TECHNICAL DEVELOPMENT REPORT NO. 391

TELEVISION ELECTRONIC MARKER FOR RADAR HAND-OFFS

FOR LIMITED DISTRIBUTION

by

Lawrence B. Ii

Navigations Aids Evaluation Division

March 1959

FEDERAL AVIATION AGENCY
TECHNICAL DEVELOPMENT CENTER
INDIANAPOLIS, INDIANA

FEDERAL AVIATION AGENCY

E R. Quesada, Administrator

D M. Stuart, Director, Technical Development Center

This is a technical information report and does not necessarily represent FAA policy in all respects

TELEVISION ELECTRONIC MARKER FOR RADAR HAND-OFFS

SUMMARY

This report describes the development of a television electronic marker for application with scan-conversion equipments The scan-conversion equipment is used to convert rho/theta radar information to rectilinear television information as well as to store this radar information to provide a trail history of the aircraft targets being displayed The electronic marker has an XY control stick which can be manipulated to mark a particular aircraft on the television raster for controller hand-off to remote locations With this marker, it is possible for a controller to point out any aircraft on the television raster to one or more controllers whose positions are remotely located The marker can consist of any preselected symbol and/or alpha-numeric designation

INTRODUCTION

Scan-conversion equipments are being installed presently in many of the Air Route Traffic Control (ARTC) Centers and control towers in the United States. These equipments convert rho/theta radar information to rectilinear television (TV) information The scan-conversion tube has the capability of storing the rho/theta radar information, and thus provide a trail history of the aircraft targets being displayed. A problem that confronts traffic controllers is that of identifying a particular aircraft on a radar display when the controller positions are remotely located from one another. For rho/theta displays, light guns have been developed[1] to identify the aircraft under consideration. This provides positive target identification but has some disadvantages, such as random triggering of the marker on noise or precipitation, and requiring the radar controller to trigger the light gun only when the sweep passes through the target. Thus, on slow-scan radar (6 rpm - 10-second scan), it is possible to mark a target only once every 10 seconds With the scan-conversion system, new techniques can be employed to facilitate the hand-off function in controlling aircraft. To mark particular targets on the scan-converted TV display, a new type of electronic marker was designed at the FAA Technical Development Center (TDC) This marker can be used to identify positively a particular radar target on TV monitors having the same synchronizing system

[1]Lawrence B. Ii, "A Light Gun for Radar Hand-Off of Aircraft Between Air Traffic Controllers," Technical Development Report No. 384, January 1959

DESCRIPTION OF EQUIPMENT

The electronic marker described in this report may be any selected symbol and/or alpha-numeric designation. This marker can be positioned at any location on the TV raster with a high degree of accuracy and with a minimum of effort and time on the part of the traffic controller by manipulation of the XY coordinate "joy stick," as shown in Fig. 1. Figure 2 illustrates the movement of the marker on a TV display from one position to another.

A block diagram of the electronic marker and its possible system application for radar hand-offs is shown in Fig. 3. The sync separator in Fig. 3 is used to separate the composite horizontal and vertical sync of the scan-conversion or camera equipment. In the vertical block, the sync pulse triggers a linear delay generator to position the marker vertically on the TV raster. This delay generator triggers a display gate generator used to develop a saw-tooth waveform. The length of the vertical display gate determines the number of horizontal raster lines that will scan the marker negative placed over the face plate of a 1-inch cathode-ray tube (CRT). In each horizontal block in Fig. 3, the horizontal sync pulse triggers a linear delay generator to position the marker horizontally on the TV raster. This horizontal delay generator triggers a horizontal display gate generator to develop a saw-tooth waveform. The length of the horizontal display gate determines the size of the horizontal portion of the marker. Thus, the TV raster on the 1-inch CRT consists only of that portion of the total TV raster where the marker is to be generated. This procedure utilizes the maximum CRT resolution for generating the marker.

The CRT raster is intensified by the horizontal display gates which ride on a vertical display gate pedestal. The generating marker information is mixed with the scan-converted information to display the composite video as shown in Fig. 1. Figures 4 and 5 are the schematic wiring diagrams of the prototype marker. A flasher also was worked into the original design to allow the controller to cycle the brightness level of the marker when calling attention to an aircraft that is ready for hand-off. The flasher circuits were designed into the sweep circuits so that additional markers could utilize a common photomultiplier and video amplifier.

TESTS

The electronic marker has undergone minor equipment tests prior to an operational evaluation for radar hand-offs from the Indianapolis tower to the ARTC Center. On December 16, 1958, the marker was installed in the cab of the Indianapolis tower. No adjustments were made other than an adjustment of the photomultiplier sensitivity after the second day of operation. Only two adjustments of sensitivity have been made in the first 720 hours of continuous operation. Maintenance reports indicate that the operation and stability are very good.

CONCLUSIONS

This type of electronic marker for handing off targets from a tower position to an ARTC Center position is more desirable than the light gun or time-shared marker techniques Although the techniques described in this report are limited to television applications, electronic markers can be designed for other types of sweeps The marker generating equipment can be installed in the equipment room with only the control stick being located in the tower cab

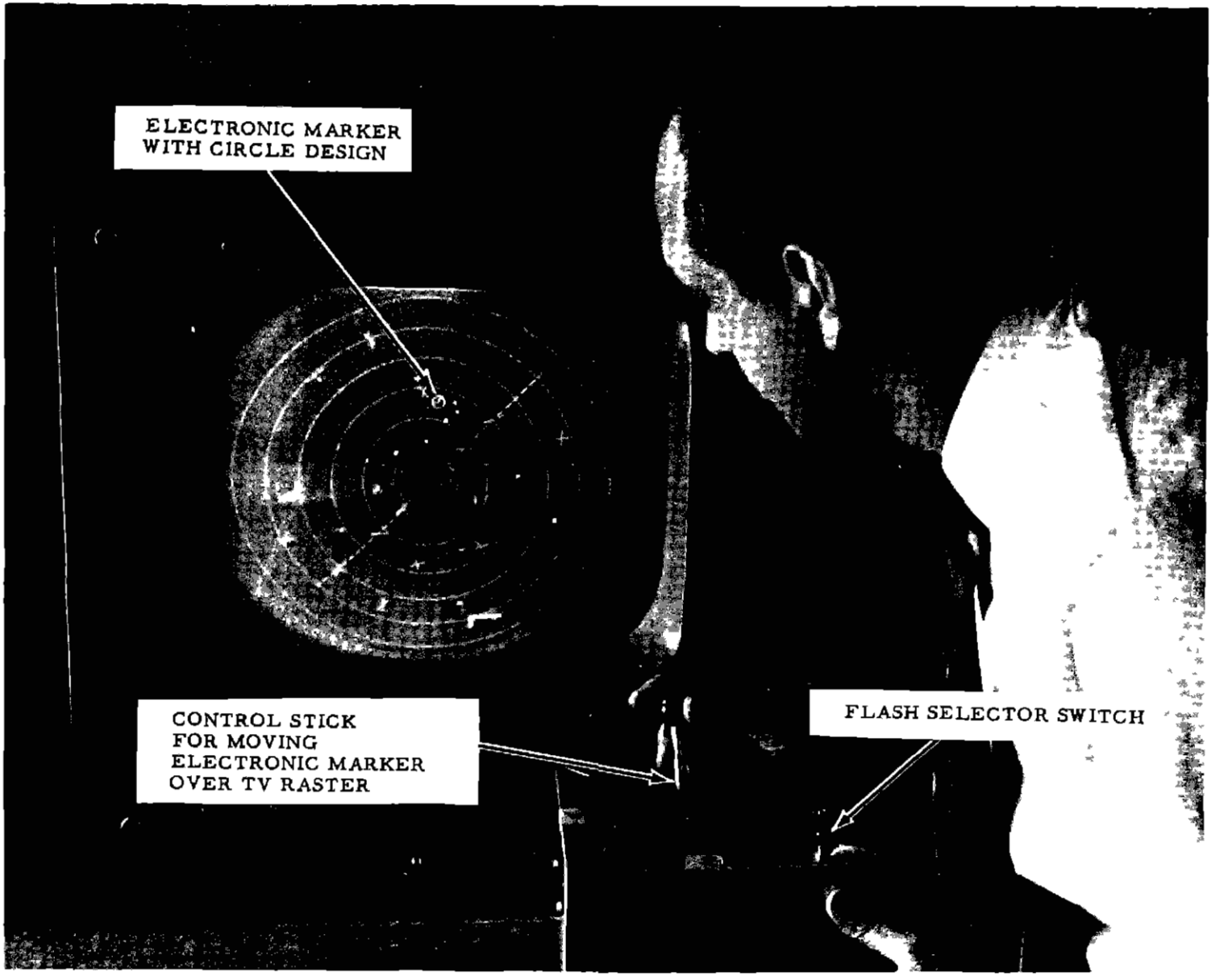

FIG. 1 SCAN CONVERTED RADAR TARGET MARKER

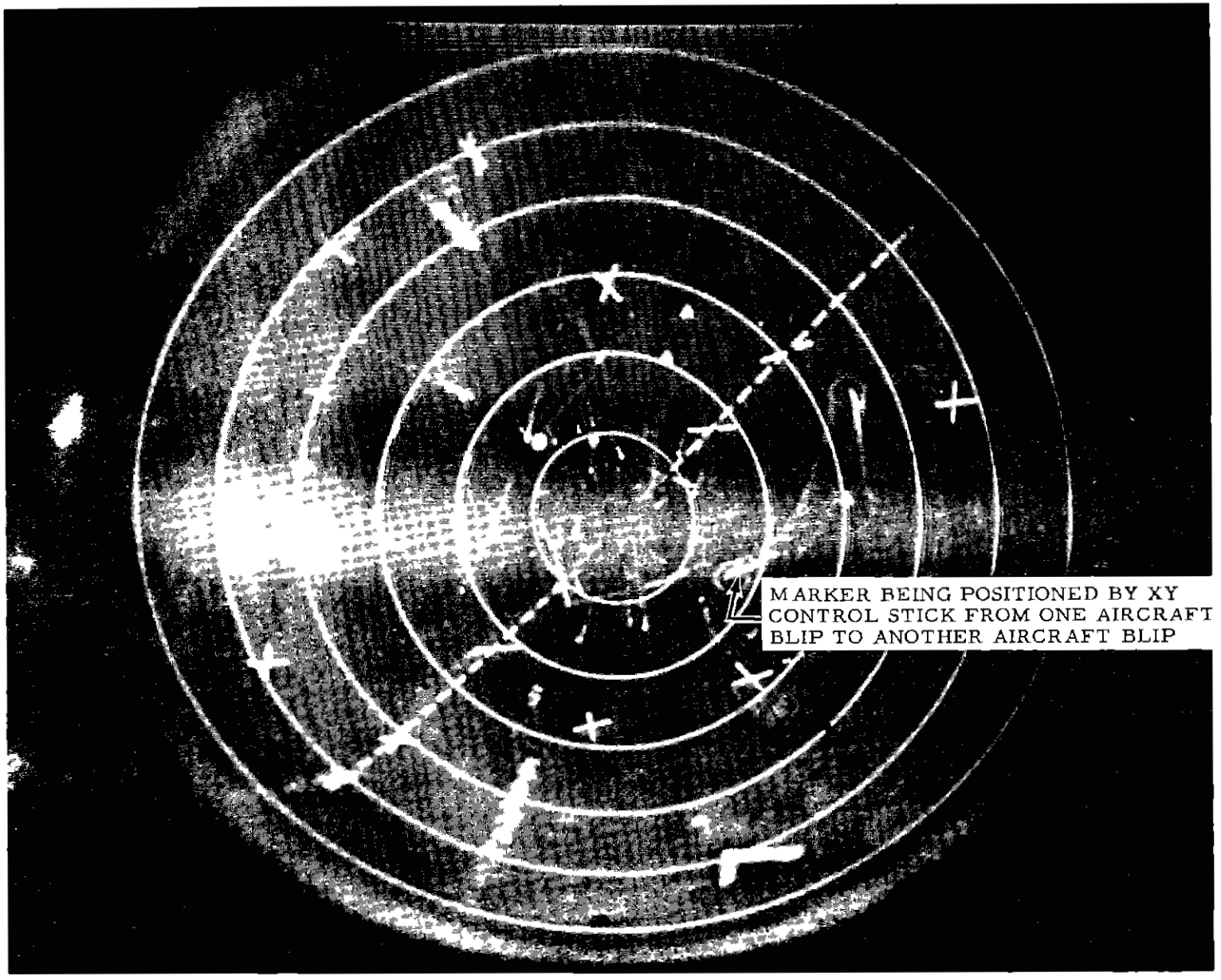

FIG 2 TELEVISION SCAN-CONVERSION RADAR DISPLAY SHOWING MOVEMENT OF MARKER

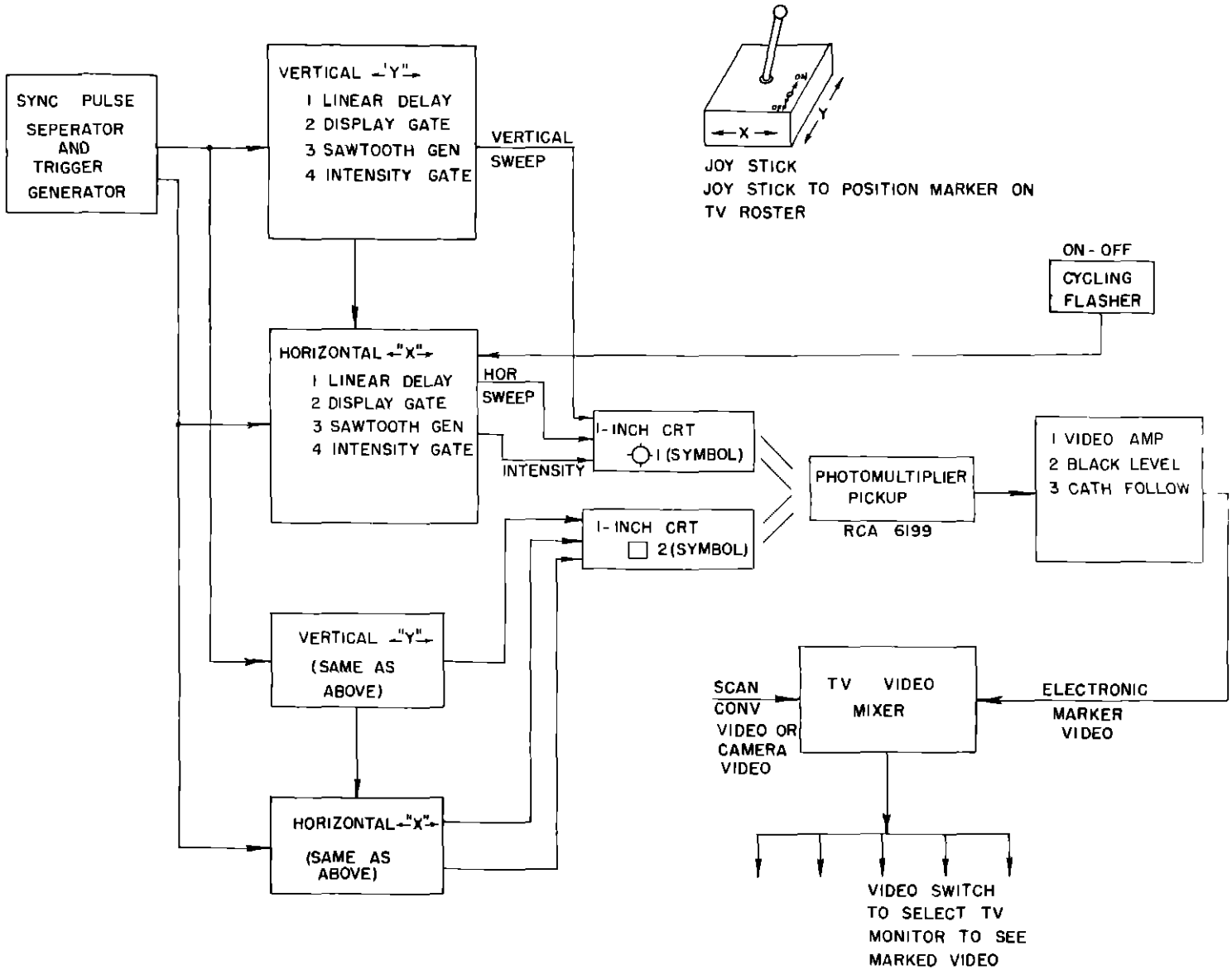

FIG 3 BLOCK DIAGRAM OF TV ELECTRONIC MARKER FOR RADAR HANDOFFS

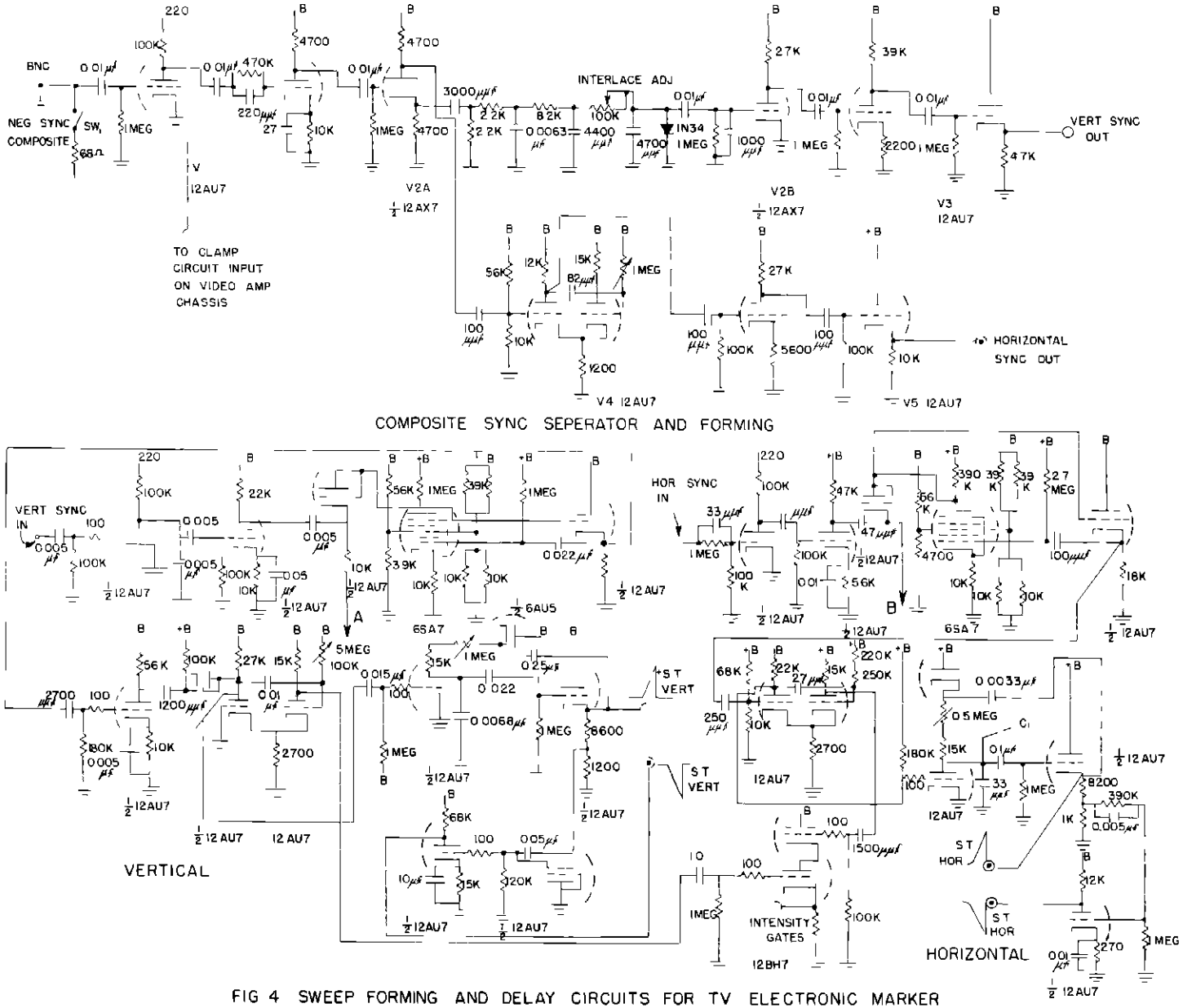

FIG 4 SWEEP FORMING AND DELAY CIRCUITS FOR TV ELECTRONIC MARKER

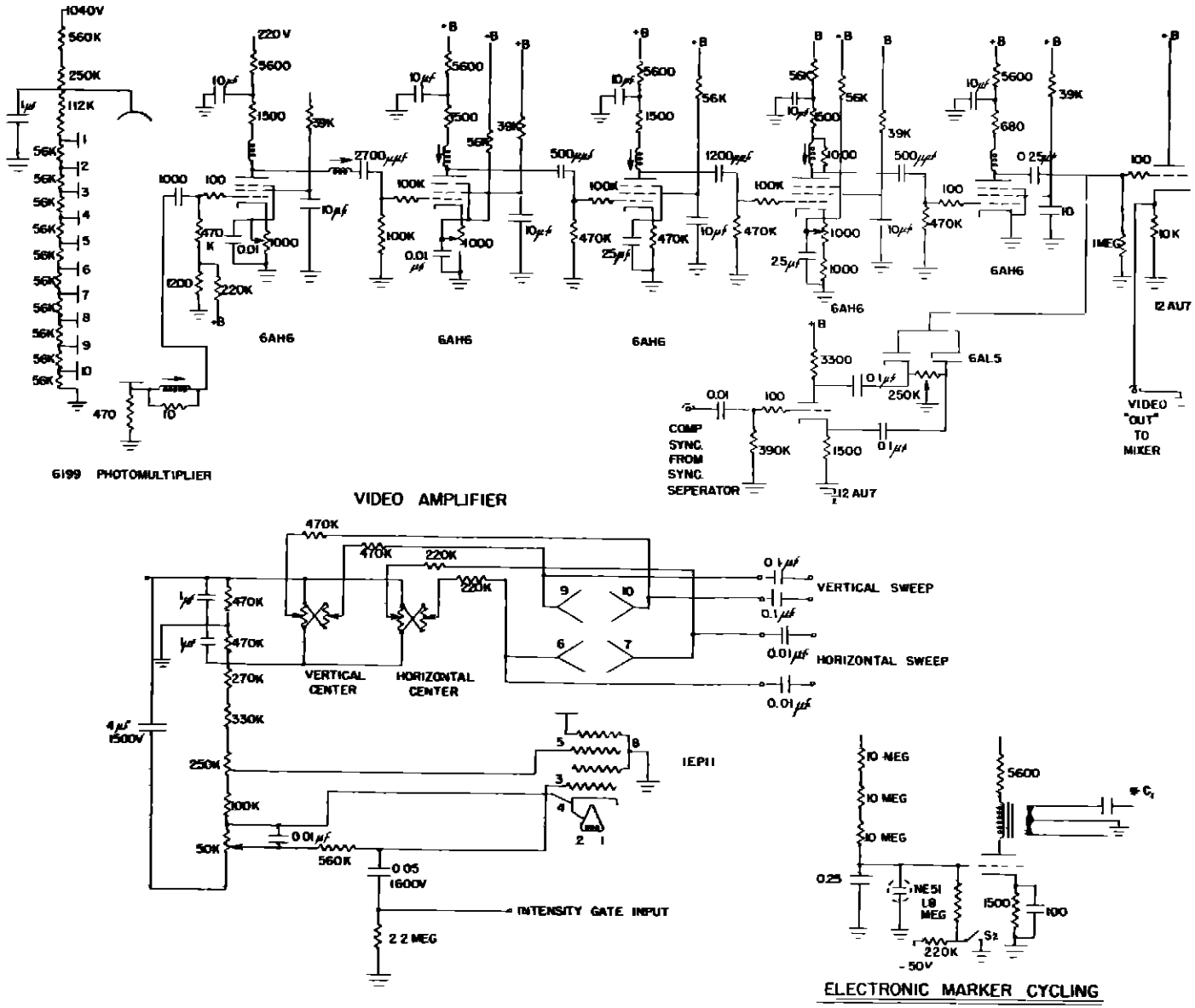

FIG 5 VIDEO PICKUP, CRT, AND AMPLIFIER CIRCUITS FOR ELECTRONIC MARKER