The UX-250—CX-350 Tube

THE very excellent little CX-350—UX-250 tube is the unhappy victim of more hard luck than the heroine in an old-fashioned serial movie. Madhouse rumors have surrounded it for 6 months, and now its own folks are not agreeing on the story they will tell in announcing it. As if that isn't enough the samples have come through with such amazing slowness that *QST* even at this date has been compelled to go out and borrow some from a good friend in order to have some chance of finding out just what to believe.

THAT FAMOUS "25-WATT" RATING

The grapevine telegraph was busy for many months announcing the 250 as a "25-watt, 200-volt tube". *That* at least can be knocked on the head at once. The 250 is so far from being a 25-watt tube *at 200 volts* that it has little (if any) advantage over the 171 at that plate voltage.

The next question is, 'Is it *ever* a 25-watt tube?' As to that, we will tell the story as it has been shown us, after which your guess will be as good as another's.

A. The rumors made it a 25-watt tube.

B. The R.C.A mimeod release says, "When used as a transmitting tube the UX-250 is rated at 25 watts as against the 7.5-watt rating of the UX-210".

C. Consideration of the amplifier ratings and of the structure of the tube made it seem that perhaps the typist had hit the wrong key in cutting the stencil.

D. In response to our questions, R.C.A. cannot stand such high temperatures. On the other hand it is larger. Cancelling these things against each other one arrives at the conclusion that the 250 ought to be able to stand about twice the plate dissipation of the 210. Rough tests seemed to show that a pair of 210 tubes in parallel were a bit more than equivalent to a 250.

All of this suggests that the typist should have hit the "1" key and made the rating "15 watts", unless the idea is to rerate the other tubes of the line, which might not be a bad idea at that, the present ratings being ultra-conservative as compared to the foreign tubes we have used. Certainly, with high-efficiency circuits it is possible to obtain more than rating from all of the older tubes of the R.C.A. line.

Meanwhile, whatever the proper rating may be, the UX-250 is a fine little oscillator, even if such activities are not approved by its makers!

AS AN AMPLIFIER

In table A, the figures for the UX-210 are taken from standard information of

TABLE A

COMPARISON OF UX-210 AND UX-250 AS AMPLIFIERS. BRACKETED VALVES REFER TO 210

Plate Voltage	250		350		425		450	
Negative Grid Bias	(18)	45	(27)	63	(35)	——	(——)	84
Plate Current	(12)	28	(18)	45	(22)	——	(——)	55
Mutual Conductance	(1330)	1800	(1500)	2000	(1500)	——	(——)	2100
Mu.	(7.5)	3.8	(7.6)	3.8	(7.7)	——	(——)	3.8
Max undistorted output (milliwatts)	(340)	900	(925)	2350	(1540)	——	(——)	4650
Fil. Volts	(7.5)	7.5						
Fil. Amp.	(1.25)	1.25						
Ht.	(5-⅜")	6-¼"						
Dia.	(2-3 16")	2-11/16"						
Base	Same	-UX Std.						

says in a letter, "No information has been given as to oscillator ratings of the UX-250. This tube is, in fact, not recommended for use in transmitting circuits, contrary to information given out by various newspapers."

About the only choice that leaves, is to try manufacturing some information from comparisons with the 210 and from trying the tube. The plate of the 250 is of a less refractory metal than that of the 210 and

R.C.A. and the figures for the 250 are taken from the same release which gave the 25-watt oscillator rating, and which may therefore need some later adjustment. The bracketed figures are those of the 210.

AS AN OSCILLATOR

With the incomplete data at hand oscillator comparisons must be made indirectly.

Referring back to the UX-210 we take

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plifier was nearly always found to oscillate or was found to be unstable. I do not understand just why this should occur.

In playing around with different keying methods, we came across the method of "common lead" or "center-tap" keying shown in D. This arrangement effectively stopped both the amplifier and the oscillator without causing objectionable clicks. In fact, key clicks could barely be heard on a three circuit regenerative receiver used for broadcast reception, located three feet from the transmitter. This circuit was used for some time but the wave was found to creep.

By keying at point E, the oscillator was kept warm throughout the entire transmission so that the tendency to creep was eliminated. No key clicks were heard with this arrangement, and in addition, operation was positive, the antenna current being *zero* when the key was up. The key at E is at low potentials, both d.c. and r.f. as the center tap on the filament is usually grounded.

It is not necessary to employ condensers and resistors in shunt with the key in this position. Due to the load of the antenna,

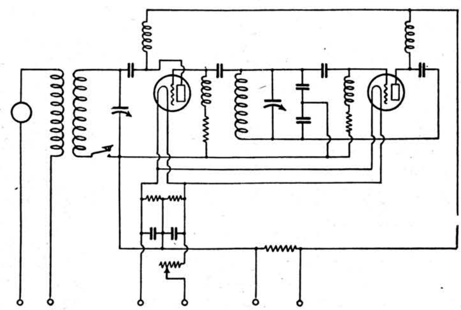

FIGURE 3. THE METHOD OF KEYING BY BREAKING THE RADIO FREQUENCY PLATE CIRCUIT OF THE AMPLIFIER AT 9BR

While probably less suited to high power work this method is thoroughly satisfactory from the standpoint of the receiving operator and the nearby broadcast listener and also has the advantage of not requiring a keying filter.

the frequency of the emitted signal several thousand cycles different than the frequency of oscillations when the oscillator is running idle. However, the transmitter can be adjusted to give the desired emitted wave, and as no power is radiated when the key is up, it does not matter if the oscillator maintains a different frequency when idle than when feeding the antenna.

The key was also inserted at the point F, but due to the capacity of the key and its associated leads, so much r.f. energy was by-passed that keying was impossible.

The keying methods shown at D and E, (Fig. 1) were found to be the best of all the keying systems tried. The keying system shown at D was used for quite a while. The complete circuit using this keying method is shown in Fig. 2. However, the keying system shown at E operated better than position D, and had the advantage of not requiring the use of relays, key thump filters, or other accessory apparatus. The final circuit used is shown in Fig. 3. The final keying system used has the disadvantage of supplying d.c. to the plate of the amplifier at all times. This has never been found objectionable in the case of 210 tubes, but might prove so in the case of larger tubes.

The resistance across the plate supply is simply used to "empty the filter" as a filter having a total inductance of 50 H. and total capacity of 9 mfd. as used here retains its charge a long time.

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from the Sept., 1926, issue of *QST* some General Electric data to indicate how the amplifier rating and oscillator rating of a tube of this general type may be expected to compare. The following figures are correct for an older type of 210 but the general proportions of the picture may be expected to apply to the present 210 and to the 250.

	As amplifier	As oscillator
Plate volts	425 (max)	350
Plate mils	30 (max)	60
Input watts	12.7	21
Rated safe Plate loss	12	15
Output watts	———	7.5 watts at eff. of 37.5%

Note that the max. amplifier input rating is approximately equal to the max. safe plate loss when used as amplifier (naturally since the plate circuit input is mainly plate loss when the tube is not working for a moment) also that the oscillator plate loss is 5/4 of this.

Referring that to the 250 we have a max. input rating of 55 mils at 450 volts which is 24.8 watts, suggesting a plate dissipation of 24 watts when resting as an amplifier. Following the assumption, we have 5/4 (24) = 30 watts plate dissipation as an oscillator which compares nicely with the 2-to-1 result of the rough test mentioned above.

Finally, if we assume the same 37.5% efficiency for this tube as was used in rating the 210 we have an oscillator rating of 15 watts and an input of 42 watts at a plate voltage of ? ? ? and a current of ? ? ?.

All of which is another method of guessing, but arrives at the same result.

—*R. S. K.*