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DISPLAY OF TWO DIMENSIONAL ULTRASONIC SCANS

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The paper deals with three aspects of the problems involved in displaying two dimensional ultrasonic scans.
These are video processing, aspects of two of the storage CRT's available for display purposes and finally some possible physical arrangements of systems using storage tubes.

(1) Video processing

The object in video processing is to build up on the screen a two dimensional picture composed of a series of dots which represent the leading edge of each received echo.

In producing the dot on the CRT face we can attempt to preserve the echo amplitude information by employing a linear processing system. Alternatively the echo amplitude information can be ignored and a boxcar processor utilised. This type of processor produces a short square pulse of fixed amplitude and about one micro-second duration irrespective of the echo amplitude, the only requirement is that the received echo exceeds a threshold.

The difference in the characteristics between these systems will be discussed with reference to the type of display obtained and the effect of the boxcar processor in increasing the displayed beamwidth will be indicated. The displayed beamwidth is a function of the type of CRT been driven and the characteristics of the normal CRT while being driven by (a) a linear processor and (b) a boxcar processor are shown and the limited signal dynamic range due to the γ of the CRT and its effect on processing is discussed in addition to the polaroid film characteristic.

The boxcar processor appears to have a better overload characteristic compared to the linear processor and setting of the CRT intensity control is less critical as the boxcar processor produces a constant size spot.

STORAGE CRT's.

As storage tubes are now featuring prominently as a means of display, it is pertinent to discuss the characteristics and indicate what effect these have on the system.

There are two types of CRT commonly being used. The half tone tube and the bistable tube, manufactured by Hewlett Packard; English Electric and Tektronix respectively.

The half tone has a dark background when set for long persistence with a high brightness display. The persistence of the display is variable and can be set to give a picture whose persistence approximates to that of a P7 phosphor. This is suitable for the rapid searching of the abdomen. The long persistence setting permits the long-term storage of the total picture.

The bistable tube does not have such a high light output and background illumination is present.

It does not possess a variable persistence feature. Erasure between scans is necessary to write in new information. The effect of variations in tube intensity setting and its influence in picture characteristics will be indicated with reference to the spot size as the determining criteria.

A brief discussion will be given regarding spot size and such features as image boundary migration and unevenness of store over the area of the screen.

The half tone tube does possess some dynamic range and can thus be driven by either a linear or boxcar processor. The bistable tube having only two levels of brightness available is better suited to being driven by a boxcar type of processor.

DISPLAY SYSTEMS.

Ultrasonic examination of the abdomen uses mostly section scans and reasonably accurate measurements can be made from the screen face. However fetal cephalometry is an important procedure and requires accurate measurement of the head size using an A scan display. In the single tube system the operator has to switch between displays to obtain the measurement. This has to be done three or four times before a satisfactory result is obtained.

Such a system can use either a half tone or a bistable tube; the half tone tube has the advantage of variable persistence but programming would be required to provide an ergonomic situation whereby the display goes into normal persistence when switched to A scan.

A more dynamic situation is to use a system based on a two tube display. The best two alternatives appear to be:-

1) a half tone tube used as the section scan display utilising the variable persistence feature with the second CRT displaying the A scan ; marker dot superimposition on section scan being possible (Hall, Fleming, Abdulla, Ultrasonics Vol. 8, No. 1, Jan. 70) .

To obtain the equivalent versitility with a bistable tube, a CRT with a P7 phosphor can be used for scanning, with a bistable tube for long term display of the section scan; for fetal cephalometry the bistable tube is switched out of store into the A scan mode. Such a system also permits display of the marker dots on section scan.