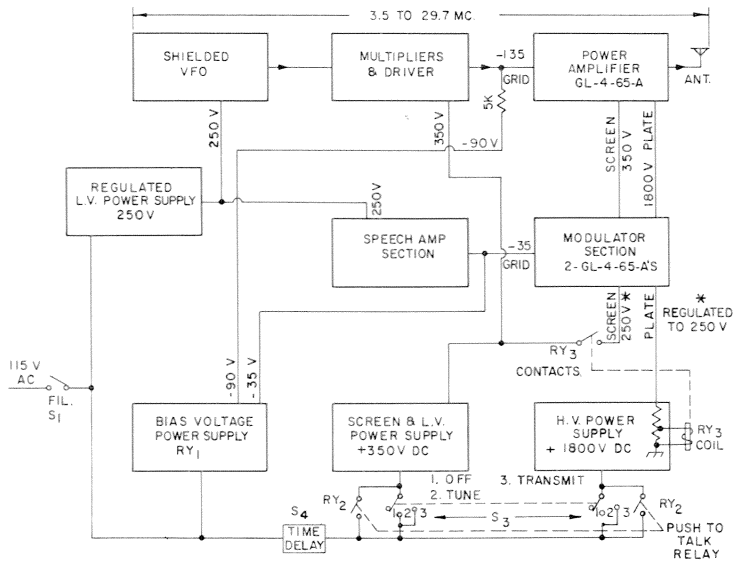

FIG. 1. BLOCK DIAGRAM of W7KCS/9's home-built transmitter, showing where protective circuits have been incorporated to protect the RF power amplifier and modulator tubes. Details are given in the text and subsequent diagrams.

TRANSMITTER PROTECTIVE CIRCUITRY (continued from page 1)

The two most used methods of preventing screen damage due to these circumstances are (1) screen dropping resistors or screen wattage limiting resistors, and (2) various current relays. The dropping resistor alone can cause screen grid failure through overvoltage resulting from low screen current.

The undesirable effects of poor screen grid voltage regulation through a dropping resistor can be partially offset by connecting a voltage regulator VR tube as shown in Figure 2. The wattage limiting resistor is chosen so that the screen grids cannot draw more than rated dissipation no matter what current they demand. The voltage regulating tubes maintain the 255 volt screen voltage for all normal values of screen current.

Should the screen grid begin excessive current the limiting resistor drops the voltage, extinguishing the VR tubes and limiting the total dissipation of the screen grid to a safe level. Note that the screen grid should be operated somewhat less than maximum allowable wattage in order to leave some reserve for this action.

SCREEN GRID OVER-CURRENT RELAYS or plate voltage sensing screen relays allow the screen voltage to be supplied by a *stiff* power source. The screen grid current sensitive relay is probably the most positive method of preventing failure. It will disconnect screen voltage when the screen grid current is excessive.

However, a less expensive method, the plate voltage sensing relay, protects the screen grid when plate voltage is not present and can be connected from the high voltage bleeder resistor to ground, as shown in Figure 2. The plate voltage will thus approach its full value before the screen power supply is connected to the tube screen grid. Unless there is plate voltage present, no screen voltage can be applied to the power amplifier or modulator tubes.

Failure of the negative control grid bias supply when it is used, is fortunately a rare occurrence. However, protection against this failure can be accomplished by installing relays in the plate and screen circuits which turn on these voltages only when bias voltage is present.

A push-to-talk switch can be connected in series with a voltage sensing relay which energizes the AC side of both the high voltage power supply and the screen power supplies. Notice in the schematic diagram of Fig. 2 that the voltage sensing relay is operated directly from the power amplifier grid bias source. Thus, plate and screen power cannot be applied unless grid bias is present. This relay in turn actuates the power relay which actually closes the primary AC circuits.

Since the coil current of the power relay is generally rather high it is advisable to use a small, low current relay in the push-to-talk circuit to actuate the power relay. Also, the power relay should be rated considerably higher than the normal primary current, since this current is largely inductive and may cause arcing and pitting of contacts on lower rated relays. Ideally, AC motor starting relays should be used to minimize these difficulties.

Damage to expensive power amplifier tubes can result from excessive plate loading, and can be pre-

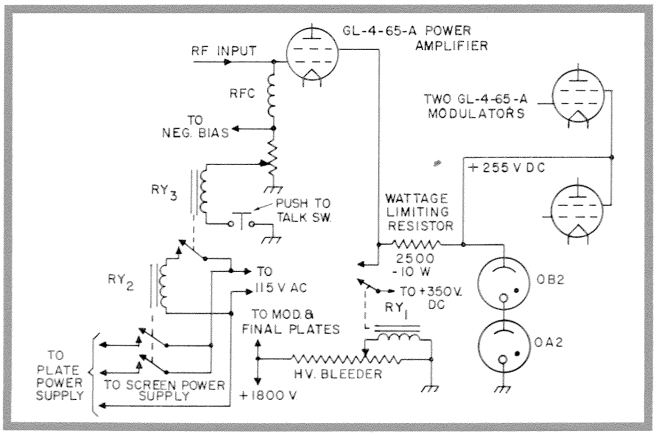

FIG. 2. SIMPLIFIED SCHEMATIC DIAGRAM of the basic protective circuits in the W7KCS/9 transmitter. High voltage plate supply cannot be turned on by RY_2 unless RY_3 is energized by the negative bias supply. Screen voltage is off until sufficient plate voltage energizes RY_1.

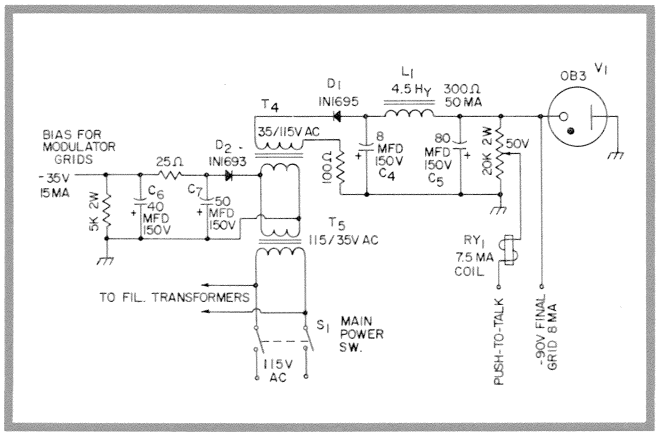

FIG. 3. SCHEMATIC DIAGRAM of the dual bias voltage supplies. Transformer T_5 and rectifier D_2 supply 35 volts negative bias for modulator control grids. T_5 also supplies primary votlage for T_4, a 90-volt regulated bias supply for RF power amplifier.