care is necessary to avoid noise pick-up, D.C. drift or slow recovery. It is customary to provide floating earth inputs for noise cancellation, and high gain amplifiers with large amounts of feedback give good linearity, and small signal first stages, for low heating drift. Balanced pair amplification is used throughout to minimise temperature drift, and high quality plastic film condensers with low dielectric hysterisis all help to give a stability of all components of the final picture to 0.1%, and minimum flyback time and fast recovery.

The advent of silicon transistors has helped minimise temperature effects, and the high power high frequency silicon transistors have been essential to achieve this type of performance. One of these is shown on a heat sink, in Fig. 2.

Careful design of deflection coils is essential, and the choice of materials can have great influence, where for example, the eddy currents in 0.001 inch mumetal can degrade the final performance.

The Character Writing Amplifier.

There is generally no requirement for rapid expansion of characters, and consequently, although push-pull deflection is used, this amplifier is more simple than that used for the main deflection. The scanning aperture on the tube face is only approximately 2cm. square, but as a bandwidth of about 2 mc/s is desirable, high frequency high powered planar epitaxial transistors are used to drive a very low inductance coil. Because of the small deflection, drift and distorsion problems are not great, and excellent results are achieved without much difficulty.

The Video Amplifier.

The video amplifier of a modern radar display is usually the most complex of the basic units. It must provide separately controlled inputs and mixing for:

a) 1st radar video
b) 2nd radar video
c) range rings
d) video map
e) secondary radar

and the following signals:

f) radar bright-Up
g) one or more character bright-up inputs
h) direction finder bright-up
i) scan-failure inhibit (blanking)
j) octagonal blanking (of signal beyond the c r.t. periphery)
k) radar video blanking, for selection purposes.

It also provides centre blaking for local ground clutter elimination, generates pedestals and correction waveforms for the rotating trace, and for different scan velocities on the different expansions. A further important facility is adjustable limiting to enable a range of signal-to-noise ratios to be painted onto the c.r.t.

The frequency performance must be sufficient to enable rise times of 0.1/uS to be achieved particularly for brightening the initial parts of complex characters, and generally a bandwidth of 4 to 5 mc/s is desirable.

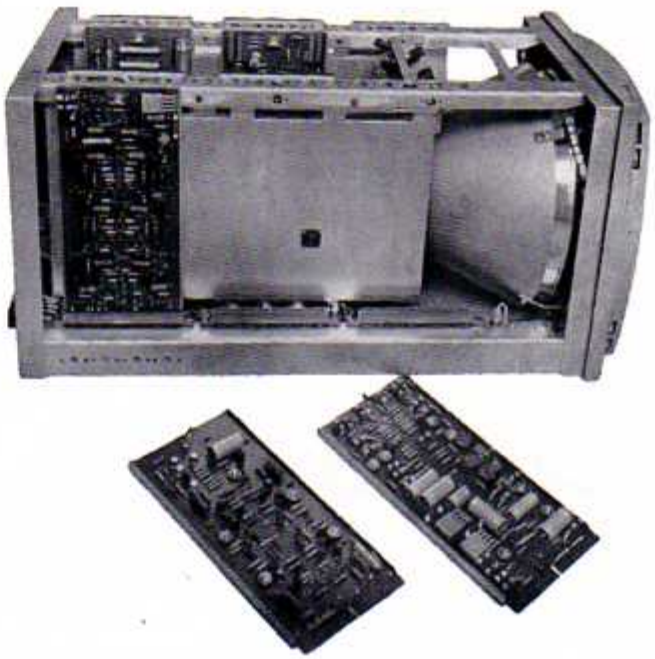

Fig. 2

Of the ancilliary equipment, the high voltage (E.H.T.) unit is probably the most important, as good regulation is essential to meet varying drive requirements. It is also preferable that it should operate at ultrasonic frequencies, as audible whistles from a large number of displays in a control room can be most undesirable.

The last unit of some importance is the focus regulator, designed to provide optimum focus over a wide range of operating temperature, and to utilise the full resolution of a modern c.r.t.

From the above brief description, it will be seen that a fully flexible modern radar display is a very complex unit, necessarily so, as it is almost always the final output to the man, from all the radar and computer data in the air traffic control environment.

Bright Radar Displays.

As previously mentioned, the most notable change that has occured in radar displays in the past few years, at least in the U.K., has been the introduction of the dual deflection system. Other changes have been normal evolutionary, such as the introduction of transistors, and greatly increased facilities.

The cathode ray tube has improved in resolution, but the brightness is still so low, that the display must be operated in very low ambient lighting conditions.

The low light output of the radar tube is the result of two basic requirements:

a) to handle the slow data rate from the radar aerial
b) the need for afterglow or persistance, to show the aircraft trails, which indicate velocity.