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Increasing The Stored Writing Rate of Charge-Image Charge-Transfer CRT's

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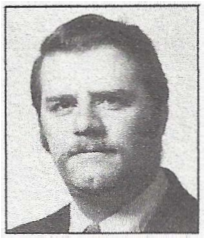

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The world's fastest stored-writing rate (2500 centimeters/microsecond), found in the Tektronix 7834 Fast Storage Oscilloscope, is achieved primarily by a number of design innovations used in the recently patented T7830 cathode-ray tube.

The T7830 is an improved version of the Charge-Image, Charge-Transfer crt, for which Tektronix holds the basic patents.

To achieve the T7830's record performance, Storage CRT Engineering had to (1) increase vertical sensitivity, (2) reduce spot size, and (3) collimate the flood beam to increase writing-speed performance.

The most efficient way of increasing vertical sensitivity without reducing writing-beam energy or using an impractical (for storage tubes) post-deflection acceleration system, is a scan-expansion scheme. (See "Meshless Scan-expansion Schemes", Bill Tomison, **Forum Report 5,** pages 4-8.) This scheme places a quadrapole electrostatic lens between the vertical and horizontal deflection plates.

The lens acts like a divergent lens, in that it enhances the beam deflection produced by the vertical deflection plates. In this way, relatively small deflection voltages can impose large screen deflections on a high-energy beam. Because this technique requires independent beam focusing in the X and Y axes, two additional quadrapole lenses must be placed between the electron gun and the vertical deflection system.

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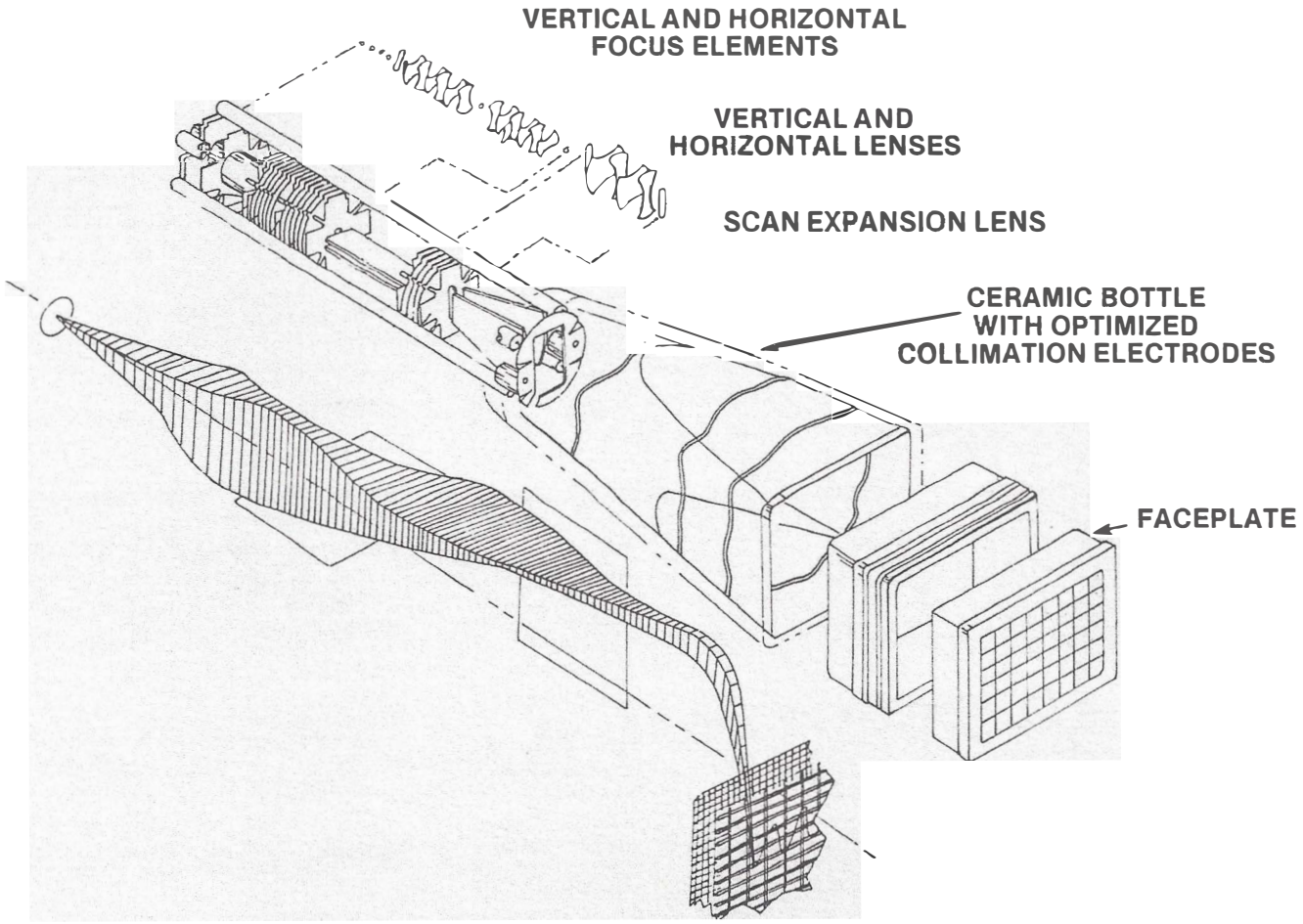

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After deflection, the sharply focused beam strikes the storage target. Because this improved design concentrates the beam energy in a smaller target area than previous designs, a faster writing rate can be achieved.

All storage tubes require auxiliary electron guns that "flood" the storage target in much the same way a slide projector illuminates a viewing screen. These flood guns, however, must be mounted to the side of the tube axis to maintain geometric symmetry of the writing beam deflection. Low energy electrons from these flood guns thus strike or pass through the target at an angle, rather than perpendicular to it, making it difficult to achieve a uniform distribution of electrons over the entire target area. Lack of a uniform distribution, in turn, limits the stored writing rate.

To overcome this limitation, Storage CRT Engineering developed an analytical technique which allows the mapping of electron trajectories through an electrical field that meets the end conditions corresponding to the operating storage system. An optimization program (PROSE) was used to find the best operating condition by yielding the constants in the partial differential equations describing individual electron trajectories and minimizing their landing error at the target surface.

The data thus acquired determined the configurations of collimation electrodes placed on the inner surface of the tube envelope between the horizontal deflection plates and the storage target. The electrodes alter the flood beam electron trajectories so that they strike or pass through the target perpendicular to its surface. This provision reduces the "differential cutoff" (a measure of distribution uniformity) by more than 20% over previous designs, with a corresponding increase in stored writing rate. □

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