A New 100-Watt Type Zero-Bias Transmitting Tube

The 838 Class-B Modulator and R.F. Power Amplifier

ALTHOUGH designed primarily for use in Class-B audio power amplifier or modulator circuits in which a pair has power output capability of a quarter kilowatt or more, the new 838 triode just announced by RCA also offers particular operating advantages in r.f. oscillator and power amplifier services as compared to older types, such as the 203-A, of the same 100-watt plate dissipation rating. In fact, since it has generally similar circuit requirements, it can be used to replace the 203-A in most applications with no more than minor modifications in the set-up. The 838 takes the same socket as the 203-A, 211 and similar tubes, the same filament supply voltage and current, and has corresponding plate voltage ratings. The tentative general characteristics are as follows:

Filament voltage (a.c. or d.c.)	10 volts
Filament current	3.25 amperes
Direct interelectrode capacitances (Approx.):	
Grid-plate	8 μμfd.
Grid-filament	6.5 μμfd.
Plate-filament	5 μμfd.
Bulb	T-18
Base	Jumbo 4—Large Pin

CLASS-B AUDIO POWER AMPLIFIER AND MODULATOR

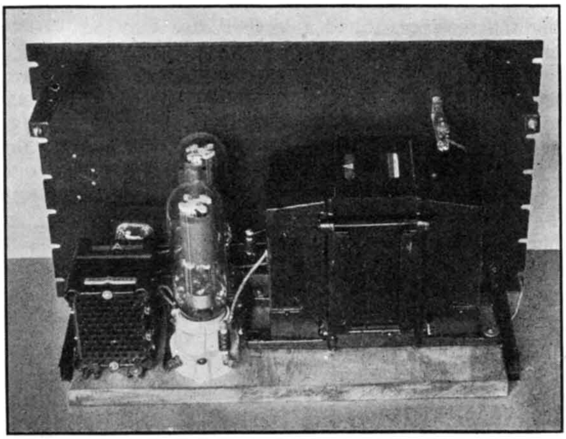
The 838 is especially interesting as a Class-B modulator in which service it operates at zero bias. The grid is designed so that the amplification factor of the tube varies with the amplitude of the input signal. The ratings, and experimental tests, show that the tube has the desirable feature of requiring even less driving power than the 203-A. Tests using a pair of these tubes have been made with the modulator unit shown in the photograph, the driver stage using a pair of 2A3's and the Class-C amplifier being an 849 operating with 500 watts input at a plate voltage of 2000 volts. The modulator plate voltage used was 1250 volts, at which the 838's have a rated audio output of 260 watts—which output they deliver without any difficulty.

The schematic circuit of the modulator is the same as that for the 203-A's (given previously in several *QST* articles) with the exception that the secondary center-tap on the input transformer is connected directly to the filament center-tap and minus B, rather than to a bias source.

Maximum ratings and typical operating conditions for Class-B audio service are as follows:

D.c. plate voltage		1250 max. volts
Max. signal d.c. plate current (per tube)*		175 max. milliamperes
Max. signal plate input (per tube)*		220 max. watts
Plate dissipation*		100 max. watts
Typical operation (2 tubes):		
Filament voltage (a.c.)	10	10 volts
D.c. plate voltage	1000	1250 volts
D.c. grid bias voltage	0	0 volts
Peak a.f. grid input volt. (approx.)	90	90 volts
Zero-sig. d.c. plate cur. (per tube)	53	74 milliamperes
Max.-sig. d.c. plate cur. (per tube)	160	160 milliamperes
Load resistance (per tube)	1900	2800 ohms
Effective load resistance (plate-to-plate)	7600	11,200 ohms
Peak driving power (approx.)	5	5 watts
Max. sig. power output, approx. (2 tubes)	200	260 watts

* Averaged over any audio-frequency cycle.



THE TEST MODULATOR USING TYPE 838 TUBES

As a result of the zero grid bias characteristic of the 838, grid current is drawn on any input signal. Hence, the input transformer can be designed for operation under approximately uniform loading conditions so as to give excellent frequency response. Of course it should also be designed to handle the required input power for the strongest signal. With a pair of 2A3's in a push-pull driver, the input transformer turns ratio

(Continued on page 74)

The New 838

(Continued from page 27)

recommended is 3.2, primary to one-half secondary. Since this is the same ratio ordinarily used with 203-A tubes, the present input transformer in a 203-A set up will be exactly suited. The grid current, incidentally, is nearly linear with grid excitation and practically proportional to power output over most of the operating range. Hence, the grid meter makes an excellent volume-level indicator, showing full power output for a total grid current of approximately 40 ma. with pure tone input and speech power output of corresponding amplitude at half this current value. (See remarks on modulation metering under "Technical Topics" elsewhere in this issue.)

On the output side, the rated load requirements are somewhat different from those given for the 203-A, it will be noticed, although there is sufficient tolerance in the characteristics of these tubes to permit the use of the usual 203-A output transformer without serious sacrifice of undistorted power output capability. At least this has been found so with the modulator previously mentioned and shown in the illustration.

R.F. APPLICATIONS

There is nothing unusual about the tube in either Class-B or Class-C r.f. circuits except that its grid characteristics permit the safe use of grid-leak bias in Class-C amplifiers, since the plate current drops to a safe value in case of loss of excitation. The recommended r.f. ratings and operating conditions are tabulated as follows:

R. F. Power Amplifier—Class B Telephony:

Carrier Conditions per tube; for use with a modulation factor up to 1.0 (100%).

D.c. plate voltage		1250	max. volts
D.c. plate current		150	max. milliamperes
R.f. grid current		6	max. amperes
Plate input		150	max. watts
Plate dissipation		100	max. watts
Typical operation:			
Filament voltage (a.c.)	10	10	volts
D.c. plate voltage	1000	1250	volts
D.c. grid voltage	0	0	volts
D.c. plate current	130	106	milliamperes
Peak r.f. input grid voltage (approx.)	60	58	volts

(Continued on page 90)

Air-Mass Conditions

(Continued from page 18)

suitably located ultra-high frequency radio transmitters and recorders as an added tool for the meteorologist. Appropriate ultra-high frequency radio links, particularly if operated on a group of frequencies, possibly could serve to advance our knowledge of the continually changing structure of the lower atmosphere.

ACKNOWLEDGMENT

Without the suggestions, advice and cooperation of Dr. C. F. Brooks of the Blue Hill Observatory of Harvard University, these observations would not have been possible, while without the additional data made available by Mr. G. W. Pickard we would have been greatly handicapped. Thanks are due to Professor H. W. Mimno at