

COMPUTERS

a n d A U T O M A T I O N

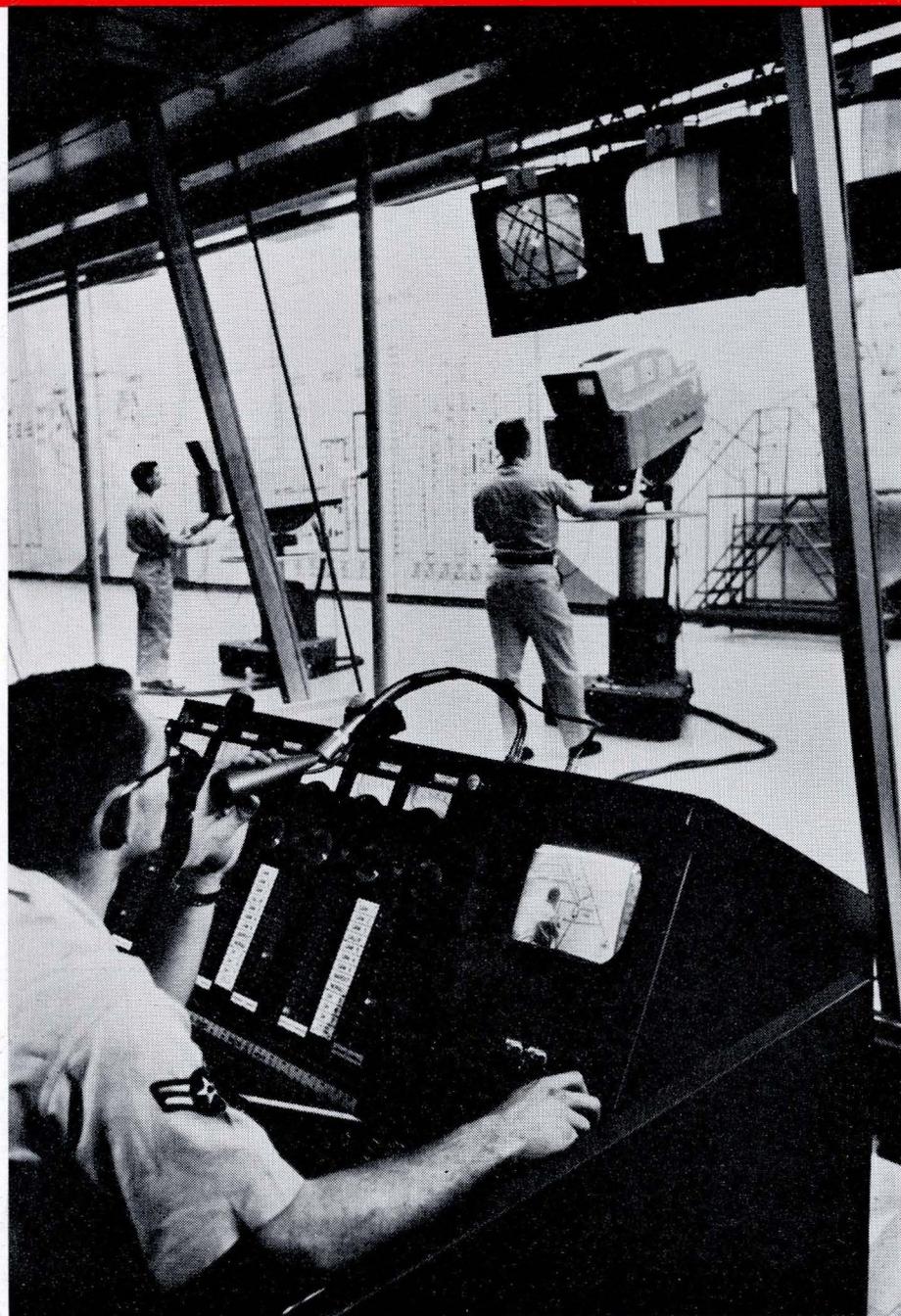
D A T A P R O C E S S I N G • C Y B E R N E T I C S • R O B O T S

**Military Airforce
Control for Maximum
Deterrence**

**Solving Production
Control Problems
With Electronic Data
Processing**

**Machine Translation
and General Purpose
Computers**

**News of Computers
and Data Processors:
ACROSS THE EDITOR'S
DESK**



APRIL

1960

•

VOL. 9 - NO. 4 & 4B

A Message to

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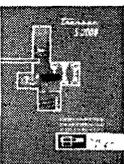


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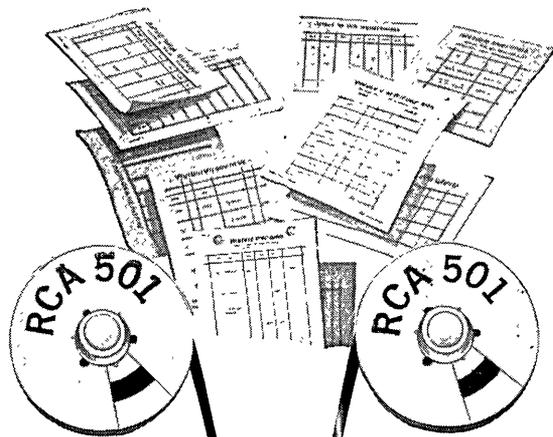
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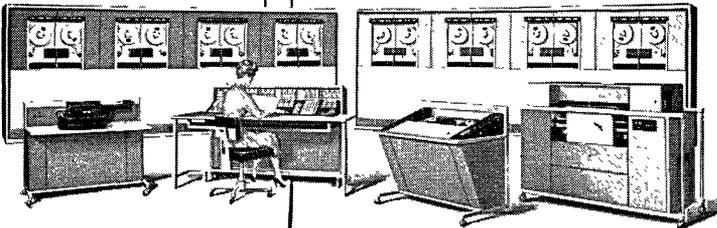
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The superb file maintenance performance of the RCA 501 System is a fact of operating experience. For information on how it can help your data processing, write to:



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Readers' and Editor's Forum

JARGON IN THE COMPUTER FIELD?

"It is good science and good scholarship always to explain everything in terms of the simplest words you know." So said Professor Howard Aiken of the Harvard Computation Laboratory, Cambridge, when we went over to visit him the other day. He said that the computer field was filling up with unnecessary special terms, a jargon, a cant, that "even the users themselves don't fully understand." But they use the terms, and it keeps the well-informed but technically uninitiated person in the dark.

"It separates ordinary people like me from people in the computer field," he said. "This is one of the reasons why we have practically stopped working in the computer field, and are instead working in the field of switching circuits.

"You have to labor and struggle to describe something in good English. So, to avoid the work, you invent a word, doing that rather than working out a carefully composed description.

"If every situation were described with a new word, communication would fail completely.

"You can expect shallow contributions if any, from persons who use an excessive amount of technical language.

"No subject is so simple that any fool could not make it complicated by the invention of a sufficient number of technical terms."

Computers and Automation is working on a revised glossary of terms and expressions in the computer field, and have done A through H at the moment of writing. Our estimate of the number of terms that will appear in this glossary due to be published this spring is over 800. The last one we published in October 1956 contained 490 terms.

Is it necessary that the number of new terms increase by about 100 a year in the computer field, when English dictionary language only increases about 1000 words per year?

THE WORKING GROUP FOR BETTER EDUCATION

Over 400 persons are now members of the Working Group for Better Education. Three "chapters" have started to form, one in the Los Angeles area (contact Bill Kegelmeyer, Ramo-Wooldridge, P.O. Box 997, Sierra Vista, Arizona), one in the Syracuse, N.Y., area (contact Sheldon Rifkin, Data Processing Operations, General Electric Co., Court St., Syracuse, N.Y.); and one in the Boston area (contact Ed Berkeley, 815 Washington St., Newtonville 60, Mass.).

The Los Angeles group is planning a 1½ day meeting at the end of March or beginning of April. The Syracuse group has already had a small meeting, and has

begun to plan an after-hours course on "logical reasoning and thinking in solving problems, no matter what they may be." The Boston group has scheduled a 5 hour meeting for March 26 in Cambridge.

A report on all the ideas contained in the comments, questionnaires, letters, and reports sent in will shortly be prepared, and will be sent out to members of the WGBE.

Sheldon Rifkin writes: "We are very enthusiastic with this project and hope that much good can come from it."

For more information about the WGBE, see pp. 8 and 9 of the February issue of "Computers and Automation."

FORMS OF IGNORANCE

I. From Mrs. P. Cammer Huntington, L.I., N.Y.

Some of your correspondents have emphasized the great importance of being able to read well and communicate intelligibly. Others have underlined the extreme necessity of good work in mathematics and the sciences.

Impeccable grammar, clear writing — for what purpose? A human computer, a human brain, gifted in the solution of physical, electronic or atomic problems — for what end?

"One may lay it down as an axiom that intellectual enlightenment in science, as in other spheres of thought, must be informed by the liberal spirit. Culture has no value unless it be for action, action directed to social good." (James R. Newman, "Scientific American," Sept., 1950).

I do not see the sense of deploring certain forms of ignorance while ignoring what is surely our number one real problem, the truly deplorable lag in scientific ethics as against scientific technology.

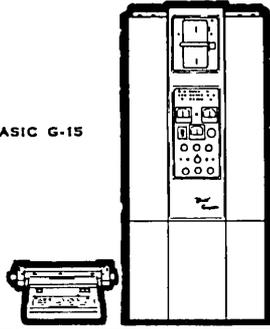
II. From the Editor

This magazine of course holds no brief for ignorance of any kind. We think that better education is important and worth discussion. We think that the social responsibilities of computer people for the good use of computers are important and worth discussion. We even think that if people were better educated, they would probably be less provincial about their social responsibilities.

As for the "number one real problem," 100 people if asked would probably give more than 80 different answers. The most we can sensibly say, I believe, is that many problems are real and very important. Among these, better education, scientific ethics, the social responsibilities of computer people, and making very

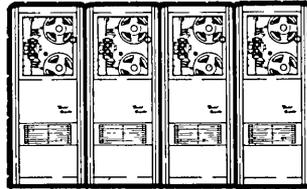
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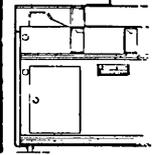
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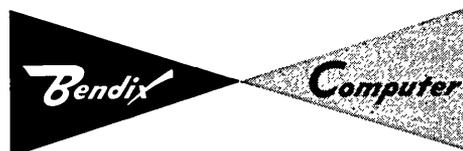


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MILITARY AIRFORCE CONTROL FOR MAXIMUM DETERRENCE

Lt. Col. Donald S. Davis, USAF

Headquarters, 57th Air Division
United States Air Force
Westover Air Force Base, Mass.

Center in Nebraska

In the 1830's the wilderness westward from the Missouri River to the foothills of the Rockies was called the Great Desert, and in the nation's capital the feeling was that the United States never would need to extend itself further in that direction.

Today, the former heart of the Great Desert, the State of Nebraska, is in the approximate geographical center of the country.

Where in the 1860's a cavalry outpost stood, lonely on the west bank of the wide Missouri River, stands now the headquarters of one of the nation's most powerful military forces, the Strategic Air Command, at Offutt Air Force Base.

General Thomas S. Power, Commander in Chief, has his headquarters here in a new \$10,000,000 control center which has been in use for about three years. A general named Custer used to work out of the same area when it was an Indian outpost, later known as Fort Crook. Some of General Power's men are still using the picturesque and rehabilitated old red brick barracks. The old parade ground, flanked by rows of officer and NCO quarters and barracks, seems an anachronism nestled among modern offices and up-to-date glass and steel airmen quarters.

Headquarters Building

The new headquarters building is not an imposing one and gives no hint that there is a building of equal size located underneath.

In the event of war the entire top three floors would be emptied of personnel. It would, however, be business as usual in the bustling underground command post. Huge steel doors, similar to fire doors on board ship, seal off the entire underground from the rest of the building. Air filtering machinery and a supply of food and water would permit personnel working there to stay underground, self-sufficient for at least a 30-day period.

Here, in this underground command post, which is manned 24 hours a day, the destruction of the war-making potential of enemies of the United States could be ordered merely by lifting a brick-red telephone from its base. A war could be directed through a communication network that is a marvel of an electronic age.

The War Room

All moves of the command's 3,000 tactical aircraft are recorded on huge panels of the war room (see front cover picture). Crews and maintenance personnel of these airplanes maintain a continual 24-hour vigil in carrying out their deterrent role as protectors of the United States and its allies. Another unique feature of

FRONT COVER: "THE WAR ROOM"

The front cover shows a portion of "the war room" in the underground headquarters of the U.S. Air Force Strategic Air Command at Offutt Air Force Base in Nebraska. Here is the center of one of the largest information-handling networks for military control of an air force. The closed circuit television system within the command post enables the top officers of SAC to keep continual check on operations without leaving their offices.

Thousands of visitors from both the United States and foreign countries have been shown through the building, all as a part of the plan of demonstrating that another "Pearl Harbor" surprise attack on the United States or its allies would be exceedingly unprofitable to the aggressor.

their deterrent mission is that the enormous areas of the world are their maneuver region. The command is now in the process of dispersing to more and more bases, within the continental United States, thereby increasing the number of targets that an enemy would have to hit to put SAC out of action.

SAC's payroll includes more than 270,000 men and women distributed at approximately 70 bases on four continents. It operates more airplanes than all of the airlines on this side of the Soviet Union and its associated countries. In addition, combat crews and other personnel assigned to the combat wings are always on 15-minute alert status — ready to go.

SAC men realize that the next war, if it comes, will be a quick one. An airplane that is in a hangar for repairs may never fly a single mission. Records of aircraft kept in SAC command post must be accurate and reflect every change. Data from electronic computing machines, which show the latest changes in aircraft combat ready status, continually pour into this room.

A visitor to SAC's command post will immediately be impressed with its size. It is about the length of a football field and nearly two stories high.

Glassed-front offices, that look like football stadium "press boxes," line one side of the room. These are the control rooms for General Power and his staff. From here they can view, from the many panels in front of them, targets, data on aircraft, weather and other information. Communications with SAC's far-flung bases and aircraft is almost instantaneous from this room. Orders can be given as fast as a man can talk. Controllers in the glassed-in "press boxes" have nearly 60 telephone lines available for instant contact with each of SAC's major subordinate commands — Second Air Force at Barksdale AFB, La; Eighth Air

Force at Westover AFB, Mass; Fifteenth Air Force at March AFB, Calif; First Missile Division at Vandenburg AFB, Calif; and Sixteenth Air Force at Madrid, Spain. Contact with the overseas air divisions — the Third in Guam and the Seventh in England — is equally rapid.

The Red Telephone

The famous "red telephone" (see Figure 1) is located in one of these control rooms — probably one of the most important rooms and one of the most vital instruments in the world. Within seconds, the controller on duty can contact SAC's subordinate command posts, scattered over the face of the world, and order execution of any of the emergency war plans which are already in the hands of the combat wing commanders.

Within minutes after receipt of these orders, SAC's B-47 and B-52 jet bombers can be heading for their pre-designated targets. Each crew knows the target it would strike under any given condition. It knows the route to the target and everything that will help put a SAC bomber over an enemy target has been planned in minute detail, and practiced until accomplishment would be little more than routine.

The IBM 704 Computers

Opening off one end of the main command post is the Computer Room, housing an IBM (International Business Machines Corp.) 704 computer. It stores on magnetic tape great quantities of information pertaining to the SAC force, including status of aircraft and missiles, crews, bases, war plans, and supplies.

In event of war, the computer would record progress of the strike force by means of punched cards. New information would be processed automatically in minimum time, giving SAC immediate and constant knowledge of the status of the strike force.

By some time in 1960, computer systems will be installed at each of SAC's subordinate headquarters and the machines will be interconnected with the central SAC machine. With this system, information in any one machine will be automatically recorded in all machines.

Air Force headquarters has signed a contract with International Telephone and Telegraph to provide an "information feeder" system from all SAC aircraft and missile control points to the SAC command post.

Other improvements to speed up the collection and posting of data are planned. One of these is the installation of animated displays for the wall panels which automatically can be kept posted by the computer.

Closed Circuit Television

Another unusual feature of the command post is a closed circuit television system. Color television cameras are installed in the main command post, the intelligence air room, and the global weather center. Receivers are located in the offices of General Power and his key staff members. The system is used to brief staff officers, eliminating the need for them to go to any one of several display rooms to gather information required for immediate decision.

The SAC Command Post also is connected by closed circuit television to the Combat Operations Center of



Figure 1 — This brick red telephone is one of the most deadly instruments in the world today. It is the key to SAC's primary world-wide alerting system. By merely lifting the phone from its holder, a SAC controller can instantly give the order to all bases to get their alert aircraft off the ground.

the North American Defense Command at Colorado Springs, Colorado. Immediate transmission of combat data over this system permits the quickest possible warning of enemy attack and allows almost instant coordination of United States' offensive and defensive aircraft movements.

Stationed at the Colorado Springs center is a team of five SAC officers headed by an experienced SAC controller. In the event of war, this team would be in constant visual contact with the SAC command post through the television hookup and would aid in coordination of SAC and NORAD (North American Air Defense) air activities.

The color television circuit also can be hooked up with Air Force Headquarters in Washington, D.C.

Thousands of Visitors

Since the opening of the headquarters in February, 1957, thousands of visitors, from both the United States and abroad, have toured the building and observed the inner workings of one of the world's great deterrent forces.

The whole world can see how the Strategic Air Command is determined to keep the peace by its capacity to dissuade any future "Pearl Harbor" attack — for the reason that it would be disastrously unprofitable. The whole world can see the workmanlike way SAC goes about it. What is more, any possible enemy also knows.

To let any possible enemy know is but another part of the bloodless war that goes on 24 hours a day in the headquarters of the Strategic Air Command.

Solving Production Control Problems With Electronic Data Processing

Edward M. McPherson

Administrator, Industry Applications Section
Electronic Data Processing Division
Radio Corp. of America
Camden, N.J.

(Based on a talk given December 2, 1959, before the Quad-Cities Operations Research Association)

It's amazing how fast the "blue sky" of yesterday becomes today's practicality. Ten years ago production control by computer was talked about with the same yearning coupled with disbelief as an artificial satellite for the earth.

Now, things have changed. Today, there are more than 8600 computers at work — many working on production control problems — and artificial satellites seem to buzz around the earth like flies around a sugar bowl.

The computer grows in importance each day as a business tool. From its first applications in relatively simple areas such as payroll accounting and billing, it has been called on to work on increasingly sophisticated problems.

Production Control

Production control belongs in the area of sophisticated problems, and presents a natural field for the computer.

Business variables have been and are being expressed as mathematical functions and are being statistically analyzed. This is fine for the computer with its fantastic ability to handle difficult mathematics and quantities of statistical work quickly, efficiently, and reliably.

The mathematical bases for solution of production control problems range from simple cost accumulation to linear programming, from Vaszony's scheduling using matrix mathematics to Morgan's critical path scheduling.

Extensive statistical analysis was largely impossible before the day of the computer, because of the sheer inability of clerks to process data in reasonable time or at reasonable expense.

Objectives of Production Control

Basically, the objectives of a good production control system are:

1. Conservation of manpower and equipment
2. Conservation of material
3. Conservation of capital

Let's look first at conservation of manpower and equipment.

Any production man will tell you that one of the most difficult problems facing him is how to have the right people and the right equipment available at the right time. It takes three to eighteen months to develop some human skills; and to produce on order some kinds of complex equipment may require as much as two years.

The elements of conserving manpower are well known. Basically, if a plant manager can tell when demands will

be placed on his operations, he can plan how to meet those demands.

Ideally, the production man would prefer an operation which manufactures a single item in a fixed periodic quantity. Although this simple situation does not eliminate absenteeism, personnel turnover, or equipment breakdown, it does reduce his production problems very considerably. And, given a static state, the production man can cushion himself against human and mechanical variations.

But this ideal situation seldom happens. Every new product and every variation of an existing product multiplies his problems of allocating manpower, equipment and overhead, making his problems complex and inter-related.

Need Accurate Information

Scheduling production to maximize profit in complex situations then requires giving the production man accurate information — often of a type and depth heretofore unavailable — on which he can develop his plans.

Today's conditions imply growing businesses in an expanding economy, and hundreds of variables affect profits. So the production scheduling problems have become mathematically important; and solving the problems fast enough to be useful for a company's day-to-day operations requires electronic speeds.

Inventory Replenishment

Production planners have always relied heavily upon "orders in the house" as the primary basis for laying their production plans. These orders may be a synthetic creation derived from inventory projections, or actual past due orders, on promises made by sales for future delivery — or a combination of all three.

If an inventory replenishment formula is the basis for setting production orders, reliability often varies widely. The degree of sophistication of the formula directly influences the validity of the results. In practice, these formulae vary from simple linear projections to highly complex equations including a wide range of influencing economic factors.

Modifying Projections

Since the country's economy is always in flux, projections must be modified frequently to fit changing conditions. A plant may produce several hundred items; demand may be projected two years into the future; the

order situation may be modified daily by orders received and observations of changing economic conditions. Such a plant has a large enough problem to require a computer. The reward: good information.

As an example, some companies today make: (1) gross projections totaled by quarters for the second year; (2) closer projections totaled by months for the last nine months of the current year; (3) still closer projections including advance orders, totaled by weeks for the second and third months of the current year; and (4) a production plan calculated by working day for each day of the current month. Projected sales, at all levels, are periodically converted to manpower and equipment requirements, in order that the production planner may anticipate production problems.

In theory, a forecast modified by orders and by changing conditions should place the production planner in the best possible condition to calculate the most economic routings of various combinations of products through the plant. In practice, this is not always so. Orders sometimes are cancelled. Some customers are given preferences. Some suppliers fail to deliver raw materials on schedule. Stable sales items are sometimes suddenly obsoleted. Quality control problems unaccountably develop. A thousand and one things can happen to wreck the best laid plans.

As a result, the production planner must also be able to recalculate his entire production program within an hour of the occurrence of some unexpected event.

Further, he can never load his shop one hundred percent. He has to load it at a reasonable level and build a reserve to carry production in the event that everything does not go as it should.

This means that within each shift's production schedule must exist the basis for recalculating the next shift's schedule.

For example, if he loads seven-and-one-half hours on the shift with one-half hour reserve for contingencies, then before the next shift starts (often the next day), he has to obtain the performance relative to the schedule and balance the next load in view of that performance.

Management Feedback

The modern production control system not only attempts to improve the speed at which items move through the plant but must improve the feedback of information to management in order that schedules may be improved.

There is no escaping costs. If you project sales, convert sales projections to manpower and equipment requirements, constantly modify these projections, establish production schedules for a month in advance, constantly revise these schedules, develop rapid feedback of information from the plant and use this information to alter your next schedule, you are going to spend money.

Such an expenditure is justified if you get fuller utilization of manpower and equipment. If by better planning and by closer timing you can raise production five percent, you have reduced the per item manufacturing cost five percent.

If you are able to calculate production costs by product mix and continue such calculations until you obtain the lowest cost mix with the highest combined revenues, then you are more fully utilizing your resources.

If you are able to determine precisely what it costs to alter a production line to provide special service to a customer, then you are in a better position to recover that cost.

Production men have long realized that they could do a better job of scheduling their operations, if they had time. Computers provide the time.

Conservation of Capital

Closely related to forecasting manpower and equipment is forecasting raw material and finished goods inventories needed.

Where raw materials are expensive, control over their purchase can generate profits. Therefore, just as firms must make an effort to anticipate their sales, they must also analyze cost trends in their raw materials. It is entirely possible that rising costs in some areas will warrant the purchase of substitute materials, or even the discontinuing of some product items.

Many Problems to Consider

Variables in considering the purchase of raw materials include: the trend in their prices; the probable demand for finished goods; storage area available; company capital reserves; the effect of delaying the filling of certain orders; the advantage of never being out of some goods versus the advantage gained in delaying raw material purchase; competitors' positions in the same circumstances; the advisability of paying a premium to maintain a source of supply; and many other variables.

Not all variables are readily measurable, but if management is to get maximum profit, it needs to be fully informed as to the probable effects of alternate courses of action.

Constant Inventory Evaluation

In conjunction with raw material inventory analyses are semi-finished and finished goods inventory analyses. A constant evaluation as to the most profitable point at which inventories should be maintained helps guide management in its decisions.

To accomplish this, it is necessary to establish inventory level controls which provide management with periodic totals as well as daily reports on exceptional conditions.

Therefore, a system that reports increments into and out of inventory and maintains upper and lower bounds of activity is required.

To be truly effective such a system has to be designed to report almost as the event occurs, since delays in reporting excess receipts to inventories or unanticipated withdrawals result in over-production or under-production.

What's In Process?

Directly tied into the production control activity is the maintenance of progress reports on the in-process inventory.

At periodic intervals the location and quantity of every item should be reviewed.

The times between the date an item is placed in production, the date of its arrival at various operations, and its completion date should be recorded to highlight 'off-schedule' items.

One way in which this is being done is to compare expected and actual time schedules for the manufacture of a product. As the product travels through various oper-

ations, its arrival and departure times are recorded and reported back to the computer. This information is then compared with the anticipated time of receipt and departure to determine the variation, if any. If the variation exceeds an acceptable bound, the information about the item is reported by the computer in the form of an exception report; and subsequent schedules are altered to take into account the delay.

Calculating Machine Loading

Process times are necessary for both establishing machine loads and for following production progress. These times can be obtained from a computer by gradually refining rough estimates until an acceptable formula for machine loading exists.

By using the computer in this way, production people are saving long and laborious industrial engineering surveys, and are placing useful production control into effect faster than ever.

Conservation of Material

If you have ever taken a physical inventory in a plant that has been in operation for some time, you would be fascinated by the variety of odds and ends which have accumulated. Often these odds and ends are so obsolete that they must be charged off as scrap.

One of the principal reasons these accumulations exist is the lack of reliable data on the origin and volume of scrap loss. More often than not a rough percentage is allocated for scrap loss — a clearly unrealistic "ball-park" figure based only on past practice.

To be properly effective such a scrap loss system must report exceptional losses immediately and pinpoint the origin.

This allows management to correct conditions and schedule compensatory production on an accelerated basis.

Realigning Operations

The key to curbing scrap losses is the ability to reschedule at will. Without the ability to realign shop operations into an economic pattern within a few hours of being notified of unusual losses, it is not possible to take advantage of minimum material inputs and still meet customer schedules.

Typical of a computer's ability in this area is that of the RCA 501, which can reschedule approximately 16,000 end products totaling some 90,000 pounds for a small bar mill in approximately 2½ minutes, and in less than ten minutes produce the control documents for the new schedule.

Integrated Data Processing

In World War II we discovered that without ball bearings the German War Machine would not run. Today we have learned that without integrated data processing our businesses cannot operate smoothly.

This means that we must build a model of an information system to represent the firm as a whole; and that when management changes policy, the change must be reflected immediately throughout the firm.

Integrated data processing systems cut across departmental lines, and collect and centralize information. The computer acts as a librarian and on call, delivers up-to-date information needed for logical, factual decisions.

Basically the objective of the integrated data process-

ing system is to cut duplication, assure management that everyone uses the same basic data in arriving at decisions, break down clannishness within the organization, reinstall a sense of total teamwork and minimize fudge factors. For instance, the RCA Tube Division is in the process of developing and installing an integrated data processing system. They have divided their problem areas into phases and have scheduled installation of the system over the next four years.

Since production control is at the heart of the system they are developing this portion somewhat earlier than other portions, such as purchase and vendor control.

The forty-five analysts and programmers working on this operation have been divided into teams. Some teams are converting the old punch-card historical records into variable records on tape. Other teams are developing projective techniques to improve forecasting. Still others are working in the shop to develop and improve control points within the production process.

All records going onto tape are being reviewed in order that provision may be made for data in future phases of the program. As each program is written for their 501, provisions are being made for tying in later programs which require the same data.

Experience indicates that integrated systems have to be built carefully. It is a slow process to design and install a fully coordinated system. The effect on operations is that each function can have ready sources of data, without the necessity of maintaining its own files. Action by any portion of the enterprise will be rapidly entered so that its effect can be known to all others. Automated paperwork, instead of being the burden of industry, can become the tool and aid to greater efficiency and profit.

REFERENCE TO MEMORY



"All these brains around here and you can't even remember your social security number . . ."

Readers' and Editor's Forum

[Continued from page 6]

positive that nuclear weapons do not destroy New York, London, Moscow, Paris, Washington, etc. — are certainly all real and important problems.

A NATIONAL ACADEMY OF SCIENCE

E. F. Cooley
Far Hills, N.J.

The United States needs more trained engineers, computer people, research scientists, and trained scientific talent of all kinds. In order to get them we must have more teachers in this field. It is fairly evident that we are steadily falling behind the Russians in both quantity and quality of trained scientific talent. Effective measures to improve this situation are nowhere apparent; drastic steps are necessary. A draft of talent to teach and a draft of high-aptitude youngsters to be taught may be the only way. But first let us consider a more acceptable method.

At certain times in the history of this country it has been thought necessary to provide for the development of military leaders by the establishment of the Military Academy at West Point, the Naval Academy at Annapolis, and now the Air Force Academy in Colorado. It seems to make good sense to copy these successful examples by establishing a National Academy of Science.

Imagine a National Academy of Science with 12 branches, each with a capacity of 5,000 students. Locate each branch in a different part of the country, on the basis of population primarily. Provide tuition and living expenses to qualified boys and girls, in exchange for a promise to serve as a teacher or research worker for three years after graduation. Obtain a qualified staff to teach them perhaps by a draft from other institutions and from industry. Maintain the quality of both teachers and students at a high level. Why not push such a plan?

The attitude of private and state institutions of learning towards this plan might consist of much opposition. But it seems utterly impossible for them to do the job alone, even if aided by Federal funds. Even if they were subsidized to expand scientific training, it does not seem probable that they could meet the requirement as satisfactorily as a National Academy of Science. Perhaps some of the educators in charge of private colleges would welcome this plan for relieving them of a very heavy responsibility. In fact, it would not be surprising if the need for 12 more branches were recognized before the original 12 were fully operating.

To those who would classify this plan as too great a degree of regimentation let me say that no one objects to regimentation more than I do. But it seems to me evident that methods less drastic than this will not be effective in time.

WHAT DO YOU THINK?

I. From Walter E. Misdorn
Minneapolis, Minn.

I heartily approve of your new "Across the Editor's Desk." I am particularly anxious to see more surveys

— how about a new list of computers installed to date and on order? I personally like articles describing applications and dealing with such subjects as the comparison of buying or leasing a computer — but disapprove of those dealing with general education.

II. From Norman E. Polster
North Wales, Pa.

I enjoy "Computers and Automation" and admire what you are doing to encourage social responsibility in computer people.

III. Charles D. Spangler
Hollywood, Calif.

It is a pleasure to read a magazine such as yours wherein so much technical information is presented in such a readable manner.

IV. David M. Summers
Worcester, Mass.

I am sorry to say that "Computers and Automation" falls a long way short of what I think a good magazine should be. You should present much more technical and worthwhile information. Your artistic lay-out smacks of the 1920's. I do not understand why you have so few pictures. And who in the world really makes use of the so-called "reference information" which you publish?

DREAMING — AN ANALOG IN A COMPUTER OF AN ASPECT OF DREAMING

Leon Davidson
White Plains, N.Y.

Some interesting and potentially fruitful interdisciplinary considerations can be deduced from comparison of some aspects of the human mental processes with some operations of electronic digital computers. One such point is embodied in the question: "Can Computers Dream?", which occurred to the writer once when he was observing the operation of a Datatron computer under his supervision.

Some human thinking processes may certainly be described in terms applicable to digital computing machines. For example, one may be "caught in a loop" temporarily, being unable to get past some particular point in a sequence of thoughts despite several "restarts." As another example, a mental process like an "acoustic delay line" seems to be used for temporarily remembering a telephone number between the look-up and the dialing, by recirculating the verbalized "sound" of the number between the brain's "hearing input buffer" and the "speech" system, without making any actual audible sound. Once dialed, the phone number may be quickly forgotten, since it never entered the "main memory."

Similarly, a computer-oriented viewpoint might help elucidate one of the puzzling aspects of ordinary dreaming. Many long-seeming dreams (as well as hallucinations induced by opiates, etc.) have an actual duration measurable in small fractions of a minute, according to valid experiments. Yet such dreams often seem to pre-

sent so much detail in each scene, and so much consecutive action, that it may take fifteen or thirty minutes to tell the complete story to another person. The action of the dream may seem to extend for hours or days of real time. The dreamer himself may find it hard to believe that the dream was almost instantaneous.

An insight into this phenomenon may be gained by drawing an analogy with a certain class of computers, namely those having "on-line" (direct) mechanical output devices (such as punched paper tape or cards, or a typewriter). When pages of typed output are being edited and printed, word by word, for minutes on end under the direction of a computer, the mechanical motions of the typewriter type-bars, etc., often use 99% of the time, while the brief computations, shifts, and other internal electronic steps of the editing program might use less than 1% of the elapsed time during the typing procedure. Thus for 99% of the time during the edit, the computer's "brain" is idling.

This condition I believe to be analogous to our ordinary waking life, when our thoughts can far outrace our bodies. For example, the mental effort required to guide our steps, when walking, occupies an infinitesimal fraction of our mental capacity. Thus, while walking, we can ponder other problems, or let our brain idle. That is, negligible "brain-time" is used in walking.

Consider now what happens to the computer described above, as it types out the data edit, if the operator turns on the "printout suppress" switch. (This has the important effect of eliminating all typewriter action, although the computer still accesses and "carries out" the typewriter commands as usual.) Instead of taking minutes to complete the typing of the pages of output, the computer will now run through the entire editing and print-out program and reach the final stop order in a matter of a few seconds. This great reduction in time is due merely to elimination of the "idle" time which had been caused by the relative slowness of the typewriter's mechanical actions, type-bar motion, etc. The computer, it must be emphasized, will still have gone through every step and complication of the editing program; it will have computed every word that should have printed out, placed it in its output register, and shifted it appropriately. In the few seconds of running with the printing suppressed, the computer will actually have "experienced" the whole output procedure, step by step, but the relatively huge external time delays caused by the mechanical output equipment would have been avoided.

It seems to me that the mode of computer operation just described, with the mechanical output actions suppressed, is analogous to the mental state of dreaming. The suppression of the mechanical output motions corresponds to the disabling of motor activity in our sleeping state. In dreams, we go through all the steps of an incident, without moving a muscle. The mere thought of walking for miles down some familiar road is sufficient to convince us (in our dream) that we have done so. Our memory supplies us (with fractional-second access times) with the various scenes encountered in the course of the walk. Thus within a fraction of a second we can have dreamed a sequence of events which would take many minutes of real time in our waking state. The mind in the dreaming state is satisfied that it has "experienced" that sequence of events, in much the same

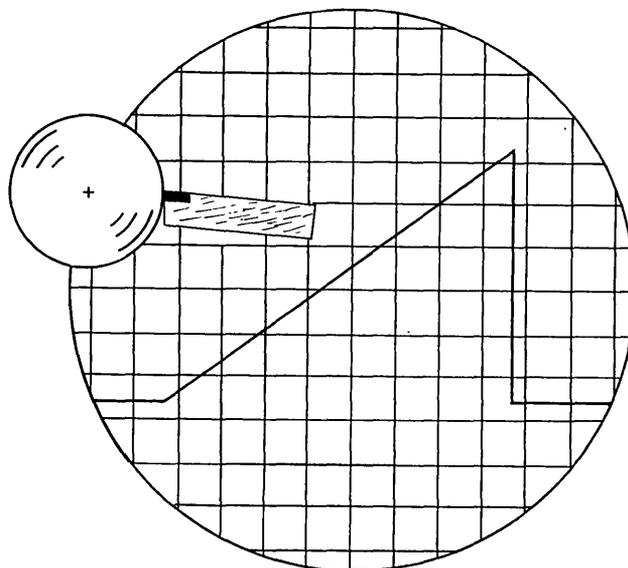
way that the computer **absolutely** could not within itself distinguish between the occasions of running an edit with and without the printout suppress switch turned on. (For instance, if the edit program had called for the computer to store the word "All's well" in a specific location in memory after each hundred words had typed out, this would have been done in exactly the same way in either case. Hence later examination of this memory location for this signal word, by a subsequent computer program, would not reveal any difference between the cases of having run with printout suppress on or off.) The mind of the dreamer knows that to have walked a few miles must have taken an hour or so, so that that elapsed time is taken for granted, even though only a second of real time has gone by.

Apparently in dreaming the mind follows through the chain of events or "program steps" which form the dream, without the "real time" delay occasioned in real life by the slow movements of our mechanical outputs, e.g., bodily movements, speech, etc. Thus the high speed of the actual human dream would seem quite understandable, being comparable to the high speed of a computer output program when the mechanical output motions are suppressed.

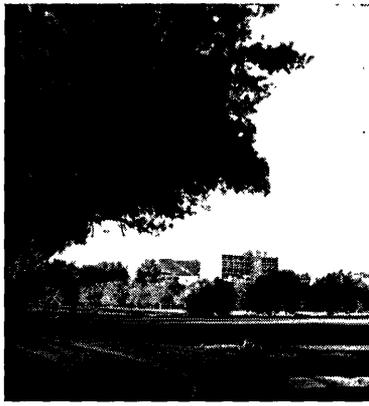
The exploration of analogies of this type may provide a useful insight furnished by computer technology and science to studies of the life sciences.

It should be emphasized that this discussion of possibilities and analogies does not constitute proof, but instead only the formulation of a hypothesis. But such formulations are also a part of scientific investigation, even if long periods of time, experiment, and work elapse between scientific hypothesis and satisfactory verification.

COMPUTER ART



A motif based on the numerical control of machine tools.



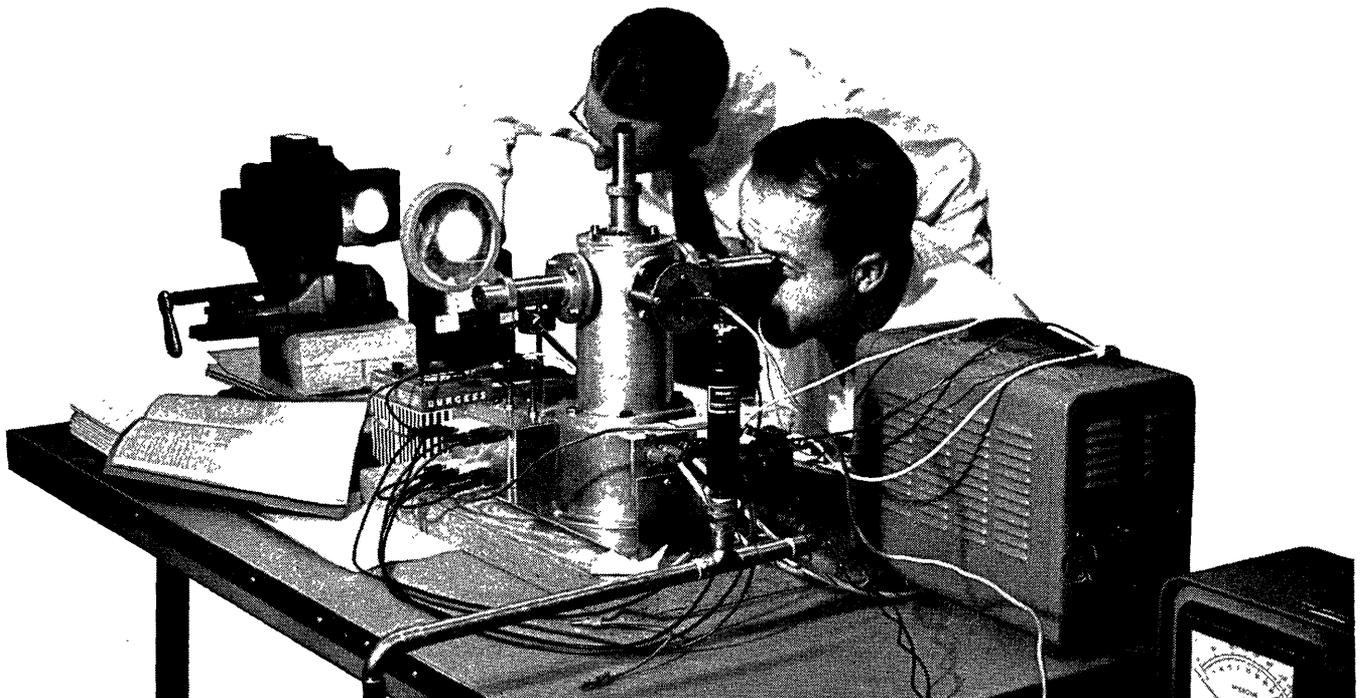
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An electron device permits scientists to study the behavior of charged dust particles held in suspension.



ANNOUNCING

F A C T
FULLY AUTOMATIC COMPILING TECHNIQUE

**NEW HONEYWELL 800 BUSINESS
COMPILER IS FIRST TO PROVIDE FOR
INPUT EDITING, SORTING, PROCESSING
VARIABLE-LENGTH RECORDS, AND
REPORT WRITING**

FACT (fully automatic compiling technique) is a complete automatic programming system for the highly advanced Honeywell 800 transistorized data processing system. It is designed to simplify the preparation of business data processing programs by providing a convenient problem-oriented language, a highly favorable source-statement-to-machine-instructions ratio, adaptability to a wide range of equipment configurations, and more data processing functions than ever before available in a compiler.

FACT LANGUAGE SHORTENS THE GAP BETWEEN MAN AND MACHINE

FACT lexicon is made up of familiar words of everyday business usage such as FILE, ENTRY, PROCEDURE, REPORT, DELETE AND UPDATE. Source programs are initiated by combining lexicon words with the names of data units (files, entries, fields) to form ordinary English sentences and paragraphs. FACT accepts programs stated in this language and automatically creates the detailed machine language programs required to direct the data processing system in its work.

FACT also provides complete printed information about its own operation, including program listings, memory assignments and diagnostic data pertaining to source statement errors encountered during compilation. All of these outputs and aids are expressed in language easily understood by the programmer.

FACT WORKS WITH SMALL AS WELL AS LARGE SYSTEM CONFIGURATIONS

FACT can compile programs using as few as four magnetic tape units and 4096 words of memory. It can take advantage of any additional equipment that may be available and programs can be compiled on one Honeywell 800 for execution on any other Honeywell 800 system.

The programmer uses environment statements to describe the equipment array available for compilation as well as the array on which the object program is to run. Each object program is compiled to operate as efficiently as possible with the allotted machine units.

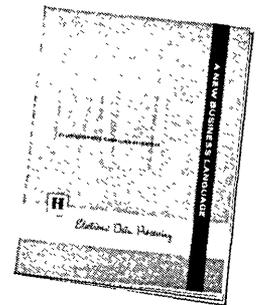
WITH FACT, FEWER PEOPLE WRITE MORE PROGRAMS IN LESS TIME

FACT may be used to prepare many different types of programs at many different levels of complexity including: input card reading and editing, creation of data files, data sorting, arithmetic computations, updating of data files, and generation of printed or punched reports based on input data, file data or program results.

The resulting compression of programming time and effort means that a given amount of work can be done with a smaller staff, jobs can be placed on the data processing system faster, programs can be modified more easily to meet changing requirements, and the data processor can be used profitably on a wider range of jobs.

HONEYWELL 800 CUSTOMERS ARE WRITING PROGRAMS IN FACT LANGUAGE RIGHT NOW

Honeywell Service as well as Honeywell EDP equipment is setting the pace for the industry as evidenced by the fact that customers for Honeywell 800 systems are even now writing programs in FACT language. Experts in the field of automatic programming, including compiler creators as well as users, have quickly recognized the outstanding characteristics of the Honeywell business compiler. If you would like to make your own comparison of FACT features with those of any other compiler, write for a copy of the new 94-page manual, "FACT — a new business language." Address your request to: Minneapolis-Honeywell, Datamatic Division, Wellesley Hills 81, Massachusetts, or Honeywell Controls Limited, Toronto 17, Ontario.



75th
PIONEERING THE FUTURE
YEAR

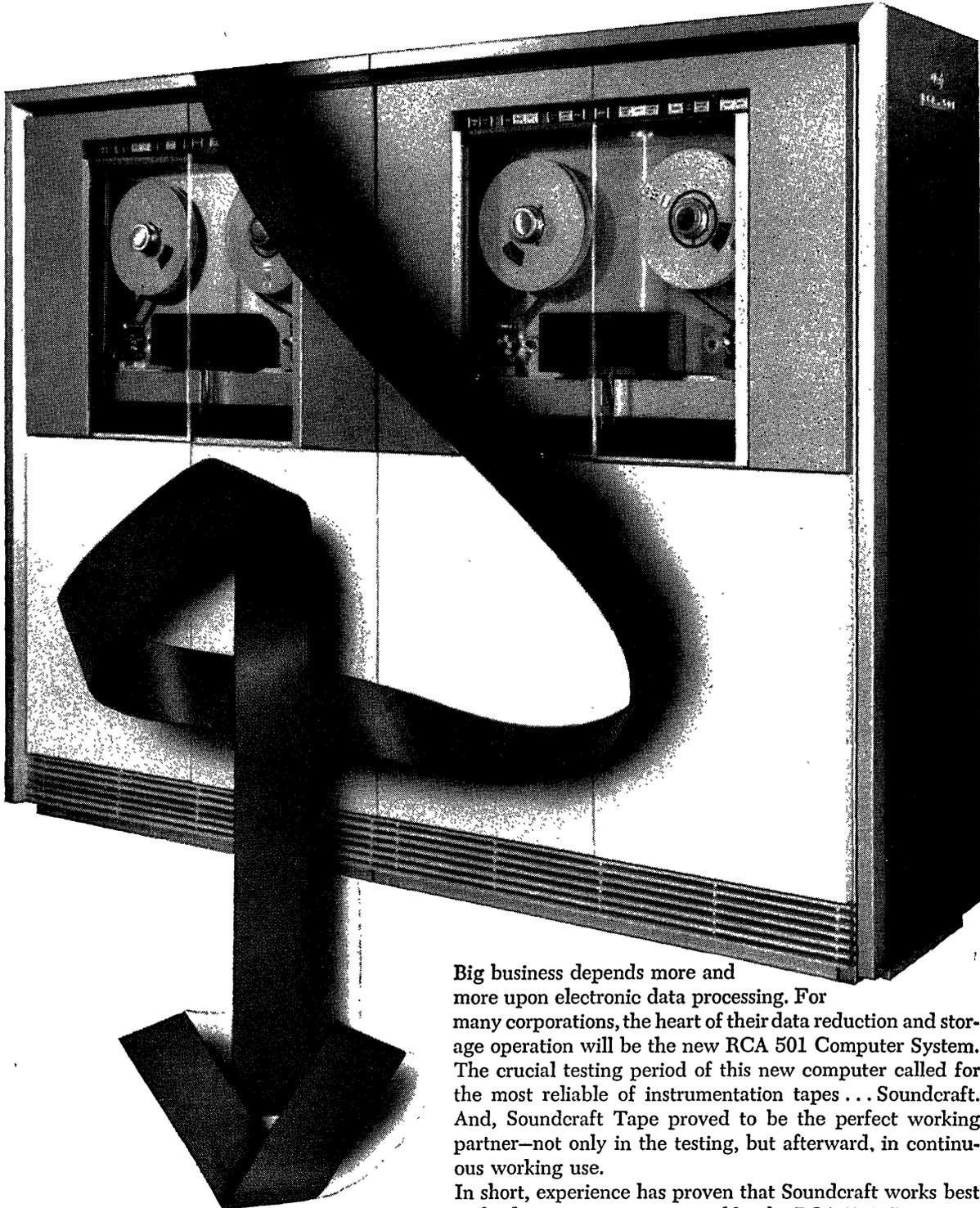
Honeywell



Electronic Data Processing

WORKING PARTNERS

RCA 501 — SOUNDCRAFT INSTRUMENTATION TAPES



Big business depends more and more upon electronic data processing. For many corporations, the heart of their data reduction and storage operation will be the new RCA 501 Computer System. The crucial testing period of this new computer called for the most reliable of instrumentation tapes . . . Soundcraft. And, Soundcraft Tape proved to be the perfect working partner—not only in the testing, but afterward, in continuous working use.

In short, experience has proven that Soundcraft works best on leading computer systems, like the RCA 501. Let precision-made, trouble-free, error-free Soundcraft Instrumentation Tapes go to work for you. *Complete literature on request.*

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NEWS of Computers and Data Processors

"ACROSS THE EDITOR'S DESK"

COMPUTERS AND AUTOMATION

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Number 4 B

APRIL 2, 1960

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IF YOU HAVE AN IMPORTANT ANNOUNCEMENT OR NEWS, mail it to us to reach us by the 15th of the month — and we shall do our best to put it into "ACROSS THE EDITOR'S DESK" and into the mail by the beginning of the next month. The purpose of this part of COMPUTERS AND AUTOMATION is a "rush report" so that our readers will know more, faster.

THE ARMED SERVICES TECHNICAL INFORMATION AGENCY BECOMES AUTOMATED TO SOLVE RETRIEVAL PROBLEMS

Office of Technical Services, Dept. of Commerce,
Washington 25, D.C.

The Armed Services Technical Information Agency at Arlington Hall, Va., receives daily some 1,200 to 3,500 requests for specific reports. It operates to provide Department of Defense agencies and their contractors on request with copies of research reports done by or for the military agencies. There are nearly a million documents in the ASTIA collection, which is growing at the rate of 30,000 titles per year.

Until an Automatic Data Processing System came into effect in February, 7,000,000 catalog cards were in use. Approximately 1,200 copies of reports had to be "hand-tailored" every day, after security clearance of each request and checking against shelf stock. Currently, 55 percent of requested material is out of stock and must be reproduced from microfilm.

Merely indexing and retrieving information fully identified in the requests is a mammoth operation. But the identity of many items is not known to the inquirers. Only automation could meet this challenge.

ASTIA started off with a Remington-Rand USS-90 (Univac Solid State Computer). This punch-card system had as its first objective speed-up of the flow of business-type information to military contractors. It was to become operational February 15. Magnetic tapes will be added about July 1 to automatically identify reports requested without mention of ASTIA catalog numbers. Tapes will also accelerate checking for duplication, mechanized compilation of cumulative indexing of the Technical Abstract Bulletin and information-retrieval. Within another year, it is hoped to copy all catalog cards on magnetic tape, making possible automatic printout, at 600-lines-per-minute, of bibliographies, together with a full

descriptive abstract of each reference. Final stage will be a Randex (random access) system, giving greater flexibility in compiling reference information.

The groundwork and first phase of the massive transition to automation by this gigantic technical information agency is reported in a new Department of Defense publication just released through the Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce.

In the automation report, the process by which a thesaurus of 9,000 "descriptors" was developed out of 70,000 subject headings is recounted as the history of "Project MARS" (Machine Retrieval System). An interim single-word heading or "Uniterm" system was found to lack definition and was merged into the descriptors. Subject coverage was split into about 290 display schedules or basic categories in a trailblazing venture.

PB 161306, AUTOMATION OF ASTIA: A Preliminary Report, Armed Forces Technical Information Agency, Dec. 1959, may be ordered from OTS, U.S. Department of Commerce, Washington 25, D.C. It contains 56 pages, price \$1.25.

TEACHING AUTOMATIC DATA PROCESSING TO SOUTH AMERICAN EXECUTIVES

John Diebold Group, New York, N.Y.

American knowledge and experience in data processing is being exported to South America, as a group of experts from The John Diebold Group, international management consultants, presents a course in automatic data processing (ADP) to South American business and government executives. The course is being given March 28-31 in Caracas, Venezuela, and covers management aspects of planning and organizing for automatic data processing. Controllers, ADP managers, systems and methods men, and other management personnel are in the course.

The South American course is part of a series which the Diebold Group is giving in foreign countries. Previous courses in Europe attracted hundreds of business and government officials interested in learning about American experiences in ADP.

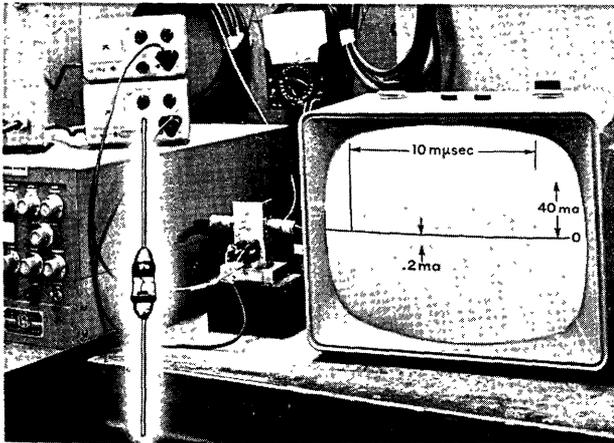
DIODES THAT SWITCH IN A BILLIONTH OF A SECOND

Sylvania Electric Products Inc., Woburn, Mass.

The world's fastest switching diode, capable of performing up to 500,000,000 logic functions in a fraction of a second, has been developed by Sylvania Electric Products Inc. Sylvania is a subsidiary of General Telephone & Electronics Corporation.

Dr. William J. Pietenpol, vice president and general manager of Sylvania's Semiconductor Division, said the new diode is designed for use in high speed military computers such as missile guidance and tracking systems, and in commercial equipment.

The diode has a guaranteed slowest speed of 0.8 billionths of a second (0.8 millimicroseconds), and a typical speed of 0.3 billionths of a second (0.3 millimicroseconds).



"As other components of comparable speed are developed, it will be possible, for the first time, for logic circuits to process ideas in a few billionths of a second", Dr. Pietenpol declared.

Designated type D-4121, the new Sylvania silicon diode is hermetically sealed and capable of operation at 150-degrees centigrade. It offers good performance despite extreme conditions of vibration, shock, temperature change and moisture. It is also capable of operation in the microwave range (1000 Mc and upward), he added.

At 25-degrees centigrade, type D-4121 offers the following electrical characteristics:

	<u>Min.</u>	<u>Max.</u>	<u>Units</u>
Forward Voltage Drop, V_F			
$I_F = 40 \text{ ma}$	-	1.5	v
$I_F = 10 \text{ ma}$	-	0.6	v
Reverse Current, I_R	-	200	ua
$V_R = 4 \text{ v}$			
Reverse Recovery time, t_{rr}	-	0.8	mms

SIGNIFICANT EARNINGS GAINS EXPECTED FOR OFFICE EQUIPMENT INDUSTRY IN 1960

Arnold Bernhard & Co., New York, N.Y.

The year 1960 will probably be one of major earnings improvement for the office equipment companies, according to The Value Line Investment Survey of Feb. 29, 1960. Backlogs are higher in all sectors of the industry. Especially encouraging is the prospective strengthening of profit margins.

There is a growing trend toward office automation. Demand for modern business machines, particularly the electro-mechanical equipment and electronic data-processing systems, is likely to expand rapidly, both in 1960 and for many years to come. The untapped markets for these high-speed devices are still vast. During the late Fifties the margins of data processing equipment makers were depressed, not by overcapacity, but by huge "make-ready" expenses in connection with revolutionary new products. In 1960, for the first time, sales volume in office automation equipment promises to rise more than special expenses for research, tooling and personnel training. The major investment of recent years in these items will begin to pay off.

The conventional equipment section of the industry should enjoy appreciably improved business this year. New machine models, much improved in styling, have been well received and new orders recently have been coming in at an increased rate. Producers of standard office machines, such as typewriters and calculators, have a heavy fixed overhead. The sizable increases in volume estimated for this year should reduce unit costs and enable earnings to recover from the 1958-59 lows.

Now that the office equipment manufacturers have behind them most of the make-ready expenses in connection with the new generation of business machines, The Value Line Investment Survey looks for them to show increasing profits over the next 3 to 5 years. Competition in the electronics field can be expected to become increasingly keen, but the potential market is enormous -- big enough for most well-managed, strongly-financed companies to prosper in the decade ahead.

STRUCTURE OF LANGUAGE AND ITS MATHEMATICAL ASPECTS -- MEETING

Mrs. Robert Drew Bear, American Mathematical Society, Providence, R.I.

On April 14-16, the American Mathematical Society will hold an important meeting at the Hotel New Yorker in New York City, in conjunction with the Association for Symbolic Logic and the Linguistic Society of America. We are expecting a minimum registration of 800 scientists for this meeting.

An important feature of the program is the Symposium on the Structure of Language and its Mathematical Aspects. There is currently a great deal of interest in this subject, resulting largely from the demand for machine translation. Computers have been the greatest impetus to activity in linguistics in modern times.

The scientists attending the other symposium, which deals with Stability Problems in Hydrodynamics and is co-sponsored by the Office of Ordnance Research and the Institute for Defense Analysis, should find the possibilities of computer applications equally relevant to their interests.

DETROIT RESEARCH INSTITUTE'S
NATIONAL CONFERENCE ON BANKING AUTOMATION

The Detroit Research Institute will hold a National Conference on Banking Automation at the Detroit Leland Hotel, Detroit, Mich., Tuesday to Thursday, May 10, 11, and 12, 1960. Following are the talks to be given:

TUESDAY

1. "The Approach to Banking Automation", Malcolm H. Gibson, Pres., NABAC, Pres. Citizens Bank of Sheboygan, Sheboygan, Wisc.
2. "Cooperative Data Processing Ventures with Small Banks", Franklin Moore, Pres. Commercial & Savings Bank, St. Clair, Mich.
3. "The Medium-Sized Bank and Automation", Richard J. Click, American Fletcher National Bank & Trust Co.
4. "The Large Bank and Automation", John A. Cost, V. Pres. Fidelity-Philadelphia Trust Co.
5. MICR (Magnetic Ink Character Recognition), A Progress Report, Part I: "Printing of Documents, On Premise, Off Premise", Len Thomasma, Dir. of Marketing, Todd Division, Burroughs Corp.
6. - , Part II: "The Bankers' Problems Relating to the MICR Program, and Suggested Means of Handling", Leonard M. Selden, V. Pres., Michigan National Bank, Lansing, Mich.
7. - , Part III: "A Case Study of a Bank now Actively Handling MICR Items", R. J. O'Keefe, Asst. V. P., Chase Manhattan Bank, N.Y.

WEDNESDAY

1. The "On Us" Field, Part I: "Account Numbering", John L. Talley, Mgr., Systems Dept., LeFebure Corp., Cedar Rapids, Iowa
2. - , Part II: "Bank Policy as Interpreted by Transaction Codes", Raymond C. Kolb, V. Pres., Mellon National Bank & Trust Co., Pittsburgh
3. "The Processing of Bank Documents -- Part I", John S. Kindy, Special Banking Repr., Burroughs Corp.
4. "The Processing of Bank Documents -- Part II -- The Future of the Transit Operation", J. C. Wotawa, V. Pres., The Federal Reserve Bank of St. Louis, Mo.
5. Group discussions, technical sessions, and equipment presentations. Some of the topics to include: Account Numbering; Imprinting Problems; Rental or Purchase of Equipment; Conversion to MICR; Electronic Data Processing; Personnel Problems; Operations Research and Banking. Other topics to be suggested by those who will attend the conference.

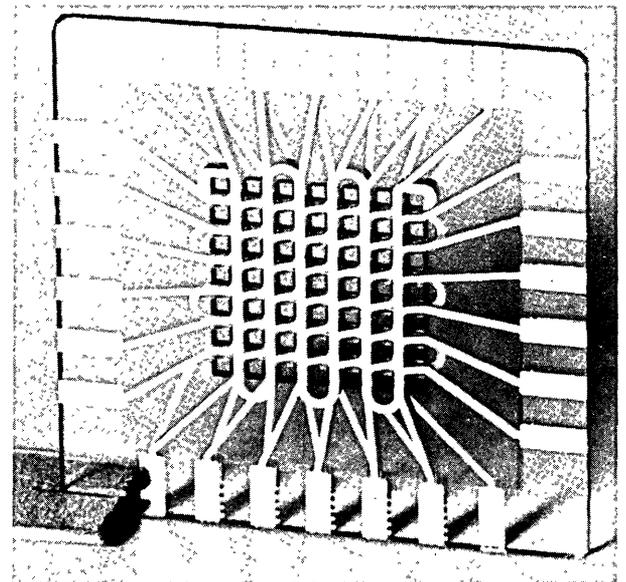
THURSDAY

1. "Sorting, A Progress Report", Calvin H. East, Special Bank Repr., National Cash Register Company
2. "Conversion of the Information on MICR Documents for Computer Processing", James Miller, Special Banking Repr., International Business Machine Corp.
3. "Computer Processing", Jesse Lynch; Touche, Ross, Bailey & Smart
4. "The Future of Banking Automation", Forde U. Steele, V. Pres., Central National Bank, Cleveland, Ohio
5. Panel Discussion.-- The panel members will answer questions submitted in advance and asked from the floor. They will also summarize the conference deliberations. The panel will consist of the speakers and in addition include the following individuals: William Shannon, V. Pres., Manufacturers National Bank; Willard Westover, Dir. of Services to Financial Institutions, Touche, Ross, Bailey & Smart.

Arvid W. Jacobson, Exec. Dir.
Detroit Research Institute
10 West Warren Avenue
Detroit 2, Michigan
TEmp 1-7866

CBS ELECTRONICS THIN-FILM MEMORY

Part of the microelectronics program just announced by CBS Electronics, the manufacturing division of Columbia Broadcasting System, Inc., is this thin-film memory plane for airborne computers. Other CBS memory units now being fabricated offer a 25-to-one saving in space compared with many of those in common use today.



System Development Corporation, Santa Monica, Calif.

The System Development Corporation has taken occupancy of one of Santa Monica's largest buildings -- a \$2.5 million dollar, two-story brick structure encompassing more than 210,000 square feet. This is "Building #5", and will be used primarily for offices and will have movable, internal steel walls which permit maximum flexibility in the arrangements of offices. It will give SDC a total of more than 600,000 square feet of space available in its five main buildings in Santa Monica. Building #4, which has been used for office space pending the completion of Building #5, soon will house a new, transistorized electronic computer. With the arrival of the new computer, SDC will have one of the world's largest computing facilities.

The System Development Corporation, a non-profit organization, was separately incorporated in 1957. SDC's primary contract is with the Air Defense Command, although it is doing some work for the Strategic Air Command. The Air Defense contract calls for two main efforts.

One of these is the development, installation, and maintenance of a System Training Program which simulates enemy air raids on United States target cities. This simulated attack program enables Air Force personnel to practice using the complex air defense warning system, both the manual system, in which men process data manually, and SAGE (Semi-Automatic Ground Environment), in which data is processed by high-speed, digital computers.

SDC is responsible for designing, writing, testing, installing and revising the computer programs used by SAGE computers throughout the nation.

SDC currently employs more than 3600 persons, including one of the largest staffs of computer programmers in the world. The Corporation's growth has been remarkable. In February of 1957, when, as the System Development Division of the RAND Corporation, it occupied the 2500 Colorado Building, there were but 600 employees.

Approximately 400 employees are on duty at the various active and planned Air Defense installations all over the North American continent, while the Strategic Air Command Control System (SACCS) Division in Lodi, N.J., employs an additional 400.

COMPUTER AT THE MISSOURI SCHOOL OF MINES AND METALLURGY

Hank Billings, Springfield, Mo.

A computer center is expected to be installed at the Missouri School of Mines and Metallurgy at Rolla, Mo., during early 1960, thanks to a federal grant.

A \$30,000 grant by the National Science Foundation will be applied toward purchase of a medium-sized electronic digital computer.

Prof. Ralph E. Lee, chairman of a faculty computer committee, said the computer will enable faculty and graduate students to solve research problems previously excluded by the time factor. He said it also will expand the curriculum in the mathematics of computing, providing engineering graduates with experience often needed for industrial positions.

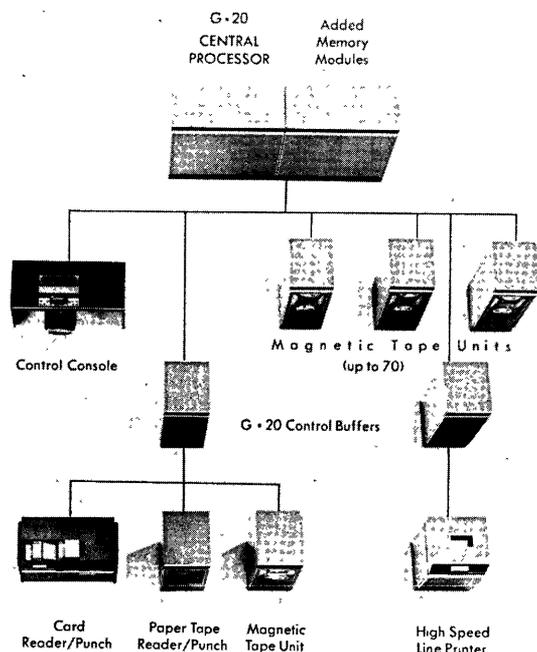
Bendix Computer Division, Bendix Corporation, Los Angeles, Calif.

The Bendix G-20 computer was announced on March 15. It has twice the speed of some of the most powerful computers on the market today and costs half as much. Its speed is 45,000 floating point operations per second. A G-20 for scientific problems would rent for less than \$10,000 per month. It has several remarkable new features:

- 1) Up to 70 units can be hitched to a communication line running to the central processor via a control buffer. Each unit can communicate independently with the central processor;
- 2) Additional special modules of core memory can be hitched to the communication line, and they are addressable, so that there exists true simultaneous input/output into directly addressable memory;
- 3) On-line inquiry or reporting stations of a customer's own design can be hitched to the communication line, because there exists circuitry in the central processor allowing for interruptions, so that the central data processor can answer questions and then return to its calculation; there are various levels of interruption;
- 4) Additional communication lines can be added if desired;
- 5) The operation of the units on the communication line is asynchronous, so that synchronous timing problems on the communication line are avoided.

The company has already received 6 orders for the G-20 computer; the first delivery is expected to be in January 1961.

Physically, the G-20 is small compared to most large-scale data processing systems. Its central processor is only 66 inches wide, 60 inches high and only 28 inches deep. Built of solid state components -- 5000 transistors and 30,000 diodes -- it has an expandable random access magnetic core memory which may consist of one to eight modules of 4096 words each. Floating point circuits are standard.



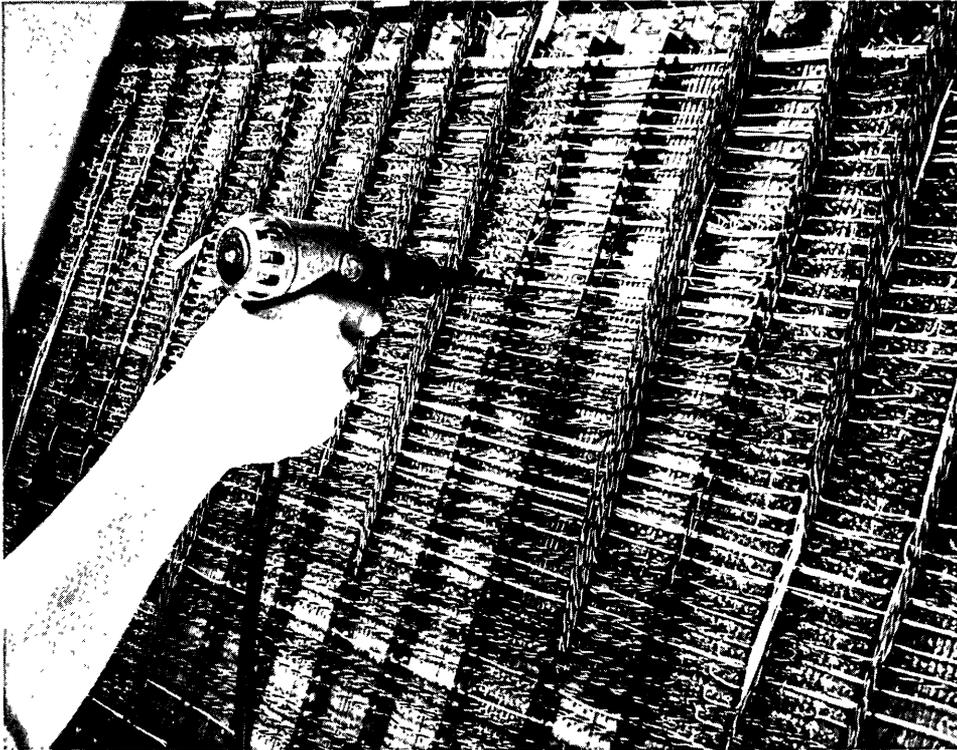


Figure 2 — Here is a maze of circuitry that goes into the logic panels of the new Bendix Corp. G-20 computer. It is wire-wrapped with this pistol-like device. Intricate wrapping and positioning of wires is handled quickly and efficiently with the power-driven tool. Ten panels like this go into every central processor of the computer to make up the arithmetical and logical circuitry.

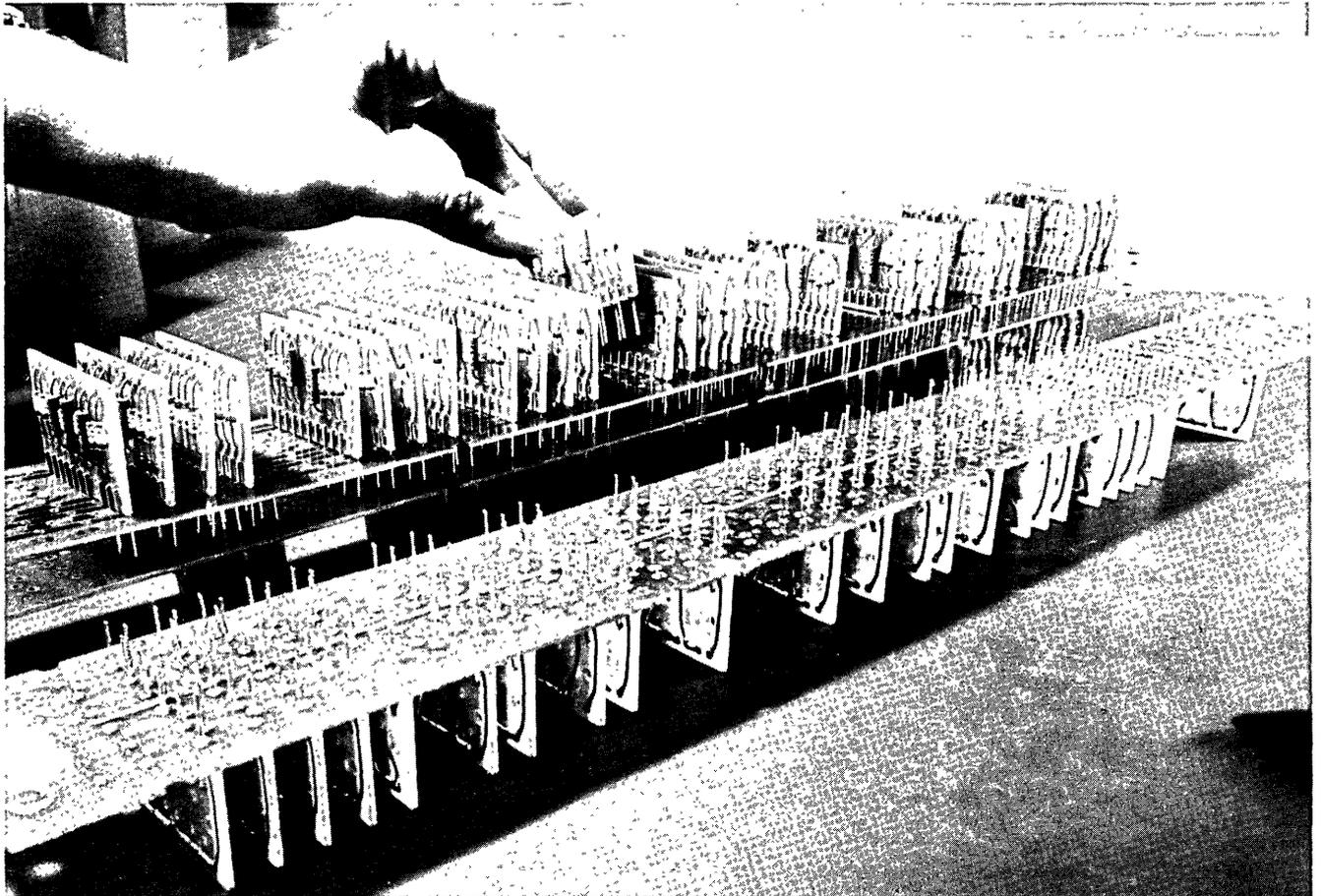


Figure 3 — This style of construction is an integral part of the new Bendix Corp. G-20 computing system. Consisting of diodes and transistors, 180 of these panels go into each central processor of the computer.

THE MONROBOT MARK XI COMPUTER

Based on information from: Monroe Calculating Machine Co., Div. of Litton Industries, Orange, N.J.

A new electronic computer sharply reduced in cost may reverse the trend toward centralized data processing. This computer was announced on February 29 by Monroe Calculating Machine Co., a division of Litton Industries.

Monrobot Mark XI is a general purpose computer capable of serving the needs of a large corporation, but priced within reach of a small business. The machine was shown at the Annual Data Processing Conference of the American Management Association February 29 through March 2.

It was pointed out that the price of the computer, \$24,500, will not only make it possible for the smaller businessman to take advantage of economies heretofore limited to larger corporations, but will make it possible for larger corporations to process data in branch offices.

The brain of the Monrobot Mark XI is a solid state logic unit which is controlled by a magnetic drum capable of storing 2000 instructions.

Whenever data can be fed into the Monrobot by punched tape or cards, the machine is capable of unattended operation. The machine can, in effect, control the operator by detecting human error and rejecting certain kinds of improper data as soon as they are entered. This ability makes it possible to train a typist to operate the machine in one day.

Because of advanced techniques for simplifying arithmetic and logical circuits, the computer requires less space than an office desk and weighs only 300 pounds. It is fully transistorized and operates from any AC wall outlet, using half as much power as an ordinary electric toaster. It requires no air conditioning.

It processes and understands both alphabetical and numerical information, and it performs logical operations as well as arithmetic operations; therefore information can be fed into Monrobot XI from punched tape, punched cards, electric typewriter, teletypewriter or number keyboard. Output may be to tape, cards, typewriter, or teletypewriter. The computer is to be marketed primarily with a tape reader for input, tape punch for output, and typewriter for both input and output. Additional units can be added to Monrobot XI in any combination, with three independent input devices and three independent output devices operating simultaneously.

Most operations will be fully automatic because of "stored programming". The machine memory, or storage, is contained on a magnetic drum, divided into 1,024 storage registers. Each register can contain one number or word, or two program instructions. The magnetic drum revolves at the rate of 86 times per second, and data flows to and from the drum in the form of electronic impulses at the rate of 160,000 per second.

The Monrobot XI averages about 83 arithmetical computations per second. In a payroll application, one machine can automatically compute the earnings and print the paychecks of 800 people in an eight-hour workday.

Among the more than forty jobs which can be handled by Monrobot XI, in addition to payroll, are invoicing, sales analysis, inventory control, capital equipment depreciation, brokerage accounting, production scheduling, oil company billing, cost analysis, labor distribution, linear programming, freight revenue accounting, scientific engineering analysis, thermodynamics, differential equations and probability analysis. The machine will handle

every kind of input or output code available, making application of the machine universal.

Data

NUMERICAL SYSTEM

Internal number system	Binary
Binary digits per word	32 including sign
Binary digits per instruction	16
Instructions per word	2
Instructions decoded	27
Instructions used	27
Arithmetic system	Fixed point; programmed floating point
Instruction type	One address
Number range	0 to $2^{31} - 1$

ARITHMETIC UNIT

Add time	3 ms*
Subtract time	3 ms*
Multiply time	3 ms*
*excluding storage access (6 ms avg.)	
Construction	Transistors
Base pulse repetition rate	180,000/sec
Arithmetic mode	Serial
Timing	Synchronous
Operation	Sequential
Source of the 180 kc pulse is a	clock track on the magnetic drum

STORAGE

Magnetic drum (5200 rpm)	1024 words - memory and instructions.
Average access time - 6 ms	Word size: 32 bits or 9 decimal digits or 5 alpha-numeric characters

INPUT FLEXIBILITY

Numerals and alphabetic characters may be in any code up to and including 8 bits.	
Paper tape (any code)	20 characters/sec
Typewriter keyboard	Manual
Teletypewriter	Manual
80 column card	16 columns/sec min.
Auxiliary sixteen key numerical keyboard	Manual
Any combination of these units to a maximum of 3 may be attached for input.	

OUTPUT FLEXIBILITY

Same as above excluding auxiliary numerical keyboard.

CIRCUIT ELEMENTS

Transistors
Crystal diodes
Printed circuits

CHECKING FEATURES

Fixed
Programmed check

POWER, SPACE, WEIGHT

105 - 125 volts, 60 cycle, 850 watts
Air conditioning not required
48" x 22" x 28" = desk size
375 lbs.

AIRLINE RESERVATIONS SYSTEM FOR AIR FRANCE

International Telephone and Telegraph Corp., New York, N.Y.

Complex airline reservation information can now be processed in a fraction of a second by an electronic system designed by International Telephone and Telegraph Corporation.

The system was developed for AIR FRANCE and is called AIRS (Automatic Integrated Reservation System). More elaborate than previous systems, it records each passenger's individual requirements to the extent of recording his original and alternate itinerary, automobile reservations, dietary preference, and also more routine data such as the passenger's seat assignment, address, and telephone number. Now being tested, AIRS will be put into regular operation by the airline early next year to cope with steadily increasing air travel.

In operation, details concerning available seats, reserved seats, and the waiting list in each class, on the 9000 AIR FRANCE flights scheduled six months in advance, are stored in six memory drums. Each may be consulted in 20 milliseconds. The drums revolve 50 times a second, and contain 600,000 distinct binary information items. Three hundred reading and writing heads permanently scan the 300 tracks of each drum, interpreting the information which passes under them at the rate of 150,000 items a second. Information such as passenger's name and address may be read from any one of 60 magnetic tapes contained in six different racks. In this way, 40,000 characters may be read each second by means of 16 reading heads.

The information entering and leaving the memory drums and tapes passes through a third series of memories which are ferrite memory components. These memories receive the information from the tape and drums and transfer it to the logical and arithmetical circuits for processing.

Each airline clerk has in front of him a console set which is used for questioning the computer and a teletype for entering the passenger's name and flight data. If the original choice is sold out, the computer will automatically suggest alternate routing so the passenger may arrive at his destination at about the same time. Each clerk communicates with the central computer for only several milliseconds. A special memory device is used as a buffer or speed adapter between the clerks and the computer since the operational speed of the equipment is independent of the relative slowness of the clerks.

The new system was developed for AIR FRANCE by two International Telephone and Telegraph Corporation affiliates in Europe - Le Matériel Téléphonique, in Paris, and Standard Elektrik-Lorenz, in Stuttgart, Germany. It will enable 500 airline clerks to record several seat reservations almost simultaneously, regardless of the complexity of itineraries, and to reply in less than five seconds to any request for information concerning any passenger from among the several hundred thousands registered. These functions can be accomplished regardless of the number of clerks simultaneously using the equipment.

THIN MAGNETIC FILMS -- SOME NOTES

Case Institute of Technology, Cleveland 6, Ohio

Thin magnetic metal films may provide the answer to the components of memory systems in making high speed computers work ever faster.

These films, as thin as 50 atoms, are prepared by evaporating metals such as iron, nickel, and their alloys in a vacuum. The growth of such films can be observed through an electron microscope; one can watch them develop from small centers that eventually grow together to form a continuous film.

Although made of a collection of single crystals, these thin films have extremely imperfect structures, with many atoms irregularly aligned. Large stresses are built up as a result. The imperfections in the structure also make them more resistant to the passage of an electric current.

Below certain temperatures, such as 600°F., the films may become spontaneously magnetized. Furthermore, magnetic patterns in the film can be changed very fast. When this is done, a small voltage is generated which can provide a signal for a computer. It is this property which makes such films of great potential value as a "memory" in modern high speed computers.

AUTOMATIC PROGRAMMING ASSEMBLY SYSTEM FOR MICHIGAN BELL TELEPHONE CO.

Burroughs Corp., ElectroData Division, Pasadena, Calif.

Computer manufacturer, user and consultant have combined talents to produce a new automatic programming assembly system. Called "BLESSED 220", the new assembly system was produced by the cooperative efforts of Michigan Bell Telephone Company; Arthur D. Little, Inc.; and Burroughs/ElectroData. Thus the title: Bell Little ElectroData Symbolic System for the ElectroData 220 computer.

This is a comprehensive system of program assembly, complete with maintenance and debugging aids; it was designed specifically for large business and scientific data processing programs of great logical complexity. It has: great program flexibility; unlimited symbolic correction facilities; error-catching features; and the ability to process large programs.

It is comprised of four components -- an assembly program with some compiler features; two tape-editing routines, one symbolic, one absolute; and a symbolic debugging routine.

The minimum system requirement for operating this automatic programming system is a 5,000-word memory Burroughs 220 computer -- including a one-input, two-output Cardatron subsystem, and four magnetic tape storage units. Burroughs 220 users already making use of this assembly system include Stanford Research Institute, U. S. Naval Ordnance Supply Office, Stanford University, and of course, Michigan Bell.

ALL HARRIS TRUST AND SAVINGS BANK CHECKING ACCOUNTS ON COMPUTER

Remington Rand, Division of Sperry Rand Corp., New York, N.Y.

Harris Trust and Savings Bank, Chicago, has opened a computing center on its seventh floor, where high-speed automatic equipment now performs the bookkeeping for all of the bank's checking accounts.

This step is the culmination of six years of research and planning. The equipment is Remington Rand Univac.

C-E-I-R HAS FORMED BRITISH SUBSIDIARY

C-E-I-R, Inc., Arlington, Va.

Dr. Herbert W. Robinson, President of C-E-I-R, Inc., announced on March 3 the formation of a subsidiary company in London which will carry the name C-E-I-R Ltd. This subsidiary will have as its objective supplying the same range of mathematical, operations research, market research, computer programming and electronic data processing machine services that C-E-I-R is now providing in the United States.

Managing Director of the subsidiary is Mr. Tom Cauter, formerly Managing Director of the British Market Research Bureau, Ltd., and for the last two years Director of Marketing, Latin America, for W. R. Grace and Company.

Professor Alexander S. Douglas, one of the outstanding British experts on the use of electronic computers, and presently Director of the University of Leeds Computer Laboratory, will be a Director of the new company and will be responsible for supplying computer services to the British market.

Closely associated with the subsidiary will be Dr. C. O. George, Vice President of the Association of Incorporated Statisticians, who will also be a Director and Vice-Chairman of the Board, and Professor Maurice Kendall, Professor of Statistics of the London School of Economics. Professor Kendall, who will have a special consulting arrangement with the company, is an internationally recognized authority on mathematical statistics. He recently made an outstandingly successful prediction about the outcome of the election in England; the Government's majority was predicted early in the evening to within three seats.

The company will initially provide analytical and programming services, but it is planned that as soon as possible a large-scale computer will be installed.

In addition, the British subsidiary will be responsible for coordinating the work of affiliated economic and market research companies in Europe. C-E-I-R, Inc. has established affiliations with international research firms covering 24 countries in Europe, Latin America and Asia.

TELEVISION SYSTEM FOR SENDING MAPS BY TELEPHONE

International Telephone and Telegraph Corp., New York, N.Y.

A television system that can transmit maps, charts and pictures over long distance telephone lines was demonstrated recently at the Air Research and Development Command's Rome Air Development Center.

The system was built by engineers of the International Telephone and Telegraph Corporation in co-operation with engineering personnel at RADC.

A special 500-mile long-distance telephone circuit between Rome and Buffalo was set up for the test demonstration. The television cameras scanned graphs giving simulated battle information and relayed them from Rome to Buffalo; and then returned the picture to receiving consoles at the Rome Center.

The ITT system uses Air Force security equipment to "scramble" information at the sending station and decode it before it appears on the receiving screens. In this way, classified military briefings can be conducted coast-to-coast.

An audio telephone line is used for two-way conversations describing the visual report. The briefer can also underline visually what he is talking about with a "real time" pointer. By manipulating a handle on the monitor console, he can point an arrow on the screen at anything he wishes to emphasize.

The TV transmission is slow scan, taking anywhere from 10 to 120 seconds a frame depending on the amount of image clarity required. Average time per frame for ordinary use is 40 seconds.

TV relay of maps, charts and pictures is limited only by the length of existing telephone lines.

In order to transmit the picture over telephone lines, the wide television signal is reduced to the narrower band width of telephone lines. This reduction -- on the order of 1,000 to 1 -- is made possible through the use of "scan-conversion storage tubes" that convert signals from an industrial television camera to the narrow band capacity of commercial telephone lines. The narrow band signal is reconverted to wide band at the receiving end.

Two channels are used, one to present a set of facts or to display changing situations, and the other to "write" and store new information for transmission and presentation after the bandwidth reduction is completed.

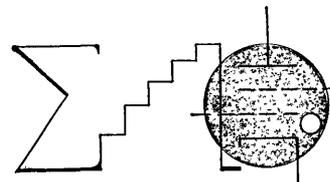
STOCK TRANSACTIONS BY COMPUTER

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

Bache and Company, Wall St., N.Y., one of the world's largest stock brokerage houses, is using a leased IBM 705 Model III computer to handle a steadily increasing volume of stock transactions. Since more than 12 million Americans are currently investing in the stock market, all of Wall Street faces the problem of handling a growing volume of information. Bache's computer enables the company to complete the paperwork on its average of 6,500 daily trades in 12 hours -- half the time needed previously.

The 705 Model III at Bache is one of the fastest data processing systems in the New York financial district -- capable of handling 780 trades a minute. The IBM 705 III is about 30% faster in data processing speed than previous models of the IBM 705. In addition to processing these purchases and sales, the system will: maintain stock records; perform margin and bookkeeping operations; and prepare monthly customer statements. This processing system also will enable Bache and Company to prepare customer portfolio analyses faster.

The 705 Model III, one of the largest commercially-available computing systems, can add a column of 11,400 five-digit figures in a second and make 45,400 logical decisions in a second. It is the third generation of electronic data processing equipment to be used at Bache. A small-scale IBM 604 electronic calculating punch, installed in 1950, was the first in this line. Three years ago the company began using a stored-program computer when it installed an IBM 650.





HRB-Singer, Inc., member of Singer Military Products Division, New York, N.Y.

A detailed infrared photo (see accompanying figure) taken with a system developed by HRB-Singer, Inc., has been declassified by the Office of Security Review, Dept. of Defense.

The reconnaissance device, called Reconofax, made a picture of Manhattan at 11 p.m., January 9, 1958, from an altitude of 4,000 feet. The so-called Manhattan Picture has been used for the last two years in military circles to demonstrate the capability of infrared for reconnaissance purposes.

Reconofax makes use of a scanning camera with an improved detector which is highly sensitive to infrared radiation. Radiation - or heat - differences between objects are recorded on film using a recording lamp. By utilizing a radio-relay system, the picture can also be developed almost simultaneously at a ground station.

Since all objects on the ground, including military targets, emit infrared, or heat, radiation, infrared provides an ideal means of producing night photographs for reconnaissance purposes. An advantage of infrared is its ability to detect radiation which is not visible, thus providing a possible means of camouflage detection.

In the Manhattan Picture, areas of considerable industrial activity, such as the power plants scattered throughout the city, are easily distinguished from areas of moderate activity - residential and commercial - and areas of slight activity, such as Central Park. Since the scanner system is heat-sensitive, the brightest objects in the photo are, of course, the hottest.

Reconofax's ability to resolve relatively small changes in temperature is seen in the clear definition of roads and paths in Central Park.

An indication that Reconofax may be valuable in submarine detection is seen in the case of ships in the Hudson River. The calm water beside a ship is easily distinguished from the agitated water in its wake. A submarine's wake might thus be made "visible".

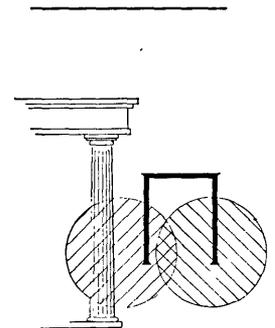
The declassification of Reconofax opens the door to numerous significant non-military applications for the system.

Since different land and water surfaces emit varying degrees of heat, Reconofax can be used in hazardous areas for obtaining weather, oceanographic and topographic data. For example, water temperature is said to be correlated with water depth. The contours of a shore line can thus be determined from the air.

Reconofax can also be used to photograph moving targets, with the scanner held stationary. The subject would thus scan itself. Applications of this nature include traffic control, assembly line inspection and burglar alarms.

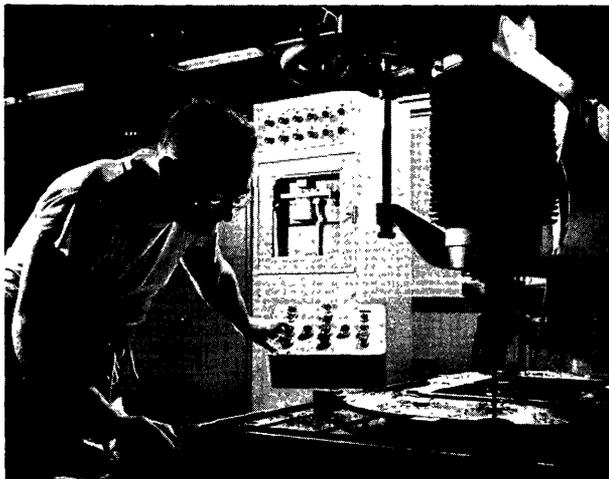
Another possible variation is one in which both scanner and subject are stationary. In this case the camera must provide a two-dimensional scan in order to provide useful information. A typical application is medical electronics. Since infections cause inflammation or heating of the skin, the film will show bright spots where infection exists.

HRB-Singer, Inc., is a member of the Singer Military Products Division, a subsidiary of The Singer Manufacturing Company. The Military Products Division combines the facilities of HRB-Singer, Inc., State College, Pa., research and development firm specializing in infrared reconnaissance systems and communications; Singer-Bridgeport, manufacturer of precision replica optical detection and electromechanical components; and Diehl Manufacturing Co., Finderne, N.J., designer and manufacturer of servomotors and electrical and electronic components.



NUMERICAL MACHINE TOOL CONTROL

Sperry Gyroscope Company, Division of Sperry Rand Corporation, Great Neck, N.Y.



Push-button production is achieved at Sperry Gyroscope Co., a Division of Sperry Rand Corp., Great Neck, N.Y., with numerical machine tool control equipment, shown above in control of a boring operation with a spacer table. In just one application of this equipment (using a six-spindle turret-drill press) at Sperry this device resulted in an estimated saving of \$67,000 annually. This equipment can control position, drilling, reaming, boring, and tapping operations. The functions are controlled automatically by pre-punched tapes. Four of these numerical control instruments are in use at Sperry. Production time for parts handled by this equipment has been cut by a third. Its use obviates the need for tool design, assembly, storage, and maintenance. Human error and fatigue are eliminated, costs cut, and reliability increased. The numerical control equipment was developed by Sperry Gyroscope Co. of Canada, and will be produced for U. S. distribution by Wheeler Electronic Corp. Both are Sperry Rand subsidiaries.

SEARCHING OF CHEMICAL PATENTS BY ELECTRONICS

Bendix Corp., New York, N.Y.

Streamlined patent-searching using electronic computer techniques is being tested at the U. S. Patent Office. Officials say it may accomplish in about half an hour a job that formerly took a skilled researcher up to a full day.

Patent Commissioner Robert C. Watson said the new system is being tested first on a huge mass of patent data covering chemical compounds that form the basis for many commonly used plastics. He said the agency's research and development office had singled out this area, covering the polymer chemical group, "because it is one of the broadest and toughest fields in patent research".

"If we lick this problem, the system could be adapted for most problems in patent searching throughout the chemical field," said Don Andrews, director of Patent Office research and development activity.

The new system relies on rapid calculation by a general-purpose electronic computer that can process data cards turned out by a punched card machine.

A government-industry research team, formed by the Office of Research & Development at the Patent

Office and the Research Division, Textile Fibers Department, of E. I. du Pont de Nemours & Co., Inc., adapted to electronics the agency's punched-card file. Up to this time it could be processed only on specially-built equipment.

A Bendix G-15 digital computer, manufactured by the Computer Division of Bendix Corporation, successfully tested the use of a general-purpose computer to search for patent information. It used a serial scanning technique.

U.S. technology is moving ahead so rapidly, Watson stated, that a bottleneck in the form of time-consuming patent searches can act as "a real deterrent to invention and capital investment" in new products and processes.

These major advantages of the new electronic patent-searching system were pointed out:

1. Besides helping patent searchers do their job rapidly and efficiently, it maintains a permanent record on magnetic tape of the areas of invention or discovery already mechanized, and is therefore readily available for subsequent searches.
2. While searching for specific patents, the computer identifies areas of invention or discovery that may have been overlooked. For instance, in searching for patented chemical compounds capable of performing a certain job, the machine may also be instructed to indicate those compounds that have similar characteristics and might also perform the job. Thus, searchers are provided with a list of alternate materials that laboratory research may prove to be cheaper or more acceptable for manufacturing a product.
3. Many private individuals are familiar with the operation of electronic computers. Magnetic tapes containing complete patent office files on certain subjects could be purchased for use on machines the searcher owns or rents. In this way, several searchers could search identical files at the same time. These "carry out" files would, of course, always be complete, insuring that files searched by private individuals are identical with those used by examiners and other Patent Office officials.

Watson said the Patent Office has long felt that development of an automated searching system would provide industry and the public with a workable solution to keeping up with the rapidly growing number of patents obtained each year. He pointed out that the Patent Office now issues more than 1,000 patents each week.

1960 COMPUTER DIRECTORY AND BUYERS' GUIDE

The June 1960 issue of "Computers and Automation" is the 6th annual Computer Directory and Buyers' Guide for the Computer Field. It will contain a Roster of over 700 Organizations in the Computer Field, and a Roster of Products and Services with over 2000 entries.

If you have not already sent us entries for your organization, products, and services, please send them to us at once: Directory Editor, Computers and Automation, 815 Washington St., Newtonville 60, Mass. For style of entry, see last year's issue or write us.

COMPUTER TALKS AT THE SOUTHWESTERN IRE CONFERENCE

Harvey Wheeler, P.O.Box 22331, Houston 27, Texas

The 12th Southwestern IRE Conference and Electronics Show, and the National Conference of the Professional Group on Medical Electronics, are taking place in Houston, Texas, at the Shamrock Hilton Hotel, Wednesday to Friday, April 20 to 22, 1960. Talks relating to computers at the conference include the following:

Wednesday, April 20

Session 2A -- Instrumentation II -- 2:30 pm

- (2) "A Digital Timing System for Airborne Application", G. P. DuBose and C. E. Grubbs, Temco Aircraft, Dallas, Tex.

Thursday, April 21

Session 4A -- Computers -- 9:30 am

- (1) "Instrumentation of an Analog Seismic Correlator", L. C. Cummings, Jr. and F. N. Tullios, Humble Oil and Refining Co., Houston, Tex.
- (2) "A Real Time Correlator", S. D. Hays, Convair, San Diego, Calif.
- (3) "Description of Rice Institute Computer", Martin Graham, Rice Institute, Houston, Tex.
- (4) "Engineering Details of the Rice Institute Computer Memory", Ted Shutz, Rice Institute, Houston, Tex.
- (5) "Engineering Details of the Rice Institute Computer Control Section", Phillip Deck, Rice Institute, Houston, Tex.

Session 4B -- Biophysics I -- 9:30 am

- (3) "Digital Print-Out System for Whole Body Scanner", John W. Beattie and George C. Bratt, Sloan-Kettering Institute for Cancer Research, New York, N.Y.
- (5) "An Analog Computer Model for the Study of Electrolyte and Water Flows in the Extracellular and Intercellular Fluids", Walter H. Pace, Jr., Tulane Univ., New Orleans, La.

Session 5C -- Biophysics II -- 2:30 pm

- (1) "Electronic and Computer Techniques in the Diagnosis of Cardiovascular Disease", W. E. Tolles, W. J. Carberry, and C. A. Steinberg, Airborne Instruments Laboratory, Mineola, L.I., N.Y.
- (2) "An Automatic Physiological Telemetry and Data Conversion System", C. A. Steinberg, W. E. Sullivan, and J. T. Farrar, Airborne Instruments Laboratory, Mineola, L.I., N.Y.

RCA COMPUTING CENTER IN WALL STREET, NEW YORK

Radio Corp. of America, New York, N.Y.

A full-range electronic data-processing center designed to serve all types of firms in New York's financial and business community has been opened on Wall Street by the Radio Corporation of America.

This is the first of a nationwide network of commercial data-processing systems which RCA will create.

A demonstration of the center's operation, which can cut in half the present paperwork of brokerage firms, was witnessed by leading members of the financial and business community. The cost of using the center would range from 50 cents to \$1.50 per trade in most cases, a saving of up to 50 percent.

The center will contain two RCA 501 data processing systems.

A group of highly-trained RCA technicians, programmers, systems analysts, operators and maintenance personnel, will operate the center around the clock.

Ninety-eight percent of the 501 system is manufactured by RCA, the only company in the data processing field which produces a majority of its own computer components and peripheral equipment.

OPTICAL SCANNING PREFERRED
BY RETAILERS RESEARCH COMMITTEE

Farrington Mfg. Co., Needham Heights 94, Mass.

Optical scanning, as performed by the Farrington electronic reader, only commercially available equipment of this type, was preferred recently over magnetic reading by an influential research committee of the nation's retailers.

At a Retail Research Institute seminar held in San Francisco in February, a committee formed to study the application of electronic developments to the retail industry, announced the decision that scanning input to any recommended system would be based on optical reading rather than magnetic reading.

In addition, such optical reading would be confined to systems reading the characters themselves, as performed by the Farrington reader, rather than coded equivalents, the committee announced.

The accomplishments of the 26 Farrington readers now in commercial operation in a wide variety of industries were explained to the committee. Representatives of four other companies described the approach each intended to take to the problems of optical scanning and what they expected they might be able to offer.

A point of interest developed at the meeting was that the chairman of the retailers' committee had been informed by the committees representing the Air Travel Plan and the Life Office Management Association that they, too, had selected optical reading as recommended input to their data processing systems, for all airlines and all life insurance companies.

DIGITAL OPERATIONAL FLIGHT TRAINER FOR NAVY JET PLANES

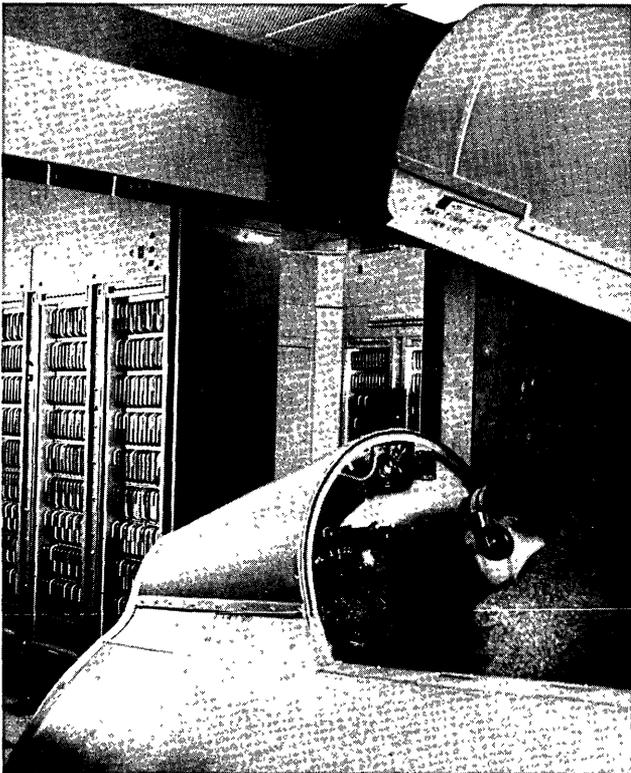
Sylvania Electric Products Inc., Waltham, Mass.

On March 11, a "Universal Digital Operational Flight Trainer" (UDOFT) developed by Sylvania Electric Products Inc. was formally accepted by the U.S. Navy. The acceptance followed UDOFT-simulated jet "flights" of a Navy F9F-2 Panther and an Air Force F-100A Super Sabre.

The "flights" were made by Navy pilot, Lt. Wallace F. Flitter, weapons systems trainer project officer at the U. S. Naval Training Device Center, Port Washington, N.Y., which is a branch of the Office of Naval Research.

A Sylvania engineer, however, is shown in the accompanying picture; he is checking operation of the UDOFT cockpit instruments during the period of testing prior to acceptance.

The digital computing equipment is capable of simulating the flight of a wide variety of supersonic aircraft types for student pilots, accepting their commands, and providing cockpit instrument and control reactions. New conditions, such as engine failure, air turbulence and storms, may be introduced by the instructor through controls outside the cockpit.



COMPLETELY AUTOMATIC TRAIN OPERATION FEASIBLE TODAY

Union Switch and Signal Co., Division of Westinghouse Air Brake Co., Swissvale, Pa.

Completely automatic train operation without the need for an operating crew is, from an engineering viewpoint, possible and practical today, according to W. A. Robison, design engineer from Union Switch & Signal - Division of Westinghouse Air Brake Company.

12B

In a talk delivered recently, Mr. Robison said that most of the equipment already being used in manual, semi-automatic and automatic operations on many railroads, some in service for several decades, can also be applied to achieve fully automatic operation. In addition, the existing geographical patterns and physical layouts of our railroad systems make them the only form of transportation which can make use of automated operation so conveniently.

The automatic traffic control system would, basically, consist of "decision-making devices" or "electronic brains" located along the railroad rights-of-way, to make decisions based on the traffic situation, concerning routing, starting, acceleration, deceleration and stopping of trains, servo units mounted on locomotives to control train movements as commanded by the "decision-making devices," and a monitoring panel from which a dispatcher would supervise train movements.

The "decision-making devices" would be designed to automatically advise a monitoring dispatcher of any abnormal traffic problem which was beyond its capability to handle, and would automatically request manual assistance from the dispatcher.

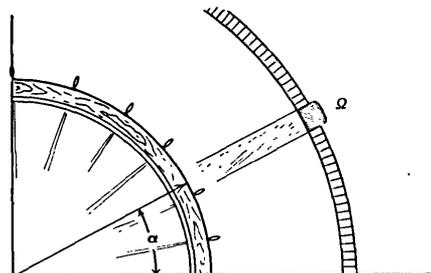
Robison stated that today's train dispatcher spends a large percentage of his time handling routine telephone calls and maintaining records of train movements. He pointed out that eliminating most of this work would not be a major problem. Pushbuttons at wayside locations would be used to request routine information from the automatic control system, and an automatic method would be used to maintain continuous records of train movements.

By freeing the dispatcher from these routine duties, and installing automatic equipment along the wayside and on locomotives, the dispatcher would only have to monitor train operation, and would then be able to supervise train movements over much longer distances than are possible today.

Robison discussed some of the more difficult problems which are being solved leading to the crewless train. These included stopping a train smoothly and accurately at a predetermined location, handling switching moves of local trains, and control of helper locomotives.

Limited automation has already been successfully applied to railroad operations. There are robot switching locomotives in freight classification yards which are remotely controlled. Consideration is being given to the remote control of helper engines as well as remote control of in-plant switching movements.

Tests are underway in New York for the small scale operation of a completely automatic train in which starting will be initiated by an automatic programmer, and the train will proceed to and stop at its destination. Automatic equipment will control its acceleration, its normal running speed, and a planned decrease in speed to stop at the desired station.



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Machine Translation and General Purpose Computers

B. D. Blickstein

C-E-I-R, Inc.
Arlington, Va.

(Based on a report given at the National Symposium on Machine Translation, Los Angeles, Calif., Feb. 2-5, 1960)

We at C-E-I-R have had an active interest in the field of machine translation since May, 1958. During this time we have programmed a translation system on the IBM 704, and are currently engaged in the design of a system for the 7090. We have done Russian-to-English translations of varied types of Russian text, including (1) studied text, (2) unknown random text prepared by Rand Corporation, and (3) Pravda political text. In this report we make some observations about the machine translation field, the arguments regarding selection of computers, design of special translating machines, and requirements for the ideal dictionary device. We shall summarize some of the arguments, and attempt to arrive at some conclusions about the hardware available to the translation effort.

The Nature of the Language Translation Process

In order to discuss the hardware limitations imposed by the process of machine translation, it is necessary to note carefully the nature of the process of translation from one language to another. The information flow itself is serial; that is, text flows through the computer in its natural sequence and consequently is processed in this order. It is a function of the translation method to determine the total number of passes that must be made through the text, and this number is an important parameter in selection of the type of equipment to be employed. The information treated in each pass of text is different; the first pass will consist of a conversion of input text into a machine-recognizable form, and the last pass will serve to put out text in the target language (or object language) from the computer to a printing device. Intermediate passes will serve to relate text to dictionaries, process basic word and phrase meanings, and perform syntactic rearrangement. As the linguistic duties of the processor are separable and may be independently performed, it is possible to break down the program for the entire system into sub-programs, each requiring one pass through the text.

Such a serial multi-pass system of organization permits the processing of texts of indefinite lengths on a continuous basis. The same kind of procedure is followed in payroll or accounting jobs. There are distinct differences between accounting and translation procedures, but the flow of data is similar, and by and large language translation presents, to the data processing field, problems similar to many which have been previously handled with considerable success.

Comparison with a Payroll Program

In the case of a payroll program, the input data consists of information identifying an employee, and giving the number of hours he has worked. Using the name as a key, a master file is interrogated, yielding the hourly rate or perhaps an abstract pay classification. From this master file information the program must by various arithmetic and logical steps determine the salary due an employee, subtract the various deductions, and eventually print a check. It will be noted that once the master file is interrogated and information extracted, the employee's name itself has no bearing on the subsequent processing procedure.

Similarly, for purposes of translation, the source language word may be completely discarded once a dictionary reference is made, if the translation can be resolved into a logical transfer of form from the object language. Miss Ariadne Lukjanow, formerly of Georgetown Univ.

Изучены реакции между этиловым эфиром пирокатехин-фосфористой кислоты и триарилбромметанами.
При взаимодействии указанных соединений образуются пирокатехиновые эфиры триарилметилфосфиновых кислот.
При омылении последних слабой соляной кислотой получены пирокатехин и триарилметилфосфиновые кислоты.
В настоящем исследовании нами изучались реакции между смешанными эфирами фосфористой кислоты, типа $A_2 \dots$ и триарилбромметанами. Реакция между этилпирокатехиновым эфиром фосфористой кислоты и триарилбромметанами по аналогии с алкилфосфористыми эфирами должна идти по реакции: $A_2 \dots$
Экспериментальные данные показали, что реакция действительно протекает по указанному уравнению.
Так, например, при нагревании смеси триарилбромметана и этилпирокатехинового эфира фосфористой кислоты происходит выделение бромистого этила и образование кристаллического вещества, представляющего собой пирокатехиновый эфир триарилметилфосфиновой кислоты. Для установления строения полученного соединения была проведена реакция омыления разбавленной соляной кислотой при нагревании от 180 до 200° в запаянных трубках.
Продуктом омыления являются пирокатехин и триарилметилфосфиновая кислота.
Полученные нами эфиры типа $A_2 \dots$ весьма устойчивы к влаге воздуха.

Figure 1 — A page of Russian text from the "Journal of General Chemistry," vol. XXII, no. 9, 1952, to be translated.

RESULT OF MACHINE TRANSLATION OF THE RUSSIAN TEXT SHOWN IN FIGURE 1

Concerning the action of triaryl bromomethanes on alkylpyrocatechol esters of phosphorous acid.

Reactions between the ethyl ester of pyrocatechol-phosphorous acid and triaryl bromomethanes were studied.

(Up) on the interaction of the above-mentioned compounds, pyrocatechol esters of triarylmethylphosphinic acids are formed.

(Up) on hydrolysis of the latter with dilute hydrochloric acid, pyrocatechol and triarylmethylphosphinic acids were obtained.

In the present investigation, the reactions between mixed esters of phosphorous acid of the type . . . and triaryl bromomethanes were studied [by us].

The reaction between the ethylpyrocatechol ester of phosphorous acid and triaryl bromomethanes should proceed, by analogy with alkylphosphorous esters, according to the reaction: . . .

Experimental data showed that the reaction actually proceeds according to the above-mentioned equation.

Thus, for example, upon heating of a mixture of triaryl bromomethane and the ethylpyrocatechol ester of phosphorous acid, evolution of ethyl bromide occurs and (there occurs) the formation of a crystalline substance which is the pyrocatechol ester of triarylmethylphosphinic acid.

In order to establish the structure of the compound obtained, a (reaction of) hydrolysis with dilute hydrochloric acid was carried out on heating (at) from 180° to 200° in sealed tubes.

The product(s) of hydrolysis are pyrocatechol and triarylmethylphosphinic acid.

The esters obtained by us of the type . . . are extremely resistant to the moisture of the air.

and now head of the Machine Translation Section at C-E-I-R, has shown that such a process may even be made independent of the particular object language in her report on a method of translation called the Unified Transfer System. The resulting translation algorithm is a logical process, involving decisions, branches, selections, and Boolean-type matches of numeric codes.

Certainly such an abstract system is machine-independent. It is completely indifferent to the machine or person that performs the algorithm.

Choice of Hardware

The nature of the operations involved, however, can be seen to place certain constraints upon the choice of hardware with a view toward operating economy and programming ease. Probably the largest of these considerations is that imposed by the dictionary-search process, an absolutely indispensable task. A great deal of thought by many manufacturers and research groups has gone into this question; and many and diverse possible conclusions have been proposed. We shall attempt to resolve the problem by reducing the argument to two basic choices.

Inasmuch as translation appears to the computer as a multi-pass serial data-processing job, a machine chosen to do the job efficiently must process high-speed serial-type input/output facilities. Thus far, computer technology has yielded just one such facility to us, that of high-speed magnetic tape. A tried and true member of the computer hardware family, magnetic tape is fast, reliable, relatively inexpensive, and reusable. In addition to serving as an input/output medium, tape serves well as auxiliary storage for the computer, and is particularly well suited to serial processing. Its main drawback lies in the fact that it is not a random-access type of storage, but this disadvantage can be partially overcome by pre-sorting of references to files of information so that rapid serial access is possible.

Increasing Speed of Tape Operations

Recently, great strides have been made both in increasing the speed of tape units and in bringing about true simultaneity of tape-computer operation. In certain commercially available equipment it is now possible to use 8 tapes simultaneously while continuing to allow the computer to perform independent logical operations. The value of such advances is primarily reflected in operating speed. For example, a process which translated on the order of 5,000 words of text per hour on the 704 can now produce 15,000 words in the same time on the 709.

The Problem of Search in a Dictionary

This improvement in tape operations has its greatest impact on the dictionary-search problem. As magnetic tape is by nature serial, dictionary search must be accomplished, in the interests of efficiency, in the following way:

- (1) The tape dictionary must be sorted.
- (2) The text must be subjected to the same sorting as the dictionary.
- (3) The two tapes must be matched against each other, extracting those entries corresponding to the text and creating a third tape of these entries which is devoid of the source language.
- (4) This third tape must be sorted back into text sequence order.

The property of simultaneity of tape operations now allows this sort-match-sort process to be considerably speeded. In fact it will permit large tape dictionaries to be economically feasible. Furthermore, this feature permits multiple technical dictionaries to be searched at no increase in operating time.

Random-Access Memory

The only practical alternative to this type of dictionary search procedure is a memory device possessing high random-access speed and capable of storing an entire dictionary at one time with equal access to any entry. In a system which has been proposed by Miss Lukjanow, each total dictionary entry should require on the average of 20 machine words of storage; thus a dictionary of 50,000 entries would require 1 million words of storage. It is estimated that at least 100,000 words per hour can be translated through a tape 7090; a comparable random-access memory would then need to have an average

access time of 36 milliseconds for an entire entry exclusive of processing time. Thus the transmission rate from storage would have to be on the order of 1.8 microseconds per word. This is considerably faster access than has been available in the past for units of the magnetic disc type. Consequently we are led to choose magnetic tape as the best presently available dictionary medium. But it is anticipated that the near future may bring about disc files that meet and even better this time. The STRETCH disc file will have an access time on the order of 4 microseconds per word; this however presupposes that the proper track on the disc has been located, an operation which may require up to 87 milliseconds. Actually, a great deal of this lost locating time can be recovered by proper buffering and interweaving of processing with look-up.

Adaptability of Current Computers to Language Translation

One of the questions we are attempting to answer is whether current machines have been designed to meet the needs of linguistic material as opposed to operations on numerical material. I should like to use as an example the chain of development of the IBM 700/7000 series. The first of this group was the 701. This machine contained basic arithmetic orders and very little else. It was soon followed by the 704, which added indexing features and certain logical operations. The 709 provided 6-channel input/output, indirect addressing, and a family of well over 20 logic operations. The 7090 increased the 709's internal speed by a factor of 5, tape speed by $4\frac{1}{2}$, and increased the channel capacity to 8. The net effect from 701 to 7090 has been the implementation of logical and information-handling abilities, rather than the improvement of arithmetic facilities; the result consists of computers which are every whit as deft in handling data processing applications as they are in numerical manipulation. There is plentiful evidence among computer users that this is so — that the general-purpose machine has become general purpose in scope as well as in name. It has also become evident that although the information in many applications is either alphabetic or decimal, the binary machine has proved itself more efficient than its decimal counterpart as a result of its higher internal speeds. Actually, the term "computer" is fast being replaced by the more appropriate term "electronic data processing machine."

Operations for Language Translation

The operations needed to perform translation are basically logical, consisting of logical "and," "or," equality tests, and decision branching. Recently certain binary machines have been announced which will be capable of utilizing magnetic disc file memories. The 7090 is presently available with a limited disc file and the forthcoming STRETCH, as we have previously mentioned, will be equipped with a disc file of extremely high capacity and access speed.

Fast General-Purpose Computers Available

We have already mentioned several general-purpose computers; for the sake of completeness, we should like

to give a brief summary of a number of these general purpose machines.

Despite the preference for binary type machines, there are some relatively new and large-scale decimal models on the market today which merit consideration. The Univac LARC, the Datatron 220, and the IBM 7070 are all machines of extremely high speed for their class, and all of them have been equipped with a set of logical-type instructions. Disc files are available for the 7070, and all three are equipped with tape units of high speed. Among the binary machines are two basic groups, those with vacuum-tube circuitry and those with transistor logic. In the former group are the IBM 704 and 709; in the latter, exhibiting operating speeds of about 5 times the vacuum-tube speeds, are the Honeywell 800, CDC 1604, IBM 7090, and the Transac S-2000. The transistorized group, I believe, offers the best bargain for translation, as the speeds are achieved at a cost increase of only about 50% over the vacuum-tube types, yielding an overall reduction in cost of about 70% on each word of translation.

Three Million Words Translated per Hour

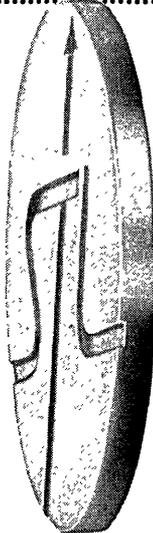
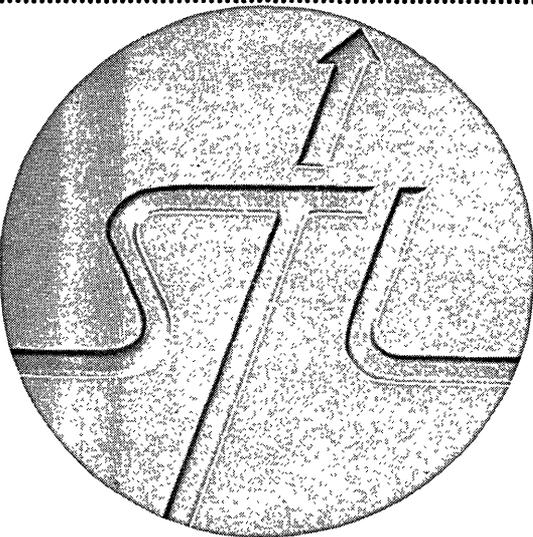
The machine called STRETCH is a computer being designed by IBM for the Los Alamos laboratory; it is literally a "stretch" into the future both electronically and logically. Operating speeds internally are about 100 times faster than those on the 704, and the advances made in logical design and asynchronous instruction structure will permit a 20% reduction in the number of instruction steps needed. The machine will be capable of handling a maximum of 32 disc files each of capacity of over 4 million words, for a total disc file capacity of over 130 million words. High-speed magnetic tapes with a transmission rate of over 10,000 words per second will operate in parallel with the machine and with each other, and main magnetic core memory of up to 262,000 64-bit words will be available. Due to the elimination of tape dictionary search, yielding roughly a 50% increase in translation rate, and the attendant speedup in internal speed, it appears that the translation system proposed by Miss Lukjanow could be implemented with a translation rate in the neighborhood of 3 million words per hour.

Special Purpose Translating Machines

A great deal of discussion has gone into special purpose translating machines. In the past few years several designs have been advanced, and some have actually been built. The dangers of this are evident if one notes the rapid obsolescence which is characteristic of both computer technology and of advances in language methods. By contrast, the user of the general purpose machine may rent his hardware from the manufacturer, thus saving a costly initial investment; he may furthermore always avail himself of the newest and most efficient equipment.

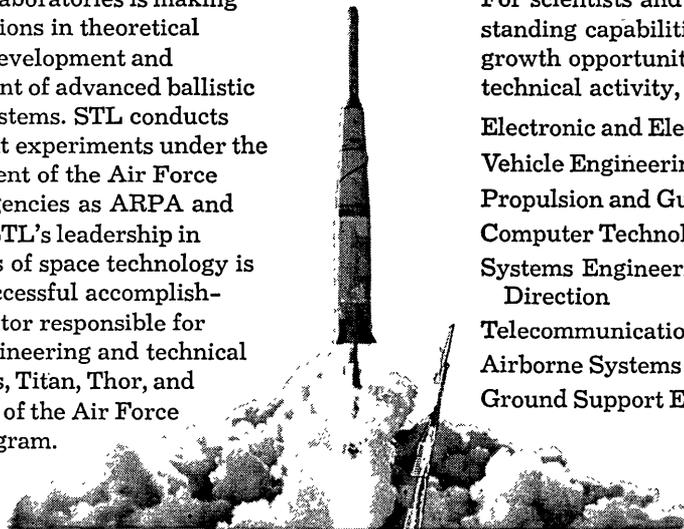
For this reason, we have decided to produce systems for the general-purpose machines only. The policy of C-E-I-R is to proceed using at all times the latest and fastest machine available, for the present the 7090; our future work will be planned for the STRETCH class of machines. Only in this way do we believe that machine translation can be made economically feasible and technically workable.

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CALENDAR OF COMING EVENTS

- April 5, 1960: 12th Annual Symposium, New Jersey Section of the Instrument Society of America, subject: Computers in the Process Industries, Hotel Essex House, Newark, N.J.; contact Dick Lightstone, c/o Robertshaw Fulton Controls Co., 44 Grand Ave., Englewood, N.J.
- April 5-9, 1960: Electrical Engineers Exhibition, Earls Court, London, England; contact P. A. Thorogood, Gen. Mgr., 6 Museum House, 25 Museum St., London, W.C. 1, England
- April 7-8, 1960: Annual Joint West Coast Regional Meeting of the Institute of Management Sciences and the Operations Research Society of America, U.S. Naval Postgraduate School, Monterey, Calif.
- April 14-16, 1960: Symposium on Basic Questions in the Structure of Languages, sponsored by American Mathematical Society and Association for Symbolic Logic, Hotel New Yorker, New York, N.Y.
- April 18-19, 1960: Third Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, Ohio.
- April 20-22, 1960: 12th Annual Southwestern I.R.E. Conference and Electronics Show including the National Medical Electronics Conference, Shamrock-Hilton Hotel, Houston, Tex.
- April 21-22, 1960: Seminar on Analog Methods in Nuclear Energy Problems, sponsored by The International Association for Analog Computation, Brussels, Belgium / Contact: Seminar-Secretariat, c/o Electronic Associates, Inc., 43, rue de la Science, Brussels 4, Belgium
- May 2-6, 1960: Western Joint Computer Conference, San Francisco, Calif.
- May 9-11, 1960: Meeting, Burroughs 220 Computer User Group (CUE), San Francisco, Calif.; contact Merle D. Courson, First National Bank of San Jose, San Jose, Calif.
- May 9-12, 1960: 2nd ISA Instrument-Automation Conference and Exhibit of 1960, Civic Auditorium and Brooks Hall, San Francisco, Calif.
- May 17-18, 1960: Symposium on Superconductive Techniques for Computing Systems, sponsored by Information Systems Branch, Office of Naval Research, at Dept. of Interior Auditorium, Washington, D.C.
- May 18-20, 1960: Operations Research Society of America Seventeenth National Meeting (Eighth Annual Meeting), Statler-Hilton Hotel, New York, N.Y.
- May 19, 1960: Conference on Parallel Programming, sponsored by Cleveland-Akron Chapter of Association for Computing Machinery, Cleveland, Ohio / Contact: L. R. Turner, NASA, Lewis Research Ctr., 21000 Brookpark Rd., Cleveland 35, Ohio
- May 23-25, 1960: 9th Annual Telemetering Conference (West Coast), sponsored by ISA with ARS, AIEE and ISA cooperating, Miramar Hotel, Santa Barbara, Calif.
- June 1-3, 1960: 6th Annual ISA Instrumental Methods of Analysis Symposium, Montreal, Canada
- June 6-7, 1960: Second Conference of The Computing and Data Processing Society of Canada, University of Toronto.
- June 14-17, 1960: Seminar on Systems Simulation Using Digital Computers, a Cornell University Industrial Engineering Seminar, Cornell University, Ithaca, N.Y.; contact J. W. Gavett, Seminars Coordinator, Dept. of Industrial and Engineering Admn., Upson Hall, Cornell Univ., Ithaca, N.Y.
- June 15-29, 1960: 7th Rassegna International Electronics, Nuclear Energy, and Cinematography Scientific Congresses and Exhibition (included in the program: Electronic computers—collation and processing of data for research operation), Palazzo dei Congressi, Rome, Italy.
- June 22-24, 1960: 1960 National Conference and Business Show, National Machine Accountants Association, Mark Hopkins and Fairmont Hotels, and Calif. Masonic Memorial Temple, San Francisco, Calif.
- June 25 - July 5, 1960: 1st International Congress for Automatic Control, AACC sponsored, with ISA, ASME, IRE and AICE cooperating, Moscow, U.S.S.R.
- August 23-25, 1960: Annual Meeting of the Association for Computing Machinery, Marquette Univ., Milwaukee, Wisc.
- Sept. 19-21, 1960: 5th Annual Symposium on Space Electronics and Telemetry, sponsored by The Institute of Radio Engineers, Inc., Shoreham Hotel, Washington, D.C.
- Sept. 26-30, 1960: 3rd ISA Instrument-Automation Conference and Exhibit of 1960, and ISA's 15th Annual Meeting, New York Coliseum, New York, N.Y.
- Oct. 4-6, 1960: Meeting, Burroughs 220 Computer User Group (CUE), Philadelphia, Pa.; contact Merle D. Courson, First National Bank of San Jose, San Jose, Calif.
- Oct. 9-14, 1960: 1960 Fall General Meeting of American Institute of Electrical Engineers, New York, N.Y.; contact Clarke S. Dilkes, Assoc. Dir., Burroughs Corp., Research Ctr., Paoli, Pa.
- Oct. 10-12, 1960: National Electronics Conference, Hotel Sherman, Chicago, Ill.; contact Prof. Thomas F. Jones, Jr., NEC Program Chairman, School of Electrical Engrg., Purdue Univ., Lafayette, Ind.
- Oct. 17-19, 1960: Symposium on Adaptive Control Systems, sponsored by Long Island Section, Institute of Radio Engineers, Garden City Hotel, Garden City, L.I., N.Y.; contact F. P. Caruthers, Symposium Chairman, c/o Specialties Inc., Skunks Misery Rd., Syosset, N.Y.
- Nov. ?, 1960: 13th Annual Conference on Electronic Techniques in Medicine & Biology, sponsored by ISA, with IRE and AIEE cooperating, Washington, D.C.
- Sept. 6-8, 1961: 1961 Annual Meeting of the Association for Computing Machinery, Statler Hotel, Los Angeles, Calif.; contact Benjamin Handy, Chairman local Arrangements Committee, Litton Industries, Inc., 11728 W. Olympic Blvd., W. Los Angeles, Calif.

A Survey of European Digital Computers

Part 3 (Concluding Part)

Joseph L. F. De Kerf

Research Laboratories
Gevaert Photo-Producten N.V.
Mortsel, Belgium

(Continued from *Computers and Automation*, March, 1960, p. 29)

Operation mode: serial. Number base: binary. Word length: 30 bits. Point working: fixed. Instructions: 1 address type (1 halfword). Store: magnetic drum. Capacity: 1,024 words. Speed: 3,000 rpm. Input/output: punched tape and electric typewriter. Operation time (average): 20 ms.

The design of a more advanced computer for own use, the ARMAC (Automatische Rekenmachine Mathematisch Centrum), was started by the Mathematic Centre in 1955. It has been completed in 1956.

Operation mode: serial. Number base: binary. Word length: 34 bits. Point working: fixed. Instructions: 1 address type (1 halfword). Store: magnetic cores. Capacity: 512 words. Auxiliary store: magnetic drum. Capacity: 3,584 words. Speed: 4,500 rpm. Input/output: punched tape and electric typewriter. Multiplication time: 5.4 ms.

More details about ARMAC may be found in the J1 of the ACM (Vol. 4, No. 1, p. 106). The prototype of a commercial computer has been developed by the Mathematic Centre recently. The computer, called X 1, is manufactured and marketed by a new firm, the N. V. Electrologica (Paleisstraat 31, The Hague), which was founded in 1956 as a subsidiary of the Dutch life insurance company Nillmij. Two X 1 computers have been installed and eight are on order (Sept. 1959).

—N.V. Electrologica: X 1

Operation mode: parallel. Number base: binary. Word length: 28 bits (sign and parity bit included). Point working: fixed. Instructions: 1 address type (1 word). 12 registers.

Store: magnetic cores. Capacity: units of up to 8 blocks of 512 words (minimum capacity 512 words). A passive store, used for input routines, fixed subroutines and so on, is added in blocks of 64 words (minimum capacity 704 words). Total maximum capacity of active and passive store: 32,768 words. Access time: 16 microsec. The connection of magnetic tape units is under study.

Input/output (maximum equipment): one 5 hole punched tape reader (Ferranti: 150 char. per sec), one punched card sorter (Bull: 700 cards per min), one or more reproducers (Bull: 120 cards per min in and out), one or more tabulators (Bull:

150 cards per min in and 150 lines of 102 char. per min out), one 5 hole tape punch (Creed: 25 char. per sec) and one electric typewriter (IBM: 10 char. per sec). The punched card equipment handles standard 80-column cards. All units operate simultaneously and computing may proceed in the meantime.

Operation speeds (access time included): from 0.032 to 0.084 ms for addition and subtraction, about 0.500 ms for multiplication and division.

Power consumption: 2.3 kVA. Floor accommodation required: 200-500 sq. ft. Technical data: 250 kc/s prf, germanium diodes (5,000-7,500), transistors (3,000-5,000), printed circuits on plug-in boards and magnetic cores. Price (basic machine, active store of 2,048 words, passive store of 1,024 words, punched card fast reader and reproducer, incl. coupling apparatus): about \$160,000. May be leased.

An experimental computer is developed at the Physical Laboratories of N. V. Philips' Gloeilampenfabrieken at Eindhoven. Details about this computer, constructed for own purposes, will be published in the Philips Technical Review.

SWEDEN

The first universal digital calculator constructed in Sweden, BARK (Binär Automatisk Reläkalkylator), was a binary relay calculator. It contains 7,500 electromagnetic relays and is controlled by panels. The word length is 32 bits. Multiplication time is about 250 ms. A detailed description may be found in MTAC (Vol. V, No. 33, p. 29).

BARK was completed in 1950. The same year design and construction of an electronic digital computer were started. The computer, called BESK (Binär Elektronik Sekvens-Kalkylator), was completed in 1953.

Operation mode: parallel. Number base: binary. Word length: 40 bits. Point working: fixed. Instructions: 1 address type (1 halfword). Computing store: Williams tubes. Capacity: 512 words. Auxiliary store: magnetic drum. Capacity: 8,192 words. Speed: 3,000 rpm. Input/output: punched tape, electric typewriter and cathode ray tube curve plotter. Multiplication time: 360 microsec.

More details about BESK may be found in the Proc. of the Int. Comp. Conf. (Darmstadt, 1955). Afterwards the

Williams tube store was replaced by a magnetic core store, with a capacity of 1,024 words, and a high speed tape punch has been added.

BARK and BESK were constructed under cooperation of the Swedish Technical Highschools, grouped by the Swedish Board for Computing Machines. BESK is used by the Board for own purposes, but several copies have been built at governmental and commercial installations. An improved commercial version, Facit EDB, is manufactured and marketed by the Facit EDB Centre (Karlavägen 62, Stockholm), established in 1956 as a subsidiary of AB Atvidabergs. Three Facit EDB computers have been installed so far (Sept. 1959). Input and output equipment may be purchased as separate units. A carousel type magnetic tape unit, Facit ECM 64, was presented at Auto-Math (June 1959, Paris).

—AB Atvidabergs: Facit EDB

Operation mode: parallel. Number base: binary. Word length: 40 bits (sign included). Alphanumeric representation: optional. Point working: fixed. Instructions: 1 address type (1 halfword). Number of operations: 39. Number of registers: 3.

Store: magnetic cores. Capacity: 2,048 words. Access time: 10 microsec. Auxiliary store: magnetic drum. Capacity: 8,192 words (256 tracks of 32 words). Speed: 3,000 rpm. Average access time: 15 ms. Up to 16 carousel magnetic tape units (Facit ECM 64) may be connected. Capacity: 64 reels per unit, 128 blocks of 64 words per reel (5.1 million decimal digits or 3.1 million alphanumeric char). Average access time: 1.9 ms per block.

Input: punched tape (Facit ETR: 500 char. per sec) and 80-column punched cards (Facit ECB: 120 cards per min). Output: punched tape (Facit ETP: 150 char. per sec), 80-column punched cards (Facit ECB: 120 cards per min), electric typewriter (12 char. per sec) and cathode ray tube curve plotter (2,000 points per sec). Conversion to and from internal binary system is automatic. Computing may proceed in the meantime.

Operation speeds (access time included): 0.045 ms for addition and subtraction, 0.290 ms for multiplication and 0.560 ms for division.

Power consumption: 16 kVA. Technical data: vacuum tubes (2,600), germanium

diodes (3,000), transistors (4,000) and magnetic cores (81,920). Price (average installation): \$500,000. Leased on special terms.

Another commercial computer is manufactured by the Svenska Reläfabriken (Tyresö, Stockholm) and marketed by AB Addo (Malmö). The computer, called Wegematic 1000, is an improved version of Alwac III E. Several are under construction and about twenty are on order (Oct. 1959). A large scale data processing system is developed.

— AB Addo: Wegematic 1000

Operation mode: serial. Number base: binary. Word length: 32 bits plus sign. Point working: fixed. Instructions: 1 address type (1 halfword), ¼ word for instructions without address). Number of operations: 80. Number of registers: 4 (1 index register).

Store: magnetic drum. Capacity: 8,192 words (256 tracks of 32 words). Speed: 3,600 rpm. Four additional tracks are used as working store. Transfer time per track (general store): 91 ms to and 107 ms from working store (32 ms if pre-selected). The possibility to connect magnetic tape units is expected in the near future.

Input/output: through Flexowriter with punched tape (10 char. per sec). A high speed punched tape console (150 char. per sec in, 50 char. per sec out) and a punched card converter (linking the com-

puter with IBM or Bull 80-column standard punched card equipment) are optional.

Operation speeds: 1 ms (optimum) or 9 ms (access included) for addition and subtraction, 17 ms (optimum) or 25 ms (access included) for multiplication and division.

Power consumption: 6.5 kVA. Floor area occupied: 27.5 sq. ft. Technical data: vacuum tubes (200), germanium diodes (7,000) and printed circuit plug-in boards (90). Price: \$43,500 (Flexowriter excluded). Not leased.

SWITZERLAND

A magnetic drum store computer, ERMETH (Elektronische Rechenmaschine der Eidg. Technische Hochschule), has been built by the Hasler AG (Bern). The computer was completed in 1955 and is installed at the Swiss Federal Institute of Technology (Zürich) for their own use.

Operation mode: serial parallel. Number base: binary decimal. Word length: 16 decimals. Point working: fixed and floating. Instructions: 1 address type (1 halfword). Store: magnetic drum. Capacity: 10,000 words. Speed: 6,000 rpm. Input/output: punched cards, paper tape and electric typewriter. Multiplication time: 10 ms.

About 1,700 tubes and 7,000 germanium diodes were used in ERMETH. The

punched card equipment for the input/output was constructed by the Mithra AG (Zürich), a subsidiary of Remington Rand. No commercial computer is manufactured in Switzerland.

UNITED KINGDOM

In "A Survey of British Digital Computers" eighteen machines, constructed by ten manufacturers were described. The information given in that paper was mainly assembled at the Electronic Computer Exhibition, held at London in November-December 1958. Ancillary equipment, purchasable as separate units, was not described. A lot of details are given in "Automation and Automatic Equipment News" (Vol. 4, No. 3, p. 794). Among the most remarkable realizations are: a xerographic high speed printer developed by Rank Precision Industries Ltd (Xeronic: 1,500 lines per min), a character reading device manufactured by Solartron Electronic Group Ltd. (ERA, Electronic Reading Automaton: 300 char. per sec) and a punched tape merger device designed by Ferranti Ltd and marketed by Ultra Electric Ltd (25 char. per sec). The speed of the Xeronic printer has been doubled (3,000 lines per min) and a character reading device is announced by E.M.I. Electronics Ltd (FRED: Figure Reading Electronic Device).

BTM has 62 computers of the type 1201 and 1202 delivered or on order. Powers-Samas has 126 PCC's delivered or on order. The proposed merger between BTM and Powers-Samas has been accomplished the 30th January 1959. The new company, I.C.T. (International Computers and Tabulators Ltd), will also market the PLUTO data processing system (announced by Powers-Samas in 1958). The central computer of the Pluto system is the Ferranti Pegasus. Ancillary input/output equipment is from I.C.T. It includes punched card readers (200 cards per min), card punches (100 cards per min), magnetic tape control units (with a 32 word nickel delay line buffer), magnetic tape units (½ inch tape, blocks of 32 words, up to 9,000 blocks per reel, read/write speed about 10,000 char. per sec) and magnetic tape operated off-line printers (Samastronic: 300 lines of 140 char. per min).

Elliott Brothers Ltd has developed an improved type of their National-Elliott 405. The new system, National-Elliott 405 M, incorporates an extended working store of 1,024 words held in a magnetic ferrite core matrix store (a Mullard construction), parity checking on all transfers within the system, and improved monitoring and indicating facilities to improve the ease of maintenance. An expanded version of the National-Elliott 802 has been announced. The magnetic core store capacity is raised to 4,096 words of 40 bits and the Elliott High Speed Tape Reader (up to 1,000 char. per sec) is used as input device. The punched tape reader is available as separate unit. The new computer, National-Elliott 803, is being used by Information Systems Inc.

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of Skokie (Illinois) as the control unit of their 609 process control system (cf. Contr. Eng., Vol. 6, No. 8, p. 52). About forty Elliott computers have been delivered and about twenty are on order (Oct. 1959). Elliott computers are marketed by the National Cash Register Company Ltd.

—N.C.R. Co.: National-Elliott 803

Operation mode: serial. Number base: binary. Word length: 40 bits (a parity bit included). Point working: fixed. Instructions: 1 address type (1 halfword). Number of operations: 64.

Store: magnetic cores. Capacity: 4,096 words (4 words of fixed orders). Access time: 6 microsec (parallel access). Any location may be used as B-modifier.

Input: 5 hole punched tape (Elliott: 500 or 1,000 char. per sec). Output: 5 hole punched tape (Creed: 25 char. per sec). Any device capable of transmitting or receiving digital data could be attached: an Elliott Punched Card Reader (400 cards per min), direct entry keyboards, analog-to-digital converters, etc.

Operation speeds (including instruction): 0.720 ms for addition and subtraction, 29.5 ms for multiplication and division.

Power consumption: 0.5 kVA. Floor area occupied (cabinet): about 7 sq. ft. Pulse rate frequency: 166.5 kc/s. Price: from \$100,000 to 110,000. Not leased.

Ferranti Ltd has announced a transistorized electric digital computer designed to provide full automatic control of many industrial processes. The magnetic core store has a capacity of 256 words of 10 bits (double length working if required) and program control is by plugboards (4,096 program steps and working constants). Input is from digital or analog control signals. Output is to a typewriter or to actuators which can switch a control unit and determine its movement direction. A description of this special purpose computer, technically known as P.C.T.C. (Process Control Transistor Computer), but also called Argus, is given in the Comm. of the ACM (Vol. 2, No. 4, p. 44). First production models are expected to be delivered in 1960. The price will probably be in the \$60,000 to 140,000 range, depending on the size of the installation. Another machine, announced by Ferranti Ltd, is the Sirius transistorized desk size computer. Designed for scientific applications, it extends the range of Ferranti computers into the small size. The prototype has been operating since early 1959 and is installed at the London Computing Centre. First deliveries are expected in 1960. Magnetic drum stores and high speed photoelectric tape readers (up to 1,000 char. per sec) are available from Ferranti Ltd as separate units. More than sixty Ferranti computers have been installed or are on order (Oct. 1959).

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—Ferranti Ltd: Sirius

Operation mode: serial. Number base: binary decimal (5-4-2-1 code). Word length: 10 decimals. Point working: fixed. Instructions: multi-accumulator type with modification (1 word). Number of operations: 55. Number of registers: 9.

Store: nickel delay lines. Standard capacity: 1,000 words (20 lines of 50 words). Average access time: 2 ms. The capacity may be directly expanded to a maximum of 10,000 words.

Input: 5 hole punched tape (300 char. per sec). Output: 5 hole punched tape (60 char. per sec) and teleprinter (10 char. per sec). A second tape reader, a second tape punch and punched card input/output are optional. The speed of the punched card equipment is 200 and 100 cards per min for input and output respectively.

Operation speeds (including access time): 0.240 ms for addition and subtraction, 4 to 16 ms for multiplication and division.

Power consumption: 0.6 kVA. Floor area occupied: 25 sq. ft. Technical data: 500 kc/s prf, vacuum tubes (19), germanium diodes (5,000), transistors (2,500), printed circuit plug-in boards (700), nickel delay lines (20 and up). Price: approx. \$60,000. Not leased.

About 400 digital computers are installed in the U.S.S.R. More than 300 of them are URAL's, a small size magnetic drum computer with an auxiliary magnetic tape store. Most applications belong to the scientific and engineering field. Maybe, the number of analog computers in use is ten times more.

Computers, developed in the early years, are MESM, SESM and KRISTALL. MESM is a small magnetic drum computer, which is claimed by the Computing Centre of the Ukrainian Academy of Science (Kiev) to be the first computer in Europe. SESM is a special purpose computer, constructed for the solution of systems of linear equations. KRISTALL is a slow computer, built for chemical calculations (mainly for X-ray diffraction analysis). An experimental relay calculator, the RBM-3, with a punched card tabulator for input and output, is rebuilt at the Leningrad Computing Centre of the Stiklov Mathematical Institute. A punched card calculator, the EV-80, is still in use there. It is very similar to the well-nown IBM 604 electronic calculating punch.

More recent computers are BESM, STRELA, M-2 and URAL. Computers under development are SETUN, KIEV, VOLGA and some other. SETUN and KIEV are nearly completed. Information about VOLGA is not yet available.

BESM I is a Williams tube store computer, developed at the Institute of Precise Machines and Computing Techniques (Moscow). The computer was completed in 1952. Afterwards, the Williams tubes were replaced by magnetic core matrices. A copy, BESM II, is under construction. The vacuum tubes are replaced by germanium diodes and the capacity of the magnetic store is doubled. BESM II will probably be manufactured in series.

Operation mode: parallel. Number base: binary. Word length: 39 bits. Point working: floating. Instructions: 3 address type (1 word). Store: magnetic cores. Capacity: 1,024 (I) or 2,048 (II) words. Access time: 6 microsec. Auxiliary store: magnetic drum. Capacity: 5,120 words. Speed: 750 rpm. External store: 4 magnetic tape units. Capacity: 30,000 words per tape. Input/output: punched tape and mechanical printer (+ off-line photoprinter from magnetic tapes). Multiplication time: 270 microsec.

STRELA is another cathode ray tube computer, developed at the Institute of Precise Machines and Computing Techniques. The original prototype, completed in 1953, has a store capacity of 1,024 words. Later on the cathode ray tubes were replaced by magnetic cores and the store capacity was doubled. About 15 STRELA's have been installed. An advanced transistorized model is under development.

Operation mode: parallel. Number base: binary. Word length: 43 bits. Point working: floating (mantissa may be decimal). Instructions: 3 address type (1 word). Store: magnetic cores. Capacity: 2,048 words. Access time: 4.5 microsec. External store: 4 magnetic tape units. Capacity: 200,000 words per tape. Input/output: punched cards. Multiplication time: 500 microsec.

M-2 is a small cathode ray tube computer, developed at the Energetics Institute of the Academy of Sciences. It was completed in 1954. Its application field is principally limited to problems in electric power systems. Much work on linear programming has been done on it. A similar machine, the M-3, with a magnetic drum store of 2048 words, was constructed at the Power Engineering Institute.

Operation mode: parallel. Number base: binary. Word length: 34 bits. Point working: fixed and floating. Instructions: 3 address type (1 word). Store: cathode ray tubes. Capacity: 512 words. Auxiliary store: magnetic drum. Capacity: 512 words. External store: magnetic tape unit. Capacity: 50,000 words. Input/output: punched tape. Operation speed: similar to STRELA.

URAL is a magnetic drum store computer, which has been manufactured in series. The prototype was completed in 1955 by the Scientific Research Institute of the Ministry of Machine and Instrument Construction. More than 300 URAL's have been installed now. In comparison with the other U.S.S.R. computers it is rather slow.

Operation mode: serial parallel. Number base: binary. Word length: 36 bits. Point working: fixed. Instructions: 1 address type (1 halfword). Store: magnetic drum. Capacity: 1,024 words. Speed: 600 rpm. External store: magnetic tape unit. Input: punched film. Output: punched film and printer. Multiplication time: 10 ms.

SETUN is a magnetic drum store computer, under construction at the Moscow State University. Magnetic cores are used as circuit components and for a small working store. Transistors are used for the read-amplifiers of the drum. Division is by subroutine.

Operation mode: serial. Number base: ternary. Word length: 18 ternary digits. Point working: fixed. Instructions: 1 address type (1 halfword). Quick access store: magnetic cores. Capacity: 81 words. Main store: magnetic drum. Capacity: 2,000 words. Speed: 7,000 rpm. Magnetic tape units: planned. Input/output: punched tape and printer. Multiplication time: 300 microsec.

KIEV is a magnetic core store computer, under construction at the Ukrainian Academy of Sciences. Magnetic drums are used as auxiliary store. Division is by subroutine. Conversion to and from the internal binary system is automatic. Operation mode: parallel. Number base: binary. Word length: 41 bits. Point working: fixed. Instructions: 3 address type (1 word). Store: magnetic cores. Capacity: 2,000 words. Access time: 10 microsec. Auxiliary store: 3 magnetic drums. Capacity: 4,000 words per drum. Speed: 1,500 rpm. Input: punched film (punched cards under consideration). Output: printer. Multiplication time: 200 microsec.

Most of the details given were extracted from Russian literature and from the reports on a return visit to the Soviet Union by four American digital computer specialists (J. W. Carr III, A. J. Perlis, J. E. Robertson and N. R. Scott). A team report, with some comments and an extensive bibliography, has been published recently in the Comm. of the ACM (Vol. 2, No. 6, p. 8).

YUGOSLAVIA

A magnetic core store computer is under construction at the Boris Kidrich Institute (Belgrade). It will be the first computer made in Yugoslavia and its completion is scheduled toward the end of 1959. Applications will belong mainly to the nuclear field. So far, no name has been given.

Operation mode: serial. Number base: binary. Word length: 30 bits. Point working: fixed. Instructions: 1 address type (1 word). Store: magnetic cores. Capacity: 4,096 words. Input/output: punched tape.

A report of the contributions of Yugoslavia to the computer field may be found in the paper of N. M. Blackman (cf. Comm. of the ACM, Vol. 2, No. 9, p. 14).

BIBLIOGRAPHY

References have been limited mainly to the Communications of the Association For Computing Machinery. In some cases the reader has been referred to the Pro-

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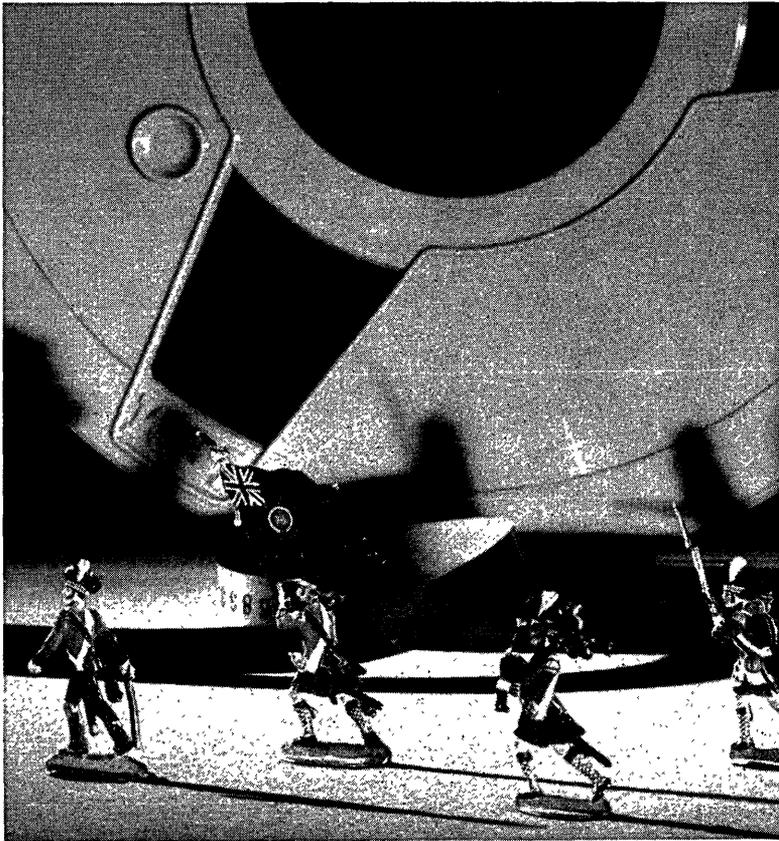
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ceedings of the International Computer Conference, held at Darmstadt in October 1955 (Electronic Digital Computing and Information Processing). Several papers presented at this conference are in English. To those presented in German a summary in English was added. A lot of details about British contributions to the digital computer field may be found in the Proceedings of the Convention on Digital-Computer Techniques, held at London in 1956 (The Proc. of the Institute of Electrical Engineers, Vol. 103, Part B, Supplement Nrs 1-2-3).

The author is compiling a bibliography of the machines described in his two surveys. A list of some West-European journals on computers and related fields is given below.

— English:

The Computer Journal. The British Computer Society Ltd, Finsbury Court, Finsbury Pavement, London, EC2.

The Computer Bulletin. The British Computer Society Ltd, Finsbury Court, Finsbury Pavement, London, EC2.

Automatic Data Processing. Business Publications Ltd, 180 Fleet Street, London, EC4.

Data Processing (in Business and Industry). Iliffe & Sons Ltd, Dorset House, Stamford Street, London, SE1. Automation & Automatic Equipment News. United Trade Press Ltd, 9 Cough Square, Fleet Street, London, EC4.

— French:

Le Bulletin de l'Association Francaise de Calcul. Institut d'Astrophysique, Boulevard Arago 98bis, Paris 14.

Chiffres (Revue de l'Association Francaise de Calcul). P. Rapin, Rue Général-Lanrezac 5, Neuilly-Seine.

Automatisme (au bureau et à l'usine). Ed. Dunod, Rue Bonaparte 92, Paris 6. Gestion (organisation). Ed. Dunod, Rue Bonaparte 92, Paris 6.

— German:

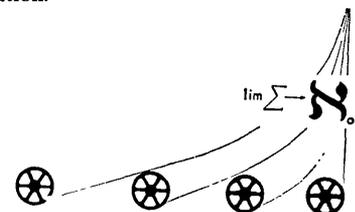
Elektronische Rechenanlagen. R. Oldenbourg, Rosenheimer Strasse 145, München 8.

Elektronische Datenverarbeitung. Friedr. Vieweg & Sohn, Braunschweig.

Titel von Veröffentlichungen über Analog- und Ziffernrechner und ihre Anwendungen. Franz Steiner Verlag GmbH, Bahnhofstrasse 39, Wiesbaden. Numerische Mathematik. Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf.

Scientia Electrica. AG Fachschriften-Verlag & Buchdruckerei, Zürich (Switz.).

NOTE: Some details about the number of European computers, installed or on order, may be found in the text. The results of a census will be published in one of the next issues of Computers and Automation.



SURVEY OF RECENT ARTICLES

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Automatic Control
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Instruments and Control
Systems
ISA Journal
Proceedings of the IRE
The Office
Scientific American

The purpose of this type of reference information is to help anybody interested in computers find articles of particular relation to this field in these magazines.

For each article, we shall publish: the title of the article / the name of the author(s) / the magazine and issue where it appears / the publisher's name and address / two or three sentences telling what the article is about.

The Sage/Bomarc Air Defense System / E. H. Goodman / Computing News, vol. 7, no. 20, Oct. 15, 1959, p 159-3 / J. W. Granholm, Box 261, Thousand Oaks, Calif.

A description of the surface-to-air missile system as guided and controlled by a Semi-Automatic Ground Environment computer. The article discusses the radar system which has been tested at various sites in the U.S., and explains how the computer has functioned in simulated attacks.

Computers in Process Control / Electronics, vol. 32, no. 44, Oct. 30, 1959, p 27 / McGraw-Hill Pub. Co. Inc., 330 West 42 St., New York 36, N.Y.

The computer has been used to partially control certain continuous processes, is being used to control the petrochemical process 24 hours a day, and will be adaptable to the supervisory control of diverse industries. Mentioned are some "control" computers on the market; some applications are sketched.

Analog Computer Aids Heart Ailment Diagnosis / R. L. Skinner, Chief Engineer, and D. K. Gehmlich, Consultant, Ensco, Inc., Salt Lake City, Utah / Electronics, vol. 32, no. 40, Oct. 2, 1959, p 56 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

A medical diagnostic technique in heart ailments involves injecting a dye into the patient's bloodstream and observing the diffusion of the dye, as the blood flows into the heart. A computer is used to integrate over the area which corresponds to the dye's curve in the blood, and to record fluctuating areas. Doctors use this information to determine the type and seriousness of a particular heart ailment.

Automath, 1959 / S. Handel, A. M. I. E. E. / Automation and Automatic Equipment News, vol. 5, no. 1, Aug.-Sept., 1959, p 16 / A. & A. E. N., 9 Gough Square, Fleet St., London, E. C. 4, England.

A review of the automation exhibition held in June, 1959, under UNESCO auspices, in Paris. The exhibits of Sweden, Japan, and France are described, including computers and components produced in those countries. A note listing all participating countries, accompanies this review.

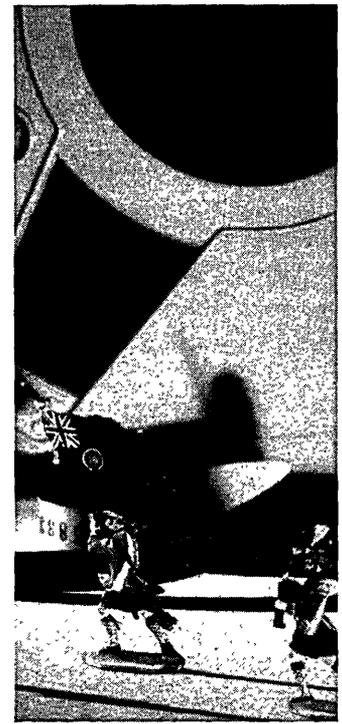
Computers in Europe / H. Ward / Automation and Automatic Equipment News, vol. 5, no. 1, Aug.-Sept., 1959, p 26 / A. & A. E. N., 9 Gough Square, Fleet St., London, E. C. 4, England.

A brief resumé of computers delivered to, and produced in, Europe. Aside from IBM and UNIVAC computers, there are the DEUCE, BESK, FACIT and PCC. The Automatic Data Processing Research Centre in the Netherlands, is discussed.

Computer Tests Dynamics of Missile Controls / H. R. Karp / Control Engineering, vol. 10, no. 10, Oct., 1959, p 25 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

A computer controlled test system automatically programs, calibrates, and generates driving signals, and then analyzes a frequency-response test for a missile servo system. This article discusses the basics of the testing system, and describes the computer used for control.

Searching and Updating Easy with Film-Tape Records / P. James, IBM Research Center, Yorktown Heights, N.Y. / Control Engineering, vol. 10, no. 10, Oct., 1959, p 128 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.



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Research Office, in California, an unusual opportunity exists for a mathematician-programmer to expand his horizons in mathematical analysis and computer programming, in an operations research environment. A B.S. degree and one to two years' programming experience are required, plus the desire and ability to contribute to pre-programming analysis. The over-all Company policies in areas of fringe benefits and profit-sharing plans are unique. Write or wire collect:

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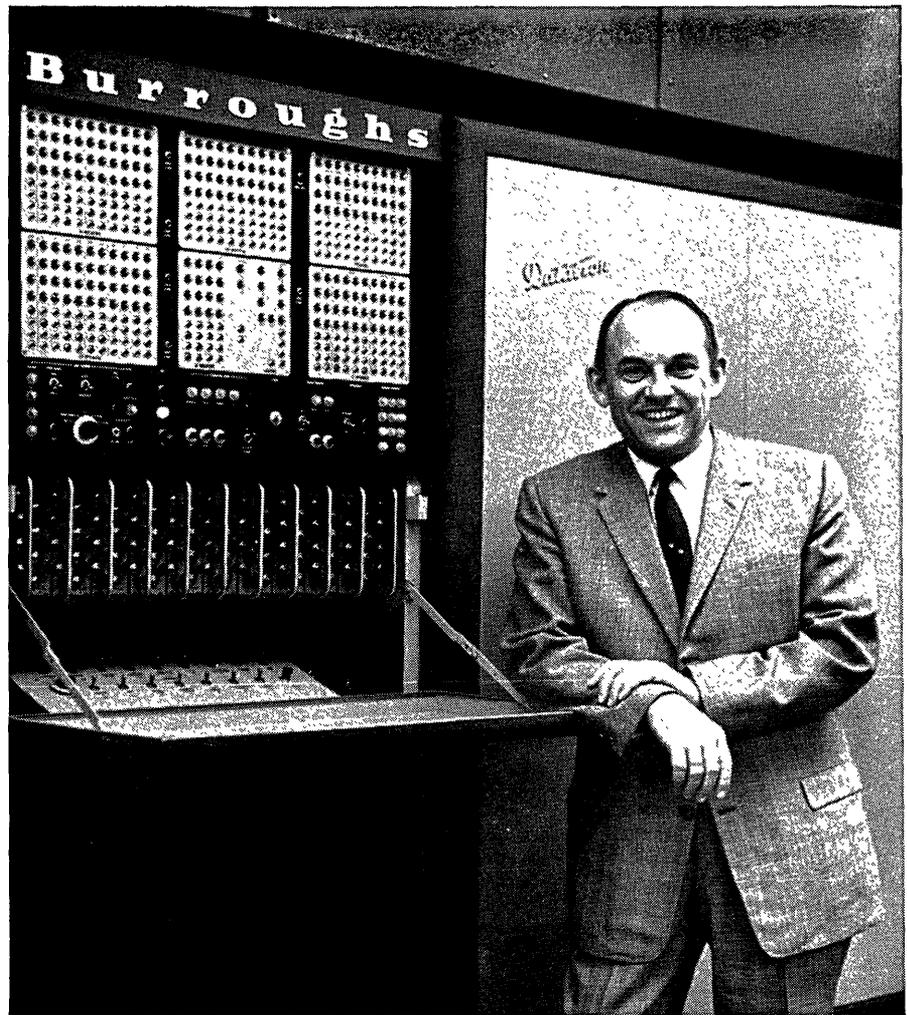
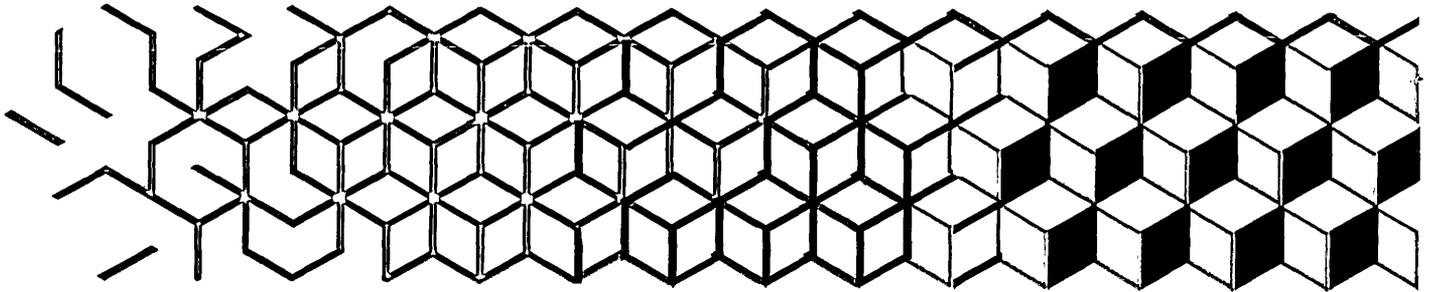
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A statement from Behr-Manning Co.: *“Our Burroughs*

computer processes our customer

order data in 1/50 the time”



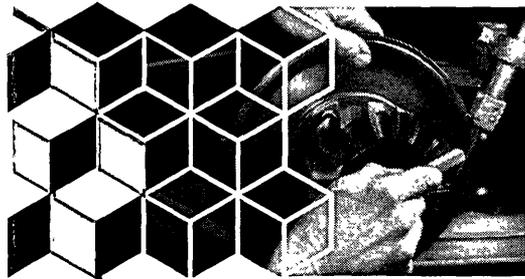
Behr-Manning's Philip Doherty (left) meets with members of his group at the Datafile.

Edwin C. Evans, Vice President and General Manager of Behr-Manning Co.

"Our Burroughs computer processes our customer order data in 1/50 the time... and provides our management with up-to-the-minute statistical reports for the control and planning of our business."

EDWIN C. EVANS

*Vice President and General Manager
Behr-Manning Co.*



Nearly 40,000 different products are manufactured by Behr-Manning Co., of Troy, New York, a division of Norton Company. These products have use in almost every manufacturing process... from the making of cars to the shelling of peanuts. The products are of three main types: coated abrasives, pressure sensitive tapes and floor maintenance products. Behr-Manning, with its parent company, the Norton Company, is the largest abrasives enterprise in the world, and Behr-Manning's cellophane and other pressure sensitive tapes, sold under the "Bear" Brand are quality leaders in their field.

Behr-Manning's vast selection of products are stocked and shipped from the factory warehouse and from 16 branch warehouses across the country. Their products are purchased by countless different types of customers through every major channel of distribution.

The company, which began as a sandpaper business in 1872, now has 3,000 employees. As Behr-Manning's line of products and list of customers grew, their record keeping and accounting procedures also became extremely complex. In November, 1958, they installed a Burroughs 205 electronic data processing system to solve their paperwork problems.

Behr-Manning's decision to purchase a Burroughs 205 was preceded by considerable investigation. Vice President

and General Manager, Edwin C. Evans, states, "We first organized a 6-man study team. The group's job was to determine whether or not a data processing program would help us, and if so, to recommend which data processing system would help us most. When we decided to enter electronic data processing, the group prepared a detailed description of our particular requirements. We settled on Burroughs equipment because the 205 best satisfied our specific needs. Furthermore, the high capacity, low-cost random access Datafiles were especially suited to our application."

The computer soon took over a number of complex clerical functions... in actuality, 19 different computational assignments, from factory payroll to budget reporting. The computer's capacity enabled it to do all of this work in only 10 hours per week.

Despite the magnitude of these jobs, this was not the chief reason for acquiring the 205. Behr-Manning's most important need is a process called "order entry," which literally automates the entire sales-inventory-billing-report cycle.

The source of all Behr-Manning operations is the customer order, which is also a source of a mass of paper work. It must be edited, analyzed and reproduced prior to completion of processing.

"All order entry, from every branch, can be done by our 205," states Philip Doherty, Behr-Manning's Manager of Operations Analysis and Planning. "We process thousands of orders a day. An original order is picked up just once at a receiving location and all the work is done automatically in the system. An order coming in from a branch office is transmitted in minutes to headquarters by private wire, quantity and item data are automatically fed to the computer, and return wire messages make stock status and shipping information instantly available to the branch office."

In addition to processing the order, the 205's magnetic tape Datafiles, each having a capacity of 20,000,000 digits of information, hold many thousands of different customer and product records. When an order is entered in the 205, the computer locates the appropriate customer and product records, then issues

either a production order or shipping instruction. It also automatically prices the order and issues the invoice. Upon completion of a customer order, the computer automatically issues factory orders to replenish the stock level of the factory or branch warehouse.

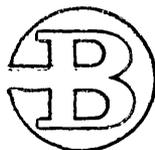
The statistics accumulated by the 205 are then prepared in numerous different reports which are distributed either daily, weekly, monthly or quarterly in a digested form for Behr-Manning management. The reports include information on sales, finance and production. Previous to the 205 these statistical analyses required as long as three weeks to prepare. Now, even the most involved report can be issued in 48 hours, and if information is needed more quickly, it can be obtained by inquiring through the computer console. In such cases, specific replies are typed automatically by the printer.

"These up-to-the-minute reports," says Behr-Manning's President, Elmer C. Schacht, "are invaluable to us in the planning and control of our business. The information obtained from one waste report alone should save us thousands of dollars a year. In addition to improving the speed and accuracy of our own operation, installation of the 205 benefits our customers with the fastest possible service."

Behr-Manning originally leased their 205 computer, but after about nine months of use, they decided to purchase it. Vice President Edwin C. Evans points out, "By June, 1959, it was obvious that our 205 would accommodate all of our 'order entry' procedures plus many of our other data processing needs. So at that time we purchased the 205 outright. The equipment had proved itself and it made economical good sense to own it rather than rent it."

Like the people of Behr-Manning, hundreds of other industrial and business users are confirming the same experience. Burroughs complete line of electronic data processing equipment is backed by a coast-to-coast team of computer specialists, all eager to tell you how Burroughs can help in your business. For additional information, write General Manager, Data Processing Systems Group, Detroit, Michigan.

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Generalized Problem Stirs Up Computing-Control / H. R. Karp and L. H. Young / *Control Engineering*, vol. 6, no. 11, Nov., 1959, p 36 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

Users and manufacturers of computers discuss the comparative merits of computers used for process control. The views of each group are presented, with the differences of opinion on the feasibility of control in the future, based upon past performance.

Computer Analogs for Common Non-linearities / C. L. Dunsmore / *Control Engineering*, vol. 10, no. 10, Oct., 1959, p 109 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N.Y.

A set of diagrams to describe analog computer circuits for four basic nonlinearities. The article offers practical hints for their application, and includes five more complex nonlinearities that are simulated combinations of the basic ones.

Data Processing—Present and Future / F. Kaufman / *American Business*, Oct., 1959, p 15 / A. B., 4660 Ravenswood Ave., Chicago 40, Ill.

This article discusses the possibilities of standardization in the computer industry, and considers this a probable necessity in the future.

How Analog Networks Solve Air-Con-

ditioning Problems / W. L. Wright and C. A. Booker / *Electronics*, vol. 32, no. 52, Dec. 25, 1959, p 34 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N. Y.

This article describes a specially designed analog computer which provides an effective means of predicting thermal behavior, and determines residential air conditioning loads. The theory behind the computer is discussed; information on amplifier outputs is given.

Gas Abstracts / Dec. 1959, vol. 15, no. 12 / Institute of Gas Technology, Chicago 16, Ill. / printed, pp 385-412, annual cost: \$18.00 to nonmembers.

This publication presents abstracts of articles published in about 150 magazines and periodicals, listed on the back cover. Thirteen subdivisions include abstracts of papers on: management; energy supply and economics; analytical methods and tests; gas distribution; equipment and instrumentation including computers; etc.

Electronic Car Tracing / Jack Small / *Systems*, vol. 23, no. 5, Sept.-Oct., 1959, p 34 / *Systems Magazine*, Sperry Rand Corp., 315 Park Ave. South, New York 10, N. Y.

The use of a computer to locate and control railroad freight cars, and to process related data, is described. The types of input to the system are explained, and the general feasibility of this kind of computer tracing of freight cars is discussed.

The New Univac Larc Computer / *The Office*, vol. 50, no. 6, Dec., 1959, p 91 / Office Publications, Inc., 232 Madison Ave., New York 16, N. Y.

Gives a brief and general description of the computer, which purportedly performs 250,000 additions or subtractions of 12-digit decimal numbers, per second. The system, renting at approximately

\$135,000 per month, may cost relatively less than other data processing systems of a similar nature.

Control Data's 1604 Computer / *The Office*, vol. 50, no. 6, Dec., 1959, p 94 / Office Publications, Inc., 232 Madison Ave., New York 16, N. Y.

The 1604 computer, which is capable of utilizing standard input-output equipment manufactured by various companies, is described. Internal structure and coding are included in the article.

Computer Gets New Airline Job / *Electronics*, vol. 32, no. 48, Nov. 27, 1959, p 46 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N. Y.

American Airlines plans to use an IBM 9090 data processing system to control and process its reservation system, in order to increase the efficiency of the system. This article explains the planned arrangement of the computer controlled system, which is expected to go into operation in 1961.

Speaking of Small Computers / *Datamation*, vol. 5, no. 6, Nov.-Dec., 1959, p 7 / F. D. Thompson Publications, Inc., 10373 West Pico Blvd., Los Angeles 64, Calif.

This article compares the relative features and merits of the Royal McBee LGP-30, the Autonetics RECOMP, the Bendix G-15, and the IBM 1620.

Characteristics of Digital Codes / Leo Rosen / *Control Engineering*, vol. 6, no. 12, Dec., 1959, p 115 / McGraw-Hill Pub. Co., Inc., 330 West 42 St., New York 36, N. Y.

This article presents some important properties of digital codes that will help engineers in their choice of a particular code. Some codes presently used in computer installations are given.

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

Bendix Aviation Corp., Computer Div., 5630 Arbor Vitae St., Los Angeles, Calif. / Page 7 / Shaw Advertising, Inc.

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N.J. / Page 2 / Deutsch & Shea, Inc.

Berkeley Enterprises, Inc., 815 Washington St., Newtonville 60, Mass. / Page 19 / —

Clary Corp., San Gabriel, Calif. / Page 28 / Erwin Wasey, Ruthrauff & Ryan, Inc.

ElectroData, Div. of Burroughs Corp., 460 No. Sierra Madre Villa, Pasadena, Calif. / Pages 32, 33 / Carson Roberts Inc.

International Business Machines Corp., San Jose 14, Calif. / Page 26 / Benton & Bowles, Inc.

Minneapolis-Honeywell, Datamatic Div., Wellesley Hills 81, Mass. / Pages 16, 17 / Batten, Barton, Durstine & Osborn

National Cash Register Co., Dayton, Ohio / Page 36 / McCann-Erickson, Inc.

Philco Corp., Computer Div., Willow Grove, Pa. / Page 35 / Maxwell Associates, Inc.

Philco Corp., Government & Industrial Group, Computer Div., 4700 Wissahickon Ave., Philadelphia 44, Pa. / Page 3 / Maxwell Associates, Inc.

Radio Corp. of America, Electronic Data Processing Div., Camden 2, N.J. / Pages 5, 27, 29 / Al Paul Lefton Co., Inc.

The Ramo-Wouldridge Laboratories, 8433 Fallbrook Ave., Canoga Park, Calif. / Page 15 / The McCarty Co.

Reeves Soundcraft Corp., Great Pasture Rd., Danbury, Conn. / Page 18 / The Wexton Co., Inc.

Space Technology Laboratories, P.O. Box 95004, Los Angeles 45, Calif. / Page 23 / Gaynor & Ducas, Inc.

Technical Operations, Inc., 3520 Prospect St., N.W., Washington 7, D.C. / Page 30 / Dawson MacLeod & Stivers

Technical Operations, Inc., 305 Webster St., Monterey, Calif. / Page 31 / Dawson MacLeod & Stivers



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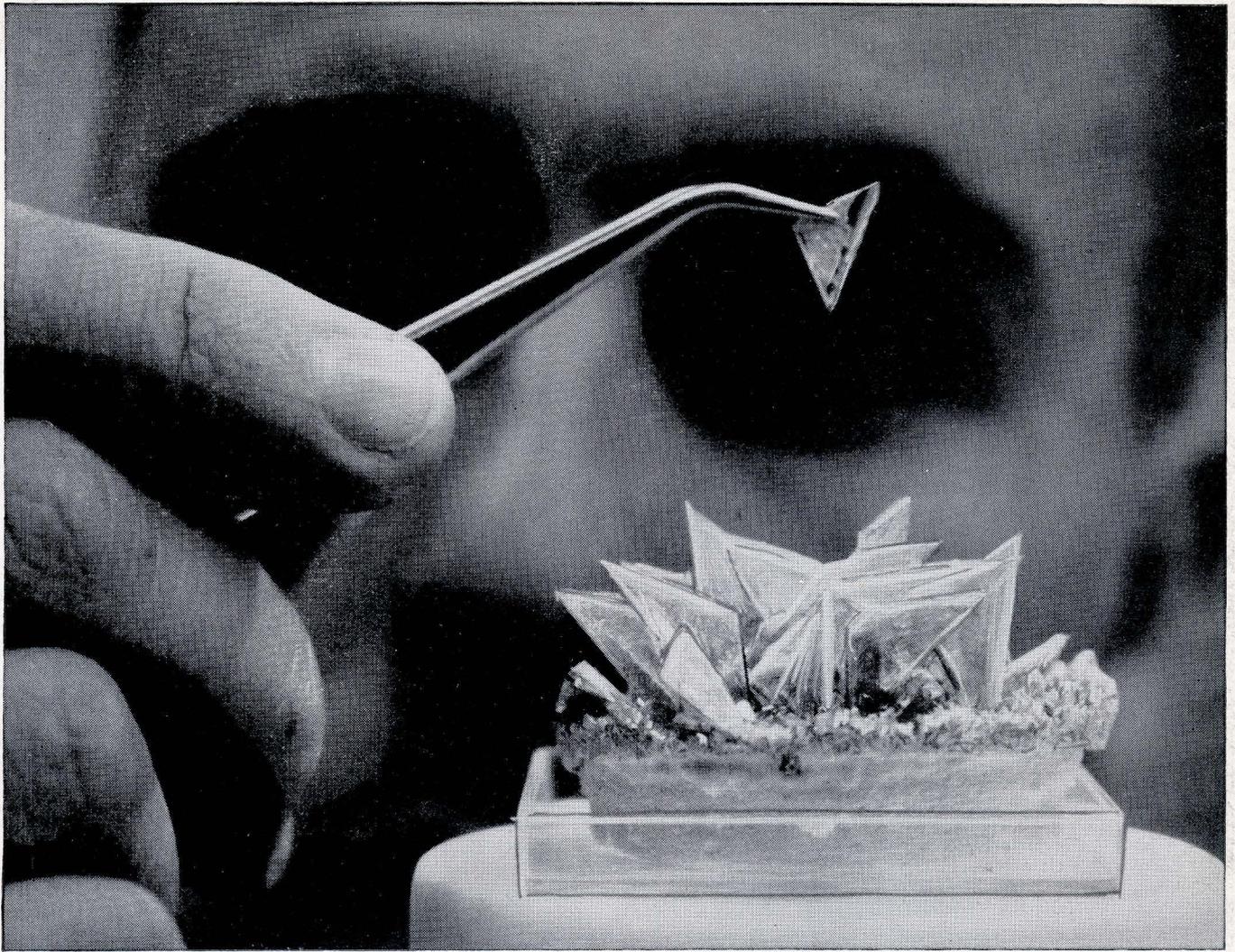
Customer Service Engineers

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