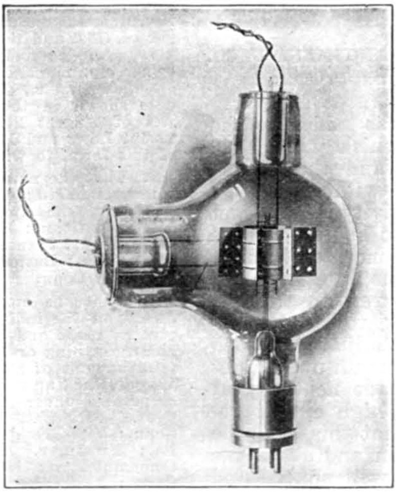
The UX-852 Transmitting Tube

By Robert S. Kruse, Technical Editor

THE whole long trail of amateur c.w. is littered with dead vacuum tubes that "went west" by some sort of break-down in the "stem", that troublesome part of the tube where all the wires come together for no reason except to permit a quick exchange of tubes—of which the ordinary amateur buys *one* in a good many months. This "quick exchange" idea with a standardized 4-prong base was fine for the Army or the Navy; a blown vacuum tube does not mean much to the United States and the main thing is to get the corpse out of the way and a new one into the set.

Now with the amateur it is another matter. A blown tube is a calamity, and he would very much like to have some sort of construction which would make base flashes impossible. On the other hand, an extra ten minutes to exchange tubes isn't particularly serious.

In 1923 or thereabouts, when amateur radio first began to work down towards 50 meters, stem-flashes and breakdowns became more and more troublesome. Not because we were the only ones; only because I *know* about us is it interesting to recollect that Boyd Phelps and I blew up over 30 of the 50-watt tubes (203 and 203-A) before they were improved to their present state. Reinartz and others must have done as well —or as badly. The tube laboratories saw clearly enough that the cure for this was to follow European practice, abandon the single-ended tube and make a double-ended or T-shaped tube with the leads coming out far apart to prevent trouble. Unfortunately, it is one thing to work out a tube in the laboratory and quite another to put it on the market. The factory and the selling end of the outfit have to be convinced that, in cash or goodwill, the new tube will pay for the changeover from the old model, or else that the old model has become obsolete because radio has changed again. In the case of the American transmitting tube, this transition was a slow and rather painful process. For quite a while the commercial folks seemed convinced that nobody outside the governmental radio services had any use for tubes. During this time the radio amateur imported his vacuum tubes in peculiar manners or else "snaffled" them —which, by the way, isn't in the dictionary with that meaning but will be understood by any Navy radio or Signal Corps man— and most amateurs.



THE UX-852 TUBE
Extremely high insulation, and very low tube capacity make it an excellent short-wave tube. It may be operated at 5 meters more easily than the standard 50-watt tube at 40 meters. At 40 meters it may be used with a larger condenser in the tuned circuit, tending to steady the wave.

(Photo Courtesy R. C. A.)

Finally we did get tubes—meant for rather long wave work where base troubles didn't bother the designers. When these tubes began to blow up by base puncture, the folks that sold them over the counter were dead sure that the tube had been abused. It wasn't until most stations were below 100 meters that it became possible to convince these people that a 203 run at ¾ rated voltage may have a stem puncture at such a wavelength as 40 meters.

The laboratory folks —being still tied to the single-ended construction by manufacturing considerations — then did what they could to improve the single-ended tube, and they did a first rate job too. There is an amazing difference between the original 203 and 202 on one hand and the present 210 and 203-A on the other. The spacings have been improved, the plates made more solid, thin wires replaced by heavier ones, glass tubes put around the leads in the stem and so on. At 160 meters, at 80 meters—and even at 40 meters, they are quite excellent, though it would be handy if the capacity of the 203-A were smaller than it is, so that one could use more condenser in the tuned circuit, and thereby make the wave a bit steadier—but more of that later.

OUR NEXT MOVE

That isn't the end of the story. Amateur radio has been almost as slow to make full use of the 20-meter band as it was in getting down to 200 meters or 100 meters, 80 meters or even 40 meters; all of which have been thoroughly worth-while moves. About 8% of the ORSs have been converted now and are finding it easier to work at 20 than to fight QRM at 40 or 80—and are finding that the "skip distance" isn't half as much of a handicap as they had been led to suppose. There will be many more active on 20 soon. Besides this, it looks as if the 5-meter band will be more in use this year than before.

At 40 meters one has to be a bit careful with tubes of the single-ended variety—and the wave isn't any too steady. At 20 meters one has to be VERY careful and the

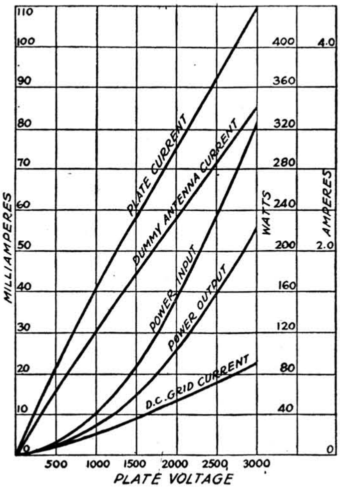


FIGURE 1. OSCILLATION CHARACTERISTICS OF UX-852 WITH NORMAL FILAMENT AND PLATE VOLTAGES, THAT IS 10 VOLTS FILAMENT AND 2000 VOLTS PLATE

wave is likely to be quite wabbly, and at 5 meters; just try to operate a 203-A at 5 meters with full output for a few hundred hours.

All of these things suggest that we need a double-ended tube or a T-shaped tube. Of course there is the 204-A—but we are not all rich. For several years we have been asking for multiple-terminal tubes and a while ago we got the first one on the American market—the DeForest "H" tube. The contrast between that tube and single-ended tubes of otherwise similar nature at any wave below 40 meters is very gratifying. Those of us who have used the "H" tube have experienced our first real freedom from the stem-puncture and the tube-capacity nuisance.

Naturally, we thought, "Now would it not be fine if we had a tube of the T-type somewhere between this and the 204-A?" Very well—we have it, the UX-852.

THE 852'S PERFORMANCE

The 852 is rated at 75 watts output, and after the manner of the Radiotrons, the

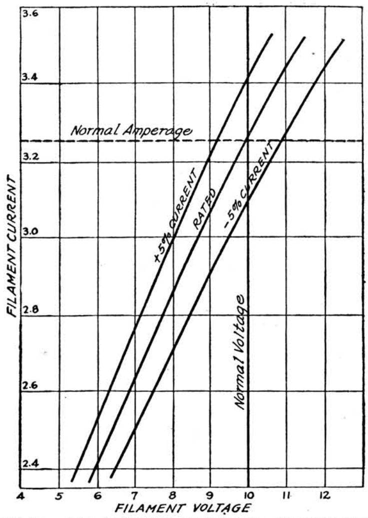


FIGURE 2. FILAMENT CURVES, SHOWING THE IMPORTANCE OF CORRECT FILAMENT VOLTAGE

rating is conservative. The tube plate is large and so rugged that 100 watts can be left on it without the least possibility of

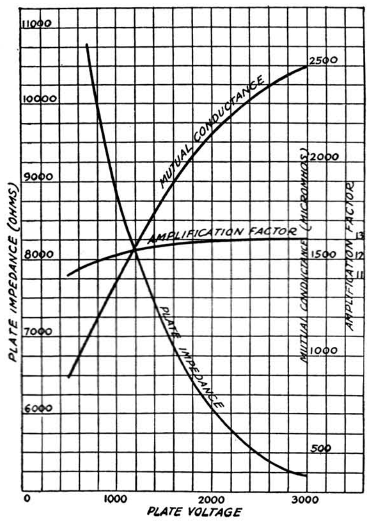


FIGURE 3. EFFECT OF PLATE VOLTAGE UPON AMPLIFICATION FACTOR, PLATE IMPEDANCE AND MUTUAL CONDUCTANCE

trouble. The insulation between leads is excellent so there is exactly no chance of trouble from flashes over any of the glass parts. The capacity of the tube is very small; it gets down to 3 meters *more easily* than the 203-A gets down to 30. The leads from the plate and grid are double and the two should be twisted together and the connection to the circuit made from the ends of this twisted pair. In doing this, some care should be taken not to break a lead off.

This *can* be done and the stubs are not

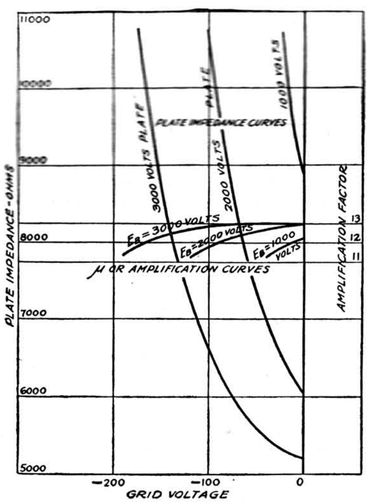


FIGURE 4. EFFECT OF GRID VOLTAGE UPON PLATE IMPEDANCE AND AMPLIFICATION FACTOR

easy to get at since they are down inside the stem, next to the mash. It seems that the plate and grid stems might be equipped with some sort of metal cap but it is possible that the heat of the tube would then start cracks. It does not matter much—a chance on a broken lead is made up for by the satisfaction of using a tube that does not make poor contact in the socket, flash-over inside or crack open because of a brush discharge.

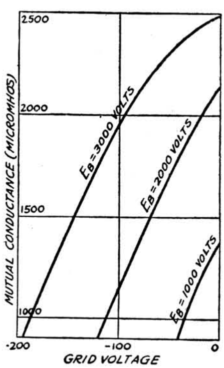


FIG. 5.

EFFECT OF GRID VOLTAGE UPON MUTUAL CONDUCTANCE

A sample tube used here has operated on an automatic key for several hundred hours at both 20 and 5 meters. The input was kept normal at 20 meters while at 5 it was first kept normal and then raised to 100 milliamperes at 3000 volts—which is of course deliberate abuse to get an idea of the performance of the tube when mistreated. Nothing in particular happened, though the plate was very much too warm. It should not run above a cherry red, which happens when about 100 watts are being left on it. If properly adjusted with normal input, the tube will show very little color on the plate, and even that cannot be seen until the filament is turned off.

Another sample tube has been used to test the insulation between filament and plate or grid. With the filament cold, 5,000 volts could be applied between it and the plate without any fuss of any sort—nothing happened. It was not judged wise to try such a test between grid and plate or grid and filament but these stood 750 volts without disturbance. With the filament burning, the tube would block the plate current whenever the grid was left "open", even

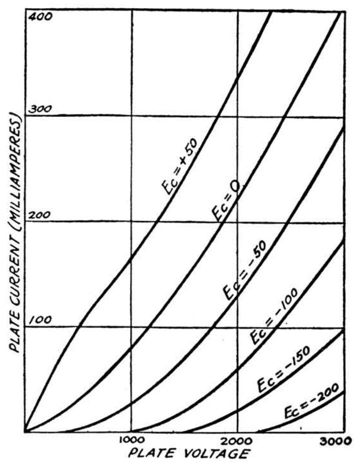


FIGURE 6. STATIC PLATE VOLTAGE-PLATE CURRENT CURVES WITH DIFFERENT GRID VOLTAGES

with voltages as high as 3500, showing that the grid insulation is excellent. Single-ended tubes seldom show such margin over normal requirements.

CIRCUITS AND SENDING RANGES

Just why anyone wants to show circuits or talk about the transmitting ranges of a tube, I do not know. *Any* good tube should work in any standard circuit, though it is more convenient to use shunt plate feed on low impedance tubes and series feed on high impedance tubes. A low-capacity tube will allow the use of more tuning condenser and that is good, for the condenser capacity is steady but the tube capacity is wabbly and tends to wabble the wave.

The sending range naturally depends on the antenna and the number of watts in it, not forgetting the plate supply. Whether the 100 watts in the antenna happen to come from a 204-A, a 203-A, an 852 or a group of 210s, does not matter in the least.

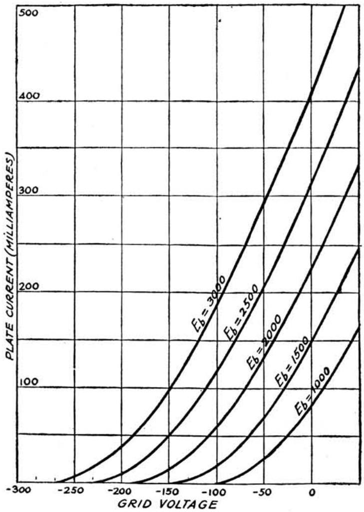


FIGURE 7. STATIC GRID VOLTAGE-PLATE CURRENT CURVES WITH DIFFERENT PLATE VOLTAGES

That the 100 watts happen to reach Hong Kong or Johannesburg does not prove that either is good or bad—the signal would have been the same if the 100 watts had come from any other sort of tube. The main business of the tube is to manufacture r.f. watts. If it does that steadily it is a good tube, even though it never has a chance to work for a good operator in a good location. As it happens, the 852 has some nice work to its credit—but that isn't what makes the tube good—nice long-range work has been done with a UV-199, which does not make it a sending tube.

TESTING

In addition to the usual tests that are given to a sending tube during and after manufacture, the 852 is tested in a 5-meter sending circuit and is required to keep on oscillating when the filament voltage is reduced to 2.

A secondary emission test is made with 750 volts plus on the plate; the filament a bit below normal and with the grid first at 0 and then at *plus* 100. The tube is required to have a low secondary emission. If the grid current reverses when the grid is positive, that tube is rejected.

CONSTANTS AND CURVES

Most of the necessary data about the tube can be gleaned from the curves, though it is well to remember that the antenna currents shown apply only to one particular dummy antenna at one particular wavelength. It is of course not possible to prophecy your antenna current with the 852 any more than it is with other tubes.

The constants of the tubes are as follows.

Filament: 3.25 amperes at 10 volts.

Plate: 75 milliamperes at 2000 volts.
Largest safe plate dissipation 100 watts, equal to cherry red.

Rated output: 100 watts under the conditions listed.

Amplification constant: 12.

Internal capacities: With the plate grounded.
Filament-grid: 1.8 picofarad.
Filament-plate: 1.6 picofarad.
Grid-Plate: 3.3 picofarad.

The very low capacities are quite impressive and show why the 852 can be used at all amateur waves, down to and including 1 meter, with some fixed condenser to steady the wave.

The variable "constants" are as follows, with normal plate and filament voltage.

	With grid at 0	With minus 100 grid volts
Plate impedance	6000	9000
Mutual conductance (Mhos)	2.0	1.3

That provides about all of the information needed and we will have a better start with the 852 than with any new tube ever presented to us.

Strays

The regular run of QSL cards bear as much resemblance to each other as do the grains of sand found along the seashore. (I suppose someone will take us up on this and tell us of all the various related families of sand there may be.) We have recently run across a couple that gave promise of being somewhat different in that the usual blagh was camouflaged by appropriate drawings, etcetera. If your card is *different* send one in to Harold P. Westman, 1711 Park Street, Hartford, Conn. Maybe a few samples of these will help us to get away from the terrible monotony.

1BJE, who uses a "Talking Tape" antenna on his S.W. receiver, noticed a discrepancy in its length and a search showed about fifteen feet of it sewed on Mrs. 1BJE's new dress for gold trimming.