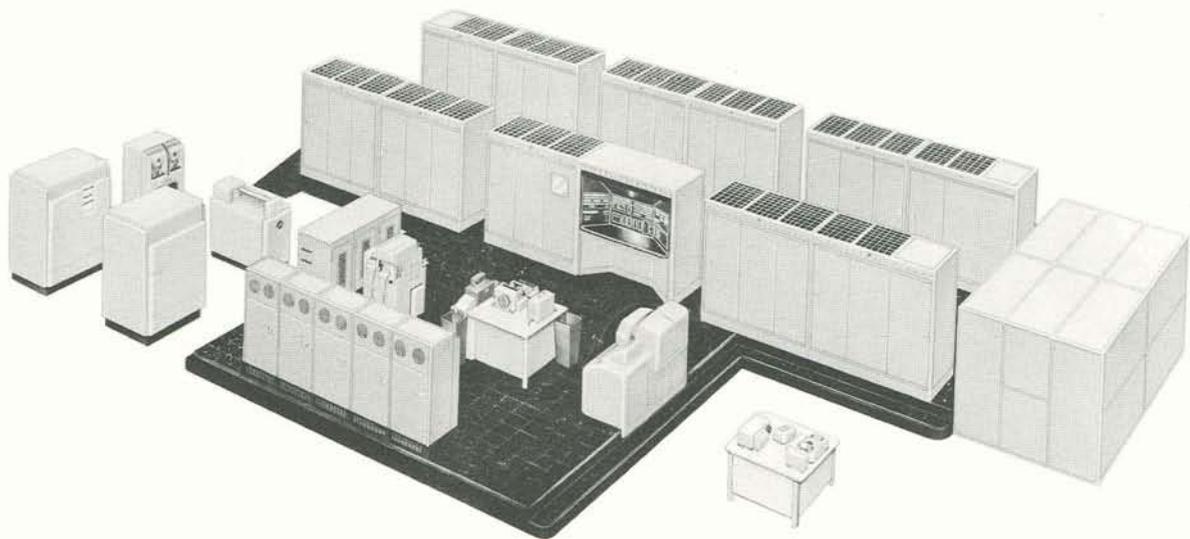


**UNIVAC[®]
SCIENTIFIC
COMPUTING
SYSTEM** model 1103A



Donald G. McBrien



03

A



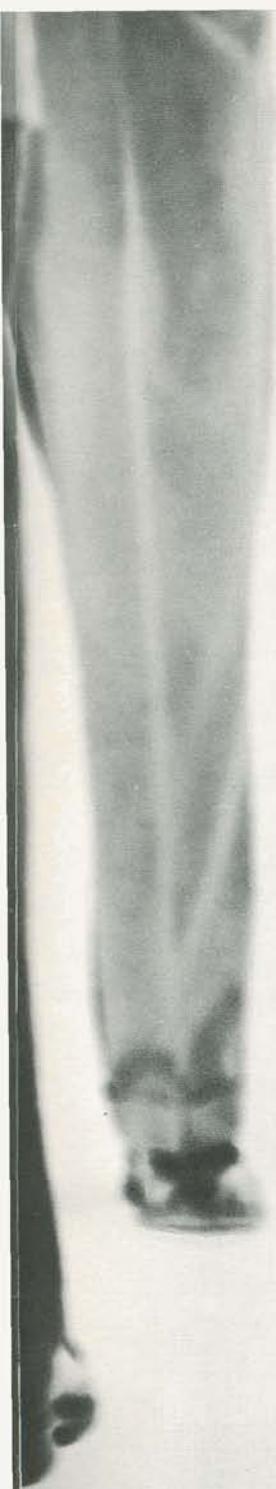
How it can serve you

In the rapid solution of engineering and research problems • in low-cost data processing for science and business • in real-time operation for fast response tests • with a variety of versatile input-output facilities.

The Univac Scientific computing system is designed specifically to solve complex problems such as those encountered in engineering and research. A wide variety of input and output equipment may be integrated with its operation and the results of its activities may take any of several forms for future processing or storage. Computing is performed at unprecedented speeds from internally stored programs and data. There are many

operational features which permit the greatest flexibility of use and the maximum utilization of its capacity for speed and storage.

Design of the Univac Scientific makes it uniquely applicable to three basic problem categories: I. Problems involving many repetitions. Each problem may take only a few minutes to solve, but it must be done over and over again hundreds, thousands, or even millions of times (as in the case of payrolls or inventory control). Certain mathematical equations, even though not difficult, may take weeks to solve. The Univac Scientific solves these types of problems in hours or even minutes, instead of weeks or



months. Allowing the computer to perform the manual labor permits not only extreme speed in obtaining final results, but releases more individuals for performing the more important phases of their assignments.

II. Sequential problems.

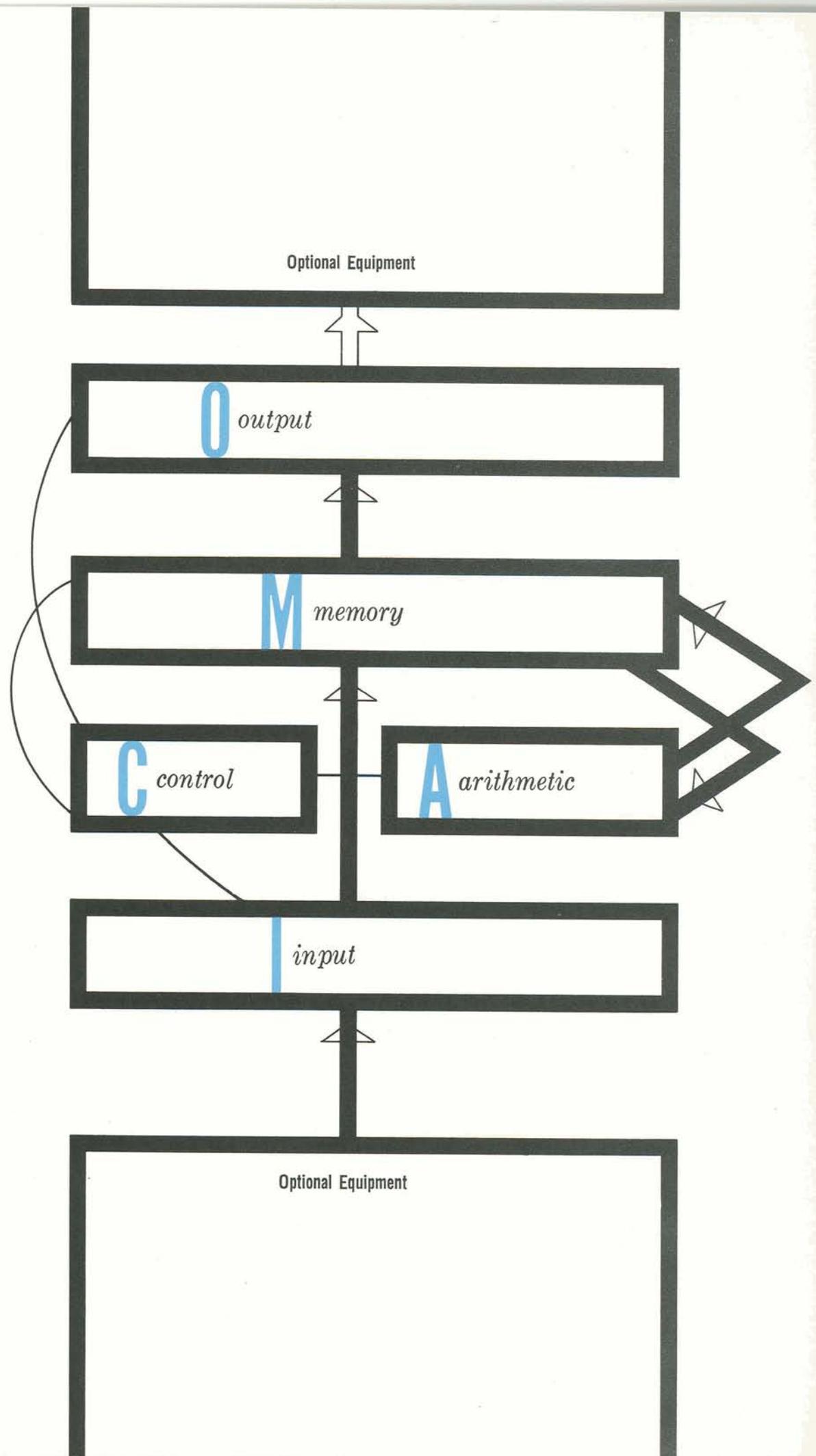
This is the type of problem in which the result of one computation is the starting value for the next problem, and may continue in a long chain. A high speed computing system such as the Univac Scientific is required because these problems cannot be solved by a large number of people operating desk calculators. One person cannot do any work until another person completes his portion of the

problem . . . it must be done in sequence.

III. Real-time problems.

This type of problem requires that the solution be completed within a specified time or the information is lost forever, and the need for the solution has passed—such as in the field of guided missiles or air traffic control. Most of these types of problems cannot be performed by human beings because of the speed with which the problems must be solved.

Thus, the Univac Scientific computing system is a high speed tool capable of performing countless operations at electronic speed. Here, briefly, is the story of how it works . . . and what it can do for you.



The computing system . . . The Input Section feeds data and computer instructions into the system. This section receives data from a wide variety of sources, among which are magnetic tape, punched cards, or on punched paper tape.

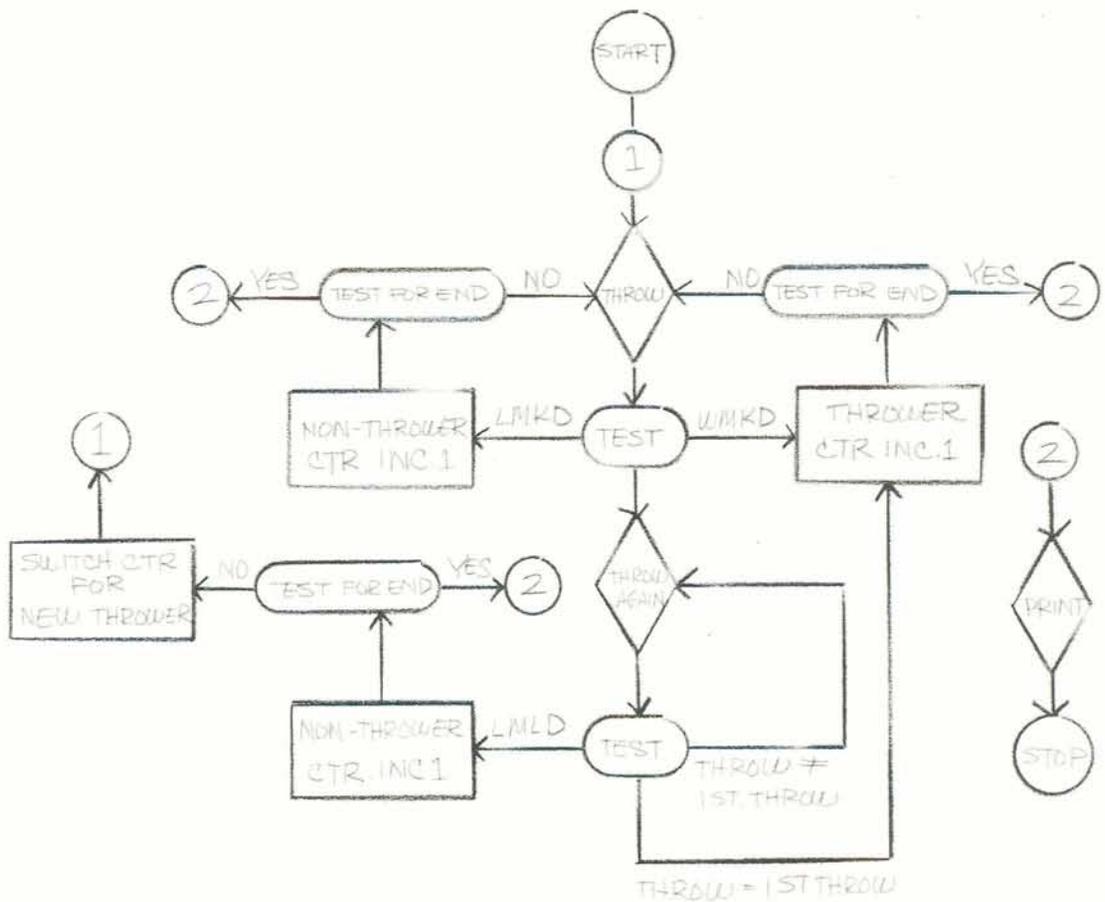
The Control Section is the "organizer" for all of the processes occurring within the computing system. This section receives all of the instructions which the computer is to carry out, interprets them, and directs their execution.

The Storage Section receives and stores all of the data which is to be operated upon. Its most important function is to store all of the information and instructions which will be used in the solution of the problem. This section supplies these data to the other sections in the computer as required. All information stored within the computer is easily accessible through a system of unique addresses. The Storage Section utilizes a

rapid access magnetic core memory, a large capacity drum memory, and for maximum storage capacity . . . magnetic tape.

The Arithmetic Section. When the computing process (referred to as the program) has been initiated, the arithmetic section performs all of the operations of addition, subtraction, multiplication, and division . . . as well as some strictly logical operations such as shifting, logical addition, and logical multiplication. This section produces the answers to the mathematical problems.

Output Section. The results of the computations are transmitted to one or more units of output equipment. This equipment may store results on magnetic tape, on punched cards, on punched paper tape, or print the information on rolls or continuous forms in several copies. The data may also be translated into plotted graphs or oscillographic records.



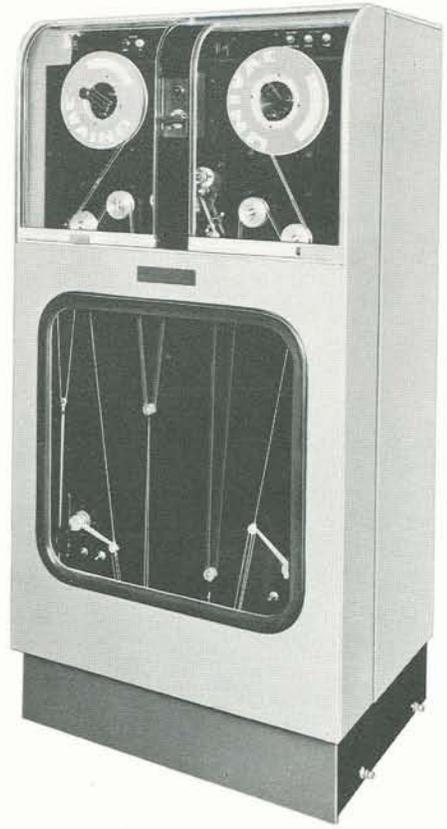
Preparing a problem . . .

The Flow Chart

The first step in preparing a problem for the computer is to analyze the problem, and to reduce it to a series of mathematical expressions. When this has been accomplished, the problem is turned over to a programmer who defines it in terms of the various actions and decisions which the com-

puter is capable of making. This is done by means of a flow diagram. This is a diagram which outlines the progress of the problem through its major phases as it passes through the computer. The flow diagram serves as a guide in the preparation of the problem for solution by the computer.

PROBLEM	
00	0000.0 00100
010	TP 00015 00004 .ZERO → I.M.C.
	TP 00015 00005 .ZERO → M.U.C.
	RJ 00050 00051 .THROW
	EJ 00017 00121 .
	EJ 00020 00121 .
	EJ 00023 00121 .
	EJ 00014 00115 .
	EJ 00022 00115 .
11	TP 20000 00011 .SAVE 1ST THRU
	RJ 00050 00051 .THROW AGAIN
	EJ 00014 00125 .L.M.L.D.
	EJ 00011 00115 .W.M.K.D.
	MJ 00000 00111 .THROW AGAIN
	MJ 20000 00210 .PR.2
	RA 00004 00016 .INC. STR. OF THROWER
	TJ 00046 00102 .TEST IF DONE
12	MJ 00000 00140 .REPLACE ADDRESS 3
	MJ 20000 00330 .PR.3
	RA 00005 00016 .INC. STR. OF NON-THROWER
	TJ 00046 00102 .TEST IF DONE
	MJ 00000 00140 .REPLACE ADDRESS
	MJ 20000 00250 .PR.4
	RA 00005 00016 .INC. STR. OF NON-THROWER
	TJ 00046 00102 .TEST IF DONE
13	MJ 00000 00140 .REPLACE ADD.
	TJ 00116 00011 .SAVE ADD. OF THROWER
	TJ 00122 00016 .REPLACE WITH NEW THROWER
	TJ 00011 00122 .STORE BACK OLD THROWER
	TJ 00011 00122 .STORE BACK OLD THROWER
	MJ 00000 00102 .THROW AGAIN
	AD 00000 0.036
	C.A.



The Program

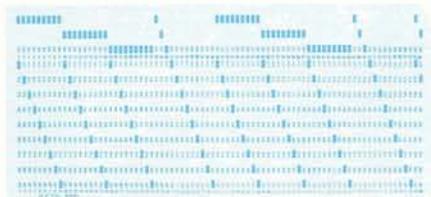
The program is then prepared. This is a listing of all of the activities which will occur as designated by the instructions selected. The instructions are listed in their proper order, and the locations (addresses) for the data are identified.

The finished program is prepared on a Unityper. Operated like an ordinary electric typewriter, this tape preparation unit produces a printed record of the program as well as a magnetic tape for transmitting the program to the computer.

The magnetic tape is then read into the computer by this high speed tape handling unit at a rate of 2130 computer words every second. *With the data and instructions now stored, the computer is ready for operation.*



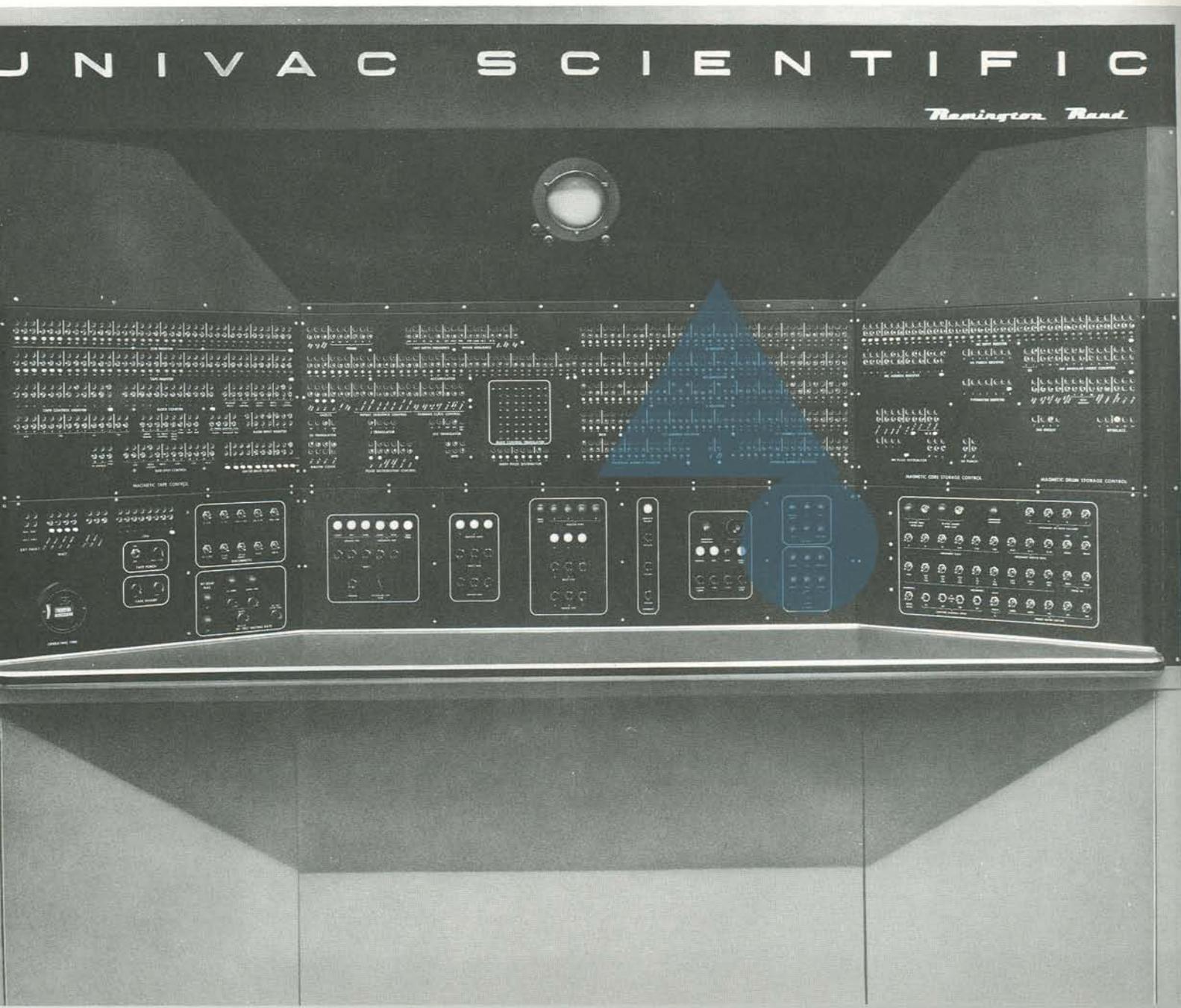
Additional data may be fed to the computer from punched cards or from punched paper tape.



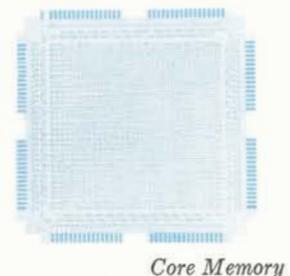
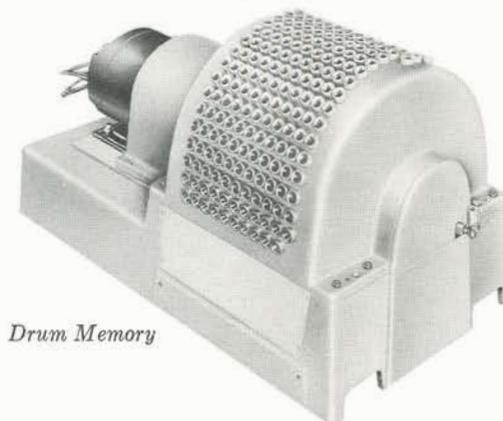
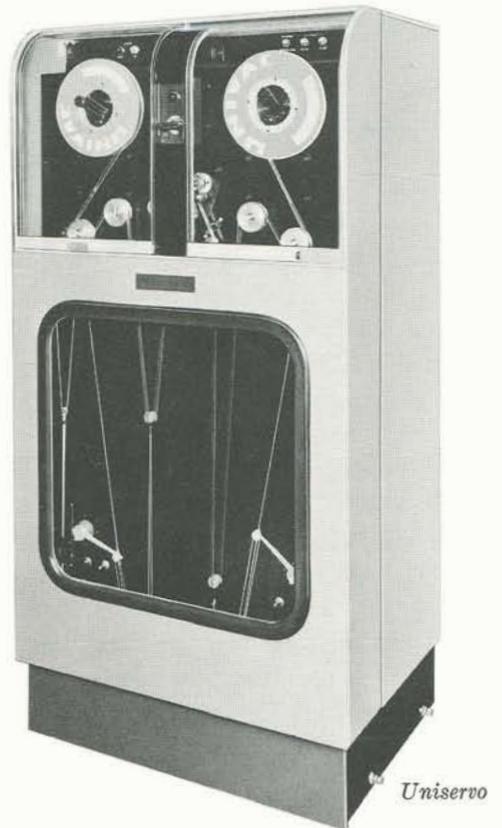
Operation . . . From his position at the Supervisory Control Console, the operator starts the computer, checks its operation, and monitors its activities. Even though the computer is automatically controlled by the instructions, it can be manually controlled by the operator when necessary. The Control Console contains all the necessary controls and indicators for manually operating the computer.

At any point in the process, the operator can check the content of the various registers by observing a display of indicators on the panel.

In the event of trouble, these fault indicators serve as a guide in locating the trouble source.



The Memory . . . The extremely high computation speed achieved by the Univac Scientific results in part from use of magnetic core storage. This rapid access memory can store thousands of "bits" of information . . . and can supply the information instantly when needed. Core storage can be incorporated for 4096, 8192, or 12,288 computer words equal to 10 decimal digits each plus sign. Storage of each word in the memory occurs by means of tiny electrical impulses which activate one core in the identical location in each of 36 frames, as shown on the diagram. There are three "bits" for each character; thus 36 bits constitute a 12-character computer word. Any word is available in 0.000008 second. In the magnetic drum memory, the bits are stored in the form of tiny magnetized spots on the surface of a rapidly revolving drum. This magnetization is accomplished by sending pulses to recording heads attached around the outside of the drum case. The address of any given word depends upon the series of heads selected, and the point of drum rotation at the time—all of which is predetermined by the instructions and synchronization. This memory stores 16,384 words in four groups of 4096 words each. The average access time to any information on the drum is 0.017 second. Great quantities of data and subroutines may be put into or removed from the computer through the use of magnetic tape by means of these Uniservo units. They also provide means for permanent data storage. Each standard 1500-foot reel of tape is capable of storing up to 384,000 words, and can transfer information at rates up to 2130 words per second.



The results may be printed or stored . . . Whenever desired, the intermediate or end results of the computation may be delivered to the output. The Card Unit . . . The output of the computer may be sent to the card unit which records the information on tabulating cards. This card unit is also used to read information from cards into the computer. Reading and punching may be performed simultaneously if desired. The cards are the familiar standard 12-row, 80-column tabulating card in which the combination of holes . . . or absence of holes . . . contains the necessary information. This unit reads, punches, or reads and punches simultaneously at the rate of 120 cards per minute. In addition to facilitating insertion and recording of information, this unit also enables reproduction of cards at the command of the computer. This is accomplished by placing the contents of a card into the computer and punching duplicate information on new cards.

The Uniservo is a magnetic tape handling device used as • An input medium for transmitting information to the computer. • An information storage device which may be activated by a program instruction. • An output device for storing intermediate or end results of a computation. This unit provides an extremely rapid method of transferring information at rates up to 2130 words per second. Uniservos (up to ten) may be connected directly to the computer. The reels of magnetic tape are 1500 feet in length; each is capable of recording up to 384,000 words.

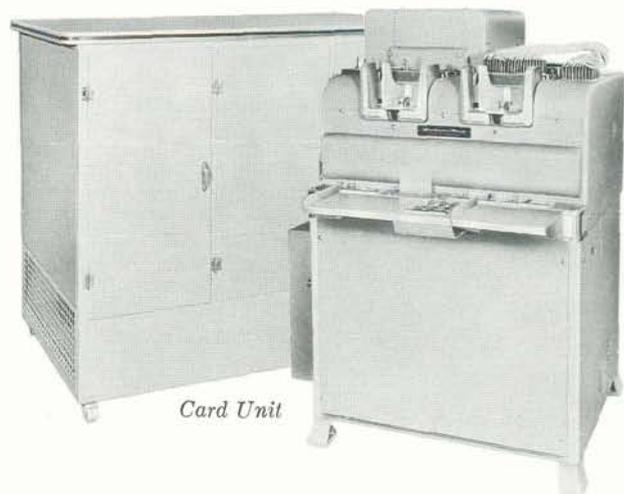
The High-Speed Printer prints up to 600 lines a minute on paper rolls, continuous forms, and with several carbon copies if desired. The printer may be connected

directly to the computer (on-line operation) or operated from magnetic tapes which have stored information (off-line operation). Flexibility of format is such that multiline printing, multiple character printing, columnar rearrangement, zero suppression, and single, double, or triple spacing is easily accomplished.

In addition to its printing ability, the High-Speed Printer also makes an excellent plotting device for graphic representation of computation result. This unit can accommodate paper from 4 inches to 27 inches wide, and up to card stock in thickness. In addition, pre-printed forms can be used—for example, up to 7500 checks can be printed every hour.

The Flexowriter is one of a number of devices used to accept information from the computer and print it in readable form. The speed at which the Flexowriter operates is equivalent to typing at the rate of 120 words per minute. The Flexowriter automatically types information by translating the computer code into Flexowriter code, and thus activating the proper one of 50 different typewriter operations. This is usually connected as a permanent monitoring printer for use by the operator or for printing the results of the less complex programs.

The High-Speed Paper Tape Punch accepts information from the computer and transforms it into punched tape at the rate of 360 inches per minute, or 3600 characters per minute. The paper tape may then be run through a Remington Rand Synchronomatic Typewriter for a printed record of the information. It may also be fed directly into a variety of telegraphic devices for transmission.

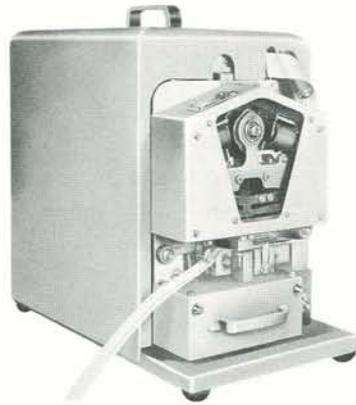




High-Speed Printer



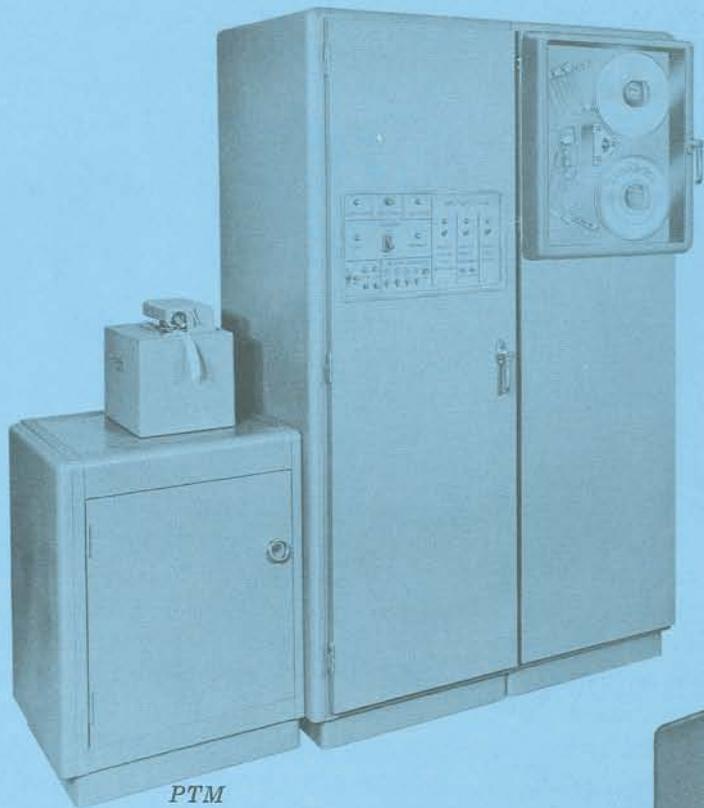
Uniservo



High-Speed Punch



Flexowriter



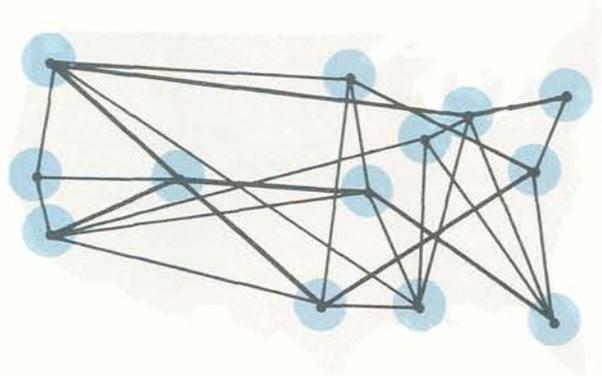
PTM



MTP



MTM



An entire organization can use the computer . . . With Univac communications equipment it is possible to utilize the services of a centrally located computer, while receiving information from distant points. The computer processing results may be transmitted to these distant points as well. This is accomplished with the Univac PTM, MTP, and MTM units . . . on standard teletype or voice channels now commercially available.

The Univac MTP converter is used to convert information stored on magnetic tape to punched paper tape for transmission over standard teletype systems.

At the receiving end is PTM converter that receives the paper tape which is perforated in accordance with the line signals, and converts this information to magnetic tape for use with Univac equipment.

The MTM Transrecorder permits information stored on magnetic tape to be transmitted directly over a standard 3kc telephone line without the intervening punched tape equipment. One MTM Transrecorder is used at each end of the line.

The Univac Scientific system, used in conjunction with these communication devices, provides a means for processing data gathered from scattered points in a nationwide system. Now, with the Univac Scientific computing system, you can have the fastest and most accurate means yet developed for decision and control.



For greater flexibility . . . a variety of peripheral equipment.

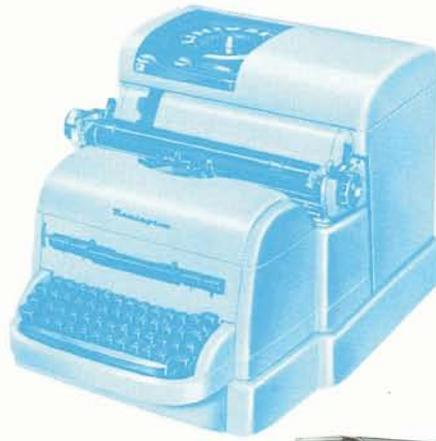
In addition to the input-output devices shown on the previous pages, other equipment is available to suit each user's particular requirements.

Unityper II. This unit is a desk-top electric typewriter with a special mechanism for the direct recording of information on magnetic tape. The operator types the information on the keyboard and receives a printed record of the information. Simultaneously, corresponding pulse code patterns are magnetically recorded on the tape by means of a magnetic head.

A mechanical interlock system in the typewriter portion of this unit locks the respective keys if two keys are accidentally depressed simultaneously and prevents recording of the characters on the tape. This unit is one of the most convenient means for putting a new program, a modification of one, or new data on magnetic tape for processing by the computer. Data on punched cards or paper tape can, however, be easily converted to magnetic tape with appropriate conversion equipment.

Card-to-Tape Converter. This unit is used to convert information stored on 80-column punched cards to a reel of Univac magnetic tape. When the conversion process is completed, the tape may then be mounted on a Uniservo and the information read into the computer at a much higher rate of speed than is possible with cards. Information from the punched cards is transferred to the tape at the rate of 240 cards per minute. All information being converted is automatically checked by this unit—after the information is on tape, the tape is read backward, then forward again. At the same time, the cards are read a second time and compared with the tapes, thus insuring complete accuracy.

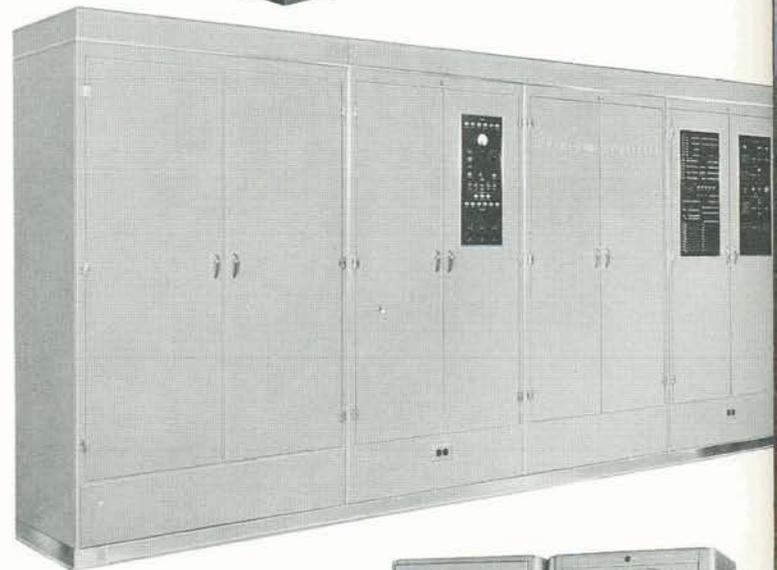
Tape-to-Card Con-



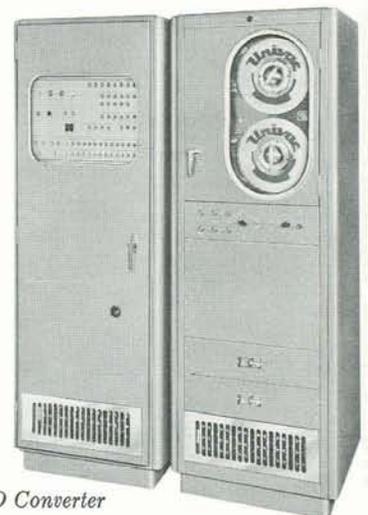
Unityper



Card-to-Tape Converter



Tape-to-Card Converter



A/D Converter

verter. This unit transfers information from Univac magnetic tape to standard 80-column punched cards at a rate of 120 cards per minute. It is often desirable to remove tapes containing computer results immediately to make way for work on other problems. Moreover, where data are needed in punched card form, this eliminates wasted computer time as would occur while operating a card punch directly from computer output. Complete self-checking circuits are incorporated to provide maximum accuracy of conversion.

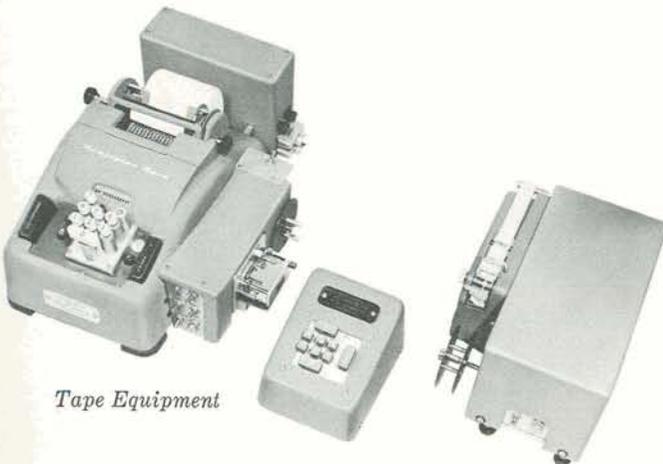
Analog-to-Digital Converter.

This unit is used for converting information obtained by analog recording instruments to the digital form used by the Univac Scientific. The analog type of recording instruments may be any devices that measure physical actions or properties (such as speed, rotation, voltage, time, temperature, pressure, or flow) and indicate measurements in a form capable of being observed, recorded, or transmitted. This converter transforms and records information at a rate of 7800 computer words per minute.

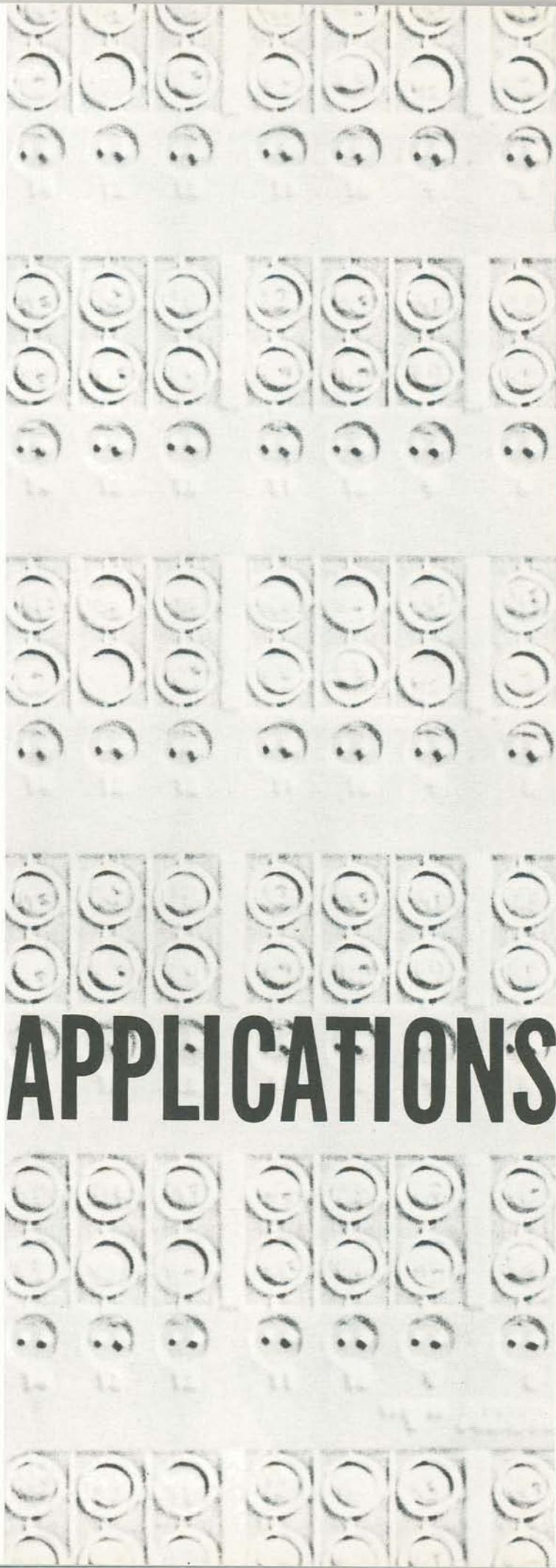
Model I I Punched Paper Tape Preparation Unit.

This unit is used to prepare and reproduce punched paper tapes for inserting information into the Univac Scientific. This unit is capable of preparing and reproducing tape with or without a printed record of the contents of the tape. In addition, it provides for the reproduction of a previously prepared tape with or without a printed record of the contents of the tape. The unit consists of a printer, main keyboard, and a motorized punch.

Most of the equipment shown here and on other pages may be used with other Univac computers, such as the Univac II and the File-Computer. A complete catalog, describing all Univac peripheral equipment is available.



Tape Equipment



SOME APPLICATIONS

Missiles. Univac Scientific systems are now in operation on such problems as flight simulation for various types of missiles and pilotless aircraft. In this way, design data can be checked without building and test flying a missile with consequent acceleration of the missile development program.

Engineering Design. The Univac Scientific is well known for its work in airfoil design; perhaps less well known is its use in designing new computers. Several large scale computers have actually been built from designs formulated in detail, down to the lengths of the wires and their color coding, on a Univac Scientific. This has been accomplished with substantial savings in engineering man-hours.

Real-Time Operation. A number of installations utilize the Univac Scientific computer for such real-time problems as wind tunnel tests where it is highly desirable, and often necessary, to adjust conditions according to developments occurring in the test. The programming ease and high speed of operation provided by this versatile computing system make the Univac Scientific uniquely adaptable to this type of service.

Linear Programming. The Univac Scientific is particularly well suited for the iterative matrix manipulations as are required in linear programming. Its arithmetic and control sections, specifically designed for large-order matrices, handle them with phenomenal speed and efficiency.

Physical Research. This is one of several classes of computation in which the Univac Scientific is unexcelled because of its great accuracy . . . especially with double-precision and floating point arithmetic and its rapid-access memory.

Weather Forecasting. The Univac Scientific is well adapted to the enormously complex matrix manipulations commonly required in the solution of the partial differential equations encountered in large scale air mass analysis. On one such problem a Univac Scientific has recently been operating continuously for 42 consecutive hours without a single error.

Market Research. This is but one of the many varieties of statistical analysis which the Univac Scientific was designed to handle with great speed and efficiency. Operations requiring fast, instantly readable and accurate output can be run directly from the computer into the Univac High-Speed Printer at the rate of 1300 characters per second (600 lines a minute).

1026-10141

Remington Rand Univac[®]

DIVISION OF SPERRY RAND CORPORATION • UNIVAC PARK • SAINT PAUL 16 • MINNESOTA

