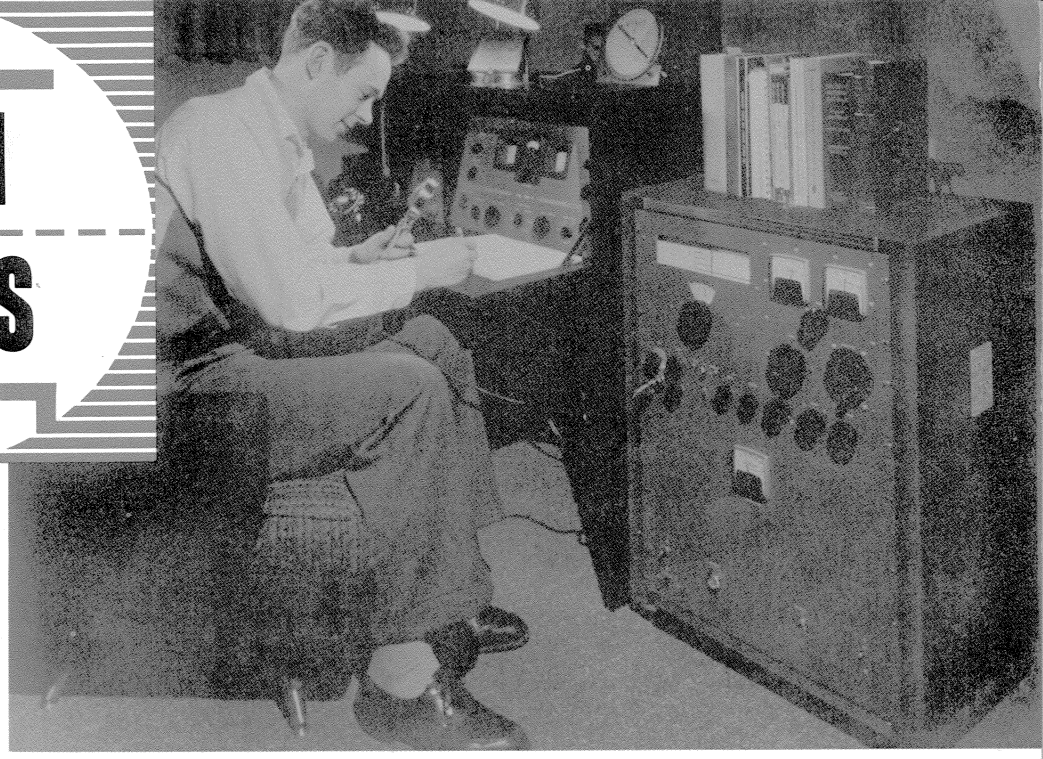
HAM NEWS
TUBES
SEPTEMBER-OCTOBER, 1961

TRANSMITTER PROTECTIVE CIRCUITRY

By Norman L. Morgan, W7KCS/9

EVERY TRANSMITTER should have circuits designed into it to protect valuable components — and especially the transmitting tubes — against failure due to accidental overloads. Be safe — not sorry — with these low-cost circuits by W7KCS/9.



NEAT STATION AT W7KCS/9, including the compact 250-watt CW and AM transmitter in which the protective circuits described in this article are installed. Transmitter covers 3.5 to 29.7 megacycles, and, except for commercial VFO and dial, is completely home made. Norm Morgan operates his transmitter mainly on the 21 and 28-megacycles bands. He is an Application Engineer with General Electric's Specialty Motor Department in Fort Wayne, Indiana. Norm has also authored several articles on electronic control circuits in trade magazines.

Adequate protection of transmitting tubes is like taking out fire insurance for your home — it's pretty inexpensive compared with the cost of power components. Often power tube failures happen during initial testing when the builder is busily checking the transmitter operation and fails to notice damaging currents in expensive tubes.

Ideally the philosophy of protection should be that the tube can survive on only its own protective circuits, as shown in Fig. 1. With this idea as the objective in designing power supplies, only the usual precautions are needed to prevent extensive tube and component damage.

Electrical failures are caused by excessive element heating or element overvoltage. Excessive dissipation is generally a result of (1) loss of excitation, (2) failure of plate or bias supplies, or (3) excessive loading. Overvoltage is mainly a result of low voltage drop in series resistors when power is correctly applied to the tube.

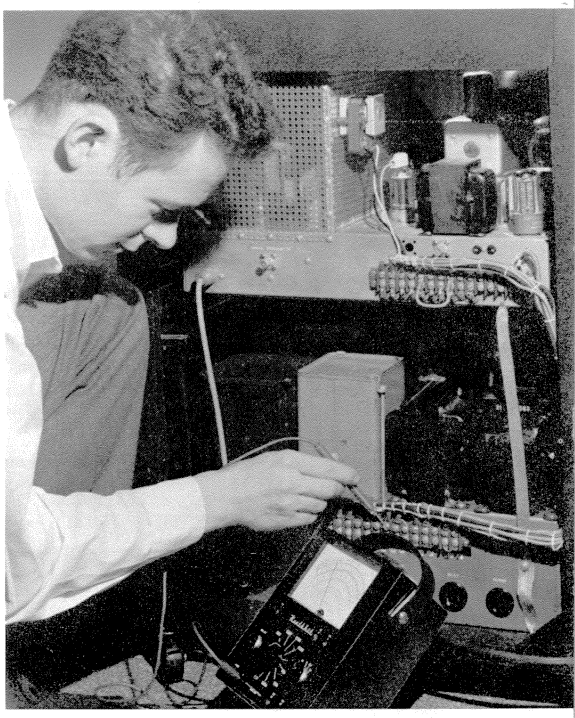
Loss of excitation in unprotected circuits can cause damaging screen and plate currents. Protection is generally supplied by clamp tubes or fixed bias to cut off these currents. Although clamp tube operation is quite popular and is extensively used by many amateur designers, it must be realized that screen grid voltage variation is built in with these circuits. Clamp tubes usually operate with a dropping resistor which results in undesirable screen voltage changes so detrimental to good SSB operation of a linear amplifier.

On the other hand, the high reliability and positive protection of fixed bias to cut off currents allows the screen grid to be operated directly from a stiff power source to achieve the good voltage regulation necessary for class AB (triodes in class B) operation of the power amplifier.

Loss of plate voltage in tetrode or pentode tube essentially transfers plate current to the screen if it is separately powered, which generally results in excessive screen grid current and rapid failure.

Actual failure of the plate power supply is a rare phenomenon, but its effect is the same as when the high voltage power supply switch is accidentally switched off during operation. This is especially true during initial tune-up and neutralizing when the plate power supply may not be energized, although screen voltage may be accidentally applied along with power to exciter stages.

(continued on page 2)



REAR VIEW of transmitter at W7KCS/9, with complete power supplies and modulator in lower unit, and RF exciter and power amplifier, and audio preamplifier in upper unit.

IN THIS ISSUE