The UX-860

A Screen-Grid Power Tube

By Harold P. Westman, Technical Editor

THE long line of radio tubes already available to the amateur and experimenter has recently had a new youngster of rather husky proportions ushered into its midst under the alphabetical-numerical cognomen of the UX-860. It being a "power" tube, there is no "CX" or Cunningham designation involved.

The UX-860 is a screen version of the 852. In cases where the 3.3 μμfd. grid-to-plate capacity of the 852 causes trouble, the 860 may be substituted and its reduction of this capacity to a value of .05 μμfd. should be very helpful. It is designed primarily for use as a radio frequency amplifier at frequencies greater than 3,000 kcs. The screen-grid does away with the necessity of neutralization although it by no means does away with the need for proper shielding of the external circuits.

While it may be used as an oscillator, it has no particular advantage over the 852 as such nor is it generally suitable for use as a modulator or audio frequency amplifier due to its high plate resistance.

This tube very much resembles the 852 in appearance. It is of the T type in which the plate and grid are supported on separate stems with their leads brought out through separate seals which insure low capacity and high insulation. The filament is supported on a third stem and its leads together with the lead from the screen grid are brought out through another seal. As in the 852, the filament leads terminate in a UX base, the screen-grid being connected to the grid terminal of this base.

A thoriated tungsten filament in the shape of a double helix is supported from a center rod and requires no springs. The plate is cylindrical with six fins or wings to dissipate heat. The screen is of close mesh and is interposed between the control grid and plate. It is as high as the tube and is supported by collars clamped to the filament and grid stems.

The filament should be operated at its rated voltage. Loss of emission may be occasioned by either overloading or underloading the filament. Loss of emission due to reduced filament voltage is due to too low a rate of diffusion of the active material to the surface of the filament. This is materially hastened by the application of abnormal plate voltage and high plate current.

As with the other tubes employing thoriated tungsten filaments, severe overload may cause a decrease in emission. Providing a large amount of gas has not been liberated, the emission may be restored by disconnecting the plate and screen-grid voltages and operating the filament at normal voltage for ten minutes or more. The time required for reactivation may be decreased by raising the filament voltage to 12 volts.

The maximum plate dissipation either as an amplifier or oscillator should never exceed 100 watts. This corresponds to a cherry red color of the plate. Looking at

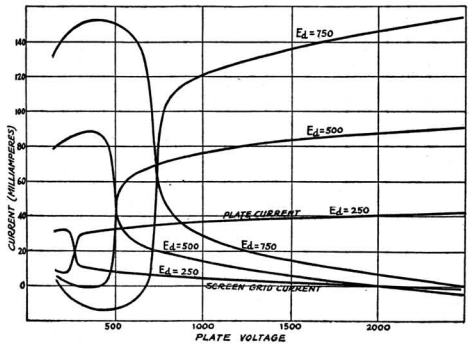

FIG. 1. SHOWING THE VARIATION OF BOTH SCREEN-GRID AND PLATE CURRENT WITH CHANGES IN PLATE VOLTAGE, CONTROL GRID VOLTAGE BEING ZERO AND FILAMENT VOLTAGE, 10.

the plate with the filament lighted is apt to be misleading because of the reflection of the light from the filament. It is best to turn the power supply to the tube off and note the plate color.

The screen voltage may be obtained from a separate source or from the plate supply system. The use of a separate source is not only expensive but does not offer as much safety as does the second method. If the plate voltage is removed and the screen voltage maintained, the screen current will increase considerably and overload that element, destroying it perhaps. On the other hand, if the screen voltage is obtained from the plate supply system, any changes in plate voltage will also result in a change in screen voltage and the ratio of the two will remain about the same, thus eliminating this danger.

If a resistance of approximately 100,000 ohms be placed between the positive terminal of the plate supply and the screen, the voltage on the screen will be of a satisfactory value. When using this method of

supply, the filament circuit should not be opened with the plate voltage on or the full plate voltage will be applied to the screen needlessly stressing the seal, etcetera. In all cases, the impedance between the screen and filament must be kept low by means of by-pass condensers. At no time should the screen dissipation exceed 10 watts which as in the case of the plate is indicated by a cherry red coloring.

Under normal operation, a bias of approximately 200 volts should be applied to the control grid. When a leak is substituted for battery bias, its value should be about

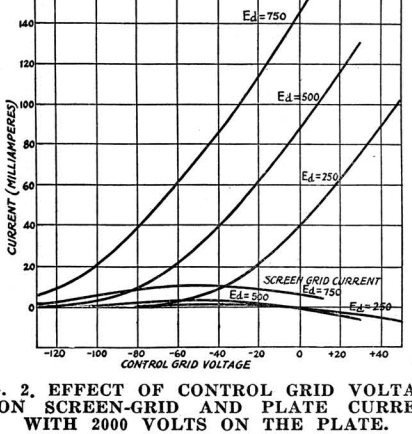

FIG. 2. EFFECT OF CONTROL GRID VOLTAGE UPON SCREEN-GRID AND PLATE CURRENT WITH 2000 VOLTS ON THE PLATE.

10,000 ohms. The value of bias is not critical and variations to suit particular circuit arrangements may be made. Both grid and plate leads are in the form of two conductors which should be twisted together. If only one of these conductors is used, excessive heating at the seal may result.

Some characteristics of the tube are given herewith:

Filament voltage	10.
Filament current	3.25 amperes.

The following values are obtained with normal plate voltage (2000 volts) zero grid bias and normal screen voltage (500 volts);

Plate current	70 milliamperes.
Plate resistance	150,000 ohms.
Mutual conductance	1.35 milliamperes/volt.
Amplification factor	200.

Approximate direct interelectrode capacities (I. R. E. definitions).

Plate-to-grid (Filament and screen grounded)	.05 μμfds.
Grid to filament and screen	8.5 "
Plate to filament and screen	9.0 "

Maximum operating plate voltages

Modulated plate voltage d.c.	2,000. volts.
Non-modulated plate voltage d.c.	3,000 volts.
A.c. plate voltage (r.m.s.)	3,000. volts.
Maximum plate current d.c.	100. mils.
Maximum plate dissipation	100. watts.
Maximum screen dissipation	10. watts.
Nominal screen voltage	500. volts.

The filament voltage current characteristics are the same as for the 852 and are not given here. This curve may be found on page 21 of the May, 1927 issue.

This tube should be of interest to those operating crystal controlled transmitters or other types of oscillator-amplifier circuits at the higher frequencies where feedback is so damaging.

As with all other power transmitting tubes excepting the 852, the 860 may only be obtained directly from the Engineering Products Division, Radio Corporation of America, 233 Broadway, New York City, New York. To save you the trouble of telling us that the 210 and 250 are obtainable through dealers, we should like to point out that these types are now considered as being primarily amplifier tubes for broadcast receivers and not transmitting tubes exclusively.

Correction

An error was made in figure 1 in the article "Some More About the Family" by A. B. Chamberlain which appeared on page 29 of the July issue. The ordinates should be labelled "TU Loss" rather than "TU", thus indicating a loss of high frequency audio energy due to transmission over a bare circuit. This is compensated for by the equalizer which has opposite characteristics.

9XL Transmissions

(Continued from Page 8)

Friday Evening Schedules
Central Standard Time

Time	Schedule A		Schedule B	
(PM)	f	λ	f	λ
8:30	3.5	(85.7)	7.0	(42.8)
8:42	3.75	(80.0)	7.2	(41.6)
8:54	4.0	(75.0)	7.4	(40.5)
9:06	8.5	(35.3)	7.6	(39.5)
9:18	9.0	(33.3)	7.8	(38.4)
9:30	9.5	(31.6)	8.0	(37.5)

Sunday Afternoon Schedules
Central Standard Time

Time	Schedule C	
(PM)	f	λ
3:00	14.0	(21.4)
3:12	14.2	(21.1)
3:24	14.4	(20.8)
3:36	15.0	(20.0)
3:48	16.0	(18.7)

September 14–Schedule "A" October 12–Schedule "A"
16– "C" 14– "C"
28– "B" 26– "B"

DIVISION OF TIME

3 minutes—QST QST QST nu9XL.
3 minutes—5 second dashes broken every half minute to give station call letters.
1 minute—announcement of frequency in megacycles per second (8.75 megacycles is sent as "8r75 MC.")

If you use these transmissions please send a note to the Experimenters' Section, A.R.R.L., 1711 Park St., Hartford, Conn.

—*H. P. W.*