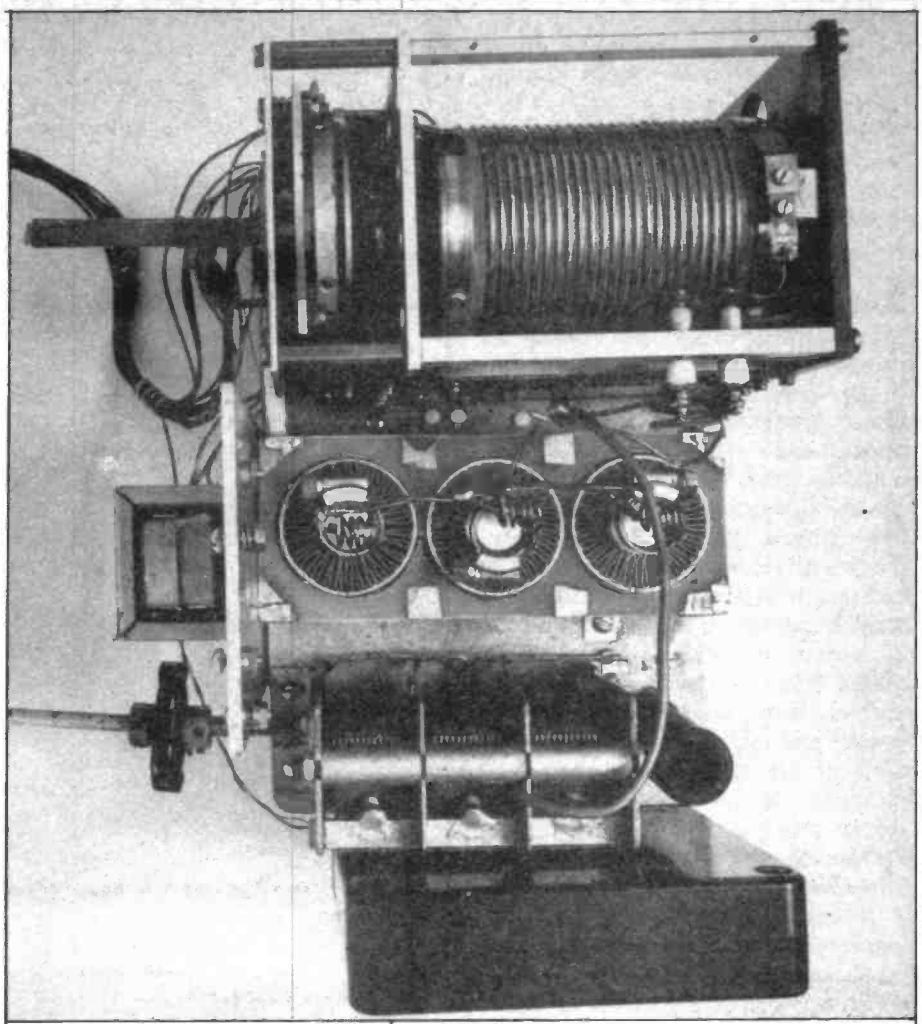
light loading and heavy drive, grid 2 draws a fairly heavy current: up to 25mA per valve. Under high loading or heavy static DC anode current, the screen grid current reduces very sharply to the point where it can actually go negative, that is, the screen electrode emits electrons just as if it were a cathode. Under these conditions, the screen has a tendency to shoot up in voltage in an attempt to reach anode potential. The power supply must prevent this by being able to sink current as well as source it. That is the function of the 22k resistor connected between the screen grid and cathode circuits. The amplifier should never be operated without this component.

Furthermore, the screen grid structure is of delicate mechanical construction and easily damaged by excessive current. If the valve anode supply should fail for any reason, the entire electron stream inside the valve diverts to the screen causing a burnout in milliseconds. Therefore, the circuit contains a current limiting valve, a 6BW6, and a 100mA fuse in the shape of a small pilot bulb. Most designs for 4CX250 based amplifiers have totally inadequate screen power supply protection.

## Construction

I used modular construction for their prototype. All electrical connections, with the exception of the RF input/output, were made through an 'umbilical cord' fitted with a multiway plug and socket. The complete unit separates into two halves: the amplifier proper, and the external case which houses the integral power supply.

A single diecast box, roughly. 2×4×7 inches features as the main chassis for the amplifier since it is both RF-proof and airtight. Good use is made of this last property. The amplifier valves need to be blown with air supplied from below, up through a chimney to the anode finning. A powerful but quiet snail blower pushes air into the box through a slot, via a custom made tinplate cowling. The valve holders, standard B8B loctal parts salvaged from an old WW2 US R/T set, are mounted in a row across the width of the diecast box. Slots and holes are cut around the valve holders, large enough to allow an unhindered, airflow yet maintaining enough mechanical strength to support the valve holders securely. A box structure, made from selectively etched PCB material, is constructed over the valve holders and associated air slots. Three holes are cut in the top of the box for the valve anodes. This arrangement forces air through the anode structures.



Note the chimney for the 4CX250B valves. It is an airtight box with three holes in the top, slightly larger than the anode diameters, made from PCB material. The bottom of the box connects with a succession of holes drilled around the B8B type valve-holders

The box system of valve chimneys has proved rather more effective than the standard Eimac bases. In fact, the whole business of valve bases for the 4CX250 has become something of a bogey. Up to 30MHz any sort of valve base will suffice and mechanical and thermal considerations will have more significance than any electrical problem likely to be encountered. In this design electrical stability is ensured by the use of 15 ohm grid stopper resistors. The anode anti-parasitic components are probably superfluous. A ferrite bead in the screen supply to each valve prevents instability caused by coupling between the valves. Whatever the precise electrics, the main thing is to make sure that plenty of air passes up through the valve anode finning.

All grid and screen grid circuitry is mounted within the diecast box and there must be no direct path to the outside. All connections into the box should be either screened or decoupled with capacitors at the point of entry. The anode tuning components are mounted directly on top of the box. The sequence of photographs show the methods of construction quite clearly.

## Operation

Using the finished unit is quite straightforward. Connect up, plug in the control lines and fire away. The input drive should be adjusted so that the grid current meter shows a slight positive upswing on voice peaks. The anode circuitry should then be tuned for maximum indication on the RF output meter. The anode current should 'whistle-up' to 700mA when the valves are correctly loaded, corresponding to a DC input of some 850W. Linearity tends to be better with 'heavy' rather than 'light' loading. ●