The Magazine of

DATAMATION

September/October

Research & Engineering

page 6 THE TECHNICAL INFORMATION PROBLEM

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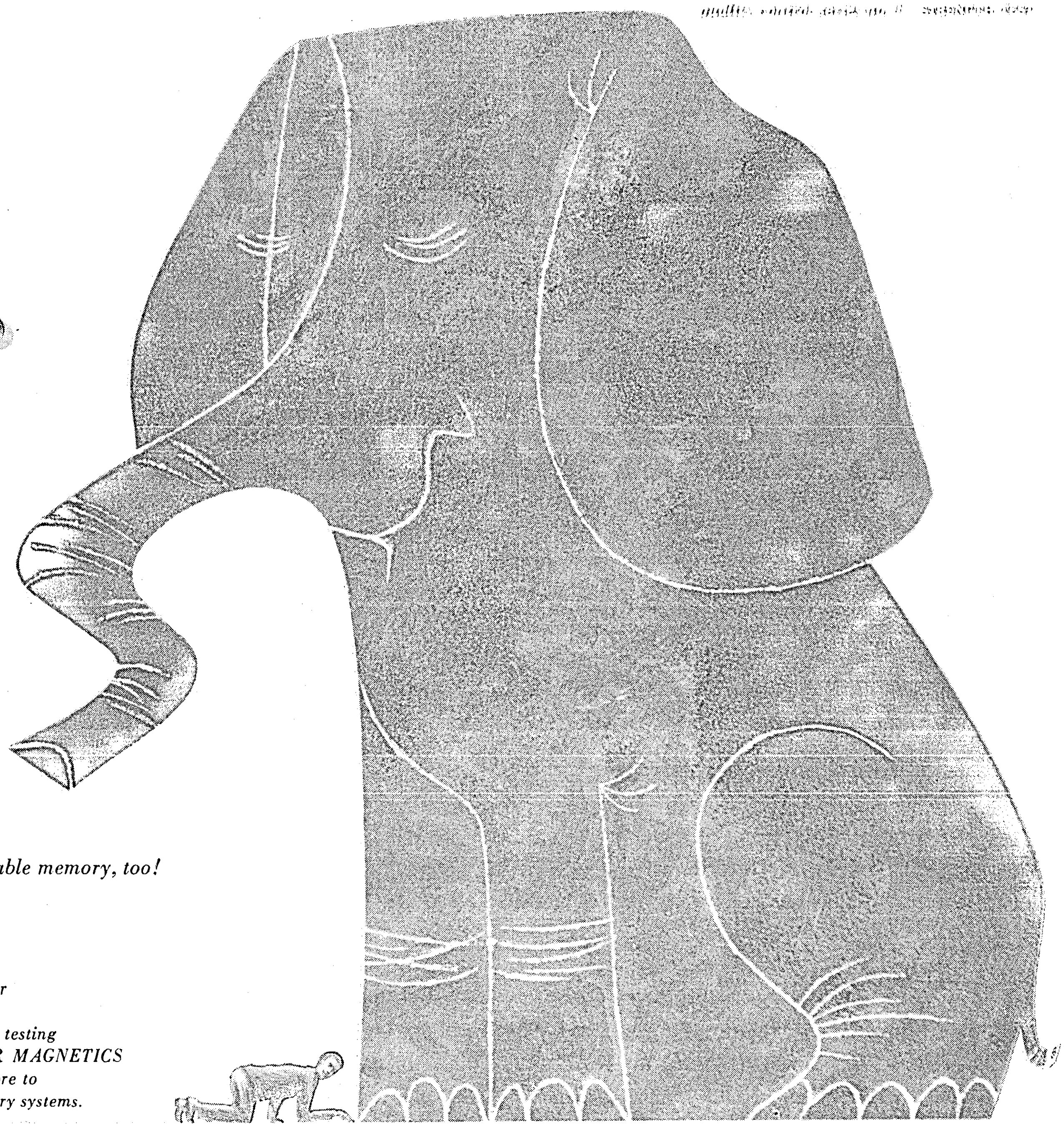

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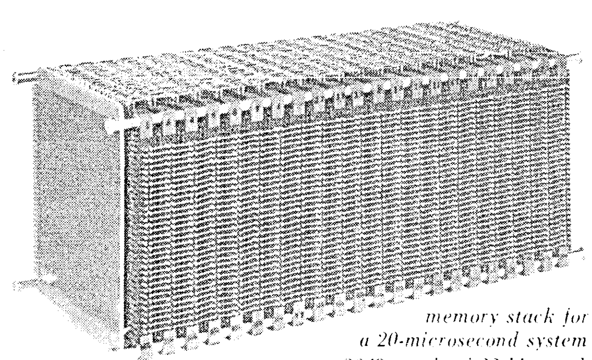

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DATAMATION 58

EDITORIAL

FEATURES

the automatic handling of information

volume 4, number 5

ARTICLES

DEPARTMENTS

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R/E, The Magazine of DATAMATION, welcomes manuscripts of three general types: application articles dealing with small, medium and large electronic data processing systems; articles covering the design of components, sub-systems and systems; and other general articles of interest to the data processing industry. Material submitted should be accompanied by pictures and illustrations when possible. Unsolicited manuscripts to be returned to writer should include return postage but editor assumes no responsibility for their safety or return (although all reasonable care will be taken).

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DATAMATION *in business and science*

UNIVAC 1105 SET FOR BUREAU OF CENSUS

Construction of a Univac Scientific 1105 computer has been completed by Remington Rand and the first unit is being delivered to the Bureau of Census in Washington for 1960 census use. The Bureau will eventually use two 1105's in its Washington headquarters and several others are to be placed in U. S. universities for collaborative census use. . . . Philco Corp. and the Uptime Corp. of Rawlins, Wyo., will develop and market a new high speed punched card reader, the Speedreader 2000. Equipment was invented by Raymond B. Larsen, Uptime president.

HAPPENINGS, RECENT AND NOTABLE

Computer Equipment Corp., is the new name for the company formerly known as Digitron, Inc. The name change was effected "in order to clarify the nature of the business in which our growing electronic firm is engaged," according to A. C. Bellanca, president of the Los Angeles firm. . . . Reese Engineering, Inc., Philadelphia, has formed a Digital Systems Engineering department. It will provide a complete service from consultation to systems assembly with particular emphasis on special data handling equipment. Lowell S. Bensky heads the department . . . Servomechanisms Inc., Hawthorne, Calif., has received an order amounting to nearly a half-million dollars from Lockheed Aircraft for production of true airspeed computers.

SUBSTITUTE 'BANKING' FOR 'RETRIEVAL?'

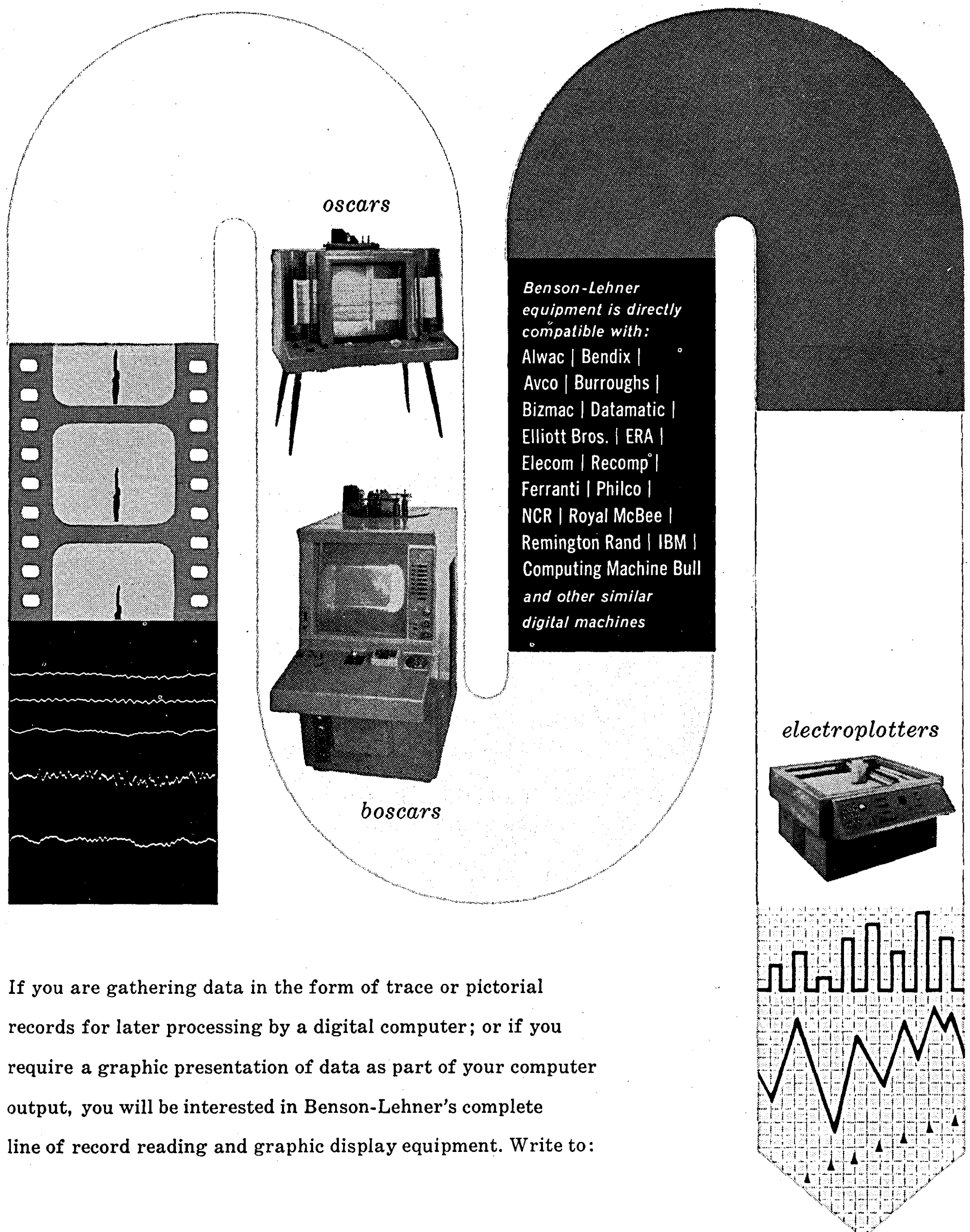
The area of datamation now referred to as "data retrieval" is predicted to grow to major proportions during the next decade, according to Bernard S. Benson, Benson-Lehner Corp., president. In a recent talk to leading members in the data processing field, Benson pointed out that a misnomer is being created in the use of this phrase because the retrieval of information is only one part of an overall process. He suggested that this particular operation be renamed "data banking" which covers investment, internal organization and withdrawal.

U. S. NAVY'S OVERALL COMPUTER PICTURE

Navy Management REVIEW has released a table showing the growth of electronic digital computer installations in the United States Navy. Figures for 1958 and 1959 are estimated. Dollar amounts exclude cost of supporting punched card installations. This table is reprinted by courtesy of the REVIEW.

END FISCAL YEAR	Number of Systems Installed			Number of People			Dollars (Thousands)		
	Total	Bus.	Sci.	Total	Bus.	Sci.	Total	Bus.	Sci.
1954	5	1	4	102	49	53	$ 849	$ 234	$ 615
1955	10	2	8	166	64	102	4720	605	4115
1956	20	8	12	262	94	168	3891	1160	2731
1957	29	13	16	586	368	218	9184	4234	4950
1958	48	26	22	988	718	270	12299	7272	5027
1959	72	46	26	1242	930	312	23057	15961	7096

benson-lehner *computer input-output*



If you are gathering data in the form of trace or pictorial records for later processing by a digital computer; or if you require a graphic presentation of data as part of your computer output, you will be interested in Benson-Lehner's complete line of record reading and graphic display equipment. Write to:

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IS THERE A TECHNICAL INFORMATION CRISIS?

Merritt L. Kastens is an assistant director of Stanford Research Institute, Menlo Park, California. He has responsibility for certain special program developments as well as the Institute's research service departments.

A native of Chicago, Kastens received a B.S. degree in chemistry in 1944 from Roosevelt College in Chicago. Later he took graduate studies on inorganic physical chemistry at the University of Chicago.

During 1944-45 Kastens was a research chemist with the Armour Research Foundation in Chicago. His wartime service as an ensign in the U.S. Navy included duty as engineering officer on board an attack transport in the Pacific.

From 1946 to 1952 he was associate editor of *Chemical & Engineering News* and *Industrial and Engineering Chemistry*, working in San Francisco, Chicago and New York. He is the author of several articles on chemical production techniques, the chemical industry, and research management. He joined SRI in 1952.

The problem of organizing technical information has received more study, particularly at high levels of the governmental and scientific communities, in the past year than in the entire previous era of modern science. Does this attention imply that the nation is suddenly faced with a new situation arising from the Russian satellite program—some new pattern of circumstances that requires an immediate countering action in order to prevent losing the technological race?

Obviously not. Specialists concerned with the organization and dissemination of technical information have been pointing out for many years that the rapid increase in level of technological activities has far exceeded the concept and rate of growth of information processing facilities. Those who have responsibility for organizing and budgeting research and development efforts have been increasingly aware of the rising cost and frustrating inadequacies of the available mechanisms for finding recorded knowledge. The rapidly increasing accumulation of technical information and the lack of adequate organization for its utilization imposes an increasing economic burden on our society and threatens to drown our scientists and engineers in a flood of paper.

International events have emphasized the time dimension of present-day technology, and particularly the military significance of time. In technical development the major time interval is between the initial scientific discovery and the design of a prototype device. More time is lost—or more time is to be gained—between the laboratory and the drawing board than there is between the drawing board and the production line. In this period, where ideas rather than physical materials are involved, speedup is most feasible. Thus, from a military standpoint, the information system itself has become a "weapon system." It is the weapon system on which all military devices, as well as our peacetime progress, depend.

The problem is an old one. What is new is the general appreciation of its seriousness. Out of this arises hope that major steps toward solution may at last be undertaken. We can no longer afford the piecemeal efforts toward fragmentary solutions, which have been the only kind of efforts this problem has enjoyed in this country until now.

The acute awareness of the need arrives at a time when there is prospect for major help for solution from technology itself. Recent developments in machine systems for information storage and retrieval, although still far from adequate for the job at hand, are definitely encouraging. The technique of "organized invention" for the solution of practical problems has long since proved its efficacy in the applied-research laboratories of the world. The newer techniques of operations research, systems analysis, and applied behavioral sciences, are providing increasing evidence that an organized, systematic approach to very complex problems is effective, economical, and, indeed, may be the only feasible approach.

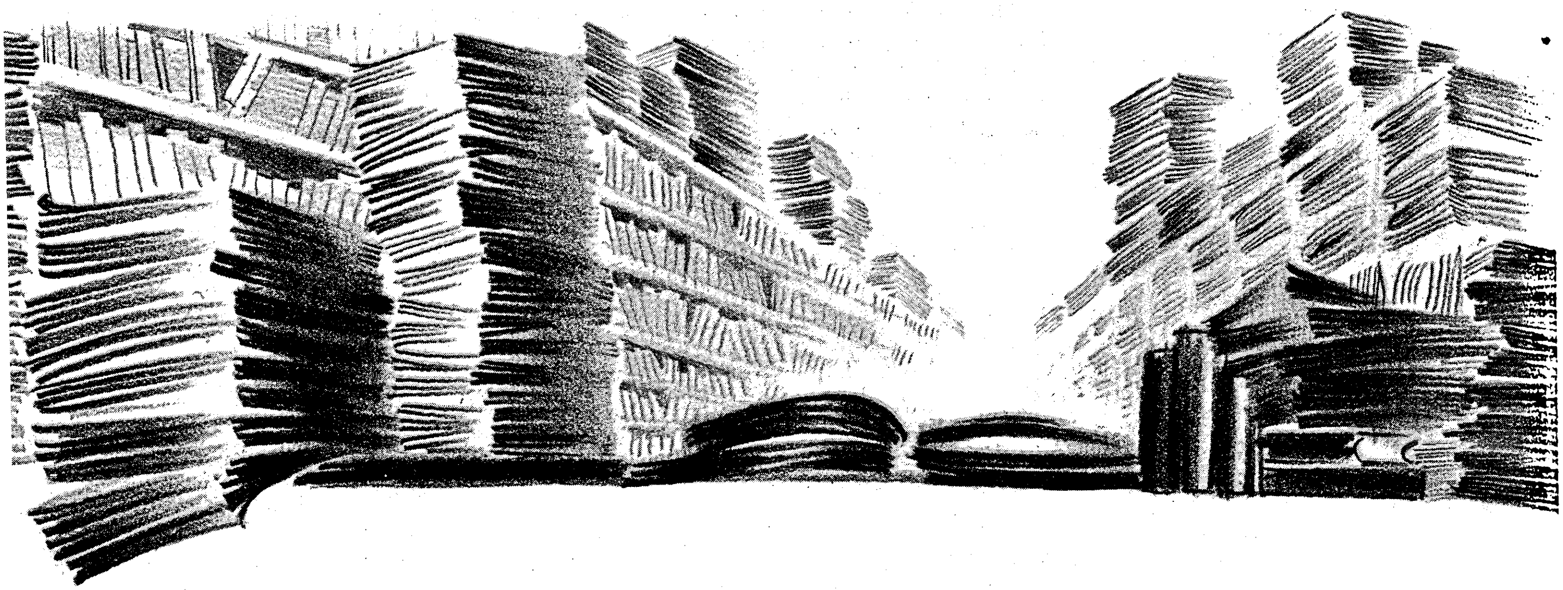
The cost of inadequate technical information processing facilities in duplication, in delay, in the failure to solve both military and civilian problems in the shortest time is real; it is large; it is constantly growing. The tools for the solution of the problem are available. Failure to use them now can only delay and make more difficult the effort ultimately required to prevent chaos in technical communications.

M. L. KASTENS

Reprinted from STANFORD RESEARCH INSTITUTE JOURNAL, Number One, 1958.

FACETS OF THE

TECHNICAL INFORMATION PROBLEM



Technology, so adept in solving problems of man and his environment, must be directed to solving a gargantuan problem of its own creation. A mass of technical information has been accumulated and at a rate that has far outstripped means for making it available to those working in science and engineering. But first, the many concepts that must be considered in fashioning such a system and the needs to be served by it must be appraised. The complexities in any approach to an integrated information system are suggested by the following questions.

by CHARLES P. BOURNE and DOUGLAS C. ENGELBART

Recent world events have catapulted the problem of the presently unmanageable mass of technical information from one that **should** be solved to one that **must** be solved. The question is receiving serious and thoughtful consideration in many places in government, industry, and in the scientific and technical community.

One of the most obvious characteristics of the situation is its complexity. A solution to the problem must serve a diversity of users ranging from academic scientists engaged in fundamental investigations to industrial and governmental executives faced with management decisions that must be based on technical considerations. The solution must accommodate an almost overwhelming quantity of technical and scientific information publicly available in many forms through many kinds of media and in many languages.

Some students of the problem, including men with many years' experience in various aspects of information handling, have viewed this complexity and concluded that the problem cannot be solved in its entirety. These authorities have recommended a piecemeal attack on components of the problem.

Stanford Research Institute believes that the techniques of systems analysis coupled with an understanding of the potentials of machines permit a powerful approach to the solution of this many-faceted problem. In fact, it may very well be that only by grappling with the problem as a single, integrated system can a realistic and lasting solution be attained.

However, to deal with the information system as a whole, it is necessary first to define its complexities with as great detail as possible. As an aid to the preliminary mapping of the system, a study group at SRI polled a portion of the Institute's own professional staff of engineers and scientists for questions they believe must be answered before an effective system can be designed. A representative list of the questions raised in this fashion is given in this article.

The list is impressive, but obviously not exhaustive. It does confirm the multiplicity of points of view that must be appreciated before this problem can be attacked.

Many of the questions require simple factual answers (see "Data Needed About Information Sources and Services," p. 9). They can be answered by straightforward techniques of counting, surveying, sampling, and estimat-

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ing. A few of the answers are already available, but the fact that most questions of this type cannot be answered from available sources emphasizes the pressing need for a much better quantitative assessment of the size and nature of the information problem before a rational attempt to solve it can be undertaken.

Another group of questions involves essentially matters of national and scientific policy that ultimately must be answered arbitrarily. Data and analysis can give guidance to the answers but the ultimate decision will be based on judgment of relative needs and relative values.

questions relating to policy

What are the specific aims of the program?

Will the system start with only new information? Or will it process back literature, and, if so, how far back?

Will the Service process requests from allied countries? To what extent? Will it coordinate with the Soviet Union?

Can part of the operations be done abroad? What about translations?

Will an international classification, indexing, or retrieval system be adopted or promoted?

Will the system be designed to serve the brilliant, the sophisticated, as well as the more unsophisticated?

Will the Service be financially self-supporting?

Will big business have any better access than small businesses or individuals?

Could a private citizen or scholar afford to use the Service?

How will prices be established for the Service?

What is the range of subject matter to be included?

Will classified information be included?

Will safeguards be established to insure that classified information is kept under proper control?

What type of information should be included? Books (texts, tables)? Technical and trade journals? Conference proceedings and papers presented but not published? Industrial and government interim and final project reports, etc.? Operation and instruction manuals? Patents? Manufacturers' catalogs? Newspapers and general magazines?

Who will be responsible for selecting the material to be included?

What protection will be provided users who want their queries to remain confidential?

Should service be provided outside the technical community? To congressmen? Executives? Businessmen? High-school students?

a proposal for a national technical information service

Members of Stanford Research Institute have long given thought to the increasing disparity between the accumulation of new knowledge and the means for organizing it for widespread utility. With this problem brought into sharp focus by recent events on the international scene, the Institute believed it appropriate to formalize its views on the magnitude of the problem and to suggest a possible solution. In January, a draft program for a National Technical Information Service was prepared and copies distributed to members of the President's staff, to selected members of Congress, to various agencies within the federal establishment, and to industrial leaders and technical societies, all known to be concerned over the state of technical information affairs.

This document describes a program to solve the nation's technical information problem through the establishment of a national service for the collection, processing, storing, retrieval, and dissemination of scientific and technical information from both foreign and domestic sources. The program comprises five phases, interrelated and partially concurrent:

1—Establish a central organizing and administering, federally constituted Agency.

2—Determine the gross dimensions of the problem.

3—Establish an interim information center using existing services and techniques.

4—Analyze the factors that determine the design and operation of an ultimate National Technical Information Service.

5—Encourage present and initiate additional research and engineering development programs leading to systems and equipment necessary to implement the ultimate National Technical Information Service.

This proposal, and others, for solution of the problem are currently under study by the interested bodies of the nation. Meanwhile, at the Institute, study of various phases of the technical information problem, both in the gross, and of specialized aspects of data handling, storage, and retrieval, is continuing.

Who will control the policy in the matter of designing, establishing, and/or operating the Service? An appointed committee, such as for the NACA? A civil servant? A political appointee? A committee elected by scientific organizations?

Would it be feasible to establish legal authority to speed up the standardization and coordination of existing facilities (such as the F.C.C.)?

Who is competent to design, establish, and/or operate the System? Would this be a civil-service organization?

Could the objectives of the Service be achieved by expanding existing government agencies (e.g. Bureau of Standards, the Library of Congress, Armed Services Technical Information Agency)?

If the Service were not directed by some existing government agency, would it not be best handled by some university?

Would it be economically feasible for any sort of commercial enterprise or non-profit corporation organized by the professional community, or by private industry, to establish and run a Service which would assure continued social and technical progress?

If we must look to the federal government for support, what residual responsibilities remain with the professional societies? Should private groups continue to sponsor special collections?

What economic and political limiting factors exist with respect to the freedom one would have in utilizing or changing those organizations already active in the documentation field, and whose existence could be over-shadowed by a national Service?

What about copyrights? Would royalties be forthcoming to the owner of the copyright if the Service distributes the material? What will be the impact on the technical publishing industry?

Charles P. Bourne and **Douglas C. Engelbart** are research engineers at Stanford Research Institute's computer laboratory. Mr. Bourne gained his first electronics experience in USN schools from 1950-51. From 1952 to 1953 he served as instructor of various aspects of guided missile operation and maintenance with Convair Guided Missile Division and as adult education instructor in electronics at Chaffy Junior College. After receiving his BS degree from the University of California in 1957, he was employed as a research engineer at SRI where he has been engaged in research on mechanization of information retrieval and logical design.

Dr. Engelbart received his BS degree in electrical engineering at Oregon State College in 1948, MEE in 1953, and PhD in 1955 at the University of California His theses were concerned with design and programming of drum-type computers and special gas-discharge tubes for use in computers. He has worked as professor of electrical engineering at the University of California, as electrical engineer at Ames Aeronautical Laboratories, and as consultant. In October 1957 he joined the SRI staff. Information retrieval is one of his specialties.

Should the Service act as a publisher for collections of papers (reprints) in very new and special fields?

How will the priority schedules be fixed for the Service?

How soon could the Service be initiated? With an immediate manual system? With an ultimate mechanized system?

What factors will determine the location? Can strategic dispersal considerations influence the location without adversely affecting efficiency?

Is the proposed Service simply an attempt to copy Russia?

Might not an interim solution be to translate and distribute the exhaustive Russian abstracts, thus leaving our interim energies free for other uses?

Might it not be better to reduce the amount of literature produced rather than go to the tremendous expense of providing super-service for all of it? Can a quality filter be applied to this output?

Why not allocate federal money to support more direct interchange between working scientists? Perhaps more meetings, special conventions, seminars, etc., would be more economical than better literature processing? Couldn't the money be better spent on education to achieve a given increase in scientific effectiveness?

Could a substantial portion of the information problem be solved by teaching the users more about present-day documentation techniques?

questions requiring research

Some of the questions posed to the study group will require considerable study and research to produce valid answers. The research will be in many fields—in the social as well as in the natural sciences. Some of the study must be quite profound—even theoretical. Some will be more straightforward. Many of these questions must be answered before the policy decisions implied in the previous group can be made with confidence.

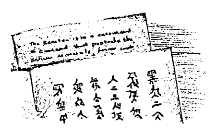
Can we separate apparent need, influenced by present concepts and experience, from real need? Lack of awareness of the potentialities of recently developed methods (or methods not yet developed) can easily result in an unimaginative formulation of the possibilities and opportunities for advantageously using recorded information.

How will users' habits and needs evolve as a good System becomes available?

How are the information needs of a user affected by his age, educational level, profession, type of position held, etc.?

What are the characteristic information needs of the basic (academic) scientist? The applied researcher? The en-

data needed about information sources and services



Before the designers of an overall information center can sketch in the outlines of the System problem, a large amount of data about the information input and the existing information services must be collected. Some of the kinds of essential data are suggested by the following.

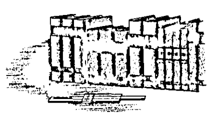
What subject fields are covered by the various journals, books, and reports? And in each case, in what depth?

What are the physical sizes of journals, books, and reports? Page size and number of pages? Frequency of publication? Kind and size of distribution? Cost or subscription price?

In what language(s) do the journals, books and reports appear?

Does each have an index? Are abstracts published, and where? Where is the information indexed?

Who, principally, are the contributors to the technical journals? Who selects or reviews papers for publication? How long, generally, between preparation and publication?



Are microfilm copies of books, journals, and reports available?

Who are the publishers of technical journals, books, and reports? Where is each located? And how long in operation?

How is each publishing operation financed?

What are the policies and objectives of the respective publishers in each field?

What fields of science and technology does each publisher operate in? In what fields does each concentrate or specialize?

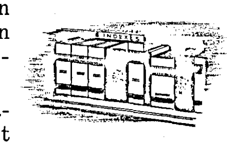
In what language(s) does each publisher produce his journal(s), books, or reports?

Could publishers of journals, books, and reports provide paper tape or other machine-readable copies of their works? At what cost?

How much has been produced to date in the various technical subject categories in journal, book, and report form? What is the physical mass of each? Are back copies available?

What libraries with technical collections, abstracting services, indexing services, and translating services are in existence? Where is each located? What is its organization? How is it financed?

What is the size and training of the staff of the various technical-information handling or processing organizations? In each case is the organization equipped to handle classified material?



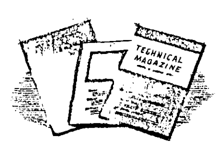
In what field(s) does each information handling or processing unit operate?

What classification and indexing systems are in use?

What is the normal time between publication of a document and its appearance in the libraries? When is it abstracted? Indexed? Translated?

What are the types and numbers of scientific and technical people using libraries, and the abstracting, indexing, and translating services? In what ways does the technical community feel it is being adequately or inadequately aided by these services?

Would the various libraries and services be amenable to negotiation of changes or increase in area of coverage, or other changes of service, to fit a reasonable, overall system, if government controlled and subsidized?



What are the charges for service by libraries? Abstractors? Indexes? Translators? Which of these services are self-supporting?

Are special compilations of abstracts, bibliographies, or translations available? And for what fees? How long required to provide such special services?

gineer? The decision maker? Are they all equally critical, or is the "applier" of knowledge the one with the biggest problem?

What is the role of information retrieval, storage, etc. in the decision-making process of the research worker, engineer, scholar, administrator, etc?

How much use does the scientist and engineer make of the facilities that are presently available?

By what processes does the scientist and engineer keep abreast of the advances in the art now? What are the relative importances of each of these processes?

How many scientists and engineers have a definite program of "keeping up with the literature"? How much time would they "like to spend?" What keeps them from spending more time?

How much of the literature that would, with reasonably high probability, be useful to a scientist or engineer, is caught by him now by his own regular surveillance of the literature? How far out of his way will the average user go to be sure that he hasn't missed some possible information . . . considering the usual distracting pressures on him, his familiarity with the sources, etc?

How many pages of literature in various categories relative to the level and interest-area of the user can we expect him to scan or search for his different information needs?

What are the relative merits of the different types of reference information services with regard to the user and his needs, desires, habits, and limitations?

What are the relative importances of the users' various informational needs? On one hand, he needs to know the newsy items such as who is working on what, what his current attack is, who disagrees with whom and basically why, etc.; and on the other hand, he also needs to be able to study in detail the carefully written treatises that may have bearing on his work Can these different kinds of needs be met by a single system?

What are the special information requirements for different specialty fields?

Does the user, when he goes outside his special field for supporting information, want information in different form or different levels than which he seeks in his own field? For instance, would he be looking more for "cook-book" techniques or for survey-type information?

How valuable would broad, multi-disciplinary searches be if they could be conducted effectively? How great is the problem of differences in nomenclature between fields?

What type of questions now go unanswered at the libraries?

Isn't the main problem of information retrieval one of identification—since people so seldom express satisfactorily their needs to the documentalist?

What are the major limitations in the various methods presently used in classifying and indexing scientific literature?

Is the problem that the information now is just not available at all, or is it that it is just hard to find?

Why aren't the existing services that process technical information satisfactory?

How many places does a user of each discipline have to look for index listings of a given special interest?

How can the processing of recorded information be planned so that it can be effective in spite of human limitations, or of limitations in numbers of human beings?

How much is missed by technical people leaning too heavily on librarians?

What relative gain in efficiency could be achieved by integration, merging, or better managing of existing documentation services?

the soviet approach to the information problem

The Soviet Union has a comprehensive technical information system in operation. In 1952 the Soviet All Union Institute of Scientific and Technical Information was established in Moscow. By 1957 the Institute had a permanent staff of 2300 translators, abstractors, and publishers. This staff is supplemented by more than 20,000 cooperating professional scientists and engineers throughout the U.S.S.R. who offer their services as part time translators and abstractors in their specialized fields.

The Institute publishes 13 "abstract journals" which annually contain over 400,000 abstracts of technical articles from more than 10,000 journals originating in about 80 countries. It systematically translates, indexes, and abstracts about 1400 of the 1800 scientific journals published in the United States.

To reduce the time between the initial appearance of the more important information in any of the world's journals and its reaching the hands of Soviet scientists and engineers through the normal route of the abstract journals, "Express Information Journals" are also printed. These carry summary information on foreign technological developments within two or three weeks after their receipt. Reports made on the work done indicate that it is not only comprehensive but also of high quality.

The Institute provides numerous other technical information services, such as provision of bibliographies, micro and full size copies of original printed material, technical dictionaries, foreign-language dictionaries, and other varied source material.

The Institute maintains an extensive program aimed to introduce machine methods to information handling. This includes translating machines, and mechanisms for codifying, storing, and retrieving technical information. Significant progress by the Soviet All Union Institute towards information mechanization methods and systems is reported.

What increase in efficiency of the scientist or engineer would result from improving the accessibility of recorded information?

What are the probable net benefits, short and long range, of an effective information Service to military, industrial, commercial, scholarly, government groups?

Can dollar costs be derived for reasonably well-proven delays and duplications, and can the total national loss rate due to this problem be realistically estimated? Can it be determined that the expense of delay and duplication now is greater than that of establishing and operating an information Service?

What is the lack of an information Service costing government agencies?

Can the savings in Federal money now spent on other information programs be diverted to a national information Service?

What are the relative costs and characteristics of different reproduction techniques that might be applicable to some of the dissemination and massive processing problems of an information service?

What are the techniques and costs involved in keeping up and in using large mailing lists in taking care of distribution of journals, etc.?

What are relative costs of providing the information in micro form as against making original-size photo copies?

Of the currently-operating abstracting services, how many are operating merely to satisfy an obligation of a professional society that would rather have somebody else do the abstracting?

What services does the Russian All-Union Institute really provide? What is the reaction of a Russian scientist to this information center?

How important is it to know what the rest of the world is doing?

Are any projects or areas of work reported almost exclusively in foreign literature?

What is the expected rate of growth of the system?

What are the potential information processing capabilities of existing mechanical devices?

What are the theoretical capabilities of existing or anticipated machine components which might be applied to the information processing problem?

How often will the system presumably be searched? How definitive will the search have to be? What volume of information should a search produce? How fast should the system respond?

characteristics of the information service

As increasing data becomes available it will become possible to consider some of the last group of questions—those dealing with the desired or necessary operating characteristics of a comprehensive technical-information processing system. Certainly, the first system implemented would be of an interim nature using existing resources, which unfortunately employ largely manual techniques. However, ultimately it is inevitable, in view of the impressive advances made almost daily in information processing techniques, that a highly mechanized system will be possible.

How soon can an interim system be functioning?

How much can be done just by concentrating on abstract distribution and better dissemination techniques?

Would it be feasible for the abstracting publications to use a standard format and type font, such that mats (or something similar) could easily be distributed to other interested publishers, thus saving printing expenses?

What technical societies could cooperate to publish a single journal instead of numerous splinter journals?

What about the scale of the Service? Does it have to be a big system or nothing?

Does "having a large information Service" necessarily mean the physical collection of all activities at one central location?

Would a group of smaller centers, for specific fields, be of greater utility and more tractable?

Would a collection of special libraries be more useful?

What can a national service provide that is different than what is now available? Is this to be an entirely new type of service, a real advance in the state of the art, or is it to be just more and better of the same thing?

Will the System have a finite capacity? One system might work well with a few million entries, but be hopeless with a hundred million.

As the System grows in size, will it be possible to make changes easily in the classification scheme and bring the old coding into the new scheme?

If a private consultant, with "need to know" established, were to work on a government project, how would he locate and procure pertinent classified material?

Will financial filtering of requests by a uniform fee structure be desirable or effective, or would it be necessary to make non-uniform fee structure so that there is essentially some "priority" given?

What means can be used to pry loose useful information that customarily doesn't get into the published technical information channels?

Will the service include a positive program to declassify material under security restrictions?

What is an acceptable delay in getting information entered into this system?

Will all material in the subject fields be included or will there be an editor or a censor?

Will an attempt be made to standardize the form of the material before it gets into the center? Does the material have to be on standard-size sheets or forms?

What happens when the system becomes overloaded?

Should service to users just be late, or should the service just be less complete?

How can we protect against freezing the specifications until enough systems work has been done to make clear what would be optimal?

Will the policy makers make sure that the final methods chosen for a retrieval system are not influenced too heavily by the requirement of compatibility with past systems?

Will abstractions be done? What kind? Descriptive? Critical? Informative? How can we get good-quality abstracts? Should the Service use volunteer abstractors directly or a staff of full-time abstractors? Or should it allow the various technical societies to organize their own volunteer abstracting services?

Will any effort be made to review old documents, and to remove or recode when necessary?

Is a standard (or artificial) vocabulary necessary? How much work will be required to design and institute such a vocabulary?

What techniques and devices can reasonably be developed and applied for facilitating such immediate requirements as printing, reproducing, storing, microfilming, billing, communicating, etc.?

What kind of data-processing system will the Service need just to keep track of its operation?

Would the information Service keep a collection of the original documents?

What special precautions must be taken to store primary records? Would a duplicate file and collection be maintained to prevent disruption of service due to fires, or other catastrophes? How much would this cost?

What is the useful life of various forms of records? In use? In storage?

What will the information Service physically provide in response to information requests?

Will the output be in English, or a code that must be translated?

Will microform copies be acceptable to the users? If not, what improvements need be made in order to gain user acceptance?

Will the information Service output be in a form that the researcher can determine which of the documents are in a locally accessible collection?

Will the system give answers (e.g., "yes," "no," "5,000 tons in 1945," etc.) as well as references?

Why not periodically publish inventories of research in progress, to indicate what research projects are currently being undertaken in each specialty field, thus helping to eliminate duplication?

Will there be a "special communication network" in which workers in the various specialized fields can easily circulate working papers or "think pieces?" A central agency could maintain printing, listing, (in appropriate subject-interest categories), and mailing facilities for this sort of service.

Will the information Service be able to retain a file of questions to be asked of all new input material, thus providing up-to-the-minute data for standing questions?

Will it be possible to stimulate more writing of "review-the-literature" papers by qualified people in the various fields, in order to provide guides for other workers?

Can a partial search be made? (For example, can 1/10 of the file be searched and the results checked to determine if further searching is justified?)

Could the information Service operate on a "just search ½ the file for me; I don't need a comprehensive search" basis?

What kind of communications network will be needed for the operation of the interim information Service? Will it be accessible to anyone by telephone or other direct device, such that the searcher can interrogate the file directly and at will?

Would the Service be available for browsing?

What technical-manpower drain would the proposed information Service program have on other high-priority scientific programs?

What professional and educational background is needed for the personnel to operate the Service?

Could university science students be used part time and during summers to help with the various processing tasks, as a means of alleviating the shortage of people with adequate technical backgrounds?

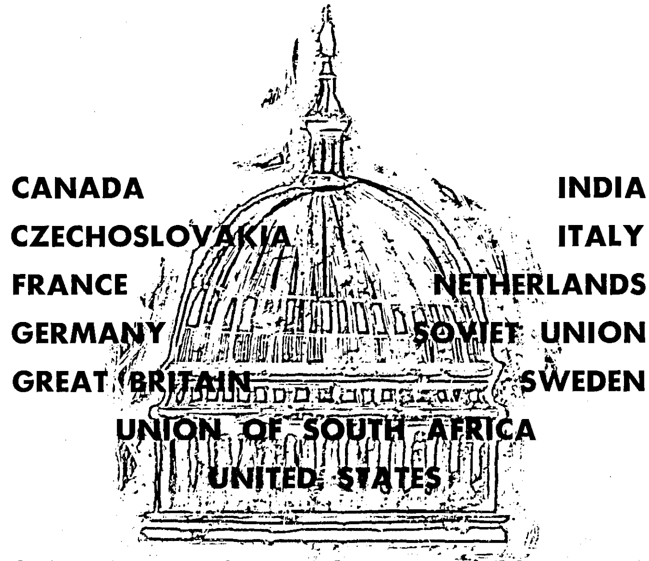
Will there be special training for abstractors and translators or for documentation and information specialists, etc.?

How much research is needed? What research budget is reasonable?

If an information Service were established, how soon could present partial services by government agencies be terminated and funds diverted to the Service? Could some special activities in industrial libraries be eliminated?

These questions, by the very nature of their origin, are random and fragmentary. Even the full list from which they have been selected is far from comprehensive However, we have found them a helpful stimulus as well as a disciplinary aid in viewing the technical-information problem in its broadest dimensions. We hope that others interested in this problem will be similarly served.

INTERNATIONAL CONFERENCE ON INFORMATION PROCESSING



Representatives of at least twelve countries will be attending the International Conference on Scientific Information, November 16 - 21, 1958, to be held at The Mayflower Hotel, Washington, D. C. The opening session address, Sunday, November 16, at 8 p.m., will be made by Sir Lindor Brown of England, Secretary for Biological Sciences (The Royal Society) followed by a reception.

The five day conference will be divided into seven areas, morning and afternoon sessions, during which the papers of scientists of various countries and of this country will be presented and discussed.

Sponsors of the conference are, National Academy of Sciences, National Research Council, National Science Foundation, and the American Documentation Institute.

This scientific information conference is expected to attract more than usual interest because of the participation of the U.S.S.R. and Czechoslovakia.

area one

Beginning the morning of November 17, area one proposes the knowledge now available and the methods of ascertaining scientist's requirements for scientific literature and reference services. Discussion panel leader is Dr. Philip Morse, Department of Physics, Massachusetts Institute of Technology. Among the thirteen papers to be presented will be one from Czechoslovakia entitled, "Systematically Ascertaining Requirements of Scientists for Information," by Jiri Spirit and Ladislav Kofnovec of the Prague Research Institute for Materials and Technology.

area two

Leading the discussion on area two's topic is Dr. Elmer Hutchisson, American Institute of Physics. Subject matter – function and effectiveness of abstracting and indexing services for storage and retrieval of scientific information. The fifteen papers to be presented include a contribution from Russia: "On the Functioning of the All-Union Institute of Scientific and Technical Information of the Academy of Sciences of the U.S.S.R.," by A. I. Mikhailov of the Moscow academy of which he writes.

area three

Subject for area three is the effectiveness of scientific monographs, compendia, and specialized information centers in meeting the needs of scientists. Present trends and new and proposed techniques and types services will be elaborated. The panel leader is Dr. Alexander King, European Productivity Agency. Five papers are scheduled and include one entitled, "Recent Trends in Scientific Documentation in South Asia: Problems of Speed and Coverage," by P. Sheel of Insdoc National Physical Laboratory, New Delhi, India.

area four

Organization of information for storage and search . . . comparative characteristics of existing systems, will be dealt with in area four and discussion is led by Dr. Eric de Grolier, Centre Francois D'Exchanges et de Documentation Techniques. Among the seven papers to be presented is, "Experience in Developing Information Retrieval Systems on Large Electronic Computers." This paper has been submitted by Ascher Opler and Norma Baird of The Dow Chemical Company in New York.

area five

Area five will review the organization of knowledge for storage and retrospective search: Intellectual problems and equipment consideration in the design of new systems. Dr. Gilbert W. King of the I.B.M. Research Center will be the discussion panel leader. Twenty papers are to be reviewed and countries represented in this area are—the U.S.S.R., Netherlands, France, Great Britain and the U. S. One paper is entitled, "On the Coding of Geometrical shapes and Other Representations, with Reference to Archaeological Documents." This has been submitted by Jean-Claude Gardin of Centre Nationale de la Recherche Scientifique in Paris.

area six

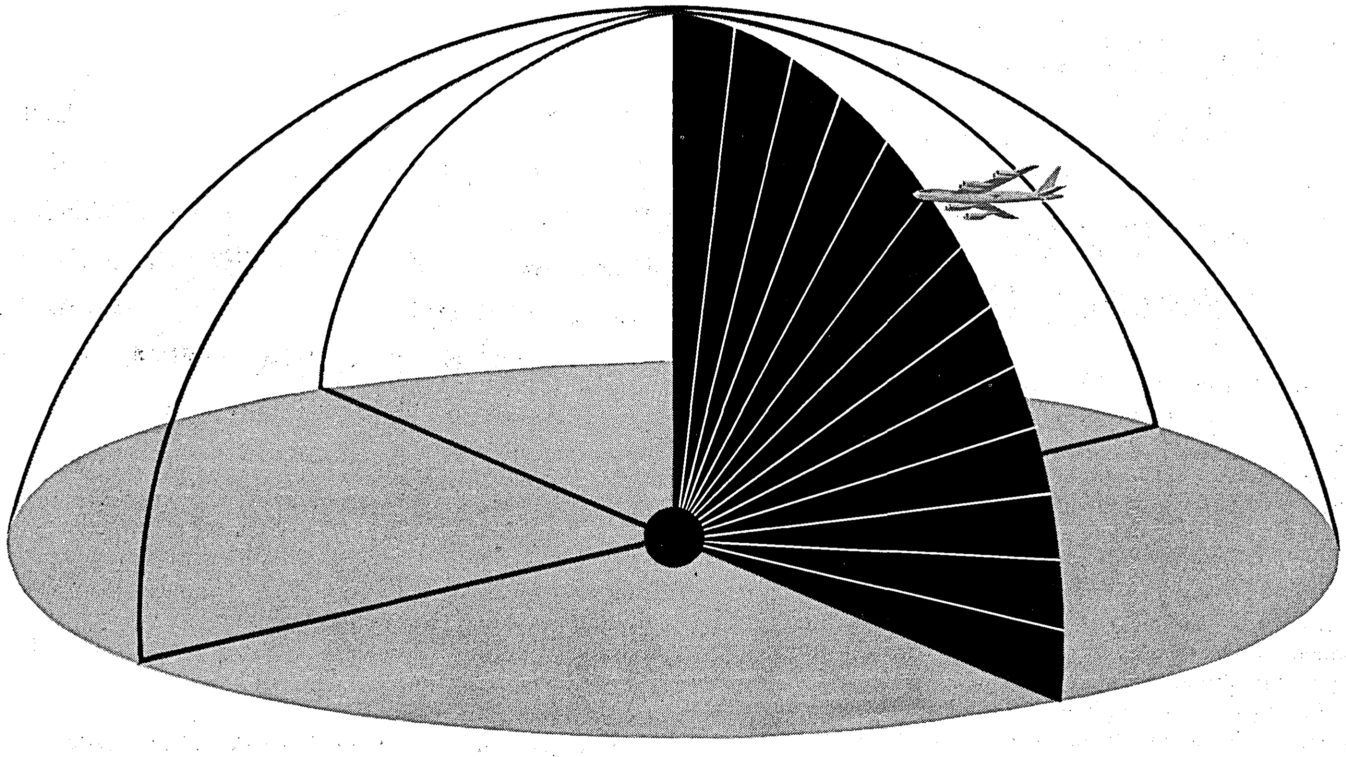
The topic for area six is the organization of information for storage and retrospective search: possibility for a general theory of storage and search. Leading the discussion will be Dr. John Tukey, Department of Mathematics, Princeton University. Among the six papers to be presented will be, "The Structure of Information Retrieval Systems," by B. C. Vickery, Imperial Chemical Industries, Ltd., Welwyn, England.

area seven

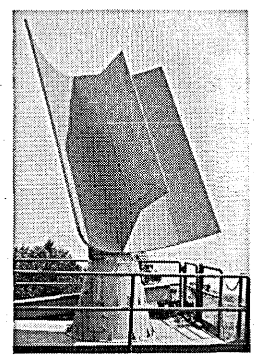
On Friday morning, November 21, the concluding area seven is devoted to a subject that is surely of universal interest. To be discussed – the responsibilities of governmental bodies, professional societies, and other groups, to provide improved information services and promote research in documentation. Mr. Verner Clapp, Council on Library Resources, Inc., will be heading the panel. Nine papers will be reviewed and include contributions from France, England, the United States and one from the Union of South Africa entitled, the "Responsibility for the Development of Scientific Information as a National Resource, by Hazel Mews, Department of Librarianship, University of Witwatersrand, Johannesburg.

There will be exhibitors at this conference from manufacturers of equipment utilized in the field of data storage and data retrieval.

For conference contact, see Important Dates in Datamation, page 35.

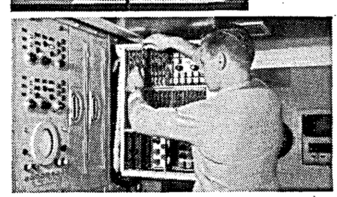


DEFEND



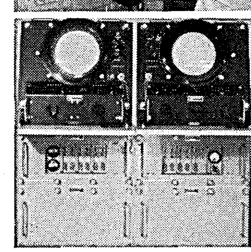
Today, creative engineering at Hughes is on the move to DEFEND . . . to counter the threat of aggressive action with electronic speed and precision.

Hughes in Fullerton, California is now creating these systems for total defense:



ELECTRONIC SCANNING RADARS, with beams that provide three-dimensional protection.

DATE PROCESSORS, which monitor the action of hundreds of aircraft and store the shifting tactical situations for high-speed assignment of defense weapons.



ELECTRONIC DISPLAY SYSTEMS which present tactical information in symbolic or language form.

Also under development are new three-dimensional radar systems for installation on surface and subsurface naval vessels. Study programs have been initiated in radar, computers, displays and integrated defense systems.

To further these studies, creative engineers and physicists are now needed. These positions promise unusual reward and opportunity for growth. Inquire further . . . for information write to Mr. L. D. Wike at the address at right.

HUGHES

GROUND SYSTEMS
PERSONNEL SELECTION AND PLACEMENT
Hughes Aircraft Company
Fullerton, Orange County, California

Circle 4 on Reader Service Card.

DATAMATION *abroad*

IN LONDON: ANALOG ANALYZER DEVELOPED

Based on development work carried out at the Imperial College of Science, London, on a transformer analog system devised by C. L. Blackburn, an advanced transformer analog analyzer has been recently built and installed at the Witton Works of General Electric Co., England. The new analyzer is called the WINA (Witton Network Analyzer) and operates on 50 cycles supply. It has a "very high" inherent accuracy of 0.1%, according to the manufacturer. The equipment is arranged in 4 sections, each consisting of a central plugboard with 52 standard analyzer units arranged in racks.

COMPUTER INSTALLATIONS ABROAD

ElectroData division of Burroughs Corp. has shipped a 205 electronic computing system to the South African National Life Assurance Co., Capetown. The insurance firm became the first in South Africa to employ datamation for policy handling . . . Italy and Germany have displayed keen interest in computing equipment that can provide shortcuts to problems in aircraft and guided missile programs, according to Paul Dennis of Bendix Computer. Dennis said his firm will install a unit at the University of Rome for the Italian Air Ministry to be used in an Italian missile program. He said major West German industrial plants such as Dornier, Zeiss and Zahnradfrabrik are vitally interested in this work . . . an IBM 650 and auxiliary equipment has been installed by the National University of Mexico in its electronic computing center.

IDP GROUP ORGANIZED IN SWEDEN

Data processing equipment users in Stockholm, Sweden, have formed an IDP Group, composed of about 40 members. Secretary is Peter Hansen of the Swedish Commerce Bank. Exchange of ideas, visits to installations, keeping up with latest changes, and exploring technical data, are some of the targets which this group has set for itself. The IDP group idea is making huge strides and certainly its future is very promising, according to our Swedish correspondent.

IBM SUISSE OPENS CENTER IN ZURICH

At the end of May, IBM, Extension Suisse, opened a data processing center in Zurich. Officiating at the opening ceremony was H. R. Luthy, director of IBM's Swiss subsidiary. Leading Swiss personalities and the president of IBM World Trade Corporation, A. K. Watson, were in attendance. The center has a 650 and a staff of 12 scientists and engineers under the supervision of Dr. Jakob Haller.

JAPANESE MARKET COMPUTERS IN '59

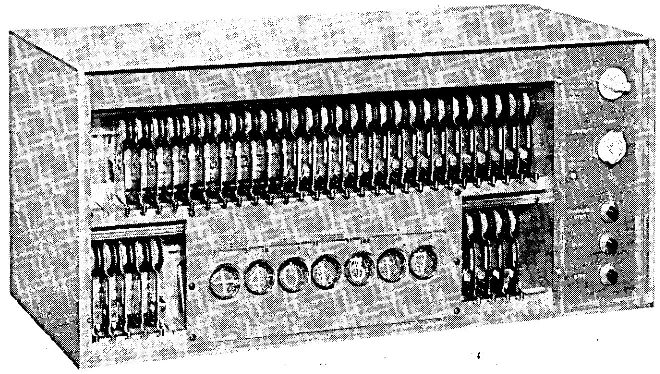
Word comes from Japan that at least three companies are expected to be producing computers commercially next year. The Musasino One (see page 31) will be on exhibit by its commercial maker at a data processing conference in Europe next year.

REVIEW OF IN-LINE INDICATORS

In two previous issues of DATAMATION we have surveyed two forms of data display devices. In the January-February issue we presented graphic display devices, and in the July-August issue — high-speed printers.

This month we offer a survey of in-line visual display devices which are used when the human observation of data is required. These in-line displays can be used in applications varying from single decades for indicating a particular channel number, etc., to complex tote board type displays used by such groups as the North American Defense Command and the Strategic Air Command in their operations control centers.

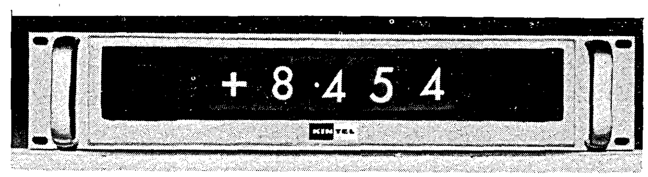
TALLY REGISTER in-line indicator



This in-line indicator is intended to serve as an input link – primarily for conversion from serial input to parallel output with simultaneous translation from one code to another (BCD to decimal, etc.) Model 274 data control unit is a tape-fed, shift register with parallel readout. Information is serially read at 60 characters per second and is shifted through the control unit. When the final position has been loaded, a signal is generated to control the output program. Controls are provided to preset the word length from two to seven characters. Additional controls are provided to permit one-character-at-a-time or one-word-at-a-time operational modes. (Tally Register Corp., 5707-37th S. W., Seattle 6, Washington.)

Circle 101 on Reader Service Card.

KIN TEL, COHU digital readout

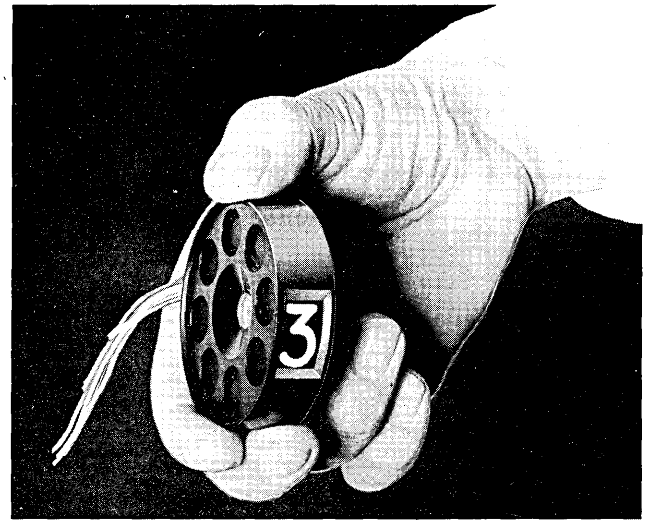


Model 471 digital readout presents numbers on a single plane, with no overlapping characters. It employs a projection system . . . providing 7,000 to 8,000 hours of lamp life. Display provided by the 471 consists of four digits (decimal and 0 through 9) plus a symbol readout with symbols +, −, AC, NN, ohm, kilohm, megohm, A/B, AC/B, AC/AC, X. Individual digits are 1⅛ in. high. The total display area is 2 in. high by 7½ in. long. Power requirements are ¼ amp at 6.3 volts AC for each symbol or digit that is lit. Vertical space of 3½ in. is required in the standard 19 in. rack mount. Special models are available with up to nine individual readouts consisting of any combination of digits or symbols required. These digital readouts are designed for use with all types of digital converters and encoders. (Kin Tel, a division of Cohu Electronics, Inc., 5725 Kearny Villa Road, San Diego 12, California.)

Circle 102 on Reader Service Card.

PATWIN
mag indicator

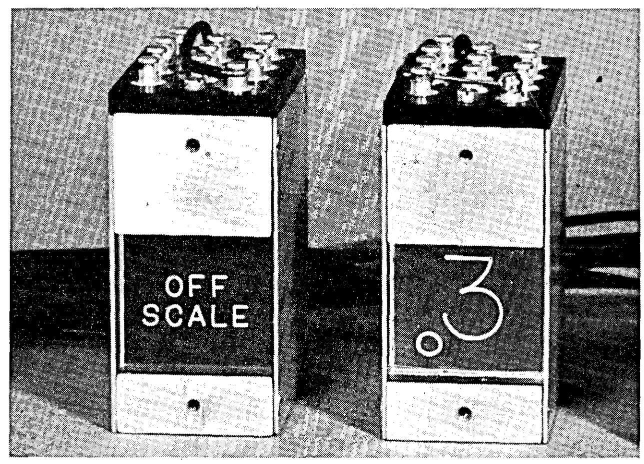
Numbers or symbols are displayed on this electro-magnetic indicator at a rate of two per second. Only .028 amperes are required for the duration of signal pulse and the display holds position, without power, until the next pulse. One moving part, weighing 1/3 oz. and mounted on a miniature precision bearing, insures long life and high reliability. Digits or symbols are large enough to be read at distances up to 25 feet and are free from parallax and glare, the manufacturer contends. Interlocking construction facilitates stacking. An external dc pulse of approximately one watt is required to actuate the indicator. Indicators are available with nominal voltages of 12, 24 or 36 volts. Average response time varies between .5 and .6 seconds for maximum rotation. (Patwin Division, Patent Button Company, Waterbury 20, Connecticut.)



Circle 103 on Reader Service Card.

MILMAN
digital readout

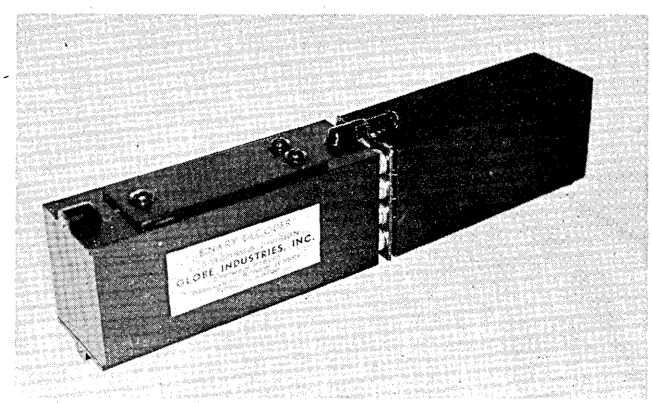
Presented on this digital readout are the lighted digits 0 through 9 and decimal point, plus other information such as polarity signs or special symbols. Modular design of the units allows side-by-side mounting for in-line presentation of information. Message readout will display, separately in one panel area, up to three different color-coded printed messages, greatly increasing the accuracy of visual observations, states the manufacturer. Message and color combinations are made up to suit individual requirements. The superpositioning of messages in the readout reduces the amount of panel area required to present a given amount of information and eliminates panel art work and engraving. The units are designed for operation on 6, 14, or 28 volts. (Milman Engineering Co., 1831 Pontius Avenue, Los Angeles 25, California.)



Circle 104 on Reader Service Card.

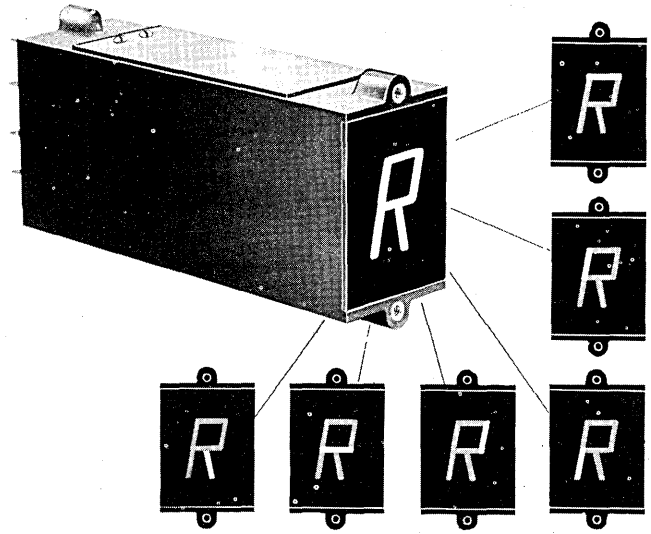
GLOBE
binary decoder

A completely self-contained unit operating from pulsed input signals on four wires, this binary decoder is a high speed relay controlled decoding matrix operating into a single plane illuminated digital readout. Operating speeds are compatible with modern tape punch and printing equipment. Various input circuits are possible. These include a parallel input containing signal and no signal conditions to indicate coded information, or a pulsed system in which power or ground pulses are fed to the input terminals. The inputs may be scanned serially from a mechanical or electronic multiplexing device. It has been found that a high speed relay at the input to a multiplexer will provide power and ground pulses to operate a bank of these decoders. This unit is particularly suitable for use in low cost remote readout or telemetering systems which require serial transmission of information, according to the manufacturer. Mechanical synchronization of scanning switches on a start-stop system has proven successful in many installations. (Globe Industries, Inc., 525 Main Street, Belleville 9, New Jersey).



Circle 105 on Reader Service Card.

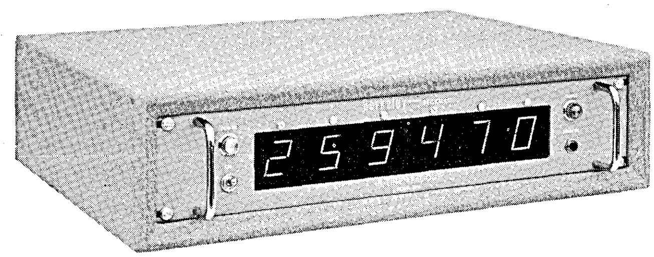
I. E. E.
in-line display



This is a new unit which will display any letter A through Z, any number 0 through 9 and + or − symbols. Designed primarily for use with electronic data handling and processing systems the alphanumeric display unit features one-plane presentation. Characters are of uniform size and intensity and readability is insured from any angle of viewing, it is claimed. The unit utilizes a 12-bar matrix, each bar having a miniature projection lamp behind it. By projecting each bar through its own lens system onto a single-plane screen, and by the selection of the proper combination of any of the 12 bars, any desired letter, number, or symbol may be formed. The size of the character displayed is approximately ⅞ in. high x ⅝ in. wide. Size of the viewing screen is 1-15/16 in. wide. This firm also manufactures a 90 degree inline display and a standard in-line display line. (Industrial Electronic Engineers, 3973 Lankershim Boulevard, North Hollywood, California.)

Circle 106 on Reader Service Card.

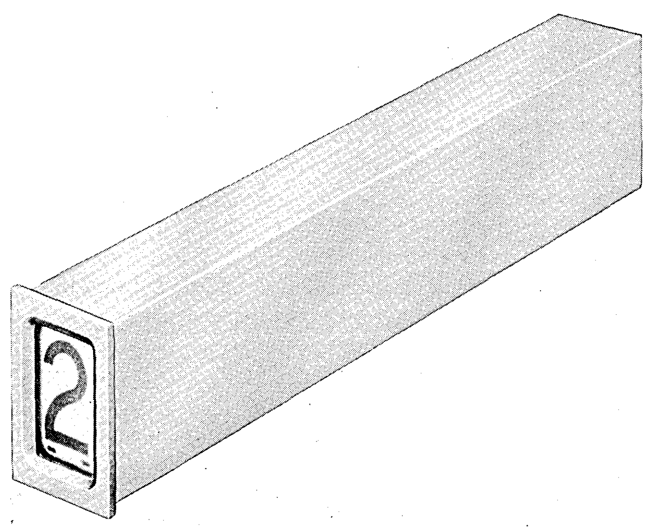
BECKMAN
in-line indicator



Model 5916 in-line indicator displays up to six red digits 1¼ in. high. Each digit is formed by a pattern of segments, each segment evenly illuminated by a grain-of-wheat lamp operated at reduced voltage for long life. This display differs from indicators using stacked lucite plates or stacked figure wires in that all digits are formed on the same surface plane. The surface image was employed in order to create an unobscured display which could be read from wide angles. Red color is used to permit readings in high ambient light. The indicator operates in response to a 1-2-2-4 binary code supplied by the manufacturer's counting instrument or some other source. The in-line indication does not change while the counter is actively scaling, but changes only at the end of a counting interval, at which time it displays the new total. Maximum display rate is 15 presentations per second. (Beckman/Berkeley Division, Beckman Instruments, Inc., 2200 Wright Avenue, Richmond 3, California.)

Circle 107 on Reader Service Card.

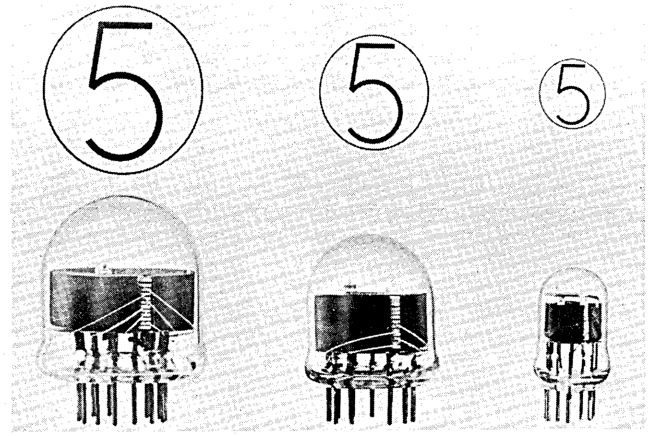
UNION SWITCH
digital indicator



A motor driven digital indicator operates on a direct drive basis, does not rely on the use of intermittent drive mechanisms to position the characters. Numbers 0 through 9 and two blanks are displayed in sequence, in response to four bit binary coded decimal input. Operating on an open circuit principle, complete code agreement of both binary ones and binary zeros is checked to assure positive and correct positioning of the indicator. The one inch character indicator utilizes the major portion of its frontal area for display. Its ability to operate as a nonvolatile binary readout, in conjunction with its inherent capabilities of storing binary data, is claimed to be its most desirable feature. The indicator is mounted in a gasket sealed case to exclude dust and moisture, thus providing operation under widely varying environmental conditions. (Union Switch and Signal, Division of Westinghouse Air Brake Company, Swissvale, Penna.)

Circle 108 on Reader Service Card.

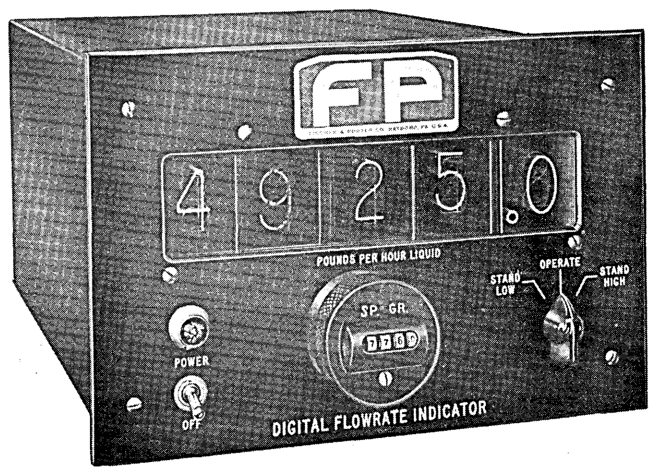
BURROUGHS indicator tubes



Nixie Indicator Tubes are completely electronic devices which display numerals or alphabetical characters in a common viewing surface. Due to this fact, a number of Nixies, when placed side by side, form an "in-line" presentation which reduces operator fatigue and makes for an easily read display. The Tubes consist of 10 metal cathodes formed in the shape of numerals or other characters and a common anode which provides a uniform electrical field. These elements are enclosed in a glass envelope which is filled with neon gas. By applying a potential between one of the cathodes and the common anode, a bright neon glow is caused to form around the selected element, thus causing it to appear clearly and distinctly at the single viewing surface. The presentation can be caused to change at a 50 KC rate. There are four basic types available: BD-200-S miniature, 6844-A standard, 7153 super, and BD-307 jumbo. (Electronic Tube Division, Burroughs Corporation, Plainfield, New Jersey.)

Circle 109 on Reader Service Card.

FISCHER/PORTER digital indicator



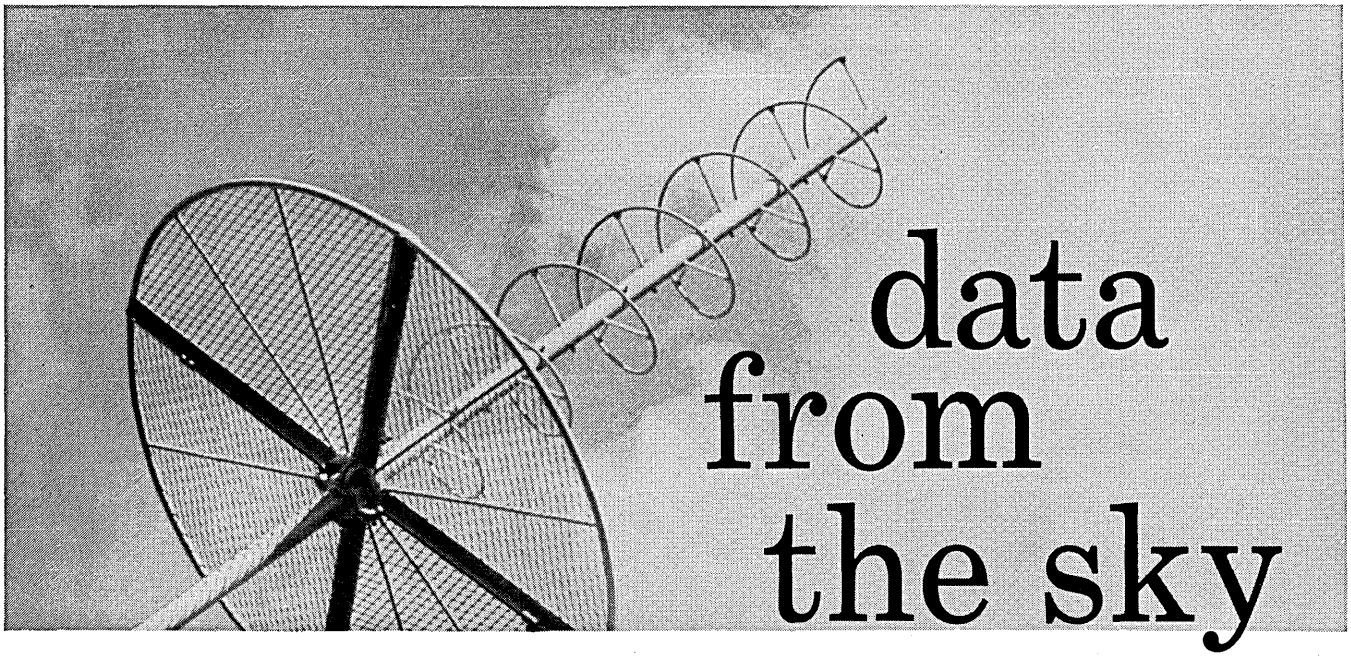
Featured in this direct-reading digital indicator, designed primarily for use with this company's turbine flowmeters, is a completely digital system, operating from the frequency output of the turbine meter, which takes full advantage of the linearity and repeatability inherent in the turbine meter primary. Some features: in-line, illuminated, digital indication. Inch-high numbers providing digital readout up to 25 feet away. Direct reading of flow, with manual correction for specific gravity as an optional feature. True integrated flow rate – integration is performed during the sampling interval and the indication is corrected immediately following each sampling period. An octupler provides information at many times the output frequency of the primary. Automatic, frequency-controlled range switching is virtually instantaneous even at maximum accelerations. Customized time base is also featured along with manual specific gravity adjustment. (Fischer and Porter Company, 758 Jacksonville Rd., Hatboro, Pa.)

Circle 110 on Reader Service Card.

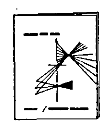
Non-Linear Systems digital ohmmeter

Series 20 digital volt-ohmmeter has been designed specifically for missile and weapons system check-out. It automatically and continuously measures and displays dc voltage, voltage ratio and resistance. The unit is available in four and five digit models. It makes three readings per second with accuracy to .01%. It is the first combination volt-ohm ratio meter having functions selected by a panel switch or remotely by means of electrical signals. Among exclusive features claimed by the manufacturer are interchangeable plug-in circuit boards, illuminated numerical read-out that snaps out for bulb inspection (with removable non-glare hood), a Wolff-Poggendorf potentiometer using precision stabilized wired-wound resistors and controlled by mercury relays. Series 20 has high input impedence, 10 megohms to 1000 megohms, operates card punches, electric typewriters and other printing devices. (Non-Linear Systems, Inc., Del Mar, California.)

Circle 111 on Reader Service Card.



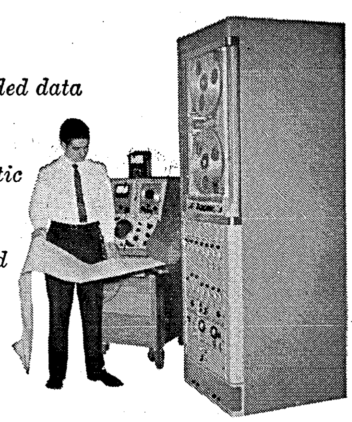
Significant data from airborne vehicles . . . missile and aircraft structures . . . power plants . . . complex weapons and control systems . . . are being gathered by Consolidated Systems designed to produce useful information in a minimum of flights or firings. These are systems of proven design, based on unmatched experience in recording, converting, and reproducing selected in-flight data. Read the complete story in BULLETIN CEC 3014-X5.



systems division **Consolidated Electrodynamics**

300 N. Sierra Madre Villa, Pasadena, California / Offices in Principal Cities Throughout the World CEC

Telemetered and recorded data are made available in the form of analog or digital magnetic tapes, punched paper cards or tapes, visual displays, and direct-readout oscillograms.



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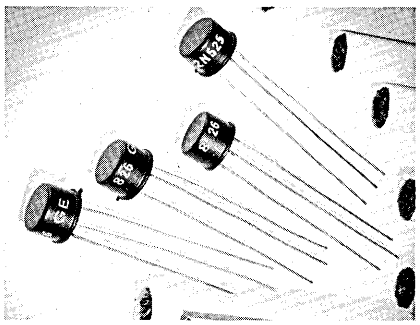
new products in DATAMATION

transistors

A new line of 30-volt, one-half ampere PNP germanium transistors for use in data processing equipment has been

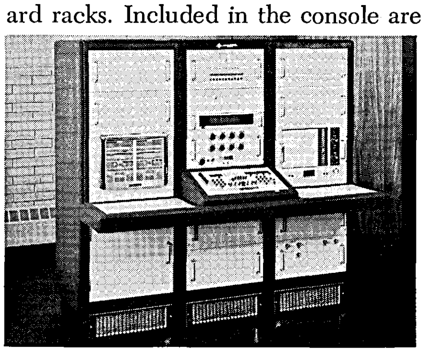


designed for medium power amplifier and low frequency, high current switching applications. The four models available: 2N524, 2N525, 2N526 and 2N527. They have a triangular lead arrangement and are housed in JETEC TO-5 package. With a collector current of 20-milliamperes and a voltage of 1-volt in a common emitter circuit, the 2N524 has a typical forward current gain of 35, the 2N525–52, the 2N526–73 and the 2N527–91. Beta holdup on all models is typically 75% of the 20-milliampere value at 200-milliamperes. For information write GENERAL ELECTRIC, Semiconductor Products Dept., Syracuse, N. Y.

Circle 150 on Reader Service Card.

analog computer

Model 200 is enclosed in a console unit equivalent in size to three standard racks. Included in the console are

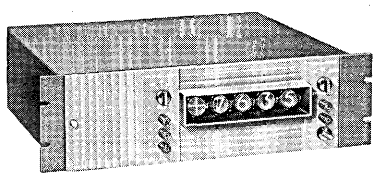


the patchbay assembly, a .01% reference voltage divider, a precision panel mounted vacuum tube voltmeter, and all the indicating lights, switches, internal wiring, power and logic controls essential to the operation of an analog computer system. A writing shelf, at desk height, extends across the console unit. Occupying the center of the shelf is a raised turret supporting the control panel which places all the computer control and monitoring switches within reach of the operator. All indicators are centralized and readily visible. For information write COLORADO RESEARCH CORP., Broomfield Heights, Colorado or use reader service card.

Circle 151 on Reader Service Card.

voltage-to-digital converters

This four-decimal digit unit, model V16-AD, utilizes 17 printed circuit cards and comes in a standard hous-

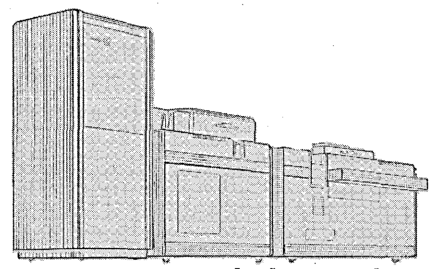


ing. Eight printed circuit card positions are left vacant for auxiliary equipment. For additional flexibility auxiliary equipment may be integrated within the housing for precision potentiometer testing or analog computer readout. Inputs are full scale, 1, 10 and 100 volts. Input impedances are 1K, 10K, and 100K respectively. A high impedance input amplifier can be incorporated for 100 megohms input impedance. The unit occupies 5¼" of panel space. It is capable of up to 1000 independent conversions per second. For information write ADAGE, INC., Dept. P, 292 Main St., Cambridge 42, Mass. or use card.

Circle 152 on Reader Service Card.

accessory ca-2

Versatility and rapidity of input-output operation for the G15 computer is increased by this unit. The acces-

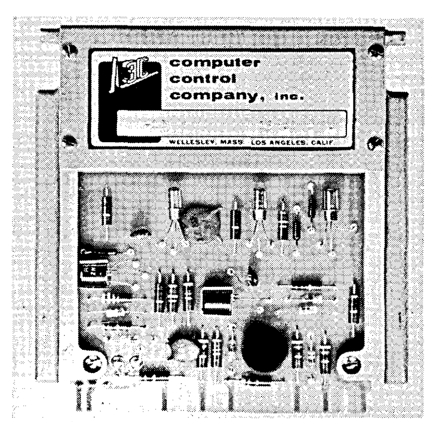


sory permits standard 80 column cards, punched in conventional numeric or alphanumeric codes, to be processed at high speed. It also handles high speed tabulation of numeric or alphanumeric printed copy. Information may be read or punched at the rate of 100 cards per minute by summary punches such as the IBM 514 or 523 (pictured at right). Output information may be tabulated at the rate of 100 lines per minute by the IBM 402 or 403. Three IBM units – one for input, one for output, and a third for either input or output – may be simultaneously connected to the CA-2. Cards may be read or punched in standard code and alphanumeric and numeric characters may be mixed. Special characters, indicated by multiple holes in card columns may be read or punched. For information write BENDIX COMPUTER, 5630 Arbor Vitae Street, Los Angeles 45, California or use reader service card.

Circle 153 on Reader Service Card.

digital module

Model SM-10 is a delay unit with amplifiers which does not incorporate any logic. It has three basic sections

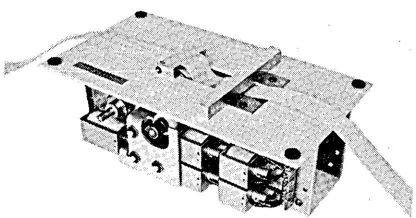


. . . a driver circuit, a magneto-strictive delay line, and an amplifier circuit. Its input is designed to be driven by a standard LE-10 logical T-PAC or other logical circuitry with right-in and erase control exercised at this point. The output of the SM-10 is similar in low driving capability to an LE-10 package. Both assertion and negation outputs are provided. Delays up to 560 microseconds are available. For information write COMPUTER CONTROL CO., INC., 92 Broad St., Wellesly 57, Mass. or use reader card.

Circle 154 on Reader Service Card.

tape punch

This punch features .046 in. diameter feedhole, .072 in. diameter codehole and is spaced .100 in. in both

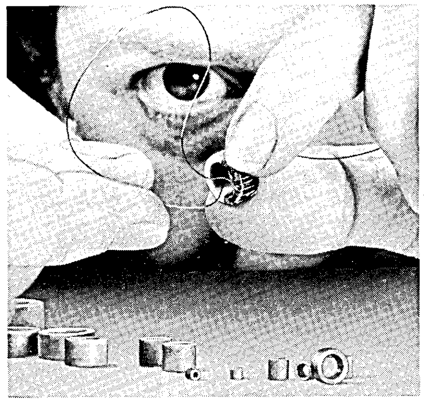


directions. The standard punch is supplied with the feedholes in line with the codeholes. The standard location of the feedhole is .394 in. from the guide edge of the tape. The punch operates on a single cycle basis by demand and can be operated at any speed up to twenty seven cycles per second, depending upon the external requirements of the equipment feeding it. The punch requires one electrical input for each codehole connection. Two cam-actuated auxiliary contacts are provided on the drive shaft. For information write PRECISION SPECIALTIES, INC., 1342 East 58th Street, Kansas City, Missouri or use reader service card.

Circle 155 on Reader Service Card.

bobbin cores

New "Poly Cap" tape wound bobbin cores are capped with a glass polyester which offers complete core pro-

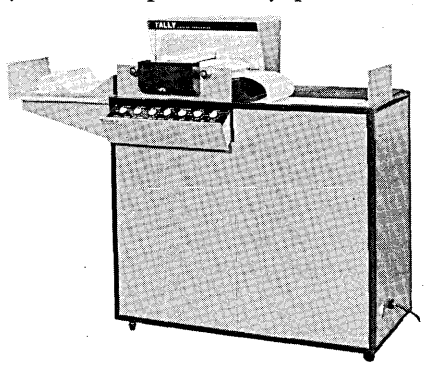


tection, according to the manufacturer. The rigid structure of the cap, which will not distort with temperature changes, allows complete freedom of handling of the assembly line without the necessity of tweezers or special tools. Another claim—the permanent sealed protection of the cap lowers production costs for users. The fitted cap, which covers the bobbin flanges, adds nothing to the bobbin width or window area. Less wire is required for windings. The caps are unbreakable in normal use and handling. For information write MAGNETICS, INC., Box 391, Butler, Penna. or use card.

Circle 156 on Reader Service Card.

digital plotter

Model 201 plots visibly at speeds up to eight points per second with four symbols or up to twenty per second

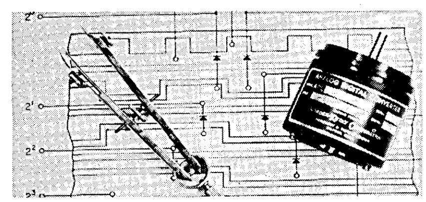


with random symbols. Results of computers can be plotted immediately. The plotted result is a series of mechanically generated printed impressions on paper or vellum. The act of plotting is a complex of mechanical actions performed by a series of subsystems. The selection of symbol, plotting value, paper position, etcetera, all are performed along the principles of a digital servo. Values and instructions are entered into the secondary buffer. Upon receipt of an instruction signal the mechanical systems are motivated until their positions is in agreement with the contents of the secondary buffer. After this, the act of printing occurs and the secondary buffer is reset. For information write TALLY REGISTER CORP., 5300 – 14th Avenue, N. W., Seattle 7, Washington or use card.

Circle 157 on Reader Service Card.

shaft encoder

Special logic used in these airborne binary shaft encoders automatically performs brush selection within the

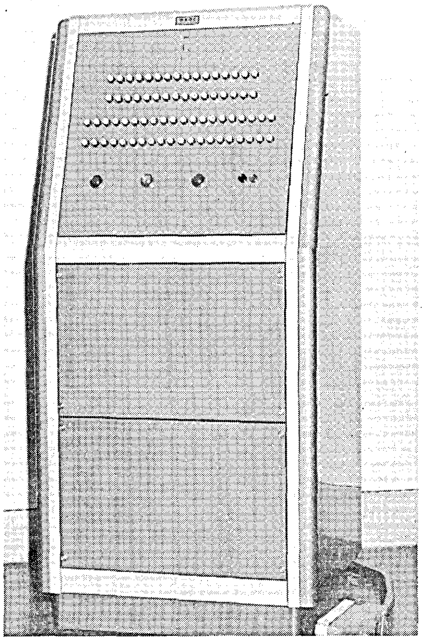


encoder eliminating electronics otherwise required for double brush V-scan systems. Digit and complement are simultaneously available in natural binary. Design provides noise-free life by preventing commutation of load currents on the disc, yet allowing continuous or pulse reading at up to 200 RPM. An error detecting scheme provides a means of detecting and rejecting erroneous readings. For information write NORDEN DIVISION, United Aircraft Corp., Wiley St., Milford, Conn. or use reader service card.

Circle 158 on Reader Service Card.

wroc 452

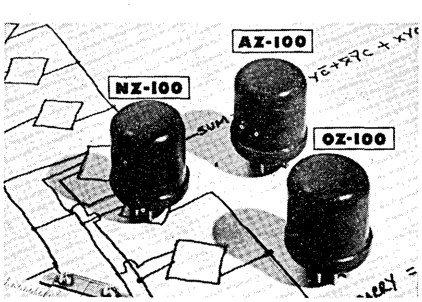
This unit is designed to increase the co selector, pilot selector and digit selector capacity of the IBM 407



printing tabulator. The WROC 452, as pictured, consists of a flexible type control panel containing 32 selectors, each one of which may, by control panel wiring, be made to operate in the manner of an IBM type pilot or co selector. It is also equipped with four multitransfer selectors consisting of 10 transfer rows and one common row, each row having 10 positions. Other features include an alpha numeric emitter, 100 position – two column digit selector and converter units. For information write MANAGEMENT ASSISTANCE, INC., 40 Exchange Place, New York, N. Y.
Circle 159 on Reader Service Card.

miniature modules

Development of a new approach to the design of digital logic called the "Manalog System" has been an-



nounced. The system consists of three basic seven-pin miniature plug-in modules, which are energized by a 100 KC R. F. power supply. The first of the three modules, type NZ100, is a "not" plug-in. It is comprised of a series-type pulse magnetic amplifier. The second module in the system is the OZ100. It consists of three silicon double anode, zener diodes with appropriate zener breakdown voltages. The third module—AZ100—contains three zener diodes of different breakdown voltage from the OZ100. For information write HOFFMAN ELECTRONICS CORP., Semiconductor Div., 930 Pitner Ave., Evanston, Ill.
Circle 160 on Reader Service Card.

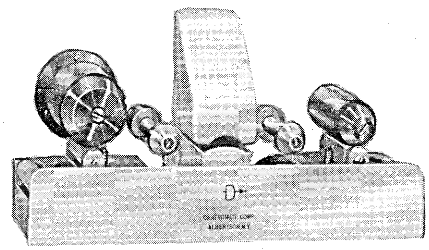
tape converter

The Kinetape Converter, 768H-1 (left below), when used with the TE-206 Kineplex Data System (right below)

provides high speed transmission of digital data from magnetic tape over voice quality telephone circuits. Data rate is 300 characters per second and is adaptable to either IBM or Univac tapes. Both the 768H-1 and TE-206 are completely transistorized and employ etched circuit cards to provide high reliability. New signaling techniques allow signal-to-noise performance and spectrum utilization. Error detection and correction is automatically accomplished by error coding and data transmission techniques. For information write COLLINS RADIO CO., 2700 W. Olive, Burbank, Calif.
Circle 161 on Reader Service Card.

tape reader

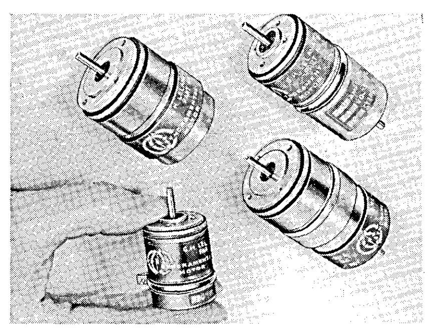
Model C301 is a photoelectric perforated tape reader. It is available in versions to handle any one of the



standard punched tape widths. Reading speeds range from 100 characters per second to 750 characters per second. The start-stop feature of this tape transport permits intermittent reading of tapes at slower rates. The reading head has been successfully operated at temperatures to 60° C. This model uses short strips requiring six inch leaders or loops of tape. Reel feed units are also available. After a stop command, 1.8 milliseconds is required for tape to come to rest. For information write DIGITRONICS CORP., Albertson Ave., Albertson, L. I., N. Y. or use reader service card.
Circle 162 on Reader Service Card.

stepping motors

Translating pulses into incremental shaft positions, these stepping motors may be used to rotate control me-



chanisms, potentiometers, counters, and rotary switches on computers and other electronic devices. With an angular increment of 36 degrees per pulse it gives 10 indexing positions

TRUST because only SCOTCH

REG. U.S. PAT. OFF. BRAND

Instrumentation Tapes assure absolute dependability inch after inch... reel after reel

You can't afford to compromise with accuracy, reliability and uniformity in critical recording work – instrumentation, computers, machine tool control and other technical applications. You need a magnetic tape of *proven* instrumentation quality, "SCOTCH" Brand Magnetic Tape.

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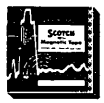


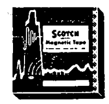

Tape Number Description	108 Std. Instrumentation	109 Std. Instrumentation	128 Hi-Output Instrumentation	159 Extra Play Instrumentation
Physical Properties				
Backing Material	Polyester	Acetate	Polyester	Polyester
Thickness in mils				
Backing	1.45	1.42	1.45	.92
Coating	.55	.55	.65	.35
Ultimate Tensile Strength ¼" Wide — Room Condition	9#	5.8#	9#	7#
Yield Strength 5% Stretch in ¼" Width	5.4#	4.5#	5.4#	3.8#
Elongation at Break	100%	25%	100%	100%
Coefficient of Friction	0.33	0.33	0.30	0.33
Residual Elongation	0.5%	1.5%	0.5%	0.5%
Slitting Tolerances	+.000 ins. —.004 ins.	+0.0% —0.8%	+.000 ins. —.004 ins.	+.000 ins. —.004 ins.
Toughness				
Tear — grams	26	3	26	12
Impact — Kc — cms	100	20	100	70
Coefficient of Expansion*				
Humidity (units per % RH change)	1.1 x 10-5	15 x 10-5	1.1 x 10-5	1.1 x 10-5
Temperature (units per °F.)	2 x 10-5	3 x 10-5	2 x 10-5	2 x 10-5
Temperature Limits for Safe Use				
Low	—40°F.	—40°F.	—40°F.	—40°F.
High	+140°F.	+140°F.	+185°F.	+140°F.
†Relative Wear Ability	100%	100%	250%	100%
Magnetic Properties				
Intrinsic Coercivity (Hci)	250	250	240	240
Oersteds Retentivity (Brs) Gauss	700	700	1100	1100
Remanence (Flux lines/ ¼" tape)	0.6	0.6	1.2	0.6
Relative Output in db at 1% distortion** 15 mil Wave Length	0	0	+6	0
Relative Sensitivity in db**				
15 Mil Wave Length	0	0	+3.5	+1.5
1 Mil Wave Length	0	0	0	+3.5
Erasing Field	1000	1000	900	800
Uniformity at 15 Mil Wave Length				
Within a Roll	±3%	±3%	±3%	±3%
Roll to Roll	±10%	±10%	±10%	±10%
Dropout Count** Errors/1 Roll	1	1	1	1

*These coefficients are unitless and represent the change per % RH or degree Fahrenheit over the following ranges:
Humidity: 20% RH to 80% HR
Temperature: -30°F. to +130°F.
**At optimum bias for each tape type.

***Measured by recording 200 non-return pulses per inch on a 0.035" track. A reduction to less than 50% normal signal amplitude constitutes a signal error. Zero errors are measured by saturating the tape undirectionally. Each spurious signal greater than 10% of normal signal amplitude constitutes a zero error. Errors per roll based on recording 7 tracks on rolls ½" x 2500'.
†Relative wear ability is considered as 100% for 109 Tape. Relative output is established by 109 which is designated as zero. All other tapes are expressed as gradations from this reference point.

FREE BOOKLET! Get all the facts about America's most complete line of instrumentation quality tapes. Mail this coupon for your free specification catalogue.

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POSITION____________________

COMPANY____________________

ADDRESS____________________

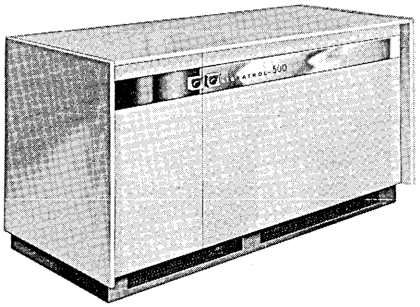
CITY__________ZONE_____STATE________

Circle 6 on Reader Service Card.

with ±½° detent accuracy at a maximum stepping rate of 15 per second. Motors need all applicable environmental tests of MIL-E-5272A. Mounting is either servo or stud and models are available for wide range of operating voltages. For information write G. H. LELAND, INC., 123 Webster Street, Dayton 2, Ohio or use card.
Circle 163 on Reader Service Card.

control system

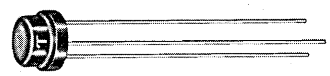
LIBRATROL — 500 system is developed around a rapid-response digital computer. The unusual aspect of this



system is the provision for a full range of process control — from accurately processing data that provides understandable information to a human operator, to complete automatic control of the entire process. Such a building block concept offers the user a single system with the capacity to accommodate expanding functions. A gradual change-over from manual process control to a completely automatic computer-controlled plant may be made without replacing this system. It has been designed for connection to existing equipment in any processing plant for a wide variety of industries. For information write LIBRASCOPE, INC., 808 Western Avenue, Glendale, California or use card.
Circle 164 on Reader Service Card.

input transistor

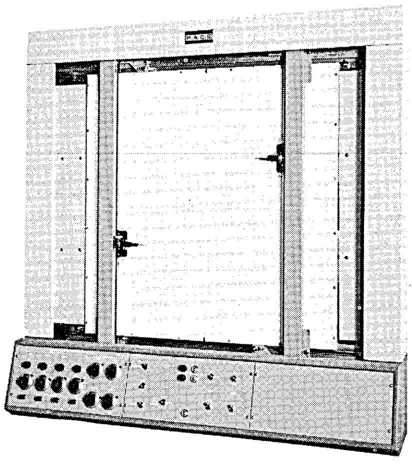
A new silicon transistor operates at low current and d.c. amplifier input stages. Recommended for operation



in the range 2-200 micro amps, the ST1026 features drift of only .05 milli-microamps per degree C and .5 milli-microamps per day. This low drift makes the transistor useful in circuits with high impedence sources. Many new low current applications are opened up by the high beta (typically 25 at 5 ua to 70 at 100 ua). For information write TRANSITRON ELECTRONIC CORPORATION, Wakefield, Mass. or use reader card.
Circle 165 on Reader Service Card.

x-y plotter

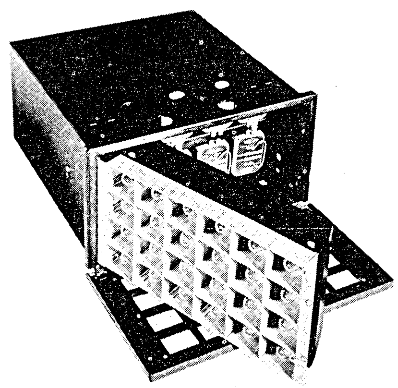
New design feature of this transistorized variplotter models 205S and T includes complete transistorization of



all amplifier and power supplies. In this way vacuum tube failures from burnout or shock damage is no longer a problem, the manufacturer claims. Other announced features — instant warmup, greater speed, large 30 in. by 30 in. plotting surface and high reliability. The announced weight is 250 pounds. Servo motors operating at 400 cps provide increased speed. It will operate in any position from horizontal to vertical. For information write ELECTRONIC ASSOCIATES, INC., Long Branch, New Jersey or use reader service card.
Circle 166 on Reader Service Card.

annunciator

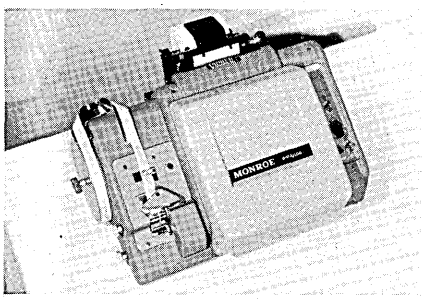
This annunciator has flashing sequence alarm, no drain circuit and has been designed for monitoring



complex automatic equipment from 24 to 96 points in the utility and continuous process industries. Series 61 annunciator is a completely integrated unit with all plug-in relays hermetically sealed. No power is used by series 61 and all signals are normal. Instant operator attention is directed to off normal conditions by flashing sequence and audible alarm. For monitoring more than 96 points, annunciator systems may be connected to operate in parallel. For information write PANNELIT, INC., 7401 North Hamlin Ave., Skokie, Illinois or use reader service card.
Circle 167 on Reader Service Card.

printing machine

Providing a printed copy or a printed copy and a punched tape, this machine is equipped with its own con-

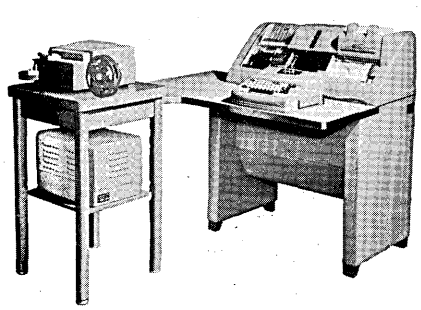


trolling circuits and power supply. The user needs to provide external contacts for data entry and start, in order to operate the unit. Dependent upon the external control circuitry and functions required, the maximum speed of complete machine cycling, 10 digits per cycle, is from 180 per minute printing only, to 64 per minute printing, accumulating and punching. The entry of a number of digits simultaneously, either printing or printing and punching in groups of digits, reduces readout control circuit complexity and greatly adds to the reliability of the system by reducing the number of operations required of the system control components. For information write MONROE CALCULATING MACHINE CO., INC., Electronics Components Div., 60 Main St., San Francisco, Calif. or use card.

Circle 168 on Reader Service Card.

tape-to-card converter

Featured in this unit is a removable plugboard which can be programmed to handle many applications, control

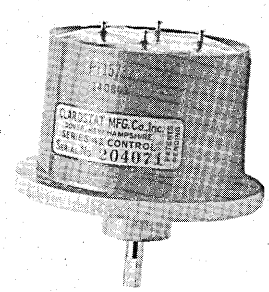


automatic card punching and provide the new converter, model C749, with flexibility. A second plugboard or coding matrix equips the unit to convert tape which has been punched with any type code – 5, 6, 7 or 8-channel. The converter operates in conjunction with any standard IBM 024 or 026 card punch, but in no way hinders normal manual operation of the card punch. If the card punch is equipped with the IBM self checking number device then certain selective indication data is automatically verified. For information write SYSTEMATICS, INC., 60 East 42nd Street, New York 17, N. Y. or use reader card.

Circle 169 on Reader Service Card.

potentiometer

A new sign/cosign potentiometer for use in computer assembly has a standard conformity plus/minus 1% peak-



to-peak, or a special conformity of plus/minus ½% peak-to-peak. The unit employs oil-impregnated bronze bearings for a recommended maximum speed of 30 rpm. Precision windings, plus a low wear wiper design, produces a guaranteed life of 500,000 cycles, the manufacturer claims. The unit has a flange mount with a diameter of 2.050 in. and 1.925 in. diameter beyond. Shaft torque is 1.0 oz. in. For information write CLAROSTAT MANUFACTURING CO. INC., Dover, New Hampshire or use reader service card.

Circle 170 on Reader Service Card.

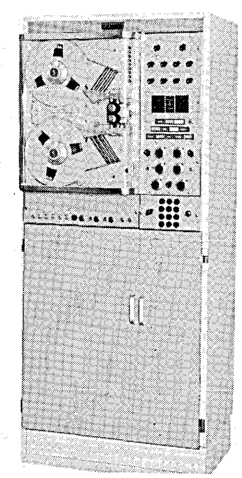
sampling switch

A new three-pole sampling switch for use in high speed aircraft instrumentations and data reduction systems features collector rings for each of the three poles, provided in a separate hermetic connector. The switch is comprised of three poles with thirty BBM contacts per pole operating at 5 rps. Two of the poles scan differential thermo couple and strain gauge output signals while the third pole provides the timing function. Special metal brushes are driven through a suitable gear reduction system by a 115 volt a.c. 400 cps single phase 15 watt motor. Noise levels in the order of 20 to 30 microvolts are maintained in this switch throughout its 1,000 hour operating life. For information write INSTRUMENT DEVELOPMENT LABORATORIES, INC., 67 Mechanic Street, Attleboro, Mass. or use reader service card.

Circle 171 on Reader Service Card.

mag tape dataplotter

This unit is capable of accepting tape codes written on IBM, Remington Rand, Electrodata, and other digital

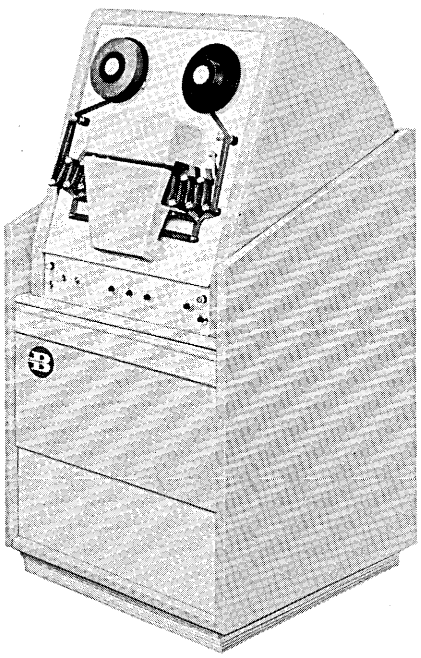


computing equipment. X-Y graphs of data recordered in digital form on magnetic tape is accomplished at high speeds. Used with any of the manufacturer's plotting boards, data can be presented in points, symbols, or continuous lines. Statistical charts of all types and many forms of mechanical drawings are drawn. For applications

other than plotting, analog voltages are readily available. For information write ELECTRONIC ASSOCIATES, INC., Long Branch, N. J. or use card.
Circle 172 on Reader Service Card.

photoreader

This unit, according to the manufacturer, reads 1000 characters per second. It is adaptable to standard



width tape, from five to eight level code. Plastic reels are available in two sizes, for tapes of 350 or 700 feet (40,000 or 80,000 characters). Features include automatic rewind and end-of-tape sensing, true straight-line loading and drift-free design. The photoreader is available as a component for mounting in any standard 19" cabinetry. For information write ELECTRODATA DIVISION, Burroughs Corporation, 450 Sierra-Madre Villa, Pasadena, Calif. Or use card.
Circle 173 on Reader Service Card.

photojunction cell

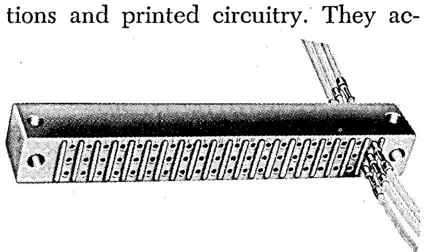
A new light sensitive cell for use in computers weighs approximately 1 gram. In computers, the RCA-7224 can be employed to translate information from punched cards and punched tape. In actual operation a beam of light passes through the whole of the card or tape and activates the tiny cell which will trigger the computer memory. The cell employs a germanium pn alloy junction and features fast rise and fall characteristics.
For information write RADIO CORPORATION OF AMERICA, Electron Tube Division, 415 South 5th Street, Harrison, New Jersey or use card.
Circle 174 on Reader Service Card.

miniature switch

A new mercury switch that weighs 1.8 grams with leads attached is designed for use in computers and other electronic devices. The extremely low shift of mass involved in actuation facilitates gang-mounted assemblies. The switch, designated AS419A1, may be mounted in any position through 360 degrees around its longitudinal axis. It may be actuated by slow, snap or fast-tilting action. For information write MICROSWITCH, a division of Minneapolis - Honeywell Regulator Co., Freeport, Ill. or use reader card.
Circle 175 on Reader Service Card.

terminal blocks

These terminal blocks have been designed for various computer applications and printed circuitry. They ac-



cept standard "AMP 53" solderless taper pins and are available in any combination of feedthru individual or shorting terminals. External wiring has been eliminated by completely protected, mold-in internal buss connections between any combination of terminals. Holes are provided for convenient stacking or right angle and perpendicular mounting. Taper receptacles are brass, gold plated over silver for low contact resistance and freedom from corrosion. A variety of molding materials are available including Melamine, Diallyl Phthalate, Alkyd and Phenolic Mica. For information write DEJUR-AMSCO CORPORATION, Electronic Sales Div., 45-01 Northern Boulevard, Long Island City, N. Y. Or use reader card.
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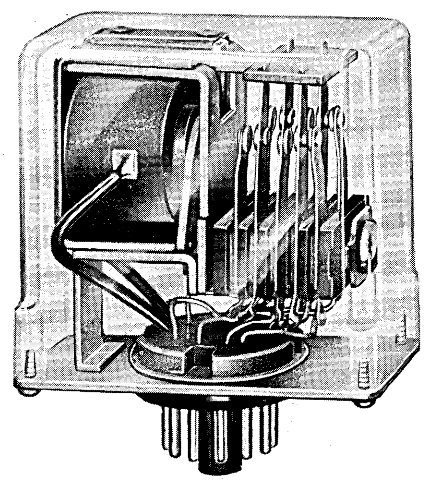
relay

Model 219 relays are designed for performance on the order of twenty million operations. They are mechani-



cally protected by plastic covers and are designed with plug-in construction for servicing. Accepted standards of insulation include spacings of 1/8 in. through air, 1/4 in. over surface and a minimum of 1500 volts AC dielectric test. Contacts have 10 ampere current carrying capacity. Plug and socket combinations are limiting factors on ratings. Stock contact arrangements are DPDT on octal plugs and DPDT plus two normally open contacts on 12-pin octal style plugs. Operating coils may be AC or DC. For information write STRUTHERS-DUNN, INC., Pitman, New Jersey. or use reader service card.
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people moving up in DATAMATION

Clair C. Lasher is the new general manager of General Electric's Computer Department in Phoenix. Joining the company in 1939, he became manager of marketing at the inception of the department in 1956. He supersedes **H. R. Oldfield, Jr.,** who has been appointed general manager of a new component division, unnamed as yet . . . Philco has announced promotion of **Sol Zechter** to manager of Transistorized Devices Laboratory in Philadelphia. Since joining the company he has handled development of equipment under government contracts in transistorized communications, telemetering—holds two patents on the latter, five pending on electronic devices . . . **Jack Cudahy** will head the new west coast office of Technitrol Engineering Co. Philadelphia. This office will provide manufacturers with technical assistance on problems of complex design.

Newly appointed member of Control Data Corporation's mechanical engineering group, **Dean M. Roush,** will have specific responsibilities associated with design of Minneapolis company's new CDC 1604 scientific computer. The initial order on a $600,000 Navy contract was announced recently. Roush was formerly mechanical engineer with Remington Rand Univac's Military Division. Other Control Data appointments: to computer engineering staff, **James D. Harris** as senior administrative assistant, **Carl E. Koehler** as systems logical designer, **James E. Thornton** as senior electrical engineer. Also, **Dr. Robert E. Smith** named senior mathmatician on professional staff.

Joseph A. Resca is now the New York district sales manager for Burroughs' ElectroData Division. He will be in charge of sales and service of company's E101, 205 and 220 computers, and EDP systems in that area. Lately manager of the division's Dallas district he was formerly with Telecomputing Corporation. ElectroData has also established two new district sales offices. **Claggett A. Jones** will head the Atlanta, Ga., office and **Charles V. Hoge** is in charge of Denver, Colo., branch . . . **William E. Brugman** has been appointed to the newly created position of components sales manager at Telemeter Magnetics, Inc.

Expansion of DATAmatic, data-processing division of Minneapolis-Honeywell Regulator Co., resulted in the opening of a Washington sales office. **Robert F. Anderson** has been appointed manager, **Fillmore Dobbs** is assistant. . . . **Gerard Q. Decker** was elected vice president of Servomechanisms, Inc., by board of directors. He was promoted from division manager of the company's Subsystems Division . . . Computer Engineering Associates, Inc., appointed **Dr. Richard H. MacNeal** as manager of their Engineering Service Division. . . . **Philip Balaban** has been named director of research for Mid-Century Instrumatic Corp., in New York.

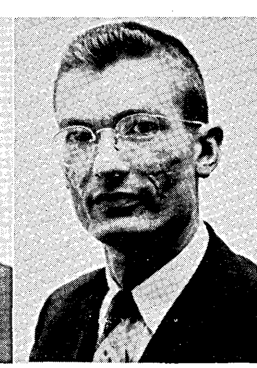
Samuel Ochlis is the new sales manager of Instrument and Equipment Division, Epsco, Inc., Boston. The division designs, manufactures, building blocks in large data handling systems. **Wallace E. Rianda** is vice-president and general manager of Epsco-West, newly established west coast division. He was formerly marketing manager of Beckman Instruments, Inc. **William F. Gunning,** technical director, **Ralph McCurdy,** in charge of production—were also associated with Beckman.

Taft B. Russell is now manager of systems sales and research and development contracts of General Devices, Inc., Princeton, N. J. . . . . Consolidated Electrodynamics Corp. has established an International Department within the Marketing Division and appointed **Rodney W. Meyer,** as director.

Computer Services Division of the Corporation for Economic and Industrial Research has announced appointment of **Robert L. Patrick** deputy director. . . . appointed manager of Sylvania's newly formed Needham, Mass., data processing facility is **Frank M. Thomas. Richard R. Fidler** will head advanced development-data conversion department. . . . **John B. Olson** is named chief engineer of Computer Measurements Corp. . . . Stromberg-Carlson has appointed **William G. Alexander** assistant general manager.

Homer M. Sarasohn is named director of engineering planning on corporate staff of IBM. He will exercise staff supervision of all product development, engineering activities and provide liaison among IBM's operating divisions. **Dr. Morton M. Astrahan** is appointed functional manager, responsible for research on data processing needs of small business. **Richard W. Porter** is appointed program manager for a large government contract.

Clair C. Lasher
GE's Computer Department



Dean M. Roush
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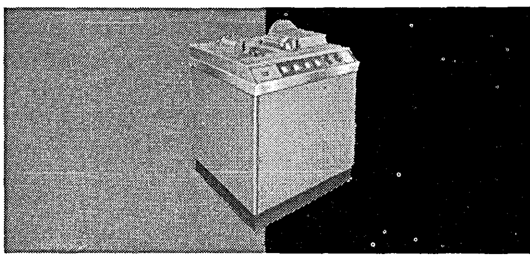

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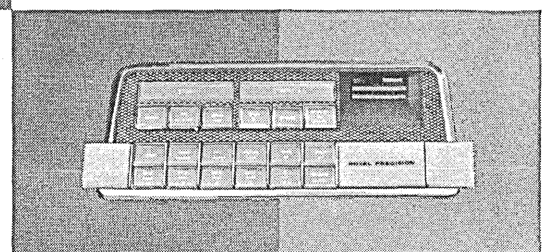

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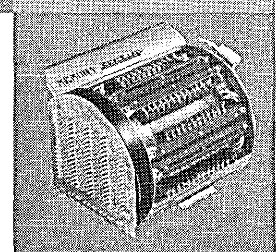

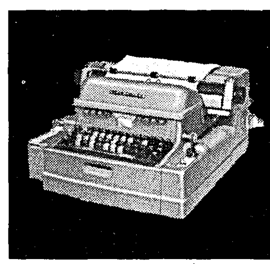

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ELEMENTARY PRINCIPLE OF PARAMETRON AND ITS APPLICATION TO DIGITAL COMPUTERS

by SABURO MUROGA
Senior Researcher, Electrical Communication Laboratory
Nippon Telegraph and Telephone Public Corporation

The idea of the parametron was born in Tokyo and is so named because its working principle makes use of "a parametrically excited oscillation." Its principle is quite common in our daily lives. Examples range from a swing and a yoyo which children like, to a parasitic oscillation of a speaker cone which is an engineer's problem.

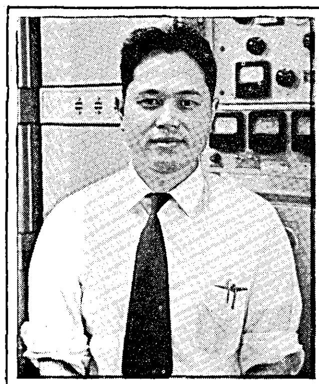
Take the first example in Fig. 1 (page 32). As a child moves his body up and down repeatedly, the swing starts to oscillate. Suppose in this case that the vertical change of the gravity center of his body has a frequency "2f". Then the movement of the swing has a frequency "f". An important fact in this case is the relation between an initial state of the swing and a phase of its final oscillation. The final oscillation of the swing can take one of two possible phases, even though their amplitudes and frequencies are the same, and which one of them is to be taken actually depends on which side of the rest point the swing was placed initially, as shown in Fig. 1.

In principle, however small this initial displacement of the swing, left or right of the point of perfect rest, it determines a phase of the final oscillation with a large amplitude. In the terminology of radio engineers, a small signal which takes one of two possible phases has been amplified into one with much larger amplitude which retains the original phase. And it is interesting to note that these two possible phases are different from each other by pi radian; that is, the voltage of one oscillation is equal to the minus of the other.

Parametron is the very realization of this by electronic means, that is, simply a pair of magnetic cores, a resistor, and a condenser, as shown in Fig. 2. A resonant circuit with a variable inductance is constructed with these components. Then an alternating current with a frequency 2f and a direct current superposed on that are applied on the primary windings of the inductance. But nevertheless the secondary windings are made to cancel an induced output to the primary input, and an alternating current with a frequency f starts to oscillate as the swing did from a vertical movement of the human body. This induced oscillation can take one of the binary phases, and if a signal with a small amplitude and a frequency f is given initially in the circuit, it will be amplified. These two are essential points of parametrons. Here the resonant frequency of the circuit, in other words, the proper frequency of the swing, should be nearly equal to half of the excitation frequency 2f.

The idea of applying this principle to switching circuits was discovered by E. Goto of Professor H. Takahashi's laboratory at Tokyo University in 1954. He made its application possible by devising a three-beat excitation and a majority decision logical operation.

Any number of parametrons can be assembled to realize a switching circuit with application of three-beat excitation as follows: Connect parametrons serially, bridging their terminals with resistances and transformers as shown in Fig. 3, and apply the excitation currents on their primary windings sequentially from the left. Then the oscillation of the parametron P1 will be coupled into the second parametron P2 as an initial small signal input to it, so that a phase of the former will be conveyed to the second. Similarly, P2 will supply the initial signal to the third parametron P3. Repeating this process over any number of parametrons, a phase of the first parametron will be correctly conveyed to the last parametron. This is a kind of shift register which is important in switching circuits. For its physical realization, it is economically impossible to prepare a source of excitation current for each parametron. The whole set of parametrons is divided



SABURO MUROGA was born in Shizuoko-ken, south of Tokyo, in 1925. In 1947 he graduated from Tokyo University with a degree in Electrical Engineering, and last year received a Ph.D. for his thesis, "Information Theory." Before coming to Nippon Telegraph and Telephone Laboratory in 1950, he was with the laboratory of the National Railways and then the Radio Regulatory Commission. In 1953 he was a participant in the Foreign Student Summer Project at Massachusetts Institute of Technology. He stayed on at M.I.T. for another six months, and then went to the University of Illinois for a half year. He holds ten patents and has fifteen papers published on information theory and digital computers, including material in the IRE Proceedings.

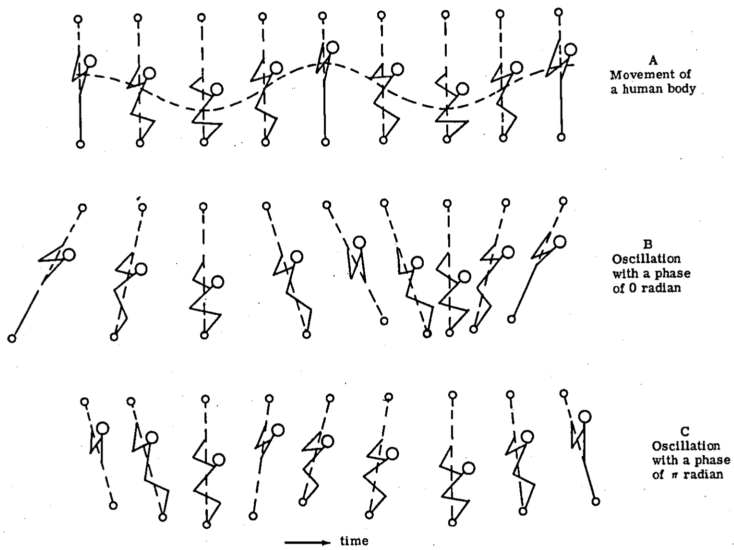


Figure 1. Parametron principle in a swing.

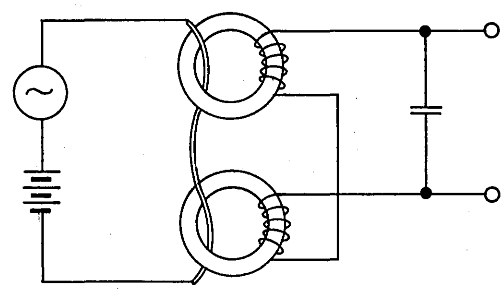


Figure 2. Parametron

into three groups so that every adjacent three parametrons belong to the groups I, II, and III, respectively.

For each of these groups, only three sources feed currents i_I, i_{II}, and i_{III}, the tails of whose envelopes overlap each other, respectively, as shown in Fig. 4. For example, the tail of i_I overlaps the head of i_{II}, but no part of i_{III}. During this overlap, phases of the oscillations in a set of parametrons belonging to group I are conveyed to those of group II, but not to those of group III. Thus, with three-beat excitation the transmission of binary signals in a single direction could be realized in a whole network of parametrons.

majority decision principle

Another important principle is the application of majority decision to logical operations of parametrons, which are indispensable for switching circuits. As widely known from Boolean Algebra, the logical operations "and", "or", and "not" are sufficient for switching circuits to perform any digital functions. For this purpose outputs of all the parametrons are coupled to inputs of the next parametrons with equal resistances. Here in Fig. 5 where a circle indicates a parametron, all the amplitudes of oscillated voltages in three parametrons are assumed to be equal. Then a phase of the parametron which is coupled from these three parametrons is obviously determined from an algebraic sum of input voltages from these parametrons of the majority decision.

Now assume the phase of the first parametron to keep O radian and the other two to be variables. If the first variable takes a phase of pi radian and the second O radian, the two voltages of the constant and the first variable cancel, leaving simply the voltage of the second variable with a phase of O radian. Thus the coupled parametron will oscillate a voltage of O radian for this input. Similarly, if the first and second both take O radian, a voltage of O radian with triple amplitude will become the input to the coupled parametron. The output phases for other combinations of the variables may be seen from

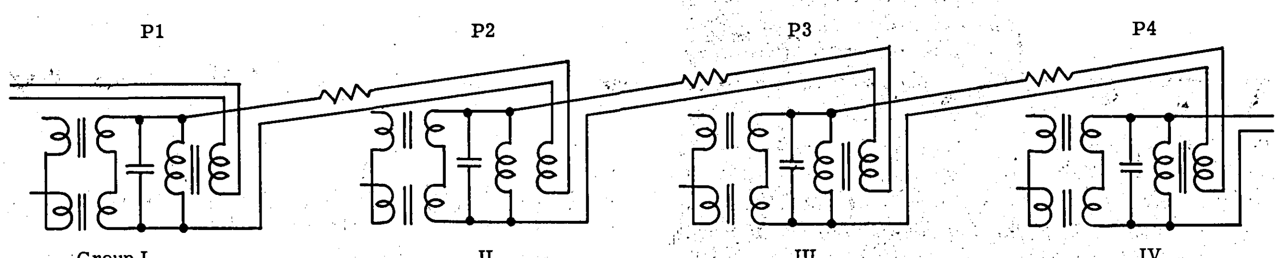


Figure 3. A shift register with parametrons

Table I which shows this circuit of parametrons to be "and" circuit, if the phases of O and pi radians are regarded as binary digits "O" and "1", respectively. Also it will be clearly understood that a circuit of parametrons will work as "or" if the first parametron takes a constant phase pi radian and the other two are regarded as variables. See Table II. The remaining "not" can be realized quite easily by reversing the polarity of the coupling transformer between the parametrons.

It is interesting to see that the majority decision principle of logical operations of parametrons is quite similar to that of neurons in living organisms. In general, logical elements standing on the majority decision principle which have been studied by the author have some interesting, unique properties as performers of the Boolean Algebraic operations and will be discussed elsewhere.

Fig. 6 shows some examples which might be encountered in switching circuits like digital computers, where a circle indicates a parametron, a coupling line with a crossing "not" and + or − inside a circle the constant 1 or 0. In these circuits the number of inputs into a parametron is limited to a maximum of three, but could be increased to five, seven, or more.

The original type of parametron uses a pair of ferrite cores with an outer diameter of about 4 mm. and a single turn primary winding for excitation and a ten turn secondary winding for the resonant circuit. Its resonant frequency was chosen at 1 2 mc. The condenser and resistor are of normal type. As easily seen from this structure, low cost and almost limitless life are expected. This type of parametron was used for our computer "M-1". Parametron consumes less than 80 mw on average. This power consumption characteristic has been much improved by efforts of Z. Kiyasu and others in our laboratory which backed

Table I— "and" circuit for constant with 0 radian

1st variable	2nd variable	Output
0	0	0
0	pi	0
pi	0	0
pi	pi	pi

Table II — "or" circuit for constant with pi radian

1st variable	2nd variable	Output
0	0	0
0	pi	pi
pi	0	pi
pi	pi	pi

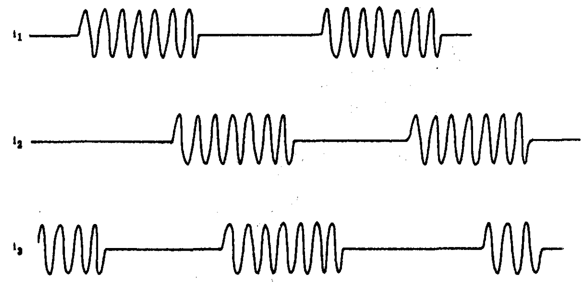


Figure 4. Excitation currents in three beats

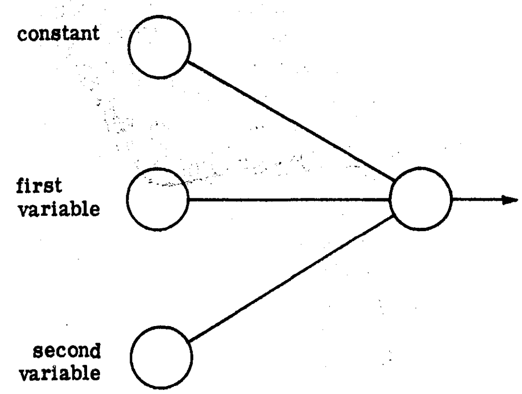


Figure 5. Majority decision principle

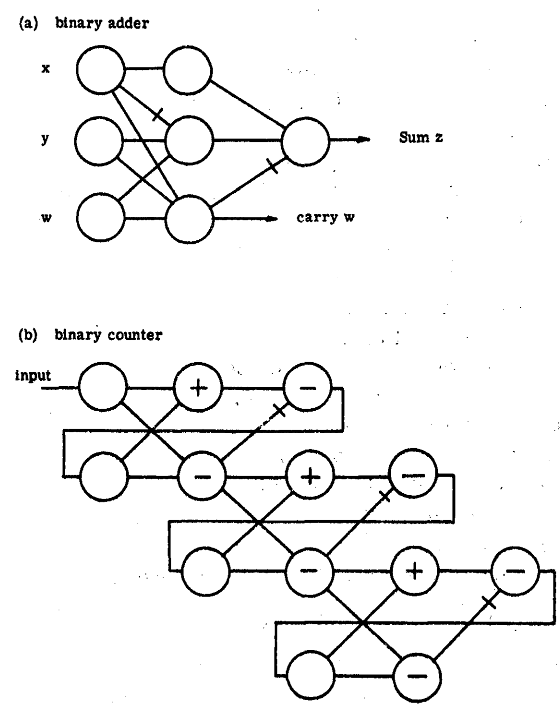


Figure 6. Examples of the parametron circuits

the development of an electronic telephone exchange and construction of a digital computer with parametrons. It was improved by three to five times.

musasino 1

Our large scale digital computer which has been constructed by the laboratory people including the author primarily for scientific problems was named "Musasino 1" after its location. It was completed in March 1957 with a small magnetic core memory capacity and had been used to calculate tables of elementary functions. In March of this year its memory was enlarged to 256 words, making its debut in public as ready for general use in our laboratory. This is the first large scale digital computer with parametrons. It is shown in Fig. 7.

The panels on the right are the source of excitation currents of 2.4 mc. The sixteen square panels in the center contain the parametrons, six upper panels being the control unit and the lower ten the arithmetic unit. Above these parametron panels are neon indicators for the accumulator, a quotient register, an order pair register, and various alarms, while manual control switches are to the left. At the rear of the room is the electrical power source.

The M-1 is a program-stored binary computer with fixed point in a parallel system. The word structure and instructions are modeled after the Illiac at the University of Illinois. Consequently, a single word represents forty binary digits as a number or a pair of orders. About 130 different instructions are available, including ones for handling magnetic tapes, for performing three different Boolean Algebraic operations, for controlling brightness of the beam spot of a cathode ray tube display and others.

The M-1 uses 5356 parametrons, of which 2800 are used for the arithmetic unit, 1600 for the control unit and 1456 for the magnetic memory, and 519 vacuum tubes for the source of high frequency excitation currents, high power drivers, the neon indicators and others. The M-1 consumes a stabilized dc power of 5 kc for the primary ac 9 kva.

The magnetic core memory, where a number of ferrite cores of 2 mm diameter are used, has a unique feature. Its working principle, which was also Goto's idea, depends entirely on alternating currents. A current of a frequency f/2 with a constant phase for selecting a desired word among the whole memory is superposed on information currents of a frequency f, each of whose phases is specified by each of the forty binary digits of a number to be stored and then it is flowed into the magnetic cores of the desired word, writing the number on these. For reading out a stored number from the magnetic cores, a current of the frequency f/2 with a constant phase flows into the desired cores from a selection matrix to induce second harmonic currents, each of whose phases depends on a polarity of the residual magnetism of the core. The selection matrix, too, consists of parametrons, of which only one is placed at a crosspoint of the vertical and horizontal

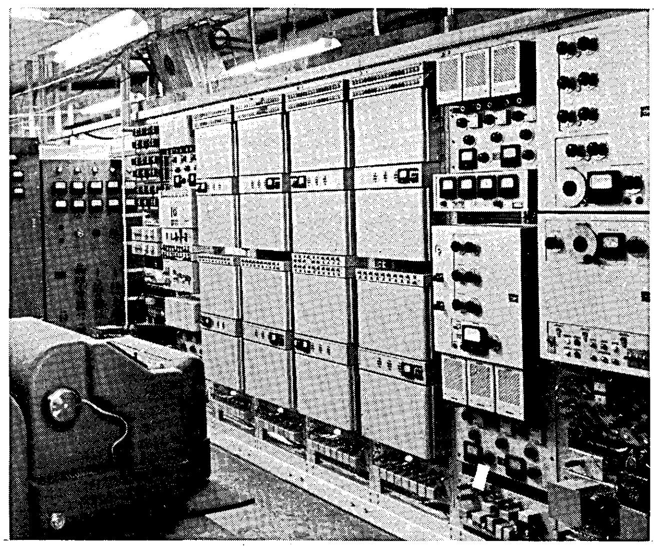


Figure 7. The M-1

wires of excitation. Ferrite cores with non-rectangular hysteresis curve are satisfactory for this memory principle.

A paper tape with six holes for a Japanese standard teletype is used for input and output. One of these holes is for odd parity check and when the tape is read by a photoelectric reader, the computer stops for failures of the check. A teletype punch is used for the output.

A number of features for speedup and easy use are included in the machine's design. A carry detector and a high speed multiplier, for example, are incorporated. The former is to sense an end of carries in addition or subtraction and consequently average times for addition and division are greatly reduced. Many alarms for incorrect orders, misoperations of the input, changes of source voltages and others are provided.

The life of a parametron is almost infinite because of its simple structure. There has been no replacement of parametrons during the 4000 hour run of the M-1. The only troubles have been bad soldering connections, but once these are fixed, that is the end of the trouble. The cost of the magnetic core memory is low because the required characteristics of the core are not rigid. The M-1 has worked very stably for these four months without any failures and with almost no maintenance. Every day, ten minutes after electricity is applied, it is available for computations.

Only relatively low speed of operation might be considered a defect of parametrons, but the M-1's speed is almost comparable with vacuum tube computers in a serial system. Its speed is linearly proportional to the repetition frequency and orders for addition and multiplication take 2 and 10 milliseconds on average, respectively, for 10 kc repetition which may be at least doubled by further adjustment in the near future.

Important dates in DATAMATION

Oct. 9-11: Information Storage and Retrieval Systems Conference, Graduate School of Library Science, University of Texas. Contact Dr. R. R. Douglass, Graduate School of Library Science, University of Texas, Austin, Texas.

Oct. 13-15: International Systems Meeting, Systems and Procedures Association, Hotel Penn-Sheraton, Pittsburgh, Penna. Contact A. M. Motter, Jones and Laughlin Steel Corp., #3 Gateway Center, Pittsburgh 30, Penna.

Oct. 16-18: The Institute of Management Sciences Annual Meeting, Philadelphia, Pennsylvania.

Oct. 20-21: Remington Rand Univac Users Conference, John Hancock Mutual Life Insurance Company, Boston, Mass. Contact R. M. Petersen, Secretary, Univac Users Conference, General Electric Company, Appliance Park, AP 1-109, Louisville, Kentucky.

Oct. 20-24: National Business Show, Coliseum, N. Y. C. Contact Rudolph Lang, Managing Director, 530 5th Ave., New York 36, N. Y.

Oct. 22-25: The National Businessmen's Exposition, Great Western Exhibit Center, Los Angeles, Calif. Sponsored by NMA. Contact Robert W. Caldwell, NMA Show Chairman, National Businessmen's Exposition, 2807 Sunset Boulevard, Los Angeles 26, Calif.

Oct. 23-24: Operations Research Society of America National Meeting, Statler Hotel, St. Louis, Missouri.

Oct.23-25: The National Society of Professional Engineers – fall meeting, St. Francis Hotel, San Francisco, Calif. Contact Kenneth E. Trombley, National Society of Professional Engineers, 2029 K St., N. W., Washington 6, D. C.

Oct.23-25: 1958 **National Simulation Conference,** Statler-Hilton Hotel, Dallas, Texas. Sponsored by IRE-PGEC. Contact J. E. Howard, 2100 Menefee Dr., Arlington, Tex.

Oct. 25: American Mathematical Society Meeting, Princeton University, Princeton, New Jersey.

Oct. 27-28: Fifth Annual East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore. Sponsored by IRE. Contact Harry Rutstein, Publicity Chairman, Lord Baltimore Hotel, Baltimore, Maryland.

Oct. 29-30: Fifth Annual Computer Applications Symposium, Morrison Hotel, Chicago. Sponsored by the Armour Research Foundation, Illinois Institute of Technology. Contact the Foundation at 35 W. 33rd St., Technology Center, Chicago 16, Illinois. (See page 41.)

Oct. 30-31: Fourth Electronic Business Systems Conference, Olympic Hotel, Seattle. Sponsored by the western division of the NMAA. Contact E. B. S. Conference, NMAA, P. O. Box 134, Seattle 11, Washington.

Nov. 3-7: Fifth Institute on Electronics in Management, The American University, Washington, D. C. Contact Lowell H. Hattery, Fifth Institute on Electronics in Management, The American University, 1901 F Street, N. W., Washington 6, D. C.

Nov. 16-21: International Conference on Scientific Information, Mayflower Hotel, Washington, D. C. Sponsored by NAS, NRC, NSF and ADI. Contact Secretariat, International Conference on Scientific Information, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C. (See page 13.)

Nov. 17-18: Federal Govt. Accountants Association's 8th Annual Symposium. Theme: "Management and Electronic Data Processing." Contact Martin C. Powers, 1523 L St., N. W., Washington 5, D. C.

Nov. 17-20: Fourth Annual Conference on Magnetism and Magnetic Materials, Sheraton Hotel, Philadelphia, Penna. Sponsored by AIEE. Contact John Leslie Whitlock Associates, Exhibition Managers, 6044 Ninth St., North, Arlington 5, Virginia.

Nov. 19-20: Northeast Electronics Research and Engineering Meeting, Mechanics Hall, Boston, Mass. Sponsored by IRE. Contact J. J. Faran, General Radio Company, 22 Baker Avenue, West Concord, Mass.

Nov. 20-21: Conference on Electronic Computation, Kansas City, Missouri. Sponsored by the Kansas City Section and the Committee on Electronic Computation of the Structural Division, ASCE. Contact Secretary, Steven J. Fenves, 203 Civil Engineering Hall, University of Illinois, Urbana, Illinois.

Nov. 20-21: American Mathematical Society Meetings; Pomona, Calif.; and Nov. 28-29: Northwestern University, Evanston, Illinois; and Durham, North Carolina.

Nov. 28-Dec. 4: National Physical Laboratory Symposium and Electronic Computer Exhibition, London, England. Contact C. V. Wattenbach, Deputy Managing Director, Dictograph Telephones, Ltd., London, England.

Dec. 3-5: Eastern Joint Computer Conference, Bellevue-Stratford Hotel, Philadelphia, Penna. Contact John M. Broomal, Burroughs Corp., Paoli, Pa. (publicity information) or Dr. F. M. Verzuh, MIT Computation Center, Cambridge 39, Mass. (program information). (See p. 40.)

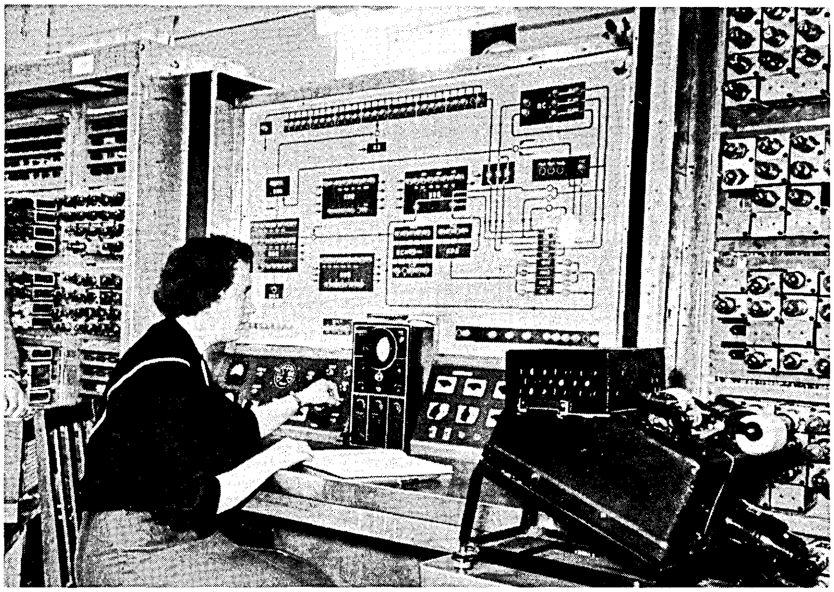
Dec. 9-10: Mid-America Electronics Convention, Municipal Auditorium, Kansas City, Missouri. Contact Wilbert O'Neal, The Vendo Co., 7400 E. 12th, Kansas City. Mo.

Jan. 20-22, 1959: American Mathematical Society – 65th Annual Meeting, U. of Penn., Philadelphia, Pa.

Feb. 12-13: Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadephia, Pa. Sponsored by the PGCT, the AIEE and the University of Pennsylvania. Contact Arthur B. Stern, General Electric Co., Building 3, Syracuse, N. Y.

Mar. 2-6: Western Joint Computer Conference, Fairmont Hotel, San Francisco, Calif. Sponsored by PGEC; AIEE; and ACM. Contact M. L. Lesser, IBM Research Laboratory, San Jose, Calif.

June 15-20: International Conference on Information Processing, Paris, France.



Engineer L. Maiboroda at the controls of SESM, Russian calculator.

COMPUTING IN THE USSR

trial work started on sesm

Trial work on SESM, a Russian electronic calculator, has been initiated at Kiev, in the calculating center of the Ukrainian Academy of Sciences. This specialized computing machine is capable of solving linear algebraic equations having up to 400 unknown factors and is the first of its kind to be produced in the USSR or anywhere in Europe, according to Soviet scientists. It is being used to reckon complex hydro-technical building and machine building designs and to solve the problems in geodesy and mathematical physics.

Extensive use of both vacuum tubes and solid state devices are featured in SESM's construction. The machine occupies 86 sq. ft.

Systems engineering was accomplished under the supervision of S. A. Lebedev and Z. L. Rabinovich at the Ukrainian Academy of Sciences.

WJCC COMMITTEEMEN NAMED

Committee heads have been named for the 1959 Western Joint Computer Conference to be held in San Francisco, March 3-5, 1959.

Joint sponsors are the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Association for Computing Machinery. Headquarters and meeting place will be the Fairmont Hotel.

Robert R. Johnson of the General Electric Computer Laboratory, Palo Alto, Calif., is general chairman and has announced the composition of the steering committee for the conference, all Californians, as follows:

Richard W. Melville of Stanford Research Institute, Menlo Park, vice-chairman and chairman of the technical program; Charles Asmus of General Electric Computer Laboratory, Palo Alto, conference secretary-treasurer; Byron J. Bennett of IBM Product Development Laboratories, San Jose, publications; George A. Barnard, III of Ampex Corporation, Redwood City, publicity; Harry K. Farrar of Pacific Telephone & Telegraph Co., San Francisco, exhibits.

Also, Kenneth F. Tiede of University of California Radiation Laboratory, Livermore, field trips; Robert M. Bennett, Jr., of IBM Research Laboratory, San Jose, registration; L. D Krider of University of California Radiation Laboratory, Livermore, printing; Mrs. Joanne Teasdale of General Electric Computer Laboratory, Palo Alto, women's activities; Earl T. Lincoln of Stanford Research Institute, Menlo Park, mailing; and Robert C. Douthitt of Remington Rand, El Cerrito, local arrangements.

IBM ANNOUNCES TRANSISTORIZED 7070

Details have been released on IBM's newest computer, the 7070, billed as "a completely transistorized computer in the intermediate price field."

By using transistors (manufactured by Texas Instruments, Inc.) one third is cut from installation and environmental control costs, IBM claims. Another claim: computer time is saved by overlapping machine operations. By using two tape channels, the 7070, while computing, reads or writes magnetic tapes at the rate of up to 125,000 characters per second. IBM says the system can handle simultaneously "several" 400-card-a-minute readers and 250-card-a-minute punches.

In order to permit in-line data processing, four files of 50 magnetic disks can be included in the system, providing for the random access storage of 24 million digits. Also available—an immediate access memory of 50,000 to 100,000 digits held magnetically in miniature ferrite cores.

As an installation aid, IBM has developed a series of general-purpose, automatic programs for the 7070.

One of the assembly routines available for the 7070 is similar to the Autocoder program, which serves as a simplifield system of program writing for the 705.

Although the language used is not Autocoder language, it resembles it somewhat. Operation codes are in mnemonic notation (a memory-aiding device) and the programmer can refer to the field to be processed in a manner that has a definite meaning to him such as "Grosspay," "FICA" and other familiar terms. Comments such as "Compute Exemption Amount" on the first instruction of a sub-routine can be written to assist the programmer in keeping track of blocks of instructions. Not only is the task of writing the program made easier, but additions, deletions, and corrections can be made without changing addresses written.

Instructions are punched into cards and fed into the 7070. The program converts each instruction into a machine-language program step, assigning locations for the instructions and for the data used in the program. An output card is punched for each instruction, and these cards comprise the program deck. Assembling of the program and the record-keeping phase of writing the program are performed by the 7070 itself.

Company officials pointed out that the 7070 will also be able to compile Fortran language, the same as used by IBM 650 and 700-series systems. The term Fortran stands for formula translation and is a means of expressing mathematical processes in a manner that the machine can read and translate into a group of program steps. The programmer writes the formula in a manner quite similar to normal mathematical notation, and the machine creates its own program to carry out the operation. For example, the formula (a+b)* c/d means: add a to b, multiply the sum by c, and divide this product by d.

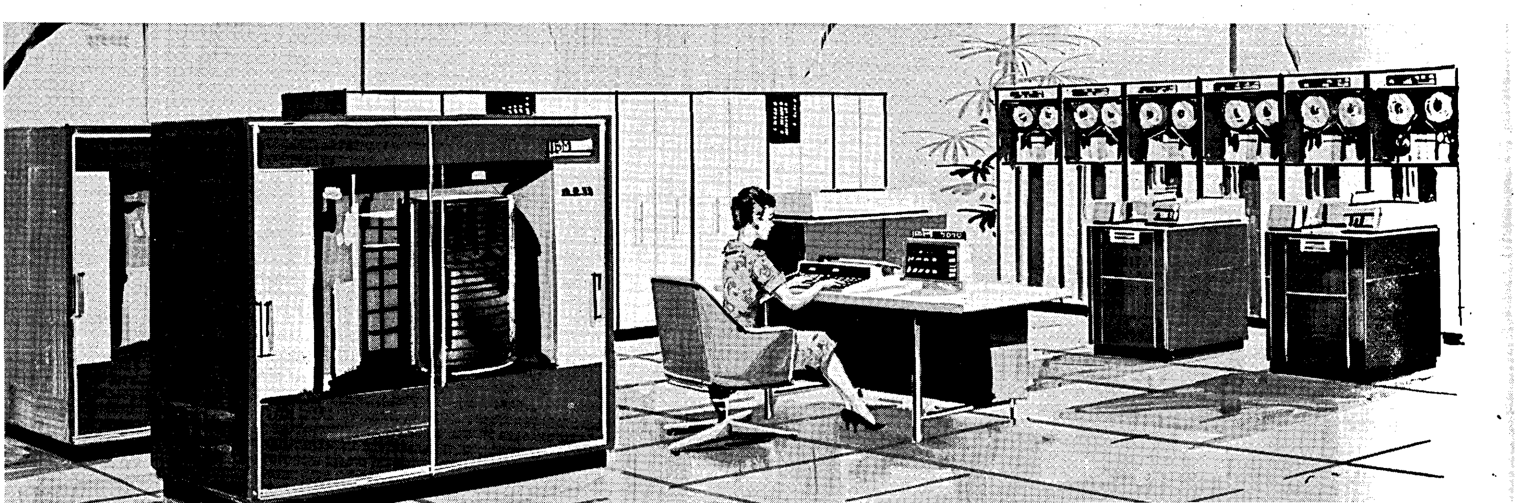
A tape sorting and merging routine will be available for the 7070. In addition, there will be utility routines for clearing core storage between limits, moving disk storage to output, load routines, tracing routines, and so on.

Another feature of the 7070 is Automatic Priority Processing which makes it possible to combine two programs and virtually eliminate any lost time waiting for an operation to be completed. Often programs are said to be "input-bound," "seek-bound," etc., referring to parts of the application that other phases must wait for at some point or points in the program. With automatic priority processing, there is no delay.

One of the programs, called the main routine, has a comparatively large number of program steps. The other, called the priority routine, has relatively few instructions but involves almost continuous use of a card reader, card punch, printer, tape unit, or disk file.

The main routine functions normally, while the tape, disk-storage, or input/output unit of the priority routine is operating. This may include reading a card, punching a card, reading tape, writing tape, seeking a disk file record, reading a file record, or writing a file record. When that operation is completed, the main routine is signalled automatically. It is possible to have more than one tape, disk storage, or input/output unit operating on a priority basis during the main routine. However, only the main routine can be signalled for priority; it is not possible to do this to a priority routine. If a second priority is ready while a first one is in progress, it will wait until the first is completed. The main routine is resumed when there are no priority routines waiting.

Circle 113 on Reader Service Card.



DATAMATION *book capsules*

CENTRALIZED INFORMATION SERVICES:–OPPORTUNITIES AND PROBLEMS by Allen Kent and James W. Perry, 1958, Interscience Publishers, Inc., 250 Fifth Avenue, New York, N. Y., 156 pp., $5.00.

This book presents an introductory analysis and summary of studies directed to the investigation of advantages and feasibility of centralized, cooperative information services.

The results of eight studies and surveys carried out over the past three years by the Center for Documentation and Communication Research at Western Reserve University have been analyzed, systematized and summarized. The purpose of the authors is to clarify the goals and indicate the practibility of future developments. Some contents of this study: Questionnaire on Special Classifications and Information Systems; Information Processing by Professional Societies; High Speed Telecommunication in Centralized Information Services.

SCIENTIFIC PROGRAMMING IN BUSINESS AND INDUSTRY by Andrew Vazsonyi, 1958, John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 474 pp., $13.50.

An attempt to develop a mathematical language understandable to businessmen using scientific techniques to solve managerial problems in terms of business, rather than in terms of mathematics, is presented. These techniques are clarified and mathematical programming and its applications are defined.

The book contains descriptions of the use of linear programming in transportation allocation; the use of statistical methods in production and inventory control. This approach has been applied with successful results, claims author Vazsonyi, in programs discussed with business people and case histories have been included.

NONDESTRUCTIVE READOUT OF MULTILEVEL MAGNETIC MEMORY by R. L. Van Allen and C. B. House, 1958, Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., Order PB 131475, 26 pp., .75 cents.

This is a report on a new method developed for nondestructive readout of memory cores as a result of Armed Forces-sponsored research and development in electronics. The method, an infinite-resolution of reading the flux level in a magnetic core without destroying this flux level, uses solid-state devices, requires less than ten milliwatts supply during nondestructive interrogation, while standby power drain is in the microwatt range.

Output information is in the form of an alternating waveform whose frequency is a function of the flux level of the storage core. Frequency ratios of 30:1 were obtained. Also developed – a circuit for clearing and resetting a core in preparation for further information storage.

AUTOMATION EXPRESS, International Physical Index, Inc., 1909 Park Avenue, New York 35, N. Y., $57.50 for one year.

Volume one, number one, published in May of this year, is the initial 40-page offering of a comprehensive digest of current Russian literature dealing with automation topics. Sifting timely articles from the current issues of many Russian technical journals each month, the publishers of the new digest present such articles as Digital and Analog Computer Systems, Servomechanisms and Components, and Magnetic Amplifiers and Circuits, with liberal use of figures and diagrams, accurately translated from the Russian into easy flowing English.

AUTOMATIC DATA REDUCTION SYSTEM–AMPLITUDE-DISTRIBUTION AND CORRELATION ANALYSES by A. Shapiro, Naval Research Laboratory, Dec. 1957, OTS, U. S. Department of Commerce, Washington 25, D.C., 11 pp., .50 cents.

Described and discussed are many forms of radio and radar data and a data reduction system which performs these analyses automatically, using data recorded on film as input. A film reader converts data to digital voltages which are totaled in a 30-level amplitude distribution.

GRIN AND BEAR IT **By Lichty**

"This eliminates guess work in medicine, doctor! Feed it symptoms and it diagnoses the case, writes a prescription and indicates the size bill the patient can pay!"

EJCC SITE—PHILADELPHIA

Over 3,000 delegates are expected to attend the Eighth Annual Eastern Joint Computer Conference which will be held on December 3, 4 and 5 in Philadelphia—at the Bellevue Stratford Hotel.

Included in the conference program are technical sessions, exhibits, a party – reception and a luncheon.

"Modern Computers – Objectives, Designs and Applications" is the theme of this year's EJCC which is sponsored by the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Association for Computing Machinery. Conference Chairman is Peter E. Raffa of Technitrol Engr. Co., Philadelphia.

"This industry is in a transition period—going from huge expenditures for research and development to a marketing program which will induce commercial sales and applications," an EJCC spokesman noted, adding, "this trend will be reflected both in the sessions and the exhibits."

Technical papers, dealing with a wide range of data processing subjects, will be presented by individuals prominent in the industry. Exhibits will cover equipment, components and services related to all phases of computer and data processing systems.

Installation of exhibits will begin on Dec. 2. They will be open from 9:30 a.m. to 9 p.m. on Dec. 3, and from 9:30 a.m. to 6 p.m. on Dec. 4 and 5. Handling all exhibit arrangements is John Leslie Whitlock and Assoc., 6044 Ninth St., Arlington 5, Va.

Vice Chairman for Registration is William E. Bradley, Philco Corp., G and I Division, Philadelphia.

In the November/December issue, DATAMATION will feature complete and detailed coverage of the Eastern Joint Computer Conference with pictures, complete program details and exhibitor information. This is in keeping with our policy of providing full coverage for every Eastern and Western Joint Computer Conference.

COMPUTER SYMPOSIUM

armour sponsors for fifth year

With the purpose of providing an effective medium of communication for persons and organizations concerned with the broad field of computers, Armour Research Foundation is again sponsoring—for the fifth year in succession—a Computer Applications Symposium. The 1958 meeting will be held at the Morrison Hotel, Chicago, on October 29 and 30.

Symposium committee chairmen, F. C. Bock, R. B. Wise and M. J. Jans, have stated that the sessions will stress the use of new computers and accessories, new techniques of computer programming, organization and operation of computer installations . . . and new applications. (This year Armour Research Foundation of Illinois Institute of Technology, have announced the expansion of their computing facility.)

Reservations can be made for one or both days by writing to Mr. M. J. Jans, Conference Secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill. Fee is $20 for one, $30 for two days, luncheon included.

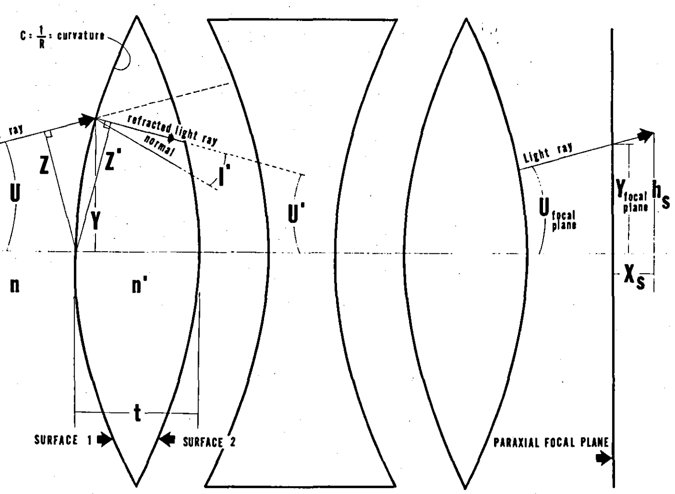
Monday morning, October 29: 8:00—Registration. 9:00—Welcome address by Mr. H. A. Leedy, Director, Armour Research Foundation. 9:10—"Operations Research and the Automation of Banking Procedures," R. A. Byerly, Director of Research, National Association of Bank Auditors and Comptrollers. 9:50—"Information Systems Modernization in the Air Material Command (Univac 1105, IBM 709)," D. E. Ellett, Colonel, USAF, Chief of Data Development Division, Air Materiel Command. 11:00—"Utilization of Computers for Information Retrieval," Ascher Opler, Consultant with Computer Usage Company.

Monday afternoon: 12:20—"Problems and Prospects of Data Processing for Defense," C. A. Phillips, Director of Data Systems Research Staff, Office of the Assistant Secretary of Defense (Comptroller). 1:50—"An Integrated Data-Processing System with Remote Input and Output (NCR 304)," R. D. Whisler, Systems and Audit Manager, S. C. Johnson & Sons, Inc. 2:30—"The Role of Character Recognition Devices in Data-Processing Systems," R. L. Harrell, Director of Electronics Processing, The Reader's Digest Association. 3:40—"Input-Output, Key or Bottleneck?" R. D. Elbourn, Chief of Components and Techniques Section, Data Processing Systems Division, U. S. Department of Commerce. 4:20—Panel discussion between session chairmen and speakers.

Tuesday morning, October 30: 8:00—Registration. 9:00—Welcome address by V. H. Disney, Manager of Electrical Engineering Research Department, Armour Research Foundation. 9:10—"Scientific Uses of a Medium-Scale Computer with Extensive Accessory Features (IBM 650)." Richard A. Haertle, Supervisor, Engineering Mathematics Group, AC Spark Plug Division, General Motors Corporation. 9:50—"Optimizing Designs with Computers," D. D. McCracken, Associate Research Scientist, Institute of Mathematical Sciences, New York University. 11:00—"Computer Applications in the Numerical Control of Machine Tools," R. B. Clegg, Engineer, Servo Machine Tool Division, Kearney and Trecker Corporation.

Tuesday afternoon: 12:20—"Frontiers in Computer Technology," R. W. Hamming, Member of the Technical Staff, Bell Telephone Laboratories, 1:50—"Computer Sharing by a Group of Consulting Engineering Firms, (Bendix G-15D)," E. M. Chastain, president, and J. McCall, general manager, Midwest Computer Service, Inc. 2:30—"Current Developments in Computer Programming Techniques (IBM 650, Univac 1)," Frederick Way, III, Assistant Director, Computing Center Case Institute of Technology. 3:40—"The Future of Automatic Programming (Univac 1103A, IBM 704)," Walter F. Bauer, Director, Computation and Data Reduction Center, Space Technology Laboratories. 4:20—Panel discussion.

DIGITAL COMPUTER AIDS IN OPTICAL SYSTEMS DESIGN



by EUGENE THORBURN
Optical Engineer
Pacific Optical Corporation

Common to the successful solving of practically all design problems in the development of today's highly complex physical systems is the mass of computations that must be continually processed as the work progresses.

How well this load of computation is managed may well be the determining factor in the profit or loss aspects of a new development; at the least, it strongly influences the degree of precision attained in the final product.

The formulation of the basic approach, the selection of the appropriate theories and concepts, the garnering of the necessary data, and the establishment of the correct design procedures, these are all matters within the technical control of the design engineer.

But the rapid and accurate evaluation of mathematics that represent the system's performance is not. For this, the design engineer today is dependent on the extent and appropriateness of the computing and calculating equipment that is available to service him at the right time and at the right place for maximum speed in the handling of this mathematical load.

Mathematical evaluations on what any system will accomplish when it is built is called "proving out" the design philosophy. And unless continuation of the design approach can be maintained by frequent mathematical evaluations accomplished quickly, it will either delay final production of the system or waste a great deal of the design group's time — a serious cost penalty in today's era of "profit-squeezing." Design complexity, with its associated volume of mathematical problem solving and performance prediction, is especially prevalent in the field of advanced optics.

Diagram (above) illustrates parameters involved in mathematical representation of path of light ray through optical systems. System performance is measured in terms of aberrations which are deviations of actual image from image derived assuming perfect lenses.

In optical system development, the mathematics employed actually predict the performance of the lenses and lens systems in terms of the deviations of light rays passing through the system from those optical paths that would give the desired object-image relationship.

These actual deviations from the theoretically required paths are imposed by the physical limitations of optical materials. Also, there exists always some finite difference between the nature of the point-source world and physical reality.

This relationship frequently imposes severe problems and involved calculations in optical design because the product of these deviations is the difference between the object as considered by the optical system and the image actually produced by the system.

The difference between the image and the object are grouped under such nomenclature as focus, resolution, depth of field, and other representative optical performance parameters.

No one has ever constructed a perfect lens system. This is a physical impossibility. Fortunately though, it is possible to accurately predict what degree of imperfection any given system will have.

But this process of predicting lens system performance is highly complex, and its solutions require not only long but also tedious mathematical calculations. The extent of the mathematical labor borders on the fantastic and can frequently price a system right out of the realm of practicality, certainly remove it from a competitive cost range.

The length and complexity of the mathematics required can rapidly be appreciated by considering that, prior to the advent of electronic computing methods, a competent lens designer often spent two or more years developing and perfecting a lens system of average complexity. Now, with the rapid advances in the field of optics, manual calculations by a designer could take a lifetime.

The majority of the designer's calculating time is not necessarily spent in formulating the basic system design. In most instances, he has to crank through the arithmetic involved in determining the effects of various adjustments in the component characteristics of the overall system. This means that, whenever he substitutes one component for a more suitable lens part, he has to recalculate these changes and how they effect the overall system.

optical firms and computers

Before electro-mechanical desk calculators first came along, the designer would spend years calculating any given project. The new calculators reduced the figure to months of computing time. But even this considerable reduction left the overall cost in time too heavily balanced in favor of essential computing time.

Although the later developed electronic computers are now frequently applied in the more complex segments of general industry, their use by optical firms has been relatively rare.

This lack of utilization might possibly be explained by the fact that, although optical manufacturers have had very definite need for their own computers, the initial cost of computing systems in relation to the potential sales volume of optical systems was difficult to justify by cost-conscious management.

On the other hand, a management team in the optical industry, aware of all contributing phases of their industry's problems, needs to balance a considerable first financial outlay against direct savings in design labor costs and indirect saving resulting from more rapid completion of final deliveries of the systems.

In a great many cases it has been proven that the introduction of fully electronic computers greatly reduced the amount of time spent in optical system development and changed the status of optical designers from arithmetical monitors to creative engineers.

Under the regime of the electronic computer, calculations as well as evaluations of the complex mathematical representations of optical system performance requires not months, but minutes, and more often seconds.

To the casual observer the mathematics predicting the performance of a single lens or the composite of lenses in a multi-lens optical system might seem rather elementary in comparison to the highly complex forms in use in today's technology. And, no optical designer would take issue with this observation. However, it is not the degree of mathematical sophistication involved, but the sheer weight of the computational burden that has turned the optical designer to the use of digital computers.

This mass of mathematical labor is the result of optical design being more of an art than science. While the relationships between the behavior of light rays and the characteristics of various media are exactly bound by unequivocal equations, the utilization of these relationships to produce high performance optical systems depends to a major degree on the judgement, experience and patience of the optical designer.

The various optical aberrations that constitute the deviation of the actual image produced from that produced by a theoretically perfect lens system cannot be singled out one by one and corrected without certain penalties in other aspects of system performance. This interaction between the several forms of aberrations require that optical designers operate in a constant state of compromise to arrive at the 'optimum' design.

This necessity for compromising advantages and weighing disadvantages sets the requirements for the ability of the designer to follow very carefully the performance trends of the system as shown by the computations. On the basis of the calculations, complemented by his experience and design judgement, the designer must make those interacting changes and adjustments in lens configuration, material, and system concept that will eventually result in satisfactory system performance.

This cut-and-try procedure is as old as optical system design, but at least relief from the drudgery of the computations has been provided by the digital computer.

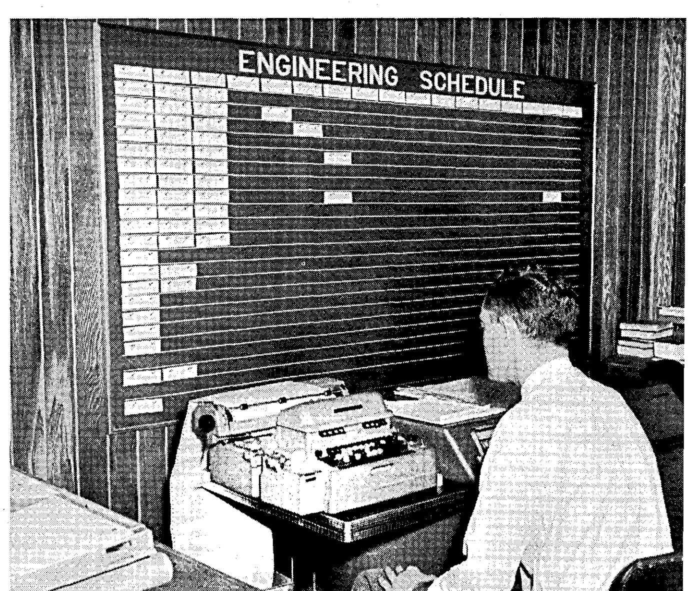
optical mathematics

The figure on page 42 is a functional diagram of the relationship between light rays and optical surfaces that form the basis of optical system design. This interaction and its associated mathematics must be investigated at each optical surface of the system and for a large enough assortment of light rays from various portions of the object to give a proper evaluation of the system performance. Opening and surface equations would express the relationships at the first surface. Transfer equations would relate the results of the first surface effects of the second surface where the surface equations must be applied again. Closing equations would establish the coordinates of the light ray as it reaches its focal point at the end of the system in terms of height above the optical axis and distance from the theoretical focal plane.

The final coordinates of the ray and the intermediate orientations are exact traces of the ray's path through the system. The deviations of this path from the path predicted by assuming perfect lens performance are a measure of the optical system's performance.

The final design of a lens system requires the thorough investigation of system performance by means of this

Royal McBee's LGP-30 desk-sized digital computer is now operating in the design department of Pacific Optical Corporation. The computer's flexibility and memory capacity make it well suited for the field of optical systems design, according to Pacific officials.



exact ray trace method. As many as thirty rays testing the performance of various portions of the lens surfaces must be carried surface-by-surface through the system. The lens designer observes the system performance in terms of the ray orientation and distribution, and makes adjustments and modifications required to optimize the system.

Fortunately, the nature of optical aberrations is such that they may be pitted against each other to achieve overall improvements. That is, carefully chosen use of certain aberrations in some lenses may result in a countering of the aberrations resulting from other lenses to the end that the final overall system aberration is much smaller than the individual lens contributions.

This portion of the design procedure places the greater portion of responsibility for success on the designer's mastery of the "art." His ability to recognize the nature of the aberration, his knowledge of the most efficient corrective action, and his appreciation of the effect of the corrective action on various other system parameters, marks the difference between success and failure of the design. It is in this area of the design effort that the digital computer, by furnishing the designer with rapid evaluations of the effects of his design judgement, proves most valuable.

two design aids

To permit rough estimates of system performance during the preliminary design stages, optical designers employ approximations to the ray trace equations which provide reasonable evaluation of the third order aberrations and overall system performance. The usual procedure is for the designer to prepare, on the basis of past experience and theoretical performance calculations, the complex of lenses and optical surfaces he deems necessary to perform the required optical task.

Once the basic system has been established the third order aberrations are computed. At Pacific Optical, the LGP-30, purchased from the Royal McBee Corp , has been programmed to perform this series of computations. The capability of the program is such that systems consisting of as many as forty optical surfaces may be analyzed.

To use the computer, the designer feeds in the curvature, thickness, and index of refraction associated with each surface of the system. The output of the computer consists of the following aberrations: spherical, coma, astigmatism, distortion, transverse longitudinal color, transverse oblique color, and Petzval curvature.

These values are printed out in terms of the contributions of each surface, and the total value of each form of aberration is also printed. Plotting these values permits the designer to re-evaluate the performance of the system and begin the series of modifications that will lead to the final design.

Previously, the majority of design work was done using the third order aberrations, except for the very final system modifications, since the amount of computation was drastically reduced in comparison to the exact ray trace procedure. However, the utilization of the LGP-30 has permitted more frequent application of the ray trace technique. The entire ray trace procedure has been programmed on the LGP-30.

As in the programming of the third order aberrations, forty optical surfaces may be considered, and the inputs of curvature, thickness, and index of refraction associated with the several surfaces are all that are required. Computer output consists of Y, sin I, and sin U, at each surface plus values of Y, U, h_s, and X_s, at the focal plane.

Consideration of the capabilities of digital computers in optical design problems have led to the concept of utilizing the computer as a means of accelerating the optimization process. Under the proposed system the basic optical system would be established and the corresponding surface data fed to the computer. A suitable criterion for optimal system performance would be established as the computer objectives. A program would be proposed permitting the computer to make adjustments in the characteristics of the surfaces on the basis of systematic trial and error operations.

Pacific Optical Corporation is devoting considerable effort in the development of such a computerized design program. In fact, the anticipation of the long range necessity for and advantages of such a program had considerable weight in making the choice of computers be purchased. The flexibility and storage capabilities of the LGP-30 make it suited for application to these computing concepts, according to Pacific Optical officials.

In considering any segment of our rapidly advancing technology, no part can be isolated from the whole. Every science today is being buffeted and shaped by the needs and demands of other sciences.

Our recent leap into space with missiles and satellites has loosed a flood of demands for more precise and elaborate optical systems for visual tracking, astranavigation.

The streamlining of industrial manufacturing is opening a broad market for optical measuring techniques yielding increased resolution in process control systems.

Television is impatiently awaiting improved camera lenses, motion pictures are desparately searching for better depth dimension effects, and the progress of aerial photo reconnaissance and mapping in three dimensions is hungry for improved equipment.

Nor is the matter entirely one of merely broadening and refining the product. Along with expanding applications has come a compacting of the time with which these new demands for optical equipment must be satisfied.

On both of these counts, broadened application and sharply constricted delivery schedules, the in-plant, readily available computer has become inevitable if optical systems manufacturers are to meet their responsibilities in the years ahead.

Circle 114 on Reader Service Card.

new DATAMATION *literature*

TRANSISTOR MANUAL: This is the third edition of this transistor manual first introduced in 1957. Fully covering circuits of various types, a completely revised section on applications and giving specifications, it tells in its 168 pages how to build almost everything using transistors. Describing basic semiconductor theory, the meaning of transistor parameter symbols, how to read a transistor specification sheet, the company contends it is of interest to expert and student. Copies are priced at $1.00. For copy write GENERAL ELECTRIC COMPANY, Semiconductor Products Department, Syracuse, N. Y. or use reader service card.
Circle 200 on Reader Service Card.

DIGITAL CONTROL COMPUTER: Four-page reference bulletin describes the RW-300 Digital Control Computer. Process control, data logging, pilot plant, and test facility applications for computer control systems are discussed and detailed specifications are listed. The computer incorporates analog-digital conversion equipment, handles up to 1,024 analog inputs, up to 128 analog outputs. Operates with wide range of digital input and output equipment: automatic typewriters paper tape and punched card readers, paper tape and card punches, and on-off devices. For copy write THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS CO. P. O. Box 45067, Airport Station, Los Angeles 45, Calif. or use reader service card.
Circle 201 on Reader Service Card.

DIGITAL MODULES: An eight-page supplement to this manufacturer's Catalog T describes the six new additions to the Series T group of transistorized digital modules. Illustrations and prices for each model are included along with a concise description of the unit and its applications. The models incorporated in this catalog supplement are: T-Pac Serial Memory model SM-10; T-Pac Static Flip-Flop model FS-10; T-Pac Thyratron Driver model TO-10; Indicator Panel model TI-10; Thirty Unit Delay Chassis model DU-10; Plugboard Panel model PB-10. For copy write COMPUTER CONTROL COMPANY, INC., 92 Broad Street, Wellesly 57, Massachussetts or use reader card.
Circle 202 on Reader Service Card.

FLIGHT DATA SYSTEM: Twenty-three page brochure on this manufacturer's Victor System 272 has fifteen diagrams and photographs illustrating the FM Flight Test Data System designed to record and process data aboard flight test aircraft with high accuracy. Automatic correction occurs by mechanical and electronic means when data is processed through reduction equipment at ground station. For copy write VICTOR ADDING MACHINE COMPANY, Government Contract Office, 3900 North Rockwell Street, Chicago 18, Illinois or use reader service card.
Circle 203 on Reader Service Card.

PORTABLE OSCILLOGRAPH: New portable two-channel oscillograph package with built-in amplifiers, Brush Mark II, is fully described in this four-page, two-color bulletin Designed for applications considered impractical for direct writing recording of electrical and physical phenomena this recording unit requires no additional equipment for operation, features pushbutton selection of our chart speeds. Low inertia, frictionless, the Mark II records directly onto ink paper. For copy write BRUSH INSTRUMENTS, Division of Clevite Corporation, 3405 Perkins Avenue, Cleveland 14, Ohio or use reader card.
Circle 204 on Reader Service Cord.

ANALOG COMPUTER TRANSISTOR: A six-page booklet deals with one phase of the transistor production cycle. Titled, "An Analog Computer Study of the Stability of a Molten Zone Refining Process used in the Production of Transistors," it describes and illustrates by diagrams technique of simulating on the analog computer, conditions experienced by a germanium rod under various conditions of temperature, rod diameter, and length of molten zone. Explained is how the analog computer can quickly, accurately solve non-liner problems for conditions impossible to observe accurately in their true state. For copy write ELECTRONIC ASSOCIATES, INC., Long Branch, New Jersey or use reader service card.
Circle 205 on Reader Service Card.

TAPE RECORDER: The new Model C-100 series of instrumentation tape recorders is fully described and illustrated in this four-page bulletin, available free to qualified members in the field. Characteristics, operating features and complete engineering specifications of the new transistorized recording system are given. Simplicity, compactness and dependability of the C-100 series is stressed. For copy write MINCOM DIVISION, Minnesota Mining and Manufacturing Company, 2049 South Barrington Avenue, Los Angeles, California or use card.
Circle 206 on Reader Service Card.

FILE-COMPUTER SYSTEM: Booklet U 1562 describes company's Model 1 File-Computer Data Automation System. Features described include: concept of building block construction, random access to the magnetic storage drums, advantages of combined internal and external programming, variety of input-output equipment. Also discussed: the parity check, automatic character and blockette counters, checking of computations by reverse arithmetic process. For copy write REMINGTON RAND Division of Sperry Rand Corporation, 315 Fourth Avenue, New York 10, N. Y. or use reader service card.
Circle 207 on Reader Service Card.

PROGRAMMING THE FILE-COMPUTER: A 249-page manual, prepared for trained programmers and computer operators, explains how to program the Univac file-computer. The book is divided into eight principal topics to facilitate study of specific areas of programming and incorporates over 175 illustrations and block diagrams. Of value to businessmen considering using this company's file-computer for data processing. For copy write REMINGTON RAND DIVISION, Sperry Rand Corporation, 315 Fourth Avenue, New York 10, N. Y. or use reader service card.

Circle 208 on Reader Service Card.

DC POWER SUPPLIES: A six-page folder describes manufacturer's custom built DC power supplies for computers, aircraft, military and special applications. Photographs and diagrams, plus chart of relative characteristics of different types of power supplies are included. For copy write GENERAL ELECTRIC COMPANY, Rectifier Department, Lynchburg, Virginia or use reader service card.

Circle 209 on Reader Service Card.

CLUTCHES AND BRAKES: Electromagnetic clutches and brakes of a new miniature line are outlined with specifications in company's twenty-six page booklet. Schematic diagrams, dimensional data and minimum performance curves are provided for ten models. Characteristics and general data is given on last page. These units feature high torque rating, rapid response, zero backlash, – are light weight and moderately priced, according to the manufacturer. For copy write AUTOTRONICS, INC., Dept. #16, Rt. 1, Box #812, Florissant, Missouri or use reader service card.

Circle 210 on Reader Service Card.

ANALOG-PUNCHED TAPE SYSTEM: This manufacturer's Model ZA-750 Analog-Punched Tape Data System is described in a four-page brochure. Principles of operation, output format, technical specifications and construction are given. Designed to meet requirements for a rugged, economical, low speed data processing system, model ZA-750 contains plug patch-board permitting quick and easy changing of program format. For copy write ELECTRONIC ENGINEERING COMPANY OF CALIFORNIA, Sales Department, 1601 E. Chestnut, Santa Ana, California.

Circle 211 on Reader Service Card.

TRANSICON DATRAC: Six-page folder illustrates this company's modularized, transistorized, reversible analog-to-digital and digital-to-analog converters, and alarm limit monitors. Line drawings and a description of the models is given. Folder contains ten pictures of Transicon Datrac plug-in building blocks and specifications on analog-to-digital, digital-to-analog converters and alarm limit monitors. For copy write EPSCO, INC., Equipment Division, 588 Commonwealth Avenue, Boston 15, Mass. or use card.

Circle 212 on Reader Service Card.

BASIC SWITCHES: A revised thirty-two-page edition of Basic Switch Catalog 62c, with illustrations and diagrams, gives details of over 200 catalog listings of basic switches and related devices. Page twenty-seven contains technical information on installation, mounting and proper selection. Switches detailed include the new high-precision roller lever switch; the adjustable actuator switch for fine adjustment; the "pulse" switch for securing electrical impulses without complicated actuating mechanisms. For copy write MICRO SWITCH, A Division of Minneapolis-Honeywell Regulator Company, Freeport, Illinois or use reader service card.

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DATA ACCUMULATOR: New automatic inspection data accumulator for tinplate, model GE 302, is covered in this four page booklet. Designed specifically for an industrial environment, maker contends this new magnetic drum system reduces accustomed number of electronic circuits; increases system reliability by reducing complexity. Booklet contains illustrations, diagrams and specifications. For copy write GENERAL ELECTRIC COMPANY, Computer Department, 1103 North Central Avenue, Phoenix, Arizona or use card.

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TAPE RECORDER/REPRODUCER: Model FR-100A, modular magnetic tape recorder/reproducer for instrumentation, is fully described in this fourteen-page, four-color booklet. Photographs and information explain how this latest equipment is being used and back page lists company equipment specialists where specifications may be obtained. For copy write AMPEX CORPORATION, Instrumentation Division, 860 Charter Street, Redwood City, California or use reader service card.

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ANALOG COMPUTER: A fully illustrated 18-page brochure and folder describes MC-5800 analog computer. Fourteen pages of specifications and descriptions are included in a four-page folder. The folder is a photographic model of the MC-5800 computer clearly illustrating the unique packaging wherein the computer may be instantly "unzippered" from the confines of its cabinet for unobstructed access during maintenance. Other features of the computer are described including circuit logic required for building-block flexibility, adaptability for high speed repetitive operation, bivariable function generation, complete automatic problem check. For copy write MID-CENTURY INSTRUMATIC CORP., 611 Broadway, New York 12, New York.

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INTEGRATED DATA SYSTEM: Systems for gaining instrumentation computed data in rapid time is detailed in this two-page folder. The manufacturer's Automatic Data Recording Monitoring System, designed for acquisition and processing of data from rocket or jet engines, is outlined with a system block diagram illustrating data flow and typical components. A small, general-purpose digital computer is an integral part of the system. For copy write CONSOLIDATED ELECTRODYNAMICS CORPORATION, Systems Division, 300 North Sierra Madre Villa, Pasadena, Calif. or use reader service card.

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ANALOG, DIGITAL UNITS: In an eight-page General Electric booklet, computers and computing systems, analog and digital, are described. Covered are such subjects as, "GE 100 Electronic Data Processor for Banking Applications," "GE Transistorized Magnetic Ink Character Reader," "GE 310 Data Acquisition System for Process Monitoring," "GE 302 Automatic Inspection Data Accumulator for Tinplate," "GE 309 Gage Logging System," "GE 307 Miniaturized AC Network Analyzer," "GE 306 Analog Computer," "GE 308 Economic Dispatch Computer," "GE 301 Heat Rate Computer," "GE Industrial Card Reader." For copy write GENERAL ELECTRIC COMPUTER DEPARTMENT, 1103 North Central Avenue, Phoenix, Ariz. or use card.

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MINIATURE CLUTCH AND BRAKE: Four page leaflet on manufacturer's new line of miniature clutches and brakes. Applications include drive for tape reader; position type servo for analog and digital computer. Leaflet gives dimensional data, specifications and minimum performance curves for electro-magnetic brake model BF-125; clutch model C-125 and brake-clutch model MC-125. For copy write AUTOTRONICS, INC., Dept. #16, Rt. 1 Box #812, Florissant, Missouri or use card.

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