

July through September, 1957

IBM Technical Papers Published in Other Journals

Considerations in the Design of Character Recognition Devices, E. C. Greanias and Y. M. Hill, *IRE National Convention Record*, Pt. 4, 119-126 (1957).

Basic factors defining the character recognition problem are discussed, including the range of style, the range of quality, and the number of different symbols to be recognized. Definitions of character quality and style factor are proposed, which assist in understanding the scope of the problem, in designing the information handling steps, and in the evaluation of character recognition devices. Practical procedures are suggested for the derivation of design parameters for each information handling step on a digital computer. By this means, a design can be obtained which is a function of the actual characters the device has seen and of the design rules.

Fade-Canceling Zero Beat Indicator for Reception of Standard Radio-Frequencies, Richard J. Blume, *The Review of Scientific Instruments*, **28**, No. 9, 703 (September, 1957).

A simple circuit is described which enables a local secondary frequency standard to be set quickly to a definite zero beat with a received short-wave signal. In principle, two identical receivers, both fed by the same antenna, are used. One receiver picks up WWV, for example, and a weak signal from the local standard. The other picks up WWV either alone or together with a second weak signal from the local standard, which is 180° out of phase with the first. The outputs of the detectors of the two receivers are subtracted, leaving only the beat note, which is recorded on a strip chart. In practice, one unmodified AM receiver is used on a time-sharing basis by means of a chopper. The bandwidth of the device may be made much less than one cycle per second, and therefore, it is particularly useful when the WWV signal is reasonably stable in phase but far too weak for an audible zero beat. Alternatively, the device may be regarded as a simple means of observing fast Doppler shifts of a received standard frequency signal. A schematic diagram and sample recorder charts are included.

Ferrimagnetic Resonance in Gadolinium-Iron Garnet, B. A. Calhoun, J. Overmeyer, and W. V. Smith, *Physical Review* **107**, No. 4, 993 (August 15, 1957).

Ferrimagnetic resonance has been observed in gadolinium-iron garnet from -192° to 72°C . The apparent g factor and line width have their maximum values at the compensation point (13°C). The coincidence of the maximum g with the vanishing of the magnetization implies that the g factors of the Gd^{+3} and Fe^{+3} are equal. The temperature dependence of the integrated intensity of the absorption is very similar to

that of the magnetization. Below -150°C , both g and the line width increase with decreasing temperature.

Growth and Optical Absorption of SrS Single Crystals, G. Cheroff, M. Okrasinski and S. P. Keller, *The Journal of Applied Physics*, **27**, No. 1, 330-31 (July, 1957). (Published as a letter to the editor.)

Single crystals of SrS have been grown and the optical transmission spectrum has been determined. From the latter, the absorption edge and the energy gap have been measured. This note describes the apparatus used and the results obtained.

IBM Electrostatic Printers, W. D. Bolton and W. E. Goetz, *Penrose Annual* (British), (1957).

The IBM 938 Electrostatic Card Printer and the IBM 939 Electrostatic Address Label Printer are automatic business machines utilizing the xerographic process. These printers reproduce printed data from IBM master cards onto secondary cards or onto mailing labels. A detailed description of the machines is presented. In particular, the newly engineered features not present in the standard process are discussed. Also described are the special optical systems and illumination requirements, including several uses of light peculiar to the requirements of these machines.

The IBM 650 RAMAC Inquiry Station Operation, H. A. Reitfort, *Proceedings of the Western Joint Computer Conference*, 49-51 (1957).

This paper describes the feature of the IBM 650 RAMAC important to "in-line" processing—the facility for quick access to the data processing system from remote locations without interfering with the daily routine. Such interrogation is done through the IBM 838 Inquiry Station typewriter. A description of the operation includes system flexibility, the program tape, the communication system, and the output format.

The IBM 650 RAMAC System Disk Storage Operation, D. Royse, *Proceedings of the Western Joint Computer Conference*, 43-48 (1957).

The IBM 650 RAMAC System combines the computing flexibility of the 650 Magnetic Drum Data Processing Machine with the quick random-access large-scale memory, which may be assembled from several of the 355 Storage Units. The combination may be programmed to perform rapid sophisticated jobs of in-line (single-step) data processing. A comprehensive description of the system and its operation is discussed, including memory capacity, operating speeds, checking, and other pertinent system data.

IBM's RAMAC Memory as Part of a System—Random Access to Data, T. Noyes and W. E. Dickinson, *Automation*, 72-76 (July, 1957).

Various types of equipment can aid the modern manager in obtaining current facts needed for plant operating decisions. One of the most important types is an electronic data storage device which permits not only rapid access to stored information but also access as determined by need. This article discusses such equipment and, by varying the emphasis, the equipment discussions also become a vehicle to illustrate various aspects of the general theme—Random Access Memories.

The Low Temperature Electrical Conductivity of n-Type Germanium, S. H. Koenig and G. R. Gunther-Mohr, *The Physics and Chemistry of Solids*, 2, No. 4, 268-283 (1957).

The dominant conductivity mechanism for the samples measured is associated either with the conduction band or with an impurity conduction mechanism according as the temperature is greater or less than $\sim 4^\circ\text{K}$. The density of impurities is sufficiently low to preclude formation of an impurity band. Rather, the mechanism of impurity conduction fits a model recently proposed by MOTT wherein compensating acceptors leave ionized donors or defects in the array of neutral donors. Conduction is then possible by migration of these donor defects after they have been thermally activated from the coulomb field of the ionized acceptors.

The conductivity of the conduction band is found to deviate from Ohm's law at fields as low as 3 per cent of the threshold field for the breakdown generally ascribed to impact ionization. A heating of the electron distribution with a subsequent variation of both mobility and carrier density is found to be responsible for this deviation. The variation of carrier density is presumed to be caused by a velocity dependence of the probability of capture of a conduction band electron by an ionized donor, whereas the mobility variations are due to the velocity dependence of the cross section for scattering both by ionized impurities and phonons.

Minimization of the Partially Developed Transfer Tree, M. P. Marcus, *IRE Transactions on Electronic Computers*, EC-6, No. 2, pp. 92-95, (June 1957); also **Minimizing Partially Developed Relay Tree Circuits**, M. P. Marcus, *Electrical Manufacturing*, 102-105 (August, 1957).

A transfer tree is a particular type of multiterminal network having a single input which may be connected to any one of a number of outputs. An n -relay transfer tree is partially developed if it has less than 2^n possible output terminals. Rearrangement of a partially developed tree can lead to a reduction in the total number of transfers required. This paper presents a method of obtaining a developed transfer tree with the minimum number of transfers.

Measuring Starting Torque During Environmental Tests, T. F. Konzal, *Electrical Manufacturing*, 152-153 (July, 1957).

For optimum servo system design, starting torques for small components, such as resolvers, potentiometers, etc., must be determined accurately under various environmental conditions. This paper describes a torque tester which allows the operator complete control over the unit being tested without disturbing the specified environment. This tester makes use of a pulley arrangement attached to a rotating drum which contains the component being tested. A weighted indicator dial is mounted on the same shaft that rotates the drum.

Programmed Marginal Checking of the SAGE Computer, H. M. Beisner and R. J. Brennan, *Convention Record of the First National Convention on Military Electronics* (June 17-19, 1957). (Sponsored by the IRE Professional Group on Military Electronics.)

Computer reliability can be increased by the ability to predict circuit failures before they actually occur. The marginal checking system used in the SAGE computer aids in predicting failures swiftly and accurately. This paper deals with the controls for this marginal checking system and how these controls may be programmed for fully automatic marginal checking operation. A procedure for selecting a circuit, applying a margin, and detecting a failure is discussed.

A Reliability Program, R. E. Kuehn, *IRE Convention Record*, 5, Pt. 10, 32-35 (1957).

This paper presents an analysis of reliability engineering and its relation to component engineering environmental testing, systems evaluations, and flight tests. The need for a reliability program to start in the planning stage and to continue through customer use is emphasized.

Reliable Operation of Electron Tubes in the SAGE System, N. E. Nitschke, *Convention Record of the First National Convention on Military Electronics*, (June 17-19, 1957). (Sponsored by the IRE Professional Group on Military Electronics.)

In the design of the computer for the SAGE System, every effort was made to have its operation as reliable as practical. Since electron tubes were felt to be the least reliable component, they were broken into two groups—"workhorse" and other. Both groups have de-rated operating conditions but special emphasis was given to the workhorse tubes from the standpoint of use in as many applications as possible, thus keeping variety of tube types to a minimum. Special attention was also given to improving these types from the standpoint of reliability and long-life performance. Results of this improvement program have decreased the failure rate for all causes to less than 7% of the nearest commercial equivalent.