The above have been measured, along with the steady-state brightness, at frequencies from 60 cps to 500 kc. From these measurements it is concluded that device applications of EL cells are feasible where fast rise bursts of light are required.

5) Electroluminescent Display Devices—L. W. Evans, Sylvania Electric Products, Inc.

One of the most recent fields of electron device development has been in the use of the phenomena of electroluminescence and photoconduction to produce devices of many kinds which find application in varied ways in the electronic industry. It is the purpose of this paper to show several of these devices which are being produced today in order to acquaint the electronic design engineers with their availability and their design characteristics.

This field can be arbitrarily divided into several separate types of devices. This is typified as follows:

1) Readout devices.
2) Electroluminescent-photonconductor circuit elements.
3) Crossed grids.
4) Bistable panels.
5) Special devices for photographic application.

By combining electroluminescent devices with photoconductor elements, the useful range of such devices can be greatly extended. Typical of such devices are translators, encoders and decoders, logic circuits, bistable panels, and image converters. Such a device as a translator in combination with a binary to decimal decoder will allow numerical readout on an electroluminescent panel.

After discussion of these devices, it becomes apparent that they can find usefulness in digital readout equipment, large display boards such as airline terminal boards, etc., plotting boards for military application, automatic scoring devices, and information storage devices. In addition, it will be apparent that other constructions of specialized nature will be suggested to the equipment design engineer.


A beam-deflection tube is described which converts the amplitude of an input voltage into an eight digit binary output at sampling rates up to 10 Mc. The tube employs a ribbon beam with a line focus, which impinges on eight columns of apertures in a code plate. The line focus is oriented perpendicular to the columns of apertures and the beam is electrically deflected by the input signal in a direction parallel to them. These apertures are arranged so that the electrons penetrate the "digit columns" in a binary pattern which identifies the beam position. Output collector electrodes, one associated with each digit column, produce output currents in parallel. An output current of 50 μA per digit is obtained by the use of a secondary electron multiplication before final electron collection. The important tube-design parameters are discussed with emphasis on deflection-plate design for maximum performance with minimum aberrations.

KLYSTRONS—SESSION IV-A

Session Chairman, J. V. Labacek, Session Organizer, B. G. Ryland

1) Broadbanding Studies of Multimegawatt Klystron Amplifiers—J. Romaine and J. Sadler, Sperry Gyroscope Co., Great Neck, N. Y.

The results of extensive experiments in the broad banding of megawatt klystron amplifiers are presented. Four C-band tubes having 5, 6, 8, and 10 cavities; a 6-cavity L-band tube, and a 5-cavity X-band tube are discussed. It is shown that bandwidths of 10 per cent in L band, 9 per cent in C band, and 5 per cent in X band can be achieved by proper stagger tuning of the driving cavities and use of a broad-band output circuit. Examination of the relationship between gain and bandwidth indicates that the choice of design parameters becomes more critical as the number of cavities is increased.

In the study of broad-band tubes, it is convenient to consider the drive bandwidth and output circuit separately. The drive bandwidth is defined as the bandwidth obtainable from the drive section with essentially a constant-impedance output circuit, i.e., a tunable output cavity. The overall bandwidth results from the combination of the response curves of the drive section and the output circuit. In practice it has been found that the tuning producing the flattest gain characteristic for the drive bandwidth must be modified in order to obtain the flattest overall characteristic with broad-band output circuit.

The broad-band output circuit consists of a double- or triple-tuned filter, the first section of which is the beam cavity. It is designed to produce a Chebycheff type of response. Actual tube filters have yielded a ripple of less than 0.5- to 2.0-db ripple. Over-all tube responses are shown for each tube, and comparisons of tube bandwidth with drive bandwidth are made for the C-band tubes. Conclusions are drawn concerning intermediate-cavity staggering for optimum drive bandwidth and the use of band-pass filters as output circuits.


The design and experimental results of a five-cavity amplifier are described. This tube operates at a mid-frequency of 425 Mc; it has a peak output of 8 Mw, a peak efficiency of 42 per cent, and a 12 per cent electronic bandwidth with the efficiency exceeding 35 per cent over a 10.5 per cent bandwidth.

The driver section of the tube has been designed on an analog computer. Small-signal space-charge-wave theory is modified in the last 2 drift stages by the introduction of kinematic large signal effects. The influence of the design parameters upon optimization of the gain-bandwidth product and phase linearity is studied. Unequal drift lengths and the distribution of cavities with various Q's in the pass band are considered. Considering the transfer function in the complex frequency plane, it is realized that a multi-cavity klystron is to a very good approximation a minimum phase network. A consequent interrelation between the phase and amplitude responses exists which allows the optimization of one only with some sacrifice in the other.

The tube employs a conventional solid beam of perpendicular to the columns of apertures and the beam is electrically deflected by the input signal in a direction parallel to them. These apertures are arranged so that the
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