A 1937 DESK TYPE Transmitter

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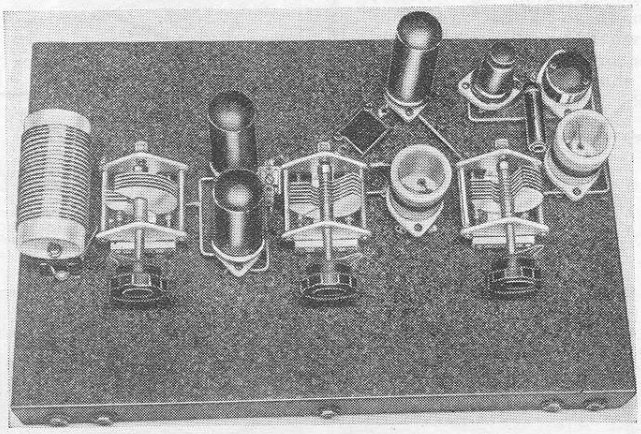
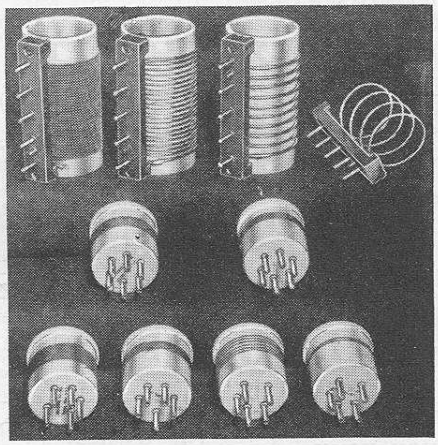
This is the second installment on our "1937 Desk Type Transmitter." Herein is described in detail the portion which takes in the 80, 40, 20, and 10 meter bands. A special crystal-oscillator *multiplier* circuit is employed, in which quadrupling is possible, thus making one crystal serve for three-band operation.



Top view of the 80 to 10 meter Transmitter.

● THIS, the second installment describing our new Desk Type Transmitter, will be devoted to a description of the 80 to 10 meter unit. The first installment in the last issue described in detail the 5-meter MOPA which is used solely for operation in that band and for no other purpose. This unit is another complete transmitter which is crystal-controlled and which may be operated on any of the amateur bands from 80 down to 10 meters. The idea was to have *all-band* operation, including the 5-meter band, and the natural problems which arise almost entirely prohibit the possibility of the same transmitting unit being used for all these bands. In order to simplify matters, a separate transmitter is used for ultra-high frequency operation.



The entire coil group.

Choosing Circuits

The problem in this transmitter was choosing a suitable crystal oscillator and multiplier circuit. The conventional tritet using a 6L6 might have been employed. However, it is surprising to note the number of fractured crystals which have been the result of maladjustment in the tritet circuits. While the tritet 6L6 can be made to perform perfectly, it is a simple matter to make some wrong adjustment and thus ruin a perfectly good crystal. Many circuit combinations were tried in order to eliminate the danger of the average experimenter ruining his crystals. The one chosen and which added little complication to the general layout was the well-known les-tet circuit designed by W2AMJ. The only addition of parts over the tritet circuit are the 6C5 tritet and its socket. We feel that the extra dollar or so increase in cost is worth-while crystal insurance. With this circuit employing a 6C5 triode and a 6L6 pentode it is possible to *quadruple* with excellent results. An 80-meter crystal, for instance, can be used to operate all three bands—80, 40, and 20. While the 40-meter crystal may be employed permitting operation on 40, 20, and 10. This arrangement employing two crystals permits the choice of two frequencies on 40 and 20 meters and one on 80 for 10. The output of the 6L6 when used as a *quadrupler* is sufficient to drive the 6L6's in parallel which make up the final amplifier. Another desirable feature of this combination using the tubes shown in the diagram is that the output circuit may be tuned to the crystal frequency without the slightest sign of feed-back or instability and no external neutralizing circuits are required.

Two 6L6's Used in Parallel

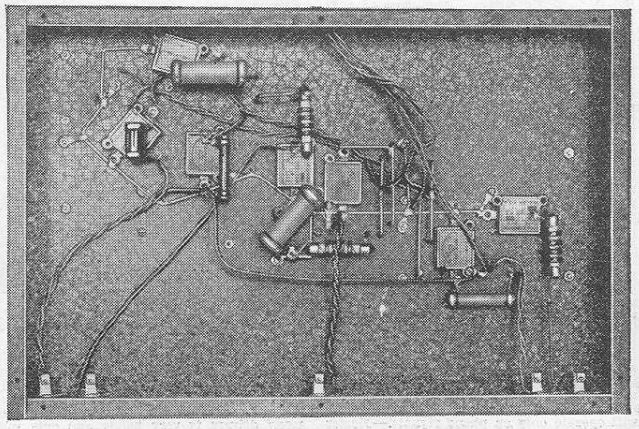
The 6L6 amplifier uses two tubes connected in parallel. Experiments have shown that this was a most satisfactory arrangement with the particular lineup which we employed. It would have been practically impossible to drive the 6L6's in *push-pull* with the single-ended output quadrupler. Down to 10 meters the parallel connection provides just as good efficiency as push-pull and, needless to say, the entire set-up is very much simplified.

The 6L6 amplifier is coupled to the multiplier stage with a 35 mmf. midget padding condenser. This, although shown variable in the diagram, was set at maximum capacity and provided the proper amount of coupling.

The first experimental tests with this transmitter were conducted with a neutralizing circuit in the final amplifier, but careful checking showed that this could be eliminated and still maintain excellent stability in the amplifier when excitation was applied to the grids. However, with the excitation removed, the 6L6 amplifier will break into oscillation, and for this reason it is recommended that all keying be done in the final amplifier, permitting the elimination of the neutralizing circuit and the necessity for a fixed bias of some kind to limit the plate current of the tubes. As a matter of precaution if one is not reasonably certain that the crystal will function at all times when the amplifier plate voltage is applied, a resistor of some 50 to 100 ohms may be incorporated in the cathode circuit of the amplifier in order to limit the plate current should the crystal fail, thus removing excitation. The entire line-up is extremely simple and very versatile. It lends itself remarkably well to rapidly changing bands, and all that is necessary is the changing of the plug-in coils. Adjustment is also very simple and even the most inexperienced can obtain excellent results by following standard tuning procedures.

425 Volts Applied to Amplifier

We have shown only 425 volts applied to the plates of the two amplifier tubes. While higher voltages may be used, this value insures longer tube life and provides ample power output. A full 40 watts is available on all bands in which this transmitter may be operated. The (*Continued on page* 562)



Bottom view, showing the method of by-passing.

voltage is reduced on the plate of the 6C5 crystal oscillator tube with a 20,000 ohm resistor. Increasing the voltage in the crystal circuit provided no greater harmonic output. The crystal in this circuit remains absolutely cold at all times, which is something that cannot be said of the average tritet circuit delivering the same power output, especially when operating on the fourth harmonic. No matter how one adjusts the various tuned circuits in this combination oscillator and multiplier stage, it is impossible to fracture the crystal or even cause it to heat, so that it can be said that it is absolutely safe and can be highly recommended to any one wishing to improve operation in the crystal stage of any "Ham" transmitter.

The plate current of the crystal oscillator will be found to be around 15 ma. This varies slightly in different bands. However, this approximate value may be accepted as generally correct. The plate current in the 6L6 frequency multiplier will be around 25 to 30 ma., depending upon which harmonic of the crystal it is tuned to. On the crystal *fundamental*, the plate current of this stage will drop to an extremely low level, 5 to 8 ma., while in the second harmonic it will dip down to between 10 and 15 ma., and on the fourth harmonic of the crystal a dip in plate current of about 2 or 3 ma. will indicate normal operating conditions. If the coupling between this multiplier and the final amplifier stage is greater than that shown, no dip at the fourth harmonic may be noticed at all. However, a neon bulb will indicate that there is sufficient power to drive the final amplifier. The grid current of the final amplifier is also another indication of ample excitation. When operating on the crystal frequency or the second harmonic of the crystal, the grid current of the amplifier may be anywhere from 8 to 12 ma. Optimum results were obtained with as low as 4 ma. grid current. On the fourth harmonic of the crystal it will be found impossible to drive the grid

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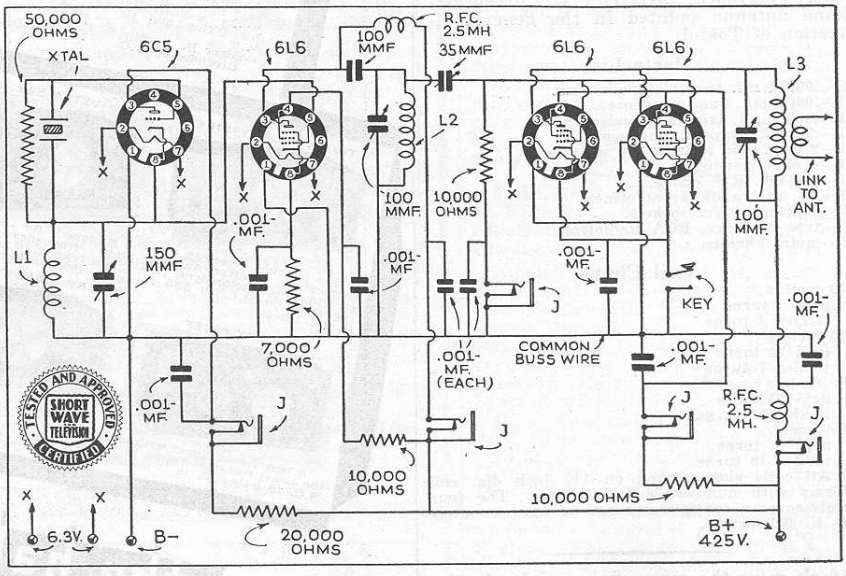
current of the amplifier over 5 mills (ma.) and in many cases it will be in the neighborhood of 4 ma. However, this low grid current is entirely sufficient to provide maximum output of the amplifier. No difference in power output could be noticed when operating on 10 meters with 4 mills grid current, as against operation on 20 meters with 10 mills grid current.

While there is no indicated method of reducing the excitation to the amplifier when operating on the lower frequency bands, it is possible to reduce the grid current by adjusting the cathode tuning condenser in the 6C5 for lower output in the oscillator multiplier group. The screen current in the final amplifier will be found to vary with the load in the plate circuit. When the plate circuit is unloaded, i.e., not coupled to the antenna, the current may be as high as 25 to 30 ma. However, when the plate circuit of the amplifier is loaded for maximum output, this screen current will drop to about 15 or 18 ma., which is the proper value for normal operation of the tubes. The recommended plate current for best all-around results of the



Hookup of Transmitter